Pilot Pioneer Expert Operation Guide
V10.5

Powering Network Experience

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1 Introduction

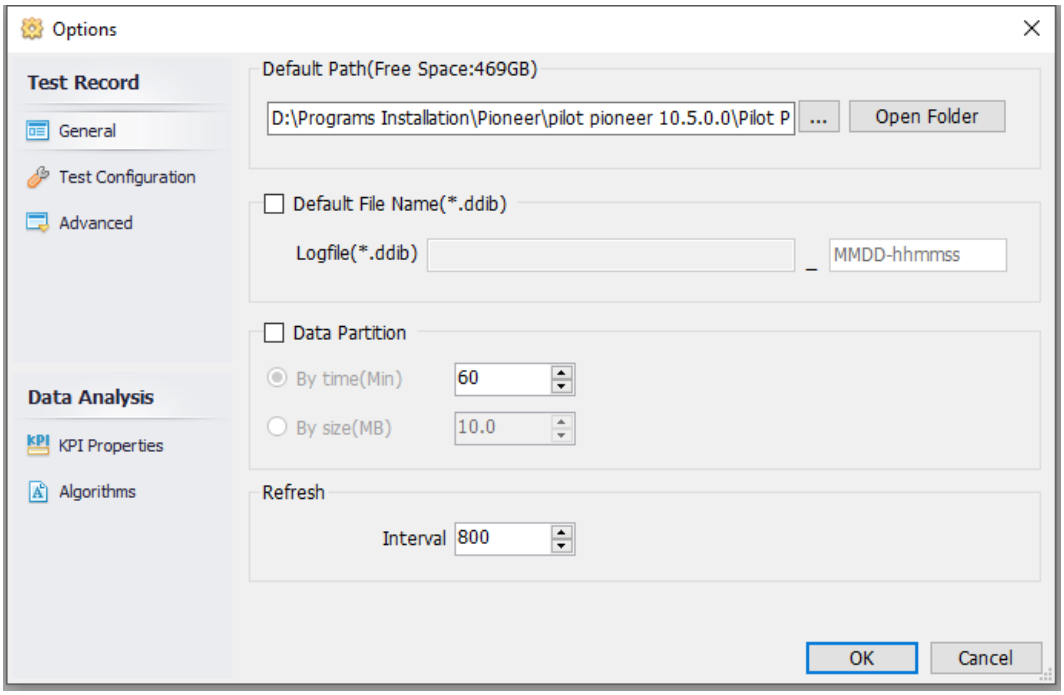
1.1 Decoding Settings

Pilot Pioneer Expert supports data analysis for multiple data formats, e.g. *.RCU, *.DCF, *.dtlog, *.CTI, *.CU, *.ddib, *.Qualcomm Files, *.GEN etc. Most of the data files need to be decoded to the *.ddib format for analysis. Users may conduct relevant configurations based on the actual situation, e.g. data file storage settings, Layer 1/2 message details settings, and LTE frame information storage settings

1. Decoded data files storage settings

   Choose **Configuration** > **Options** > **General**, click the ... button, and select a target directory to save the decoded data files. See the figure below:

   Figure 1-1 Select a storage path

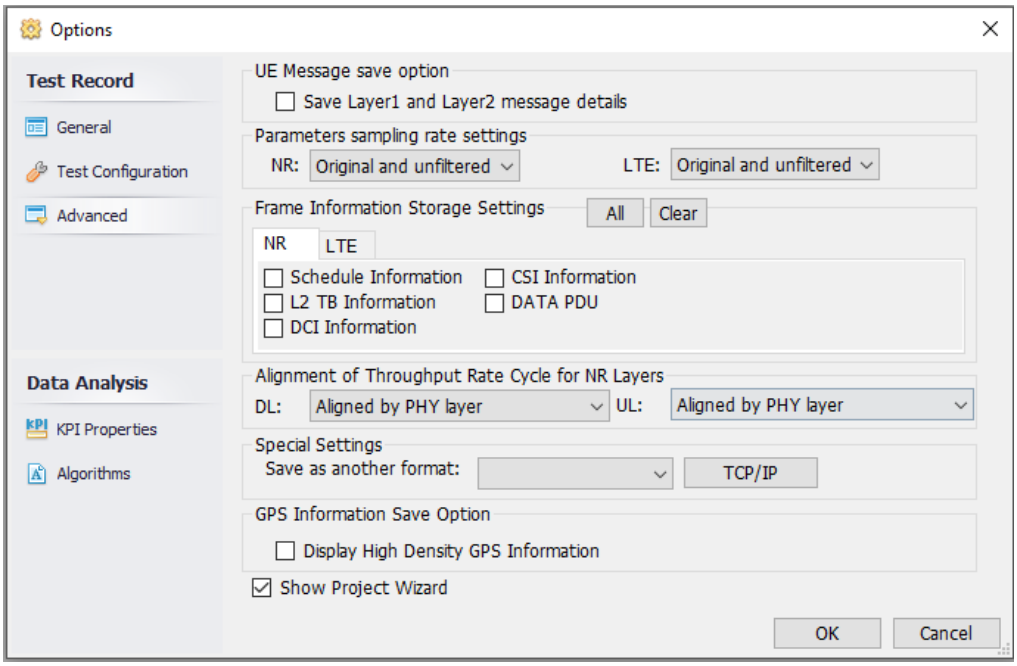


   Note: This configured storage path for decoded data files is also valid for data files generated during service test.

2. Layer 1 and Layer 2 decoding details settings

   Choose **Configuration** > **Options** > **Advanced**, select **Save Layer1 and Layer2 message details** to save the decoding details of Layer 1 and Layer 2 messages.

Figure 1-2 Layer 1/Layer 2 message configuration



Pilot Pioneer Expert does not save the decoding details of Layer 1 or Layer 2 messages by default. Users need to manually select this option to view the decoding details.

3. GPS Information Save Option

   If **Display High Density GPS Information** is selected, more accurate high-density GPS information will be saved. This option is valid only for high-speed rail test in China, and the customer who wants to access to this function may contact DingLi technical support.

4. Frame information storage settings

   Choose **Configuration** > **Options** > **Advanced**, select options under **Frame Information Storage Settings** as required, to save corresponding information. Set whether to save the frame information for NR and LTE networks. Users need to re-decode the data files after the settings, and then corresponding information will be saved.

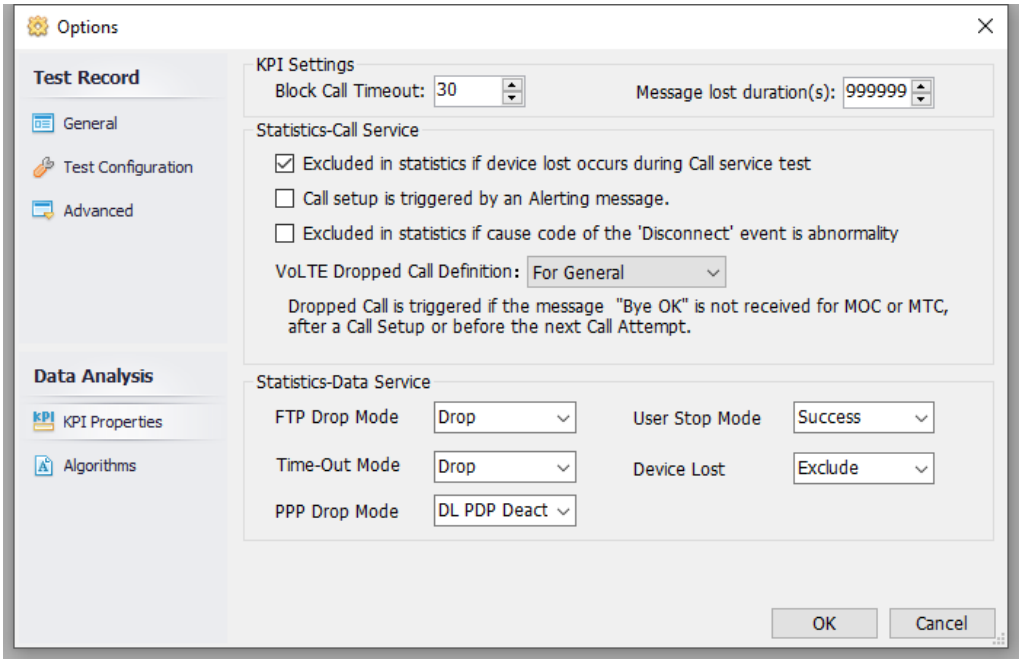
1.2 Statistics Analysis Settings

Users may conduct general configurations (e.g. statistics settings of call and data services) for all data analysis and statistics reports. Follow the instructions below:

1. Modify KPI properties

   Choose **Configuration** > **Options** > **KPI Properties** to enter the corresponding settings page. Users may modify the settings based on the actual situation, and click **OK** to save the modified information.

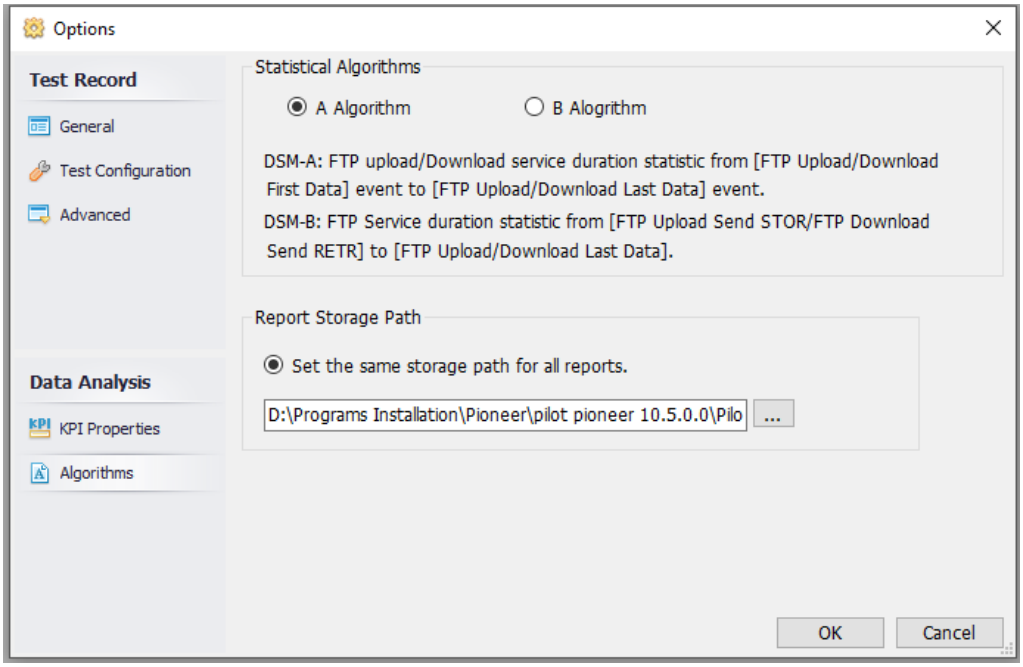
Figure 1-3 Modify KPI Properties



2. Modify FTP service statistics algorithm

There are two algorithms for FTP services to generate statistics of FTP duration, FTP throughput and so on. Choose **Configuration** > **Options** > **Algorithms** to enter the corresponding settings page. Users may select either algorithm as required based on the relevant description on the page. In addition, users may set separate storage path for each statistics report or set the same storage path for all statistics reports here.

Figure 1-4 Set FTP service statistics algorithm



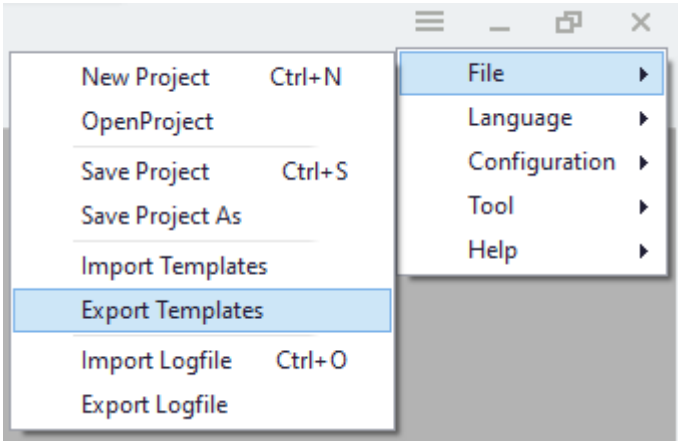
1.3 Templates Import/Export

Pilot Pioneer Expert supports templates import/export function. The templates that can be imported/exported include: report templates, analysis templates, filter templates, grid templates and parameters templates. It is convenient for sharing templates between multiple Pilot Pioneer Expert users, or between different versions of Pilot Pioneer Expert, and it is easy to import user-defined templates to the updated version or to different computers.

To export templates, follow the instructions below:

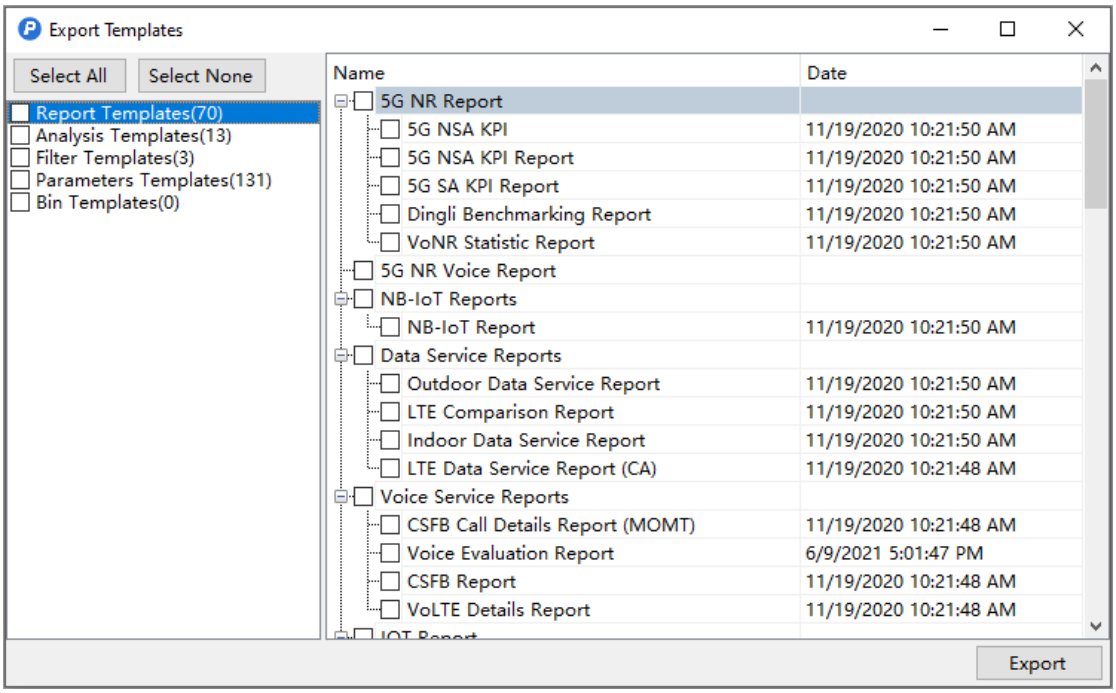
1. Click the menu bar button >**File**>**Export Templates** to enter the **Export Templates** window.

Figure 1-5 Select export templates



2. Select the template type on the left pane of the window and select templates on the right pane of the window.
3. Click **Export** to export templates to a *.ptmf file.

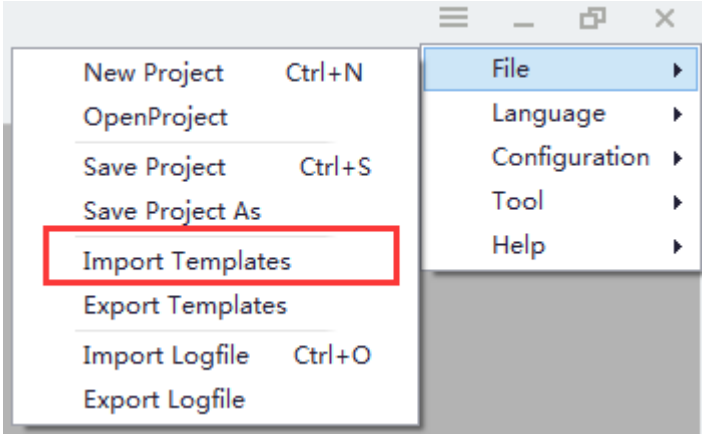
Figure 1-6 Export templates



To import templates, follow the instructions below:

1. Click the menu bar button >**File**>**Import Templates** to enter the **Import Templates** window.
1. Select a *.ptmf file from local PC to import to Pilot Pioneer Expert.

Figure 1-7 Select import templates



2 Data Management

Data files collected by DingLi products, e.g. Pilot Pioneer, Pilot Walktour, Pilot RCU, Pilot Scout, can be imported to Pilot Pioneer Expert for data management, post processing, and analysis.

2.1 Import Log Files

After the imported test data is decoded, Users may replay, generate statistics and analyze the decoded test data.

Choose one of the following methods to import logfiles:

Method 1: On the Menu bar, choose **File** >**Import Logfile**. The shortcut keys are "Ctrl+O".

Method 2: On the toolbar, click the **Import Logfile** icon ( ).

Method 3: In the navigation pane, click **Data**, and then click the icon.

Method 4: In the navigation pane, click Data>Data List> besides the icon to select a past logfile.

Method 5: Directly drag the logfile to the Data List pane.

Method 6: Double click a local logfile to automatically start Pilot Pioneer and import the logfile.

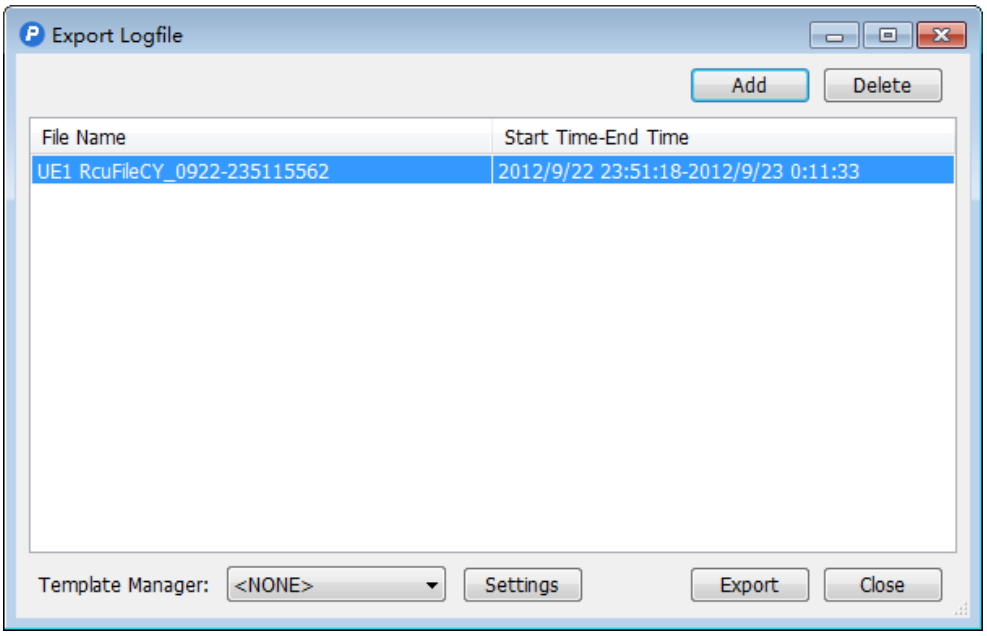
The imported logfiles will be automatically listed under **Data List**.

2.2 Export Log Files

Users may select and export log files to specific formats and paths based on their settings. Follow the instructions below:

1. Enter the **Export Logfile** window by using one of the following methods:
    - In the Menu bar, choose **File** > **Export Logfile**.
    - Select a log file on the Data List pane, and right-click it to select **Export Logfile**.

Figure 2-1 Export Logfile window



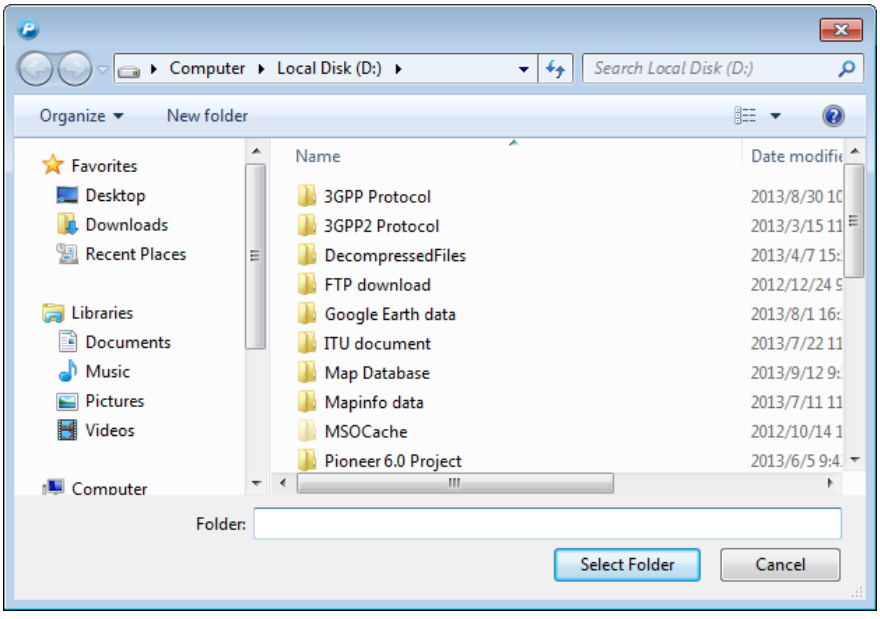
2. Click **Add** or **Delete** to add or delete logfiles as required.

3. Click **Template Manager** and **Settings** to perform configuration for log file export.

   - Template Manager: display the current template for export
   - Settings: set information for generating and modifying the template

4. Click **Export** after setting the template. In the dialog box that is displayed, set the path for saving the logfiles. Users do not need to set the file name as the file name is automatically generated.

   Figure 2-2 Save storage path



5. Click **Select Folder** to begin exporting the logfiles. After the logfiles are exported, the

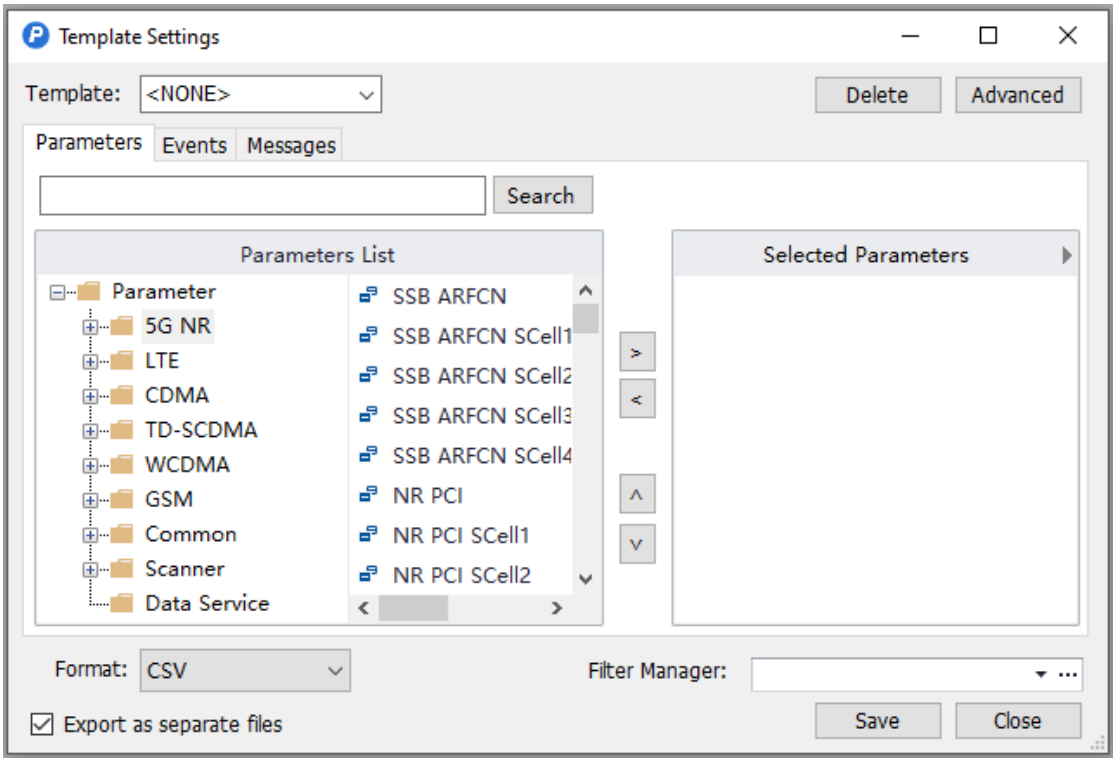
software returns back to the Export Logfile window. Users may conduct further operation or exit the window.

Users may select the parameters, events, signalling messages other information and contents to be exported in the corresponding tab and click **Save**.

Export data to *.nCTI, *.DTLog, *.CU, *.MDM, *.DLF and other data formats. Select the data format to be exported in the **Format** drop down arrow.

The figure below shows the **Template Settings** window:

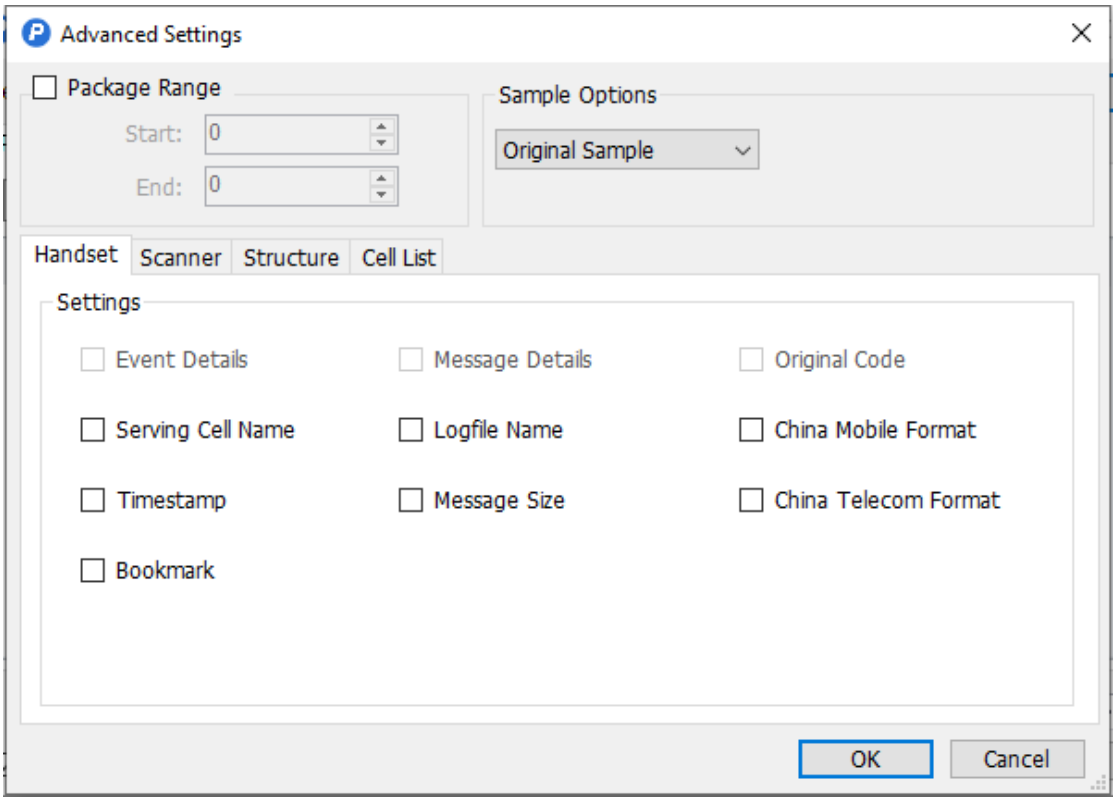
Figure 2-3 Template Settings window



The exported information may include grid information, serving cell name, message details, original code, scanner information, structure, cell list and other information.

Users may click **Advanced** to conduct further settings, e.g. **Package Range** and **Sample Options** settings.

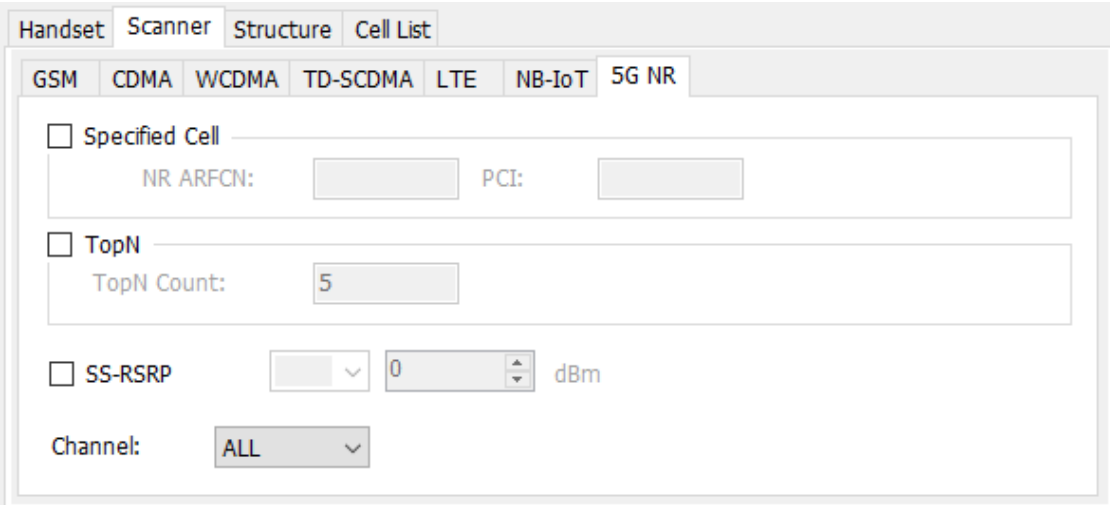
Figure 2-4 Advanced Settings



On the **Advanced Settings** page, users may

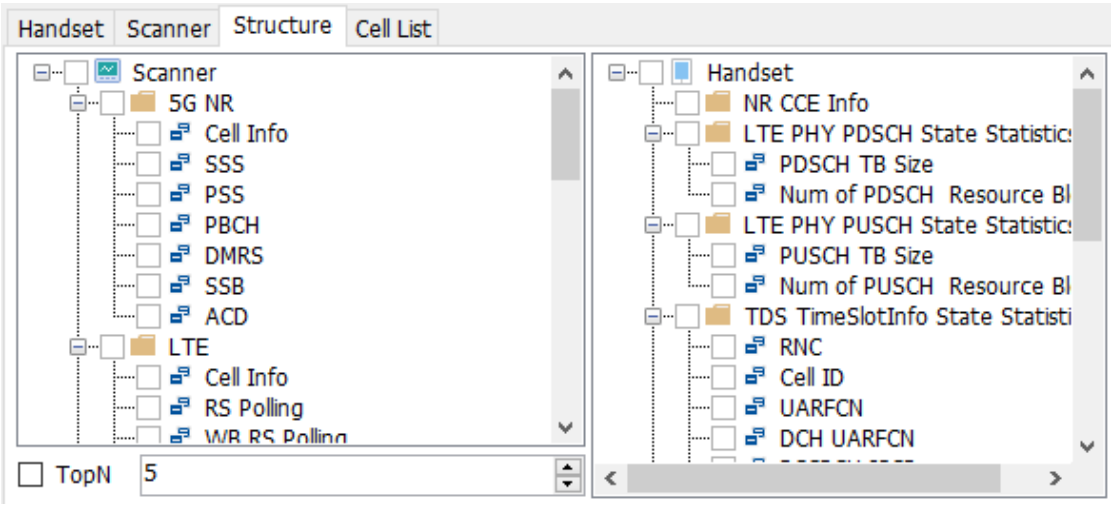
- Click **Scanner** to conduct settings for Scanner test data export.

Figure 2-5 Settings for Scanner data files export



- Click **Structure** to select data type under **Structure** to export.

Figure 2-6 Structure settings

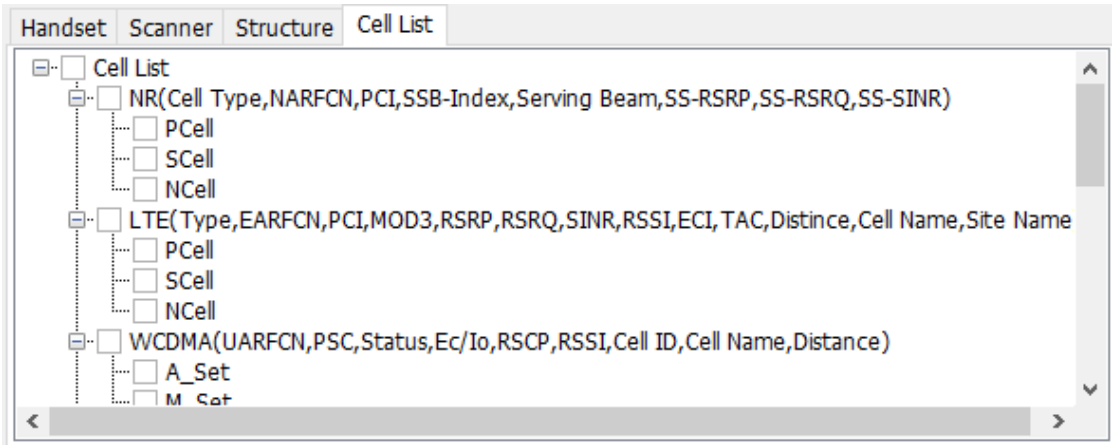


- Click **Cell List** to select the type of cells to export.

Select the type of cell (PCell, SCell or NCell) and cell information to be exported.

Export sorting TopN cells, of which sorting fields and export period may be customized.

Figure 2-7 Cell List settings

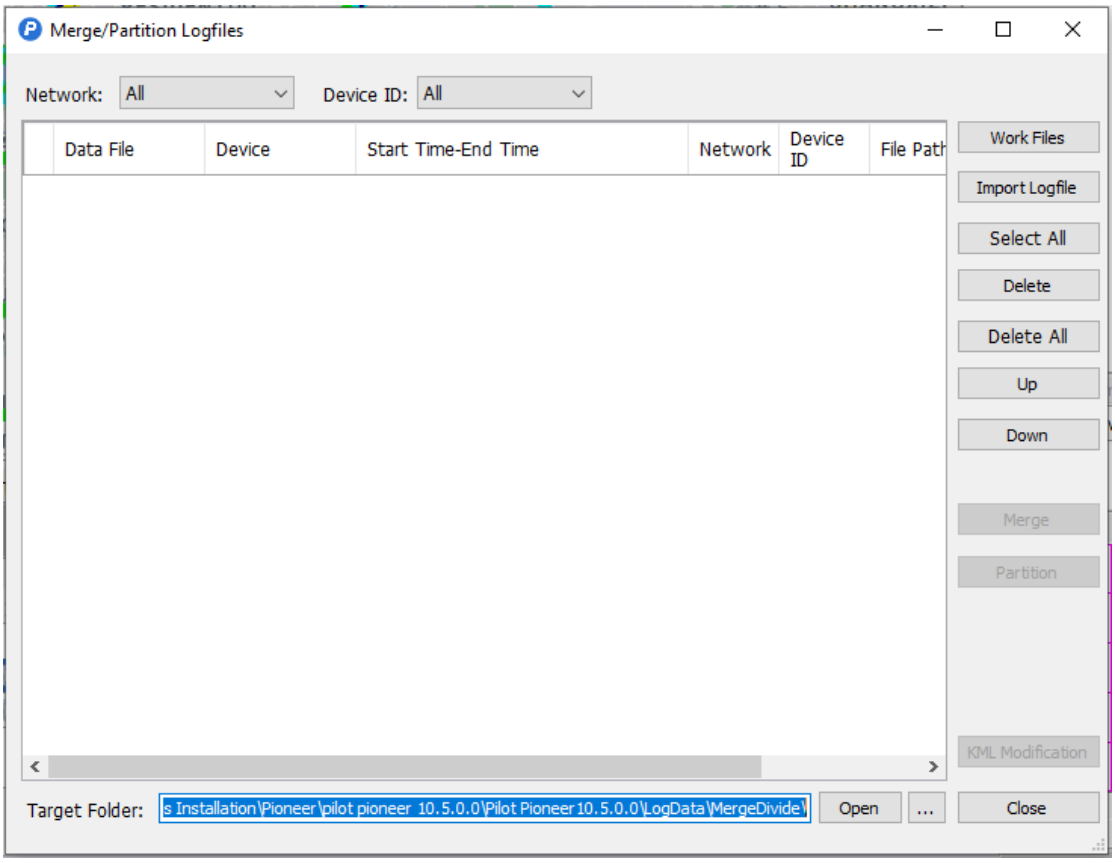


2.3 Merge/Partition Log Files

Pilot Pioneer Expert support data merging and data partition for *.rcu, *.ddib, and *.dcf data files .

Choose **Tools** > **Merge/Partition Logfiles** to enter the **Merge/ Partition Logfiles** window.

Figure 2-8 Merge/ Partition Logfiles window



2.3.1 Merge Logfiles

Pilot Pioneer Expert may merge two or more logfiles into one logfile.

To merge logfiles, do as follows:

1. Select logfiles to be merged in the **Merge/Partition Logfiles** window.
2. Select a target directory to save the merged logfile.
3. Click **Merge**.

Note: The data source must be from the same device and port.

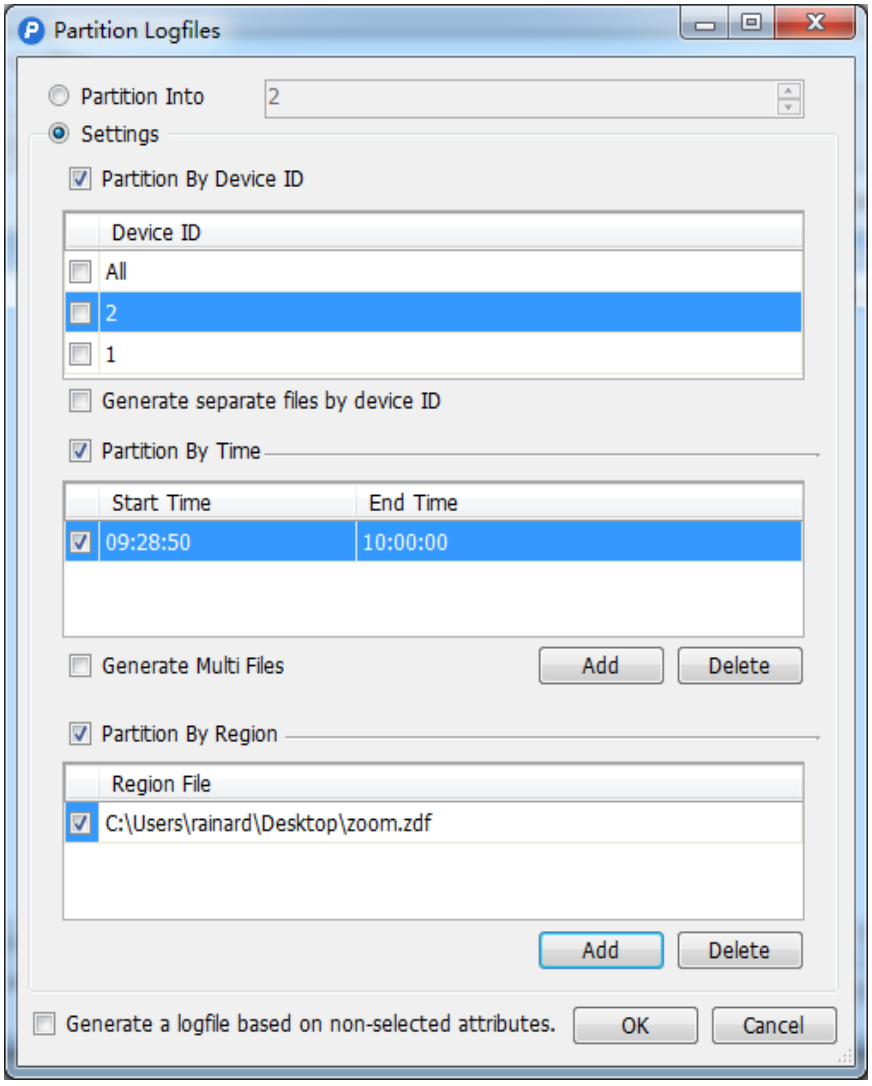
2.3.2 Partition Logfiles

Pilot Pioneer Expert may partition a logfile to several logfiles.

To partition a logfile, do as follows:

1. Select logfiles to be partitioned in the **Merge/ Partition Logfiles** window.
2. Click **Partition** to enter the **Partition Logfiles** window.

Figure 2-9 Partition logfiles window



3. Select partition conditions, which includes partition by file count, device ID, time and region.
4. Click **OK**. The partitioned files are saved in the user-defined path.

2.3.3 Re-decode Logfiles

Pilot Pioneer provides the ability to re-decode test data in case some advanced configuration options have been changed. This function is only available for *.rcu and *.dcf logfiles. If the logfiles are in *.ddib format, no re-decoding is required.

The re-decoding method is as follows.

Right click test data under **Data**>**Data List** in the navigation bar, select Redecode to re-decode the data. The status bar in the bottom right corner of Pilot Pioneer shows the progress of re-decoding. User may also press **Control** on the keyboard to select multiple test data, right click the selected test data, and select **Redecode** to re-decode multiple test data.

3 Statistics Report

Pilot Pioneer Expert provides a powerful statistics report module that supports various statistical methods and reports to meet different user's requirements. Users may directly use the predefined template to generate statistics reports, including

- 5G NR Report
- 5G NR Voice Report
- NB-IoT Reports
- KPI Statistics Reports
- Data Service Reports
- Voice Service Reports
- IoT Report
- Scanner Cell Statistics Reports
- Specialized Report
- Custom Reports
- Custom Reports Edit

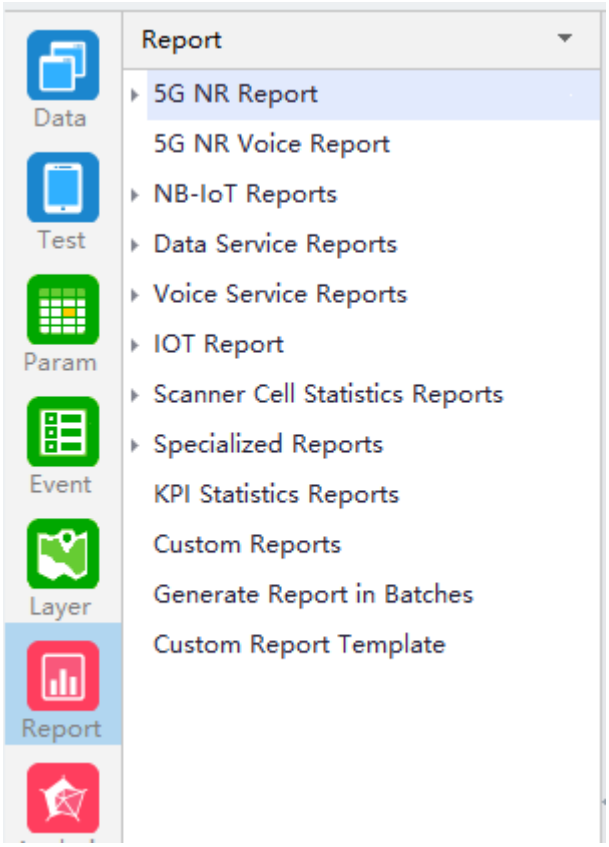
Moreover, users may customize their statistics report template and generate the statistics reports as required.

Users may click **Report** in the navigation bar to access to statistics report function.

The report navigation bar only shows some of the report templates, and users may click at the top right corner to select more report templates.

This section uses KPI Statistics Report, Custom Report, and Indoor Measurement Report to illustrate the procedure of generating a statistics report. The operation procedure is similar and application for other statistics report generation.

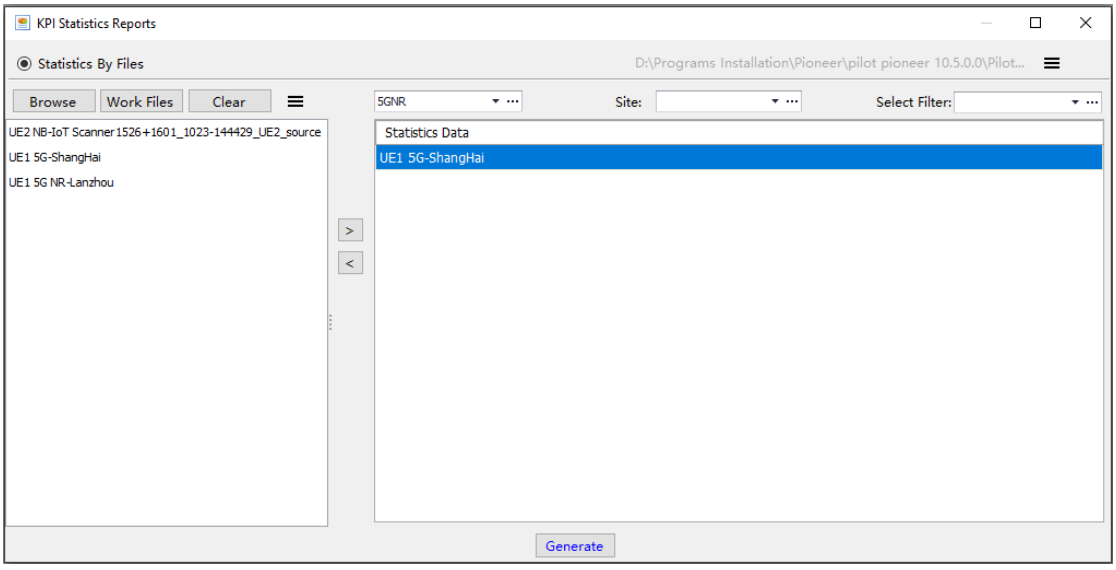
Figure 3-1 Statistics Reports



3.1 KPI Statistics Reports

The KPI Statistics Reports provides statistics results in various format, e.g. MS Excel, MS Word, MS PDF, which includes parameter information, test service, event information, message information and measurement routes.

Figure 3-2 KPI Statistics Report



Follow the instructions below:

1. Select data files as required.

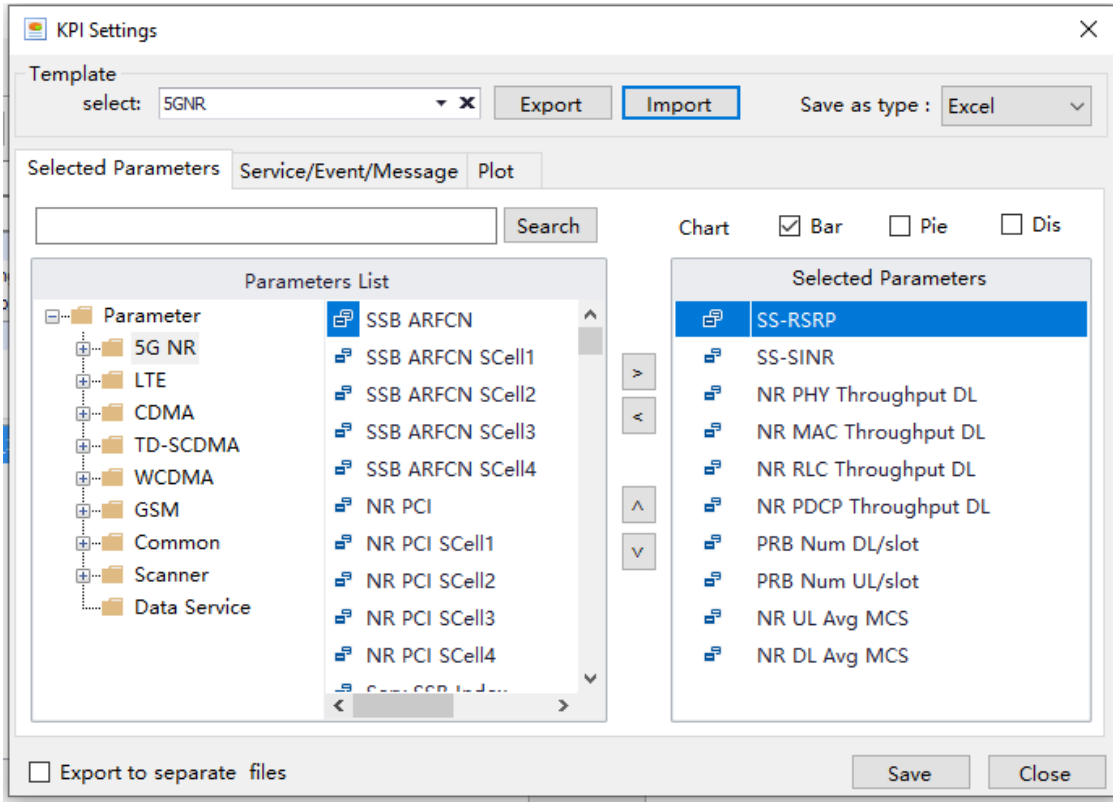
Statistics By Files: indicates that the analysis results will be generated to a log file in *.xls format.

- Click **Browse** to load data files from the local disk, or click **Work Files** to load data files from projects to the left pane.
- Click **Clear** to remove all data files loaded to the left pane.
- Click > to add data files from the left pane to the right pane for statistics report generation, or click < to move the data files from the right pane to the left pane.

2. After adding data files to the right pane, select a statistic report, and click the ... icon beside **Select** to enter the template management page.

   Users may set the template name, select parameters, and events for statistics, and then click **Save** to save the settings. See the figure below:

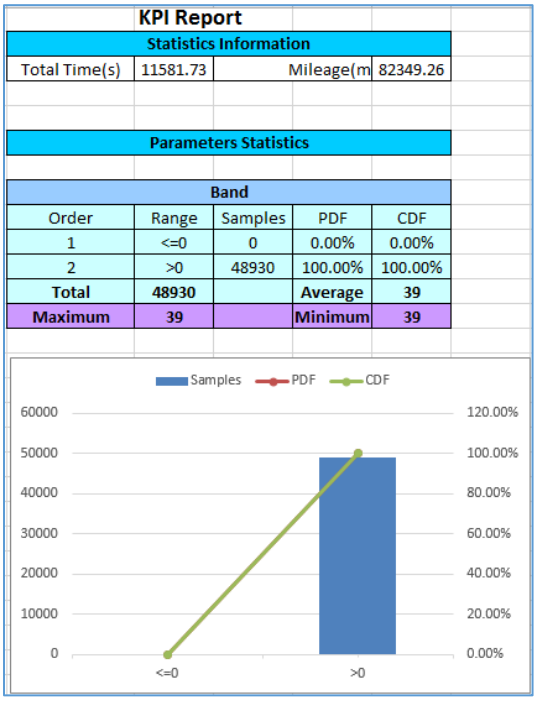
   Figure 3-3 Template management page



3. After adding data files and selecting a statistics template, click **Generate** to generate a corresponding KPI Statistics Report.

   The generation progress bar will be displayed at the bottom right corner, and the report will be automatically opened after successful generation.

Figure 3-4 KPI Statistics Report



KPI Report

Statistics Information			
Total Time(s)	11581.73	Mileage(m	82349.26

Parameters Statistics				
Band				
Order	Range	Samples	PDF	CDF
1	<=0	0	0.00%	0.00%
2	>0	48930	100.00%	100.00%
Total	48930		Average	39
Maximum	39		Minimum	39

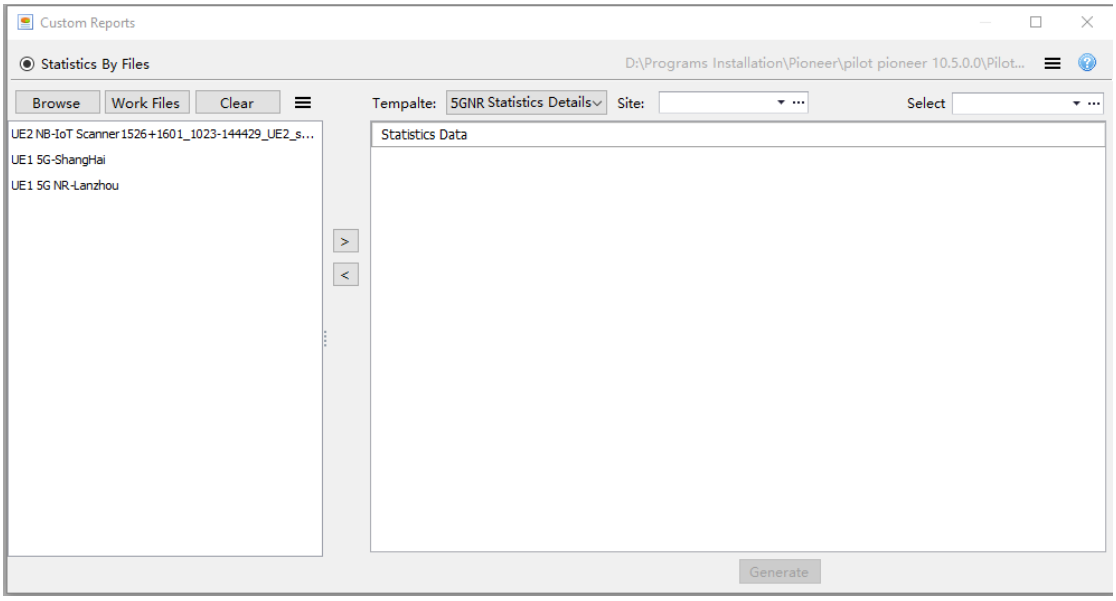
3.2 Custom Report/Pre-defined Report

Pilot Pioneer can use predefined reports for statistics, such as 5G NR Report, 5G NR Voice Report, etc., or it can use custom reports for statistics. The operation procedure is almost the same, but the custom reports have an additional step of selecting a template from drop-down arrow. The following is an example of a custom report.

Custom Report is used to generate a customized report based on the customized report template.

1. Choose **Report** > **Custom Reports** to enter the settings page.
2. Add data files and set information as required by referring to the description in KPI Statistics Reprots, click the drop-down arrow beside **Template** to select a report template, and click **Generate** to generate a corresponding report.

Figure 3-5 Custom report settings page

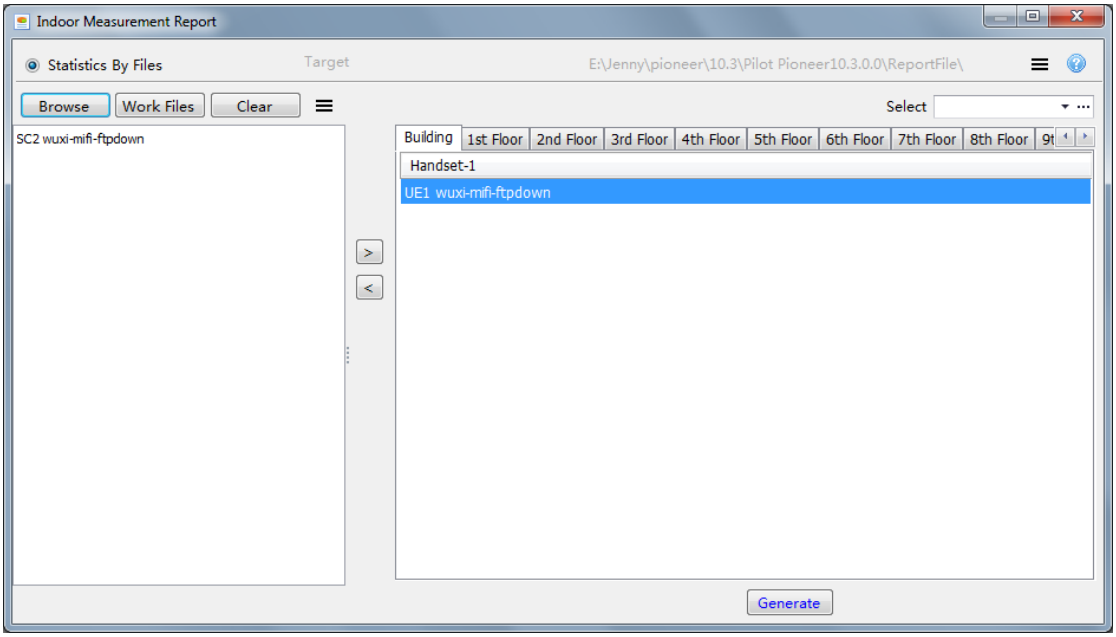


3.3 Indoor Measurement Report

Indoor Measurement Report is dedicated for indoor tests.

Choose **Report** > **Specialized Reports > Indoor Measurement Report** to enter its settings window. See the figure below:

Figure 3-6 Indoor Measurement Report settings page

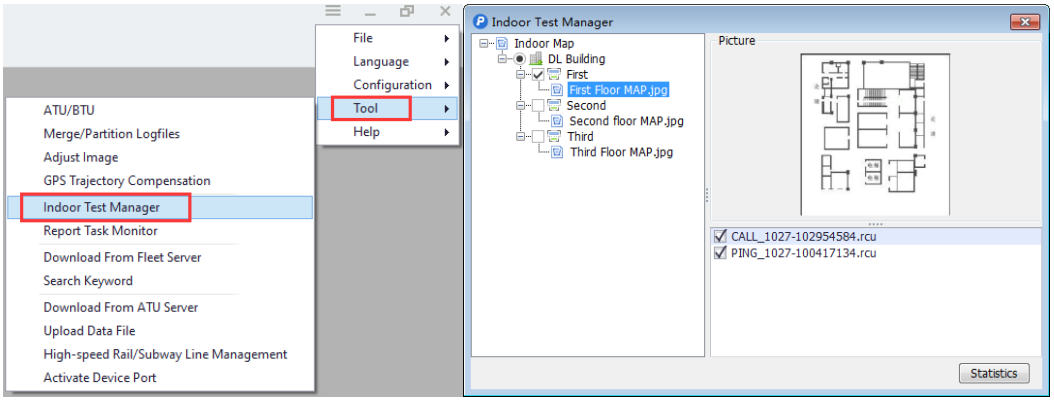


The operation procedure is similar to that of KPI Statistics Report and Custom Report. Users may refer to the description in the KPI Statistics Report to generate an Indoor Measurement Report.

For Indoor Measurement Report, users may also click the icon on the right upper corner,

choose **Tool** > **Indoor Test Manager** to enter the **Indoor Test Manager** page, where users may configure the settings and generate a corresponding report. In addition, users may add building, floor, and data files here, and conduct floor configuration for the statistics report.

Figure 3-7 Indoor Test Manager

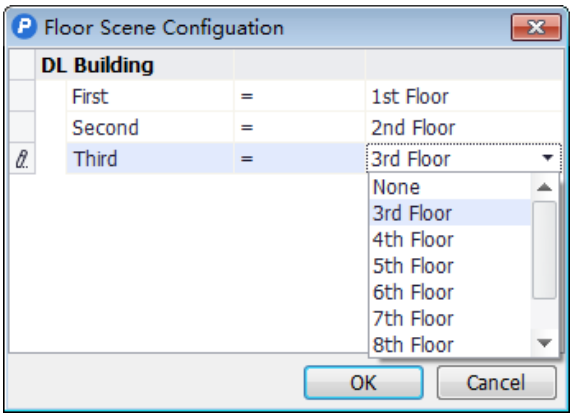


On this page, users may:

1. Add buildings and floors
   - Right click **Indoor Map** and select **Direct Import** to import the files for buildings or floors from the local PC, or select **Add Building** to add a building file.
   - Right click **Indoor Map** and select **Refresh** to automatically load the existing building or floor files in the **\LogData\Indoor** path to the left pane. The added building and floor files are saved as a folder in the installation path of Pilot Pioneer Expert (**\LogData\Indoor**).
   - Right click a building and select **Add Floor** to add floor files.
   - Right click a floor and select **Add Map** to add map files.
   - Right click a building or floor and select **Delete** to delete the buidling or floor and corresponding folder in the **\LogData\Indoor** path.
2. Select a floor to display the corresponding floor map and data files on the left pane.

   The floor map and corresponding data files must be placed in the same folder. Pilot Pioneer Expert will automatically match the map with the data files.
3. Select only one building, one or multiple floors and logfiles to generate corresponding reports.
4. Click **Statistics** to display the floor settings window, where users may perform configuration if the floor name in the report is different from that specified by users in the added building and floors.

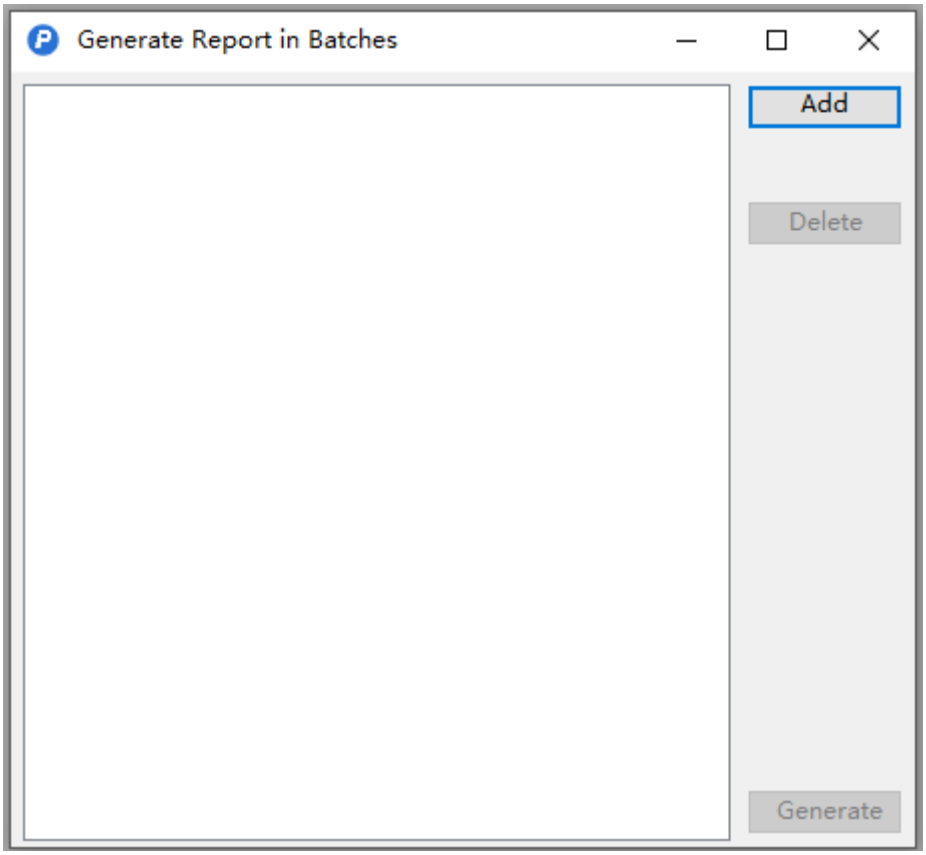
Figure 3-8 Floor information settings window



3.4 Generate Report in Batches

Click **Report>Generate Report in Batches** in the navigation pane, click + icon to open the corresponding page where users may set the report statistics conditions, and click Generate to generate the report with a single click. This is a convenient way to generate a large number of reports for projects.

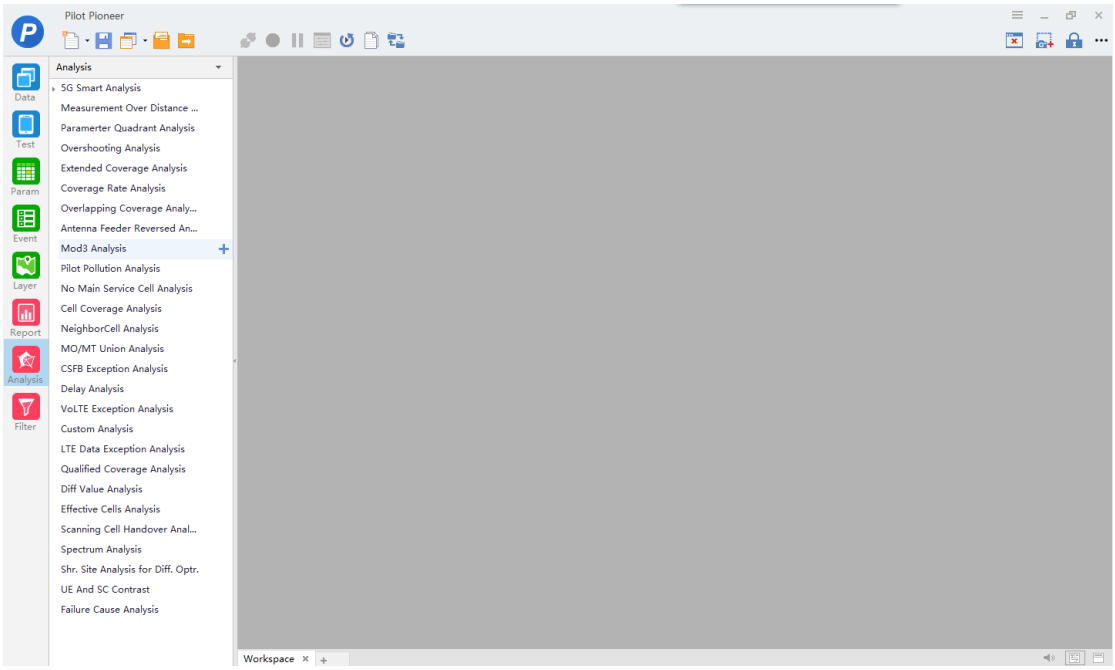
Figure 3-9 Generate report in batches



4 Analysis Functions

Pilot Pioneer Expert provides multiple analysis functions. Users may click Analysis, and double-click an analysis function, or hover the cursor over an analysis function and click the + icon that appears to enter the analysis settings page. See the figure below:

Figure 4-1 Analysis functions



The analysis results are displayed under the corresponding analysis function. Users may right click a result to

- Open the Map window to view relevant information
- Open the Table window to view relevant information
- Export the result to a specific format

This section describes the analysis operation procedure for

- Data Insight
- Coverage Rate Analysis
- Overlapping Coverage Analysis
- MOD3 Analysis
- Cell Statistics and Analysis

The operation procedure is similar and applicable to other analysis functions.

4.1 5G Smart Analysis

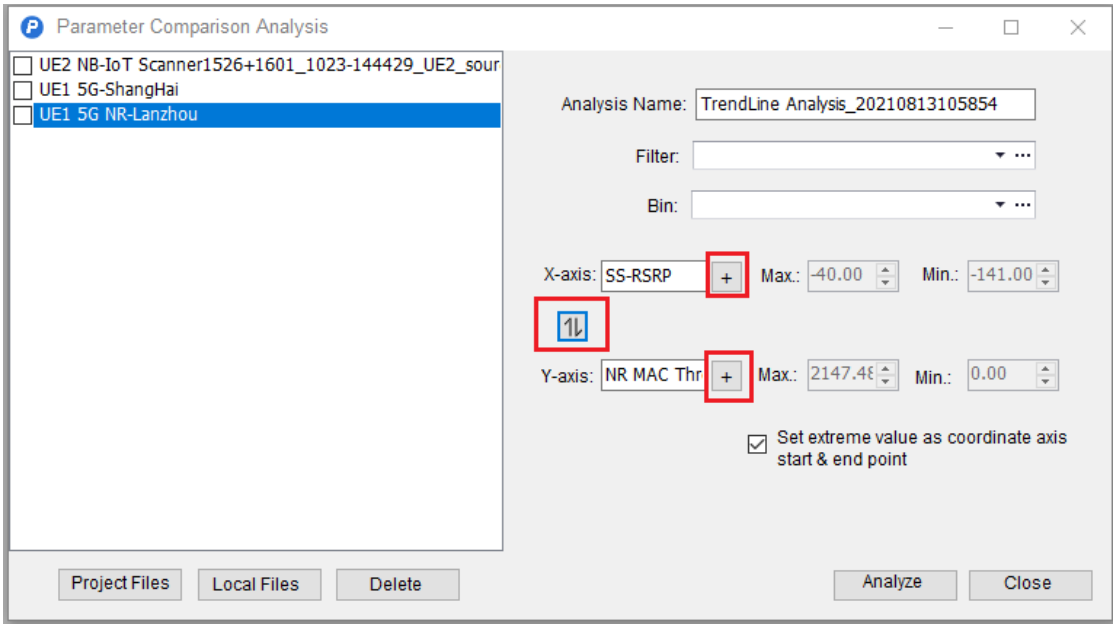
4.1.1 Parameter Comparison Analysis

The analysis for any two parameters compare the measurement trend between the selected

parameters. The closer R^2 is to 1, the better the goodness-of-fit will be.

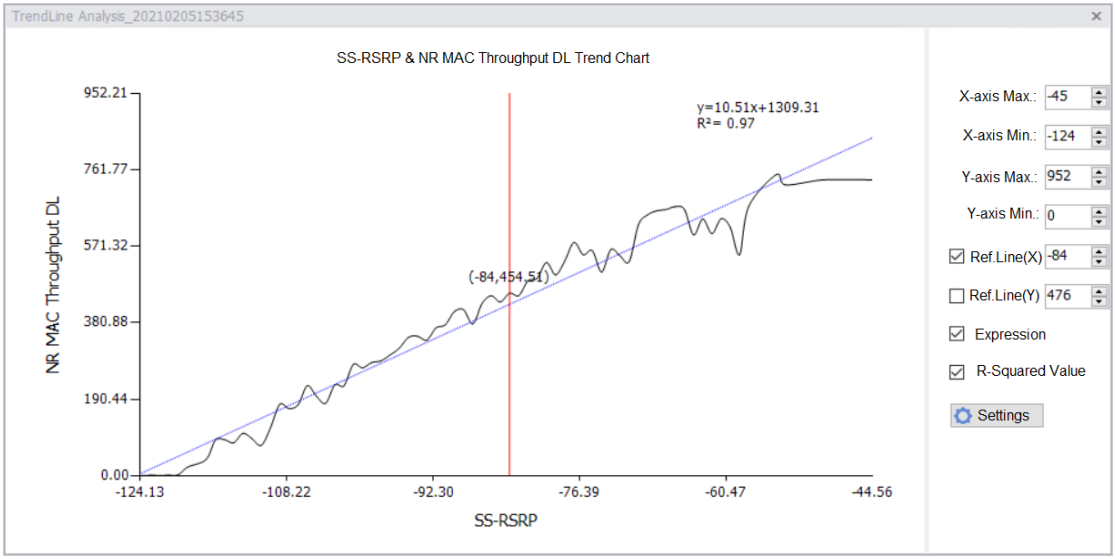
1. Click + to set the parameters for X and Y axis, or click ⇅ to switch the parameters for X and Y axis.

Figure 4-2 Parameter comparison analysis



2. The analysis results include the trend chart of the two parameters, the maximum and minimum value of X and Y axis, the correlation formula, and R-squared value.
3. Users may also select **Ref. Line (X)** and **Ref. Line (Y)** to display the X and Y value of a dedicated position.

Figure 4-3 Analysis results



4.1.2 TopN Cell Statistics and Analysis

TopN cell statistics and analysis are based on some KPIs threshold settings, and the corresponding cell level (best cell-worst cell) will be displayed in table form. The KPIs that are displayed in the analysis results table can be pre-defined by the customers, which include coverage rate, parameters, events, etc.

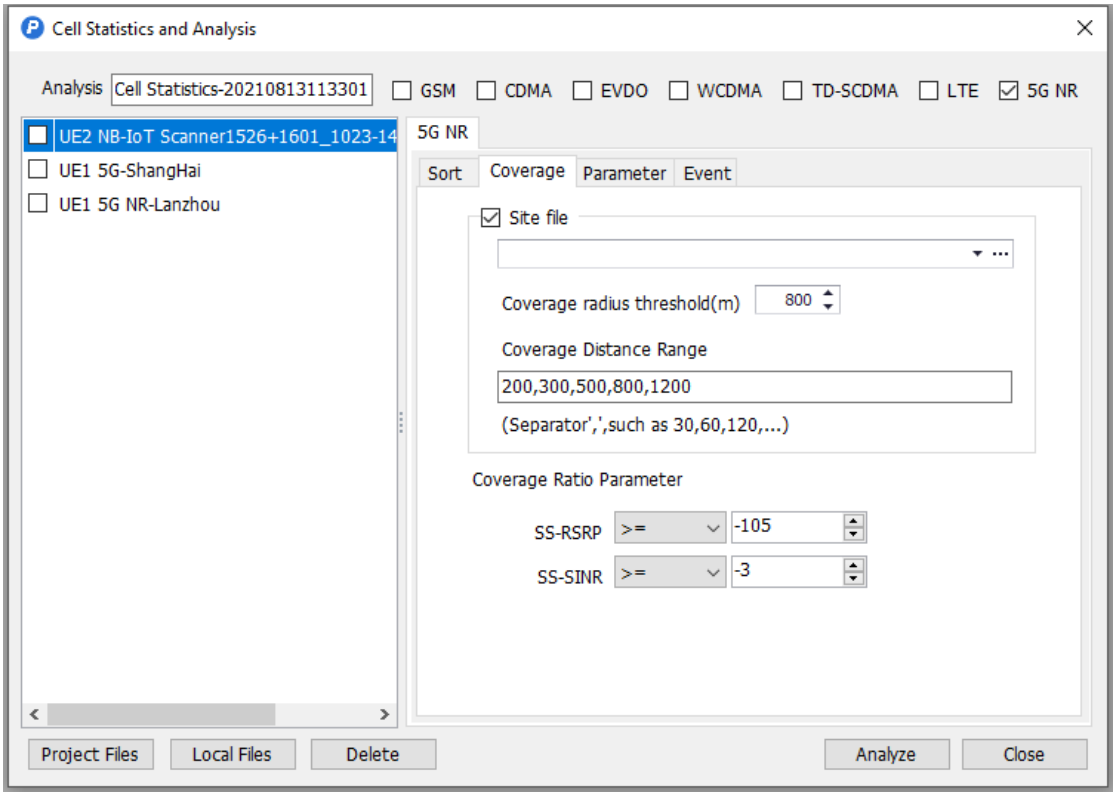
Please follow the operation below:

1. Select the network technology to enter the corresponding page where users may set the conditions respectively.
2. Customize the parameter and event information for serving cells under **Parameter** and **Event** tab.

   Customize the coverage threshold and coverage rate for the measurement samples under **Coverage** tab, and view the cell distance on the map window based on-site database.

   Customize the sorting mode of TopN cell and threshold of the qualified cell under **Sort** tab.

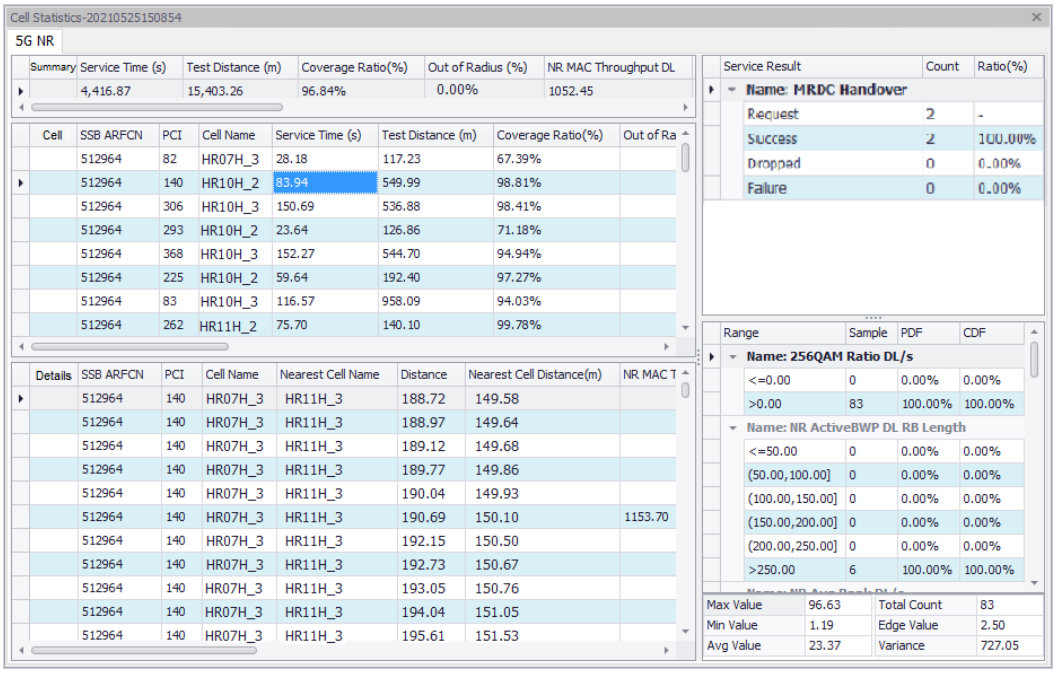
Figure 4-4 TopN cell statistics and analysis



3. The results that are displayed in the **Table** includes the total duration, total distance, total coverage rate, parameters average value and the summary information.

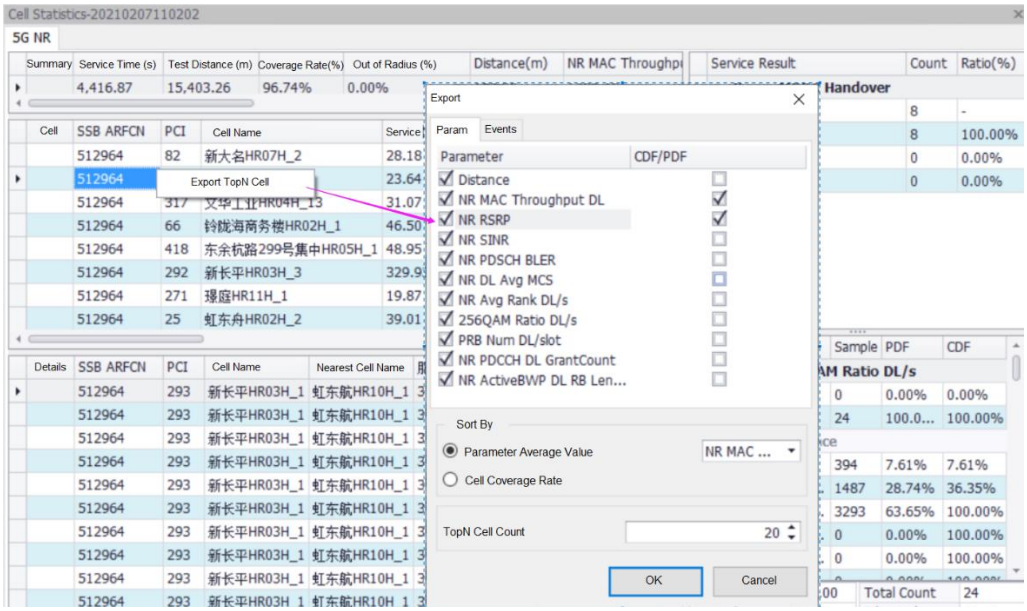
   On the top left part is the cell list information of data source, and once clicking one of the cells, the cell details information will be displayed in the bottom left part and cell parameters and events information in the right pane.

Figure 4-5 Analysis results



4. Right click a cell and select **Export TopN Cell** to enter the Export page where users may select the parameter, events cell count to be exported.

Figure 4-6 Export TopN cell



4.1.3 Data Insight

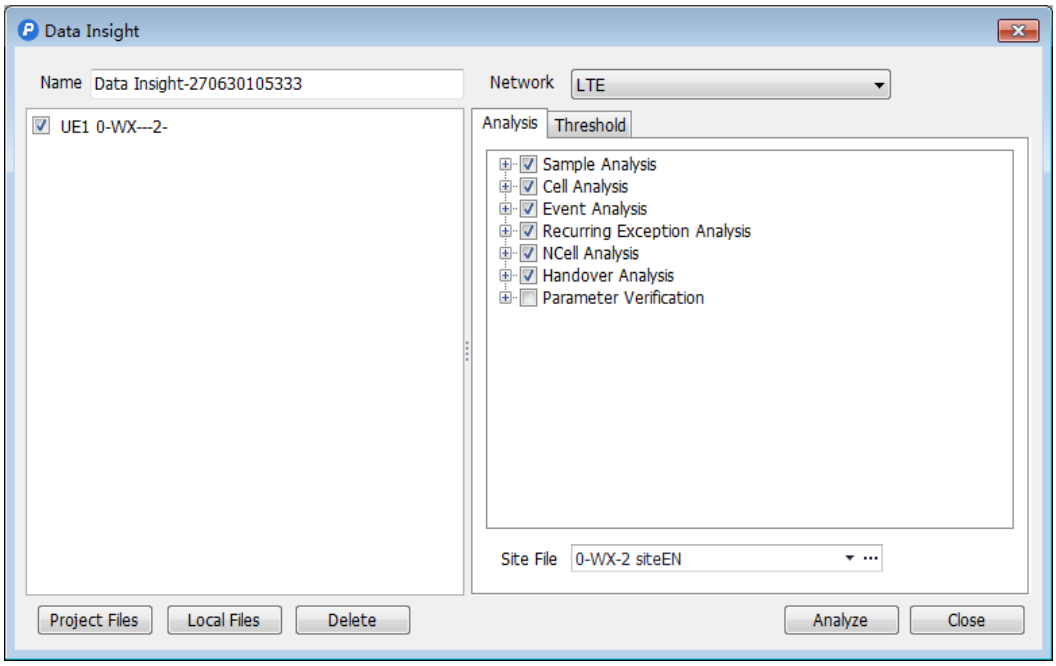
Based on collected test data and cell files, Data Insight is used to locate problems in the tested networks by analyzing sampling points, events, parameters, etc. Users may set different analysis conditions for different scenarios and filter analysis results to locate problems on cell coverage, interference, events, handover, parameters, etc.

The function supports both UE and scanner data, among which the poor coverage, extended coverage, overlapping coverage, side & back lobe coverage analysis are supported for scanner data.

Follow the instructions below to conduct corresponding analysis:

1. Double click **Data Insight** or click the corresponding icon to enter the settings page.

   Figure 4-7 Data Insight



2. Add data files.

   Users may click **Project Files** to import data files that have been imported into the software, click **Local File** to import local data files, or click **Delete** to delete selected data files that have been added into the left pane.

3. Set analysis name and **Network**. Currently, Data Insight supports only LTE and NR Radio Access Network. If the data files imported are not from LTE or NR, the data files will be unavailable for selection (greyed out).

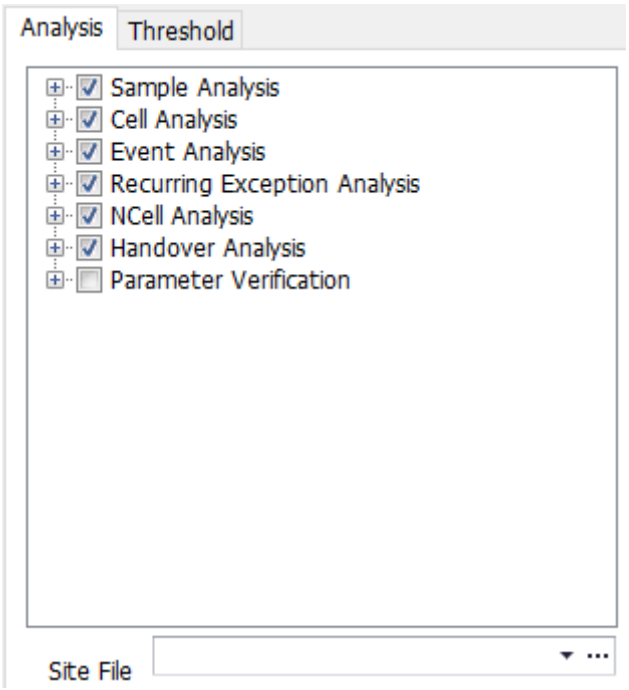
4. Select site files.

   Users may click the drop-down arrow beside **Site File** and select a site file that has been imported into the software for cell site related analysis, or click the icon to import a cell file from the local PC.

5. Select analysis types.

   Users may click the **Analysis** tab and select an analysis type (s) as required, for example, **Event Analysis**. Users may expand the analysis type to view the detailed analysis items included in the type (e.g. **FTP Event Analysis**, **CSFB Event Analysis**, **RRC Reestablishment Analysis**). See the figure below:

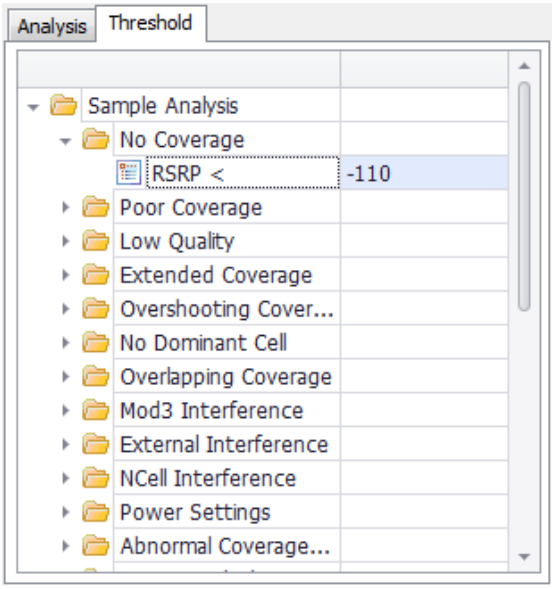
   Figure 4-8 Select analysis types



6. Set analysis threshold.

   Users may click the **Threshold** tab to set analysis conditions. Users may double-click an analysis option (e.g. No Coverage) to view the current parameter threshold or modify the threshold.

Figure 4-9 Threshold settings

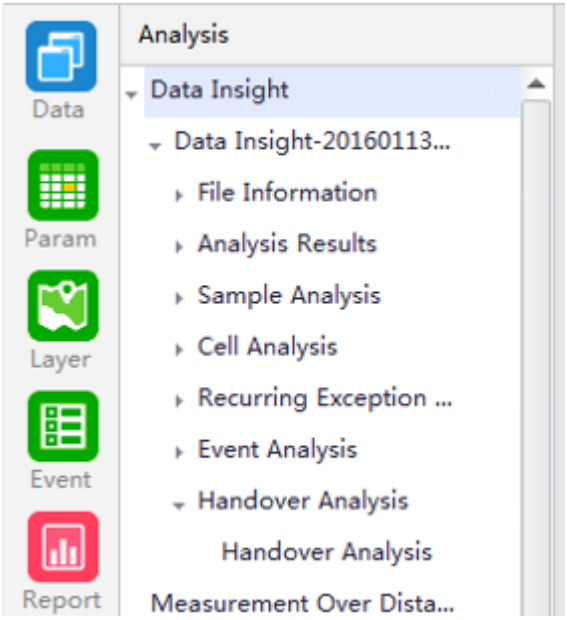


7. View analysis results.

   Click **Analyze** to generate the analysis result, which is displayed under the corresponding analysis function node.

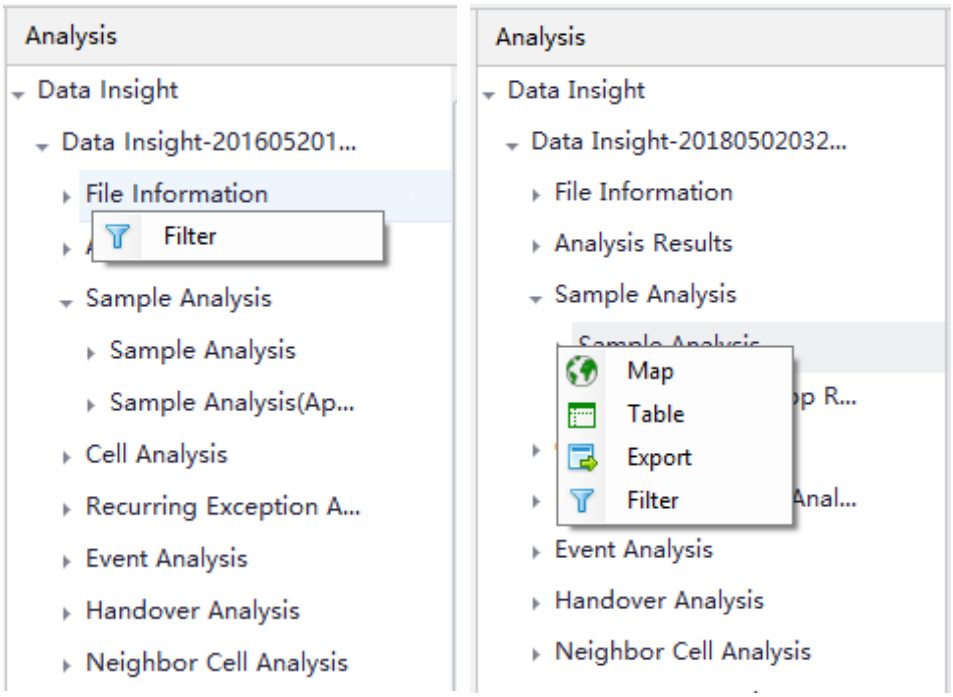
   The Table window will be open by default.

   Figure 4-10 Analysis results



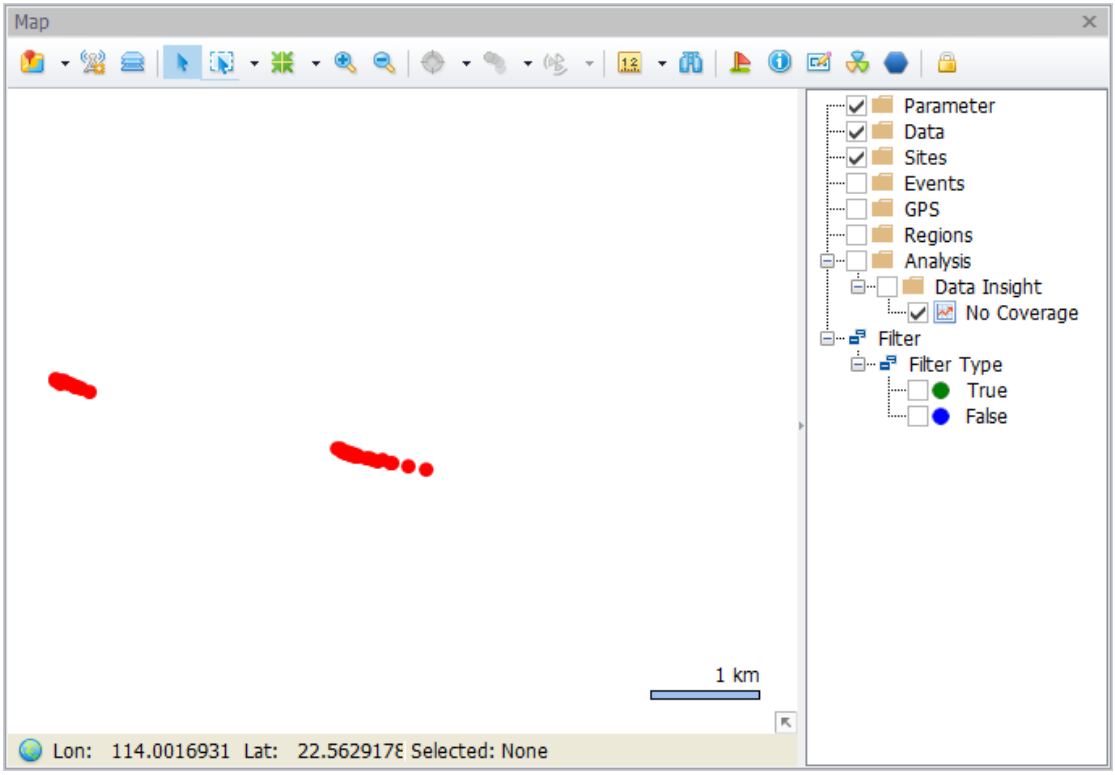
   Users may right click the analysis result and conduct relevant operation. For different analysis node, the right-click functions are different.

Figure 4-11 Right-click functions



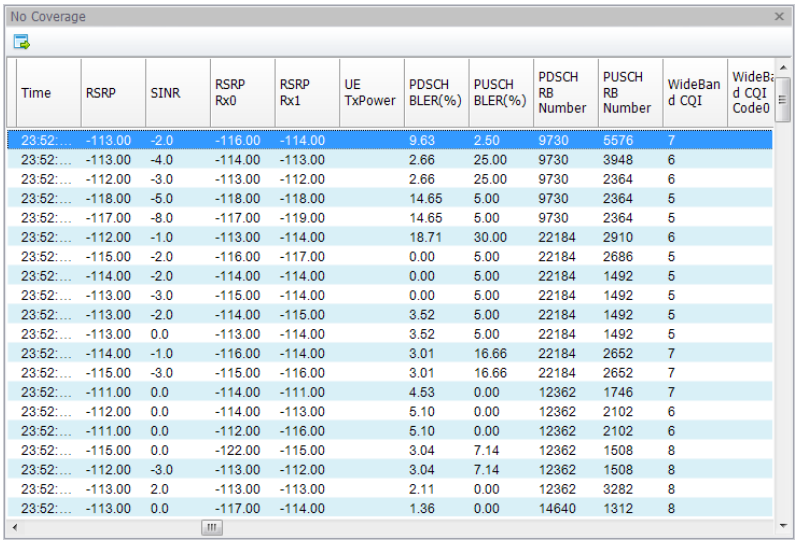
- Users may right-click a node and select **Map** to view detailed analysis information in the Map window.

Figure 4-12 Map window



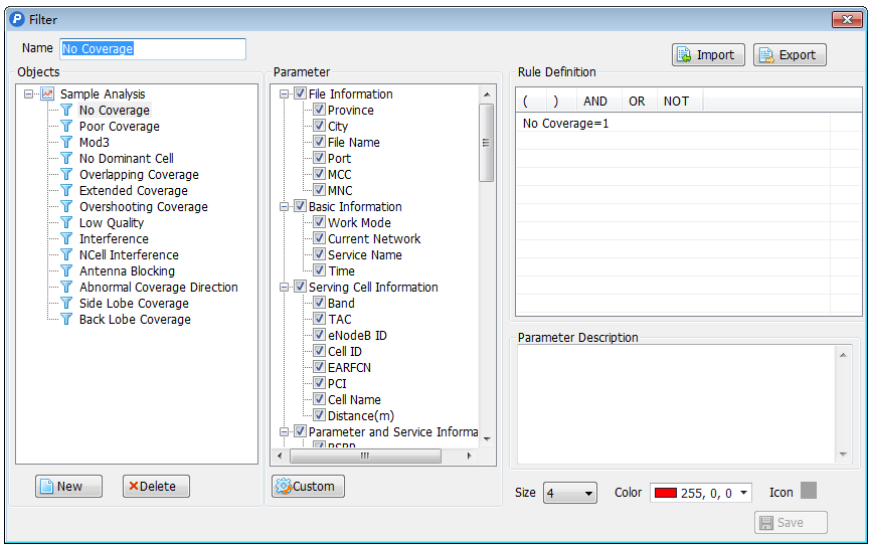
- Users may right-click a node and select **Table** to view detailed analysis information in the **Table** window.

Figure 4-13 Table window



- Users may right-click a node and select **Export** to export the analysis result to a specific path as required.
- Users may right-click a node and select **Filter** to **Filter** window, where users may view the analysis algorithm and conditions, generate new analysis results based on settings, and modify the analysis result icon as well as related icon size and color to display in the Map window.

Figure 4-14 Filter window



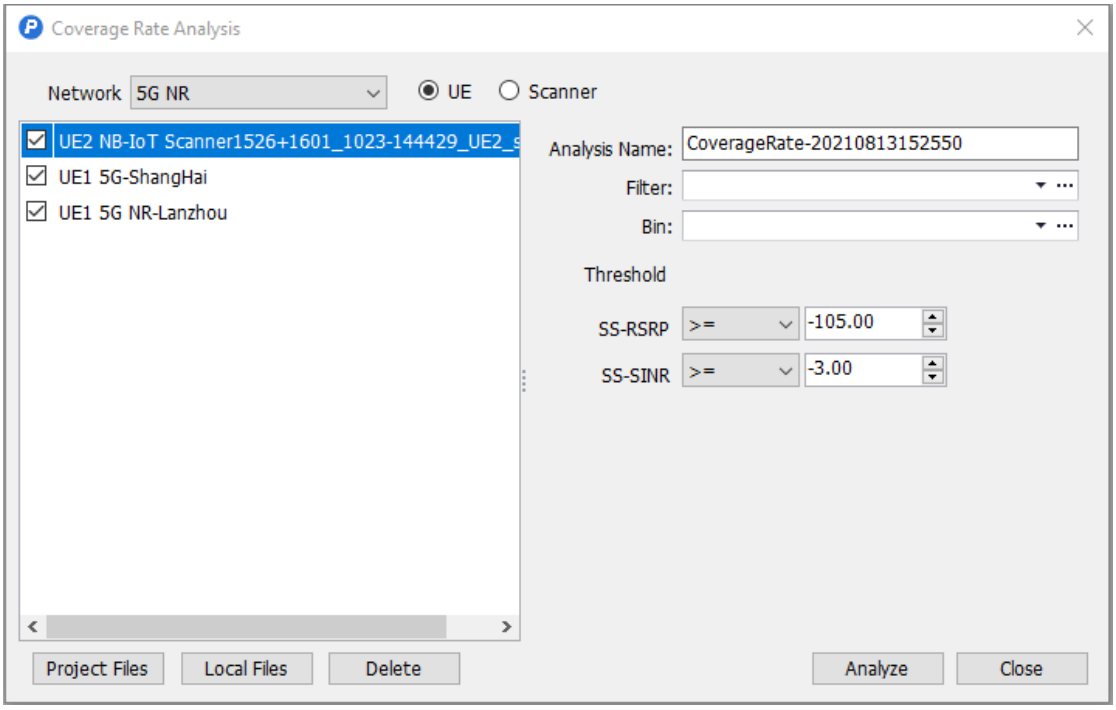
4.2 Coverage Rate Analysis

Coverage Rate Analysis is used to check the measurement samples that meet the specified coverage standard (in percentage) and the Coverage Rate of each sample.

Follow the instructions below:

1. Double click **Coverage Rate Analysis** or click the corresponding + icon to enter the settings page.

Figure 4-15 Coverage Rate Analysis settings page



2. Add data files.

   Users may click **Project Files** to import data files that have been imported into the software, click **Local Files** to import local data files, or click **Delete** to delete selected data files that have been added into the left pane.

3. Select **UE** or **Scanner** as the analysis mode, based on the actual condition. If **UE** is selected, Scanner data files in the data list will be unavailable and displayed in grey.

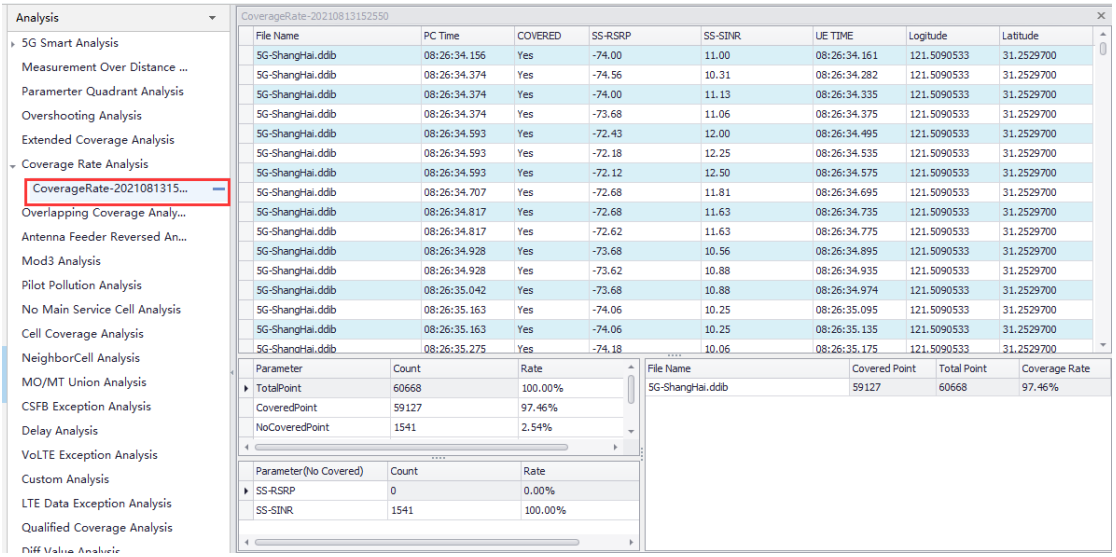
4. Set **Network**. The software will automatically set the network based on the added data files. Users may select another network type for analysis as required.

5. Set the analysis name and coverage conditions for the corresponding network technology. Users may also conduct Filter and Bin settings. For detailed operations, see section 5 and 6.

6. Click **Analyze** to generate the analysis result, which displayed under the corresponding analysis function node.

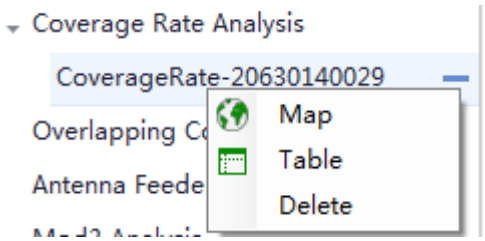
   The Table window will be open by default.

   Figure 4-16 Analysis result



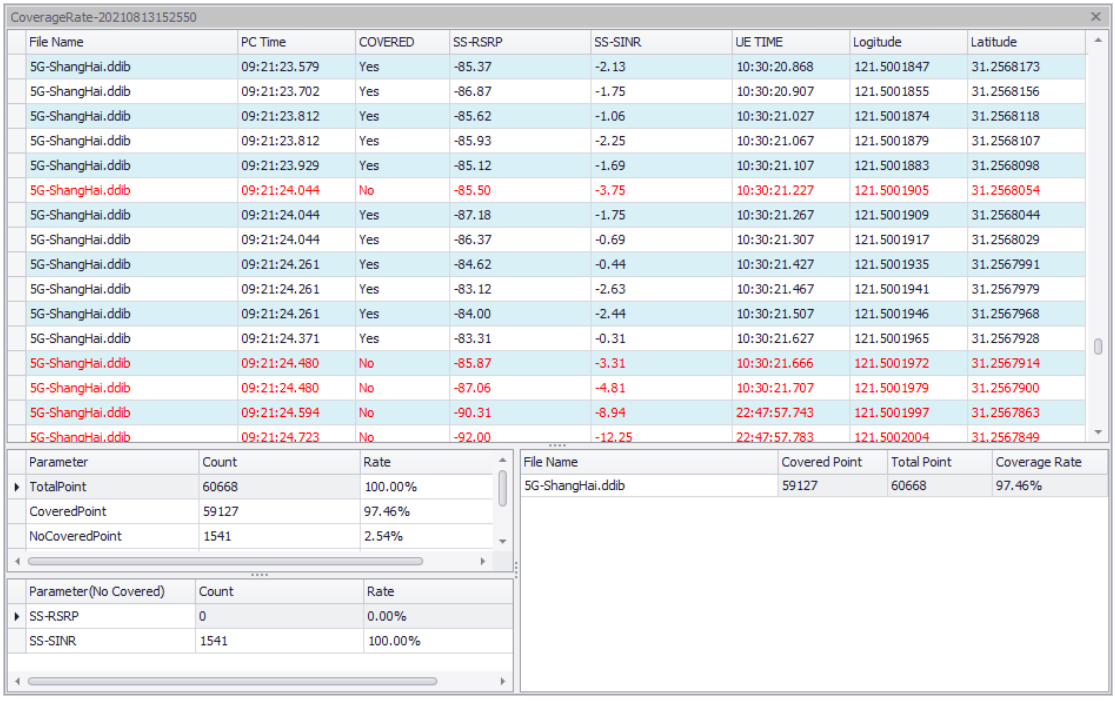
Users may right click the analysis result and conduct relevant operation.

Figure 4-17 Right-click functions



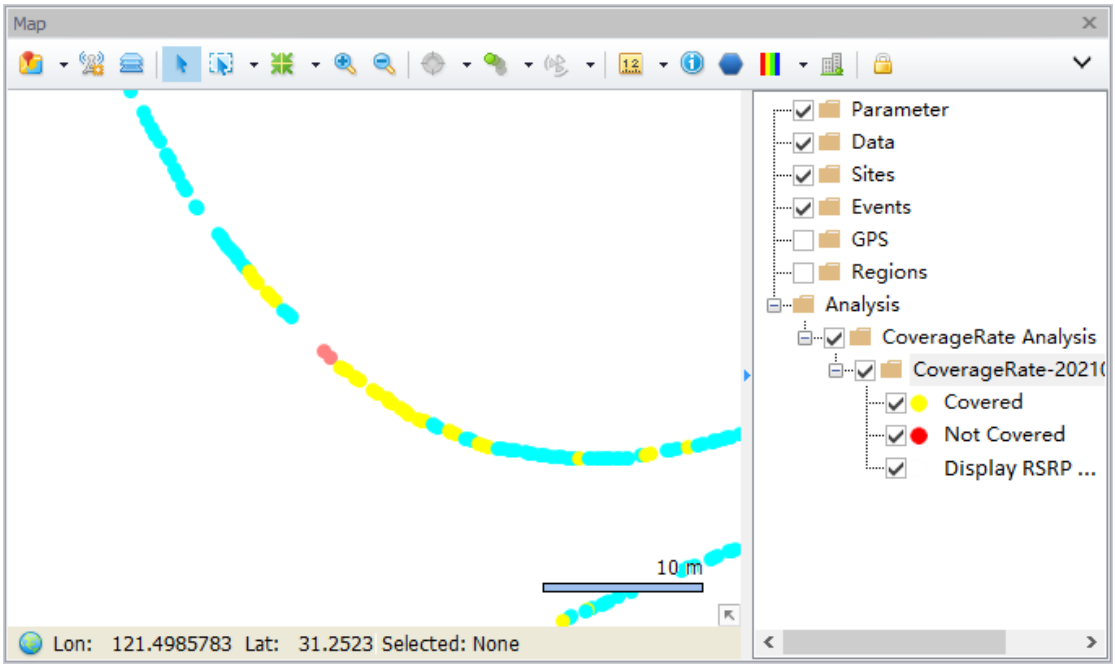
- The results that are displayed in **Table** includes the coverage results of each sample point and the summary information.

Figure 4-18 Table window



- Users may right-click to select **Map** to view detailed analysis information in the Map window.

Figure 4-19 Map window



4.3 Overlapping Coverage Analysis

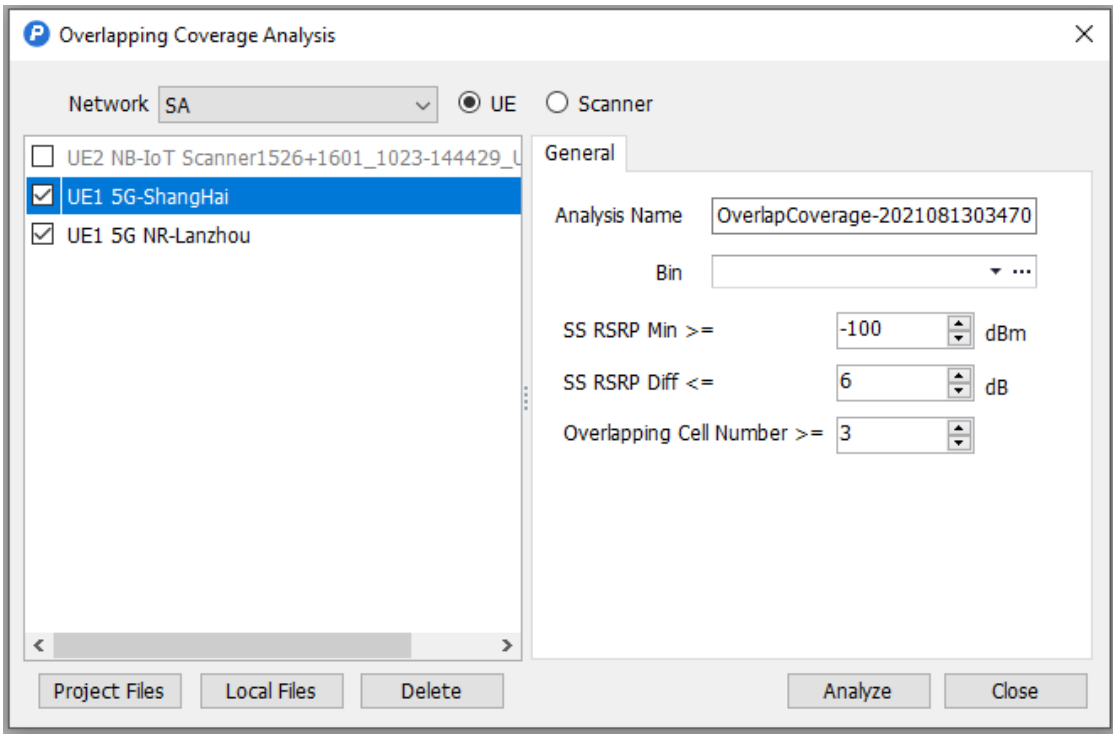
Overlapping Coverage Analysis is used to perform analysis on cells with overlapping coverage,

which may cause problems with the current servicing cell, such as low coverage signal and low network resource usage.

Follow the instructions below:

1. Double click **Overlapping Coverage Analysis** or click the corresponding icon to enter the settings page.

   Figure 4-20 Overlapping Coverage Analysis settings page



2. Add data files.

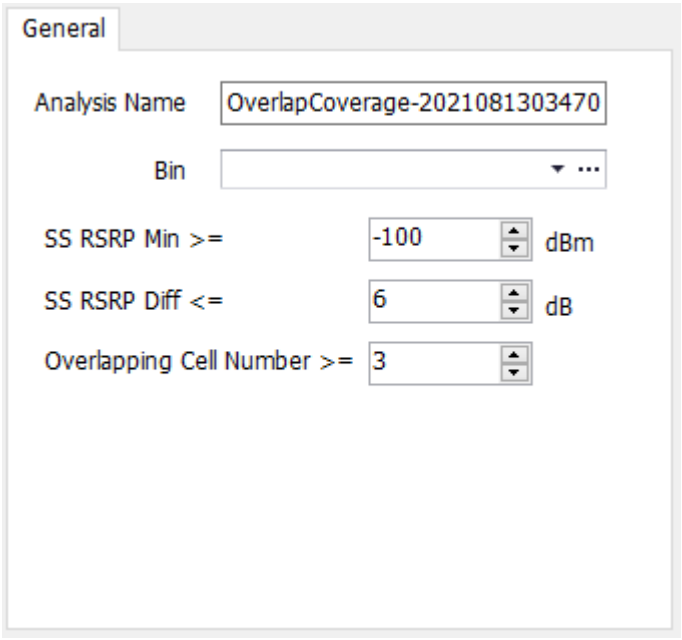
   Users may click **Project Files** to import data files that have been imported into the software, click **Local Files** to import local data files, or click **Delete** to delete selected data files that have been added into the left pane.

3. Set **Network**. The software will automatically set the network based on the added data files. Users may select another network type for analysis as required. If the data files do not correspond to the network, they are displayed in grey and unavailable for selection.

4. Select device type according to the test data, including **UE** and **Scanner**.

5. Set analysis name and parameter threshold for the analysis.

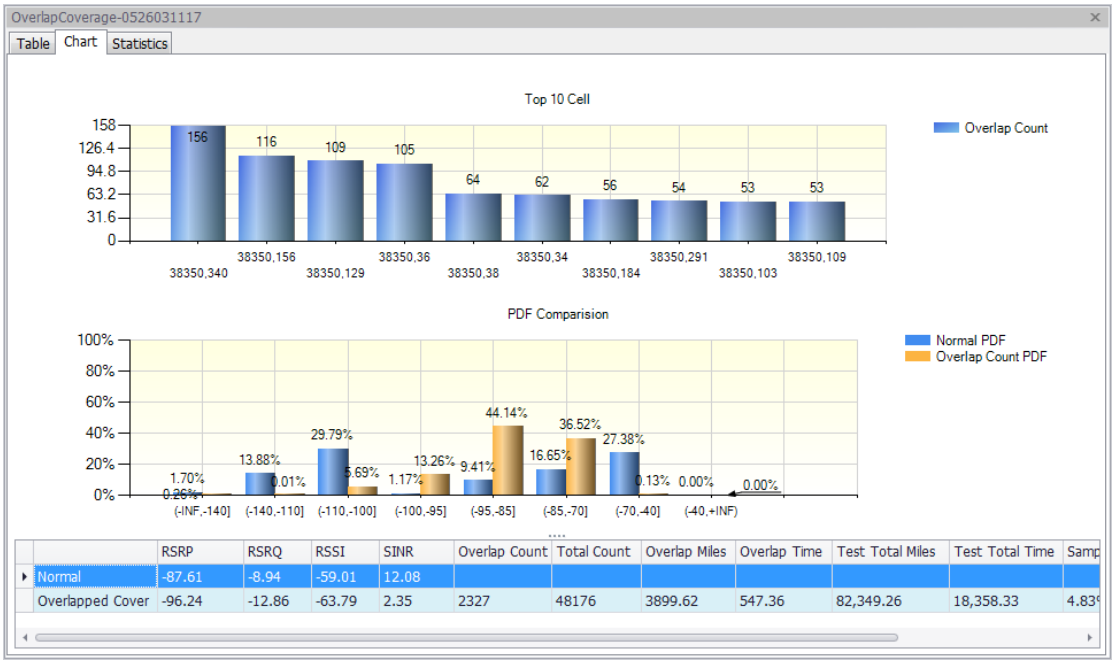
Figure 4-21 Settings under General



6. Click **Analyze** to generate the analysis result, which will be loaded under the corresponding analysis function node.

   a. The analysis result will be automatically displayed.

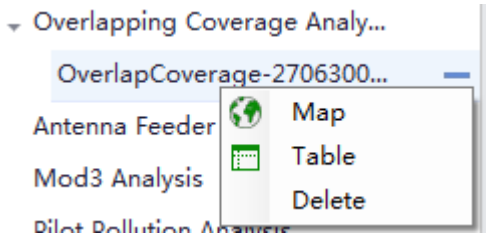
Figure 4-22 Overlapping Coverage Analysis result



   b. Users may right click the analysis result in the navigation pane and select **Map** or **Table**

to view the analysis result in the Map or Table window or select **Delete** to delete the analysis result.

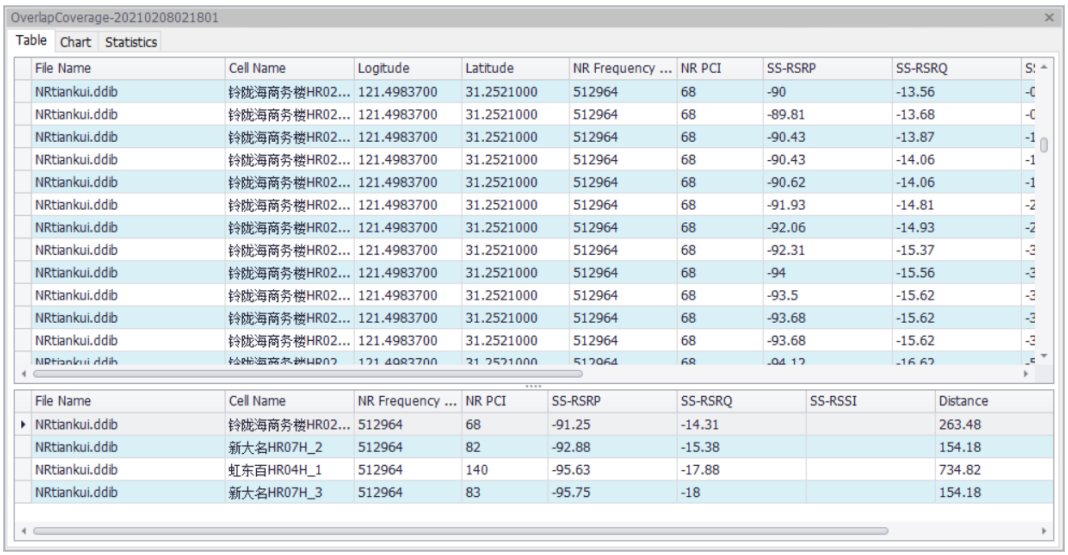
Figure 4-23 Right-click functions



c. In the Table window,

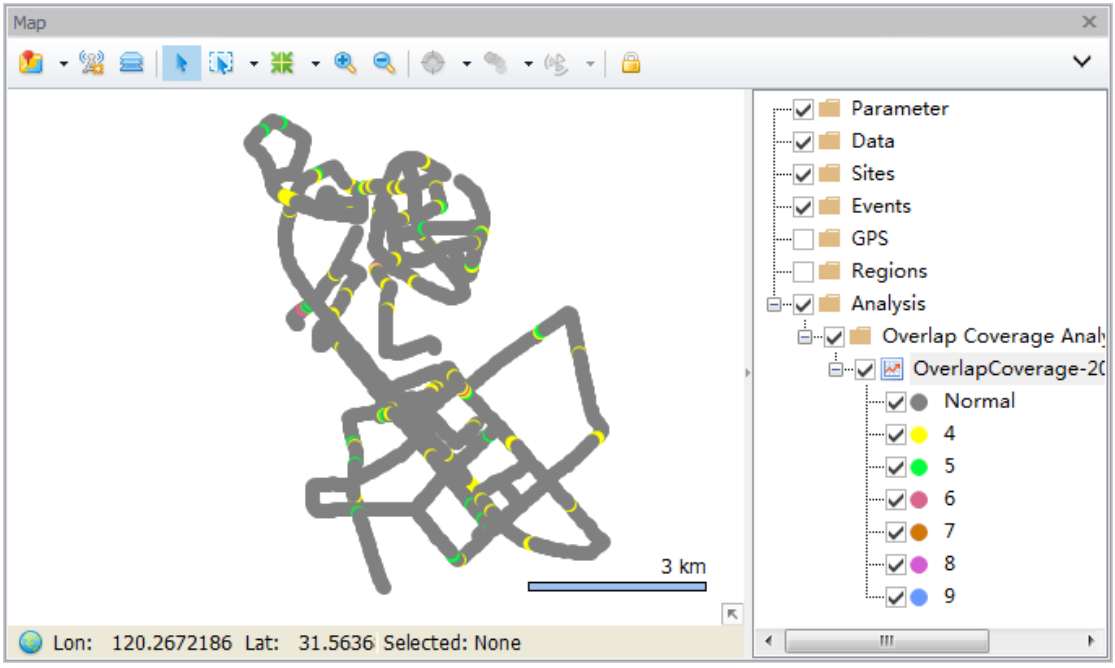
- The **Table** tab includes the samples that meet the defined conditions (at the upper part) and detailed information of overlapped cells (at the lower part).
- The **Chart** tab includes the top 10 cells by overlapping coverage sample ratio and the comparison between normal sample points and those with overlapping coverage.
- The statistics tab includes the overlapped cell statistics results.

Figure 4-24 Table window



d. In the Map window, the count of cells with overlapping coverage is displayed in the legend pane.

Figure 4-25 Map window



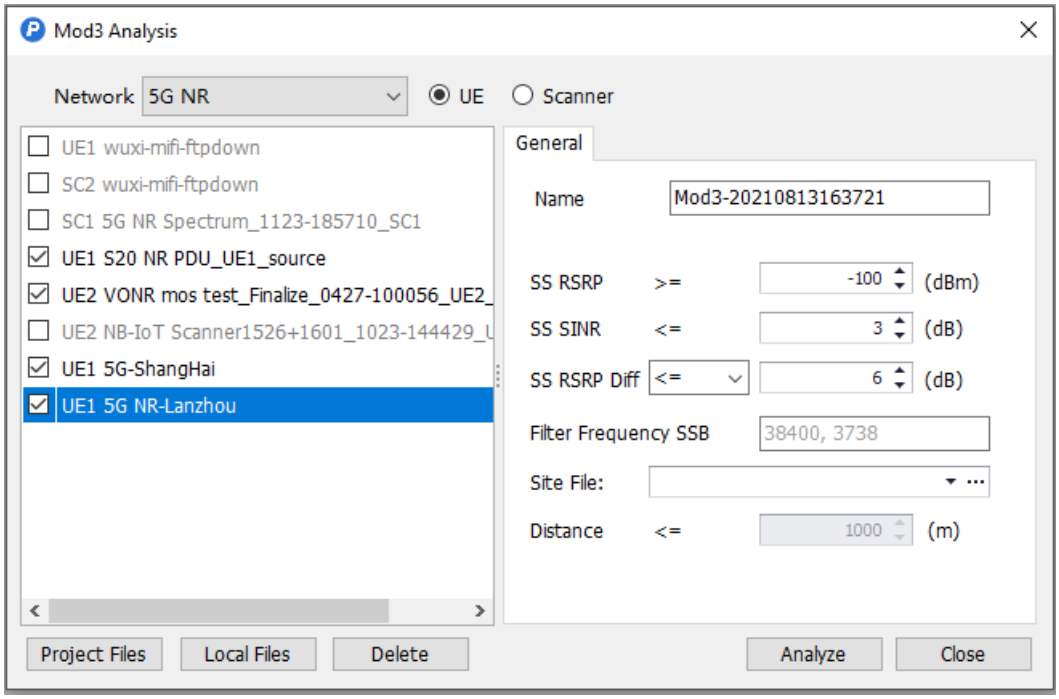
4.4 Mod3 Analysis

Mod3 Analysis is used to analyze Mod3 collision in LTE by exporting information on the measurement samples position, NR ARFCN, PCI, RSRP, RSRQ, SINR and so on.

Follow the instructions below:

1. Double click **Mod3 Analysis** or click the corresponding icon to enter the settings page.

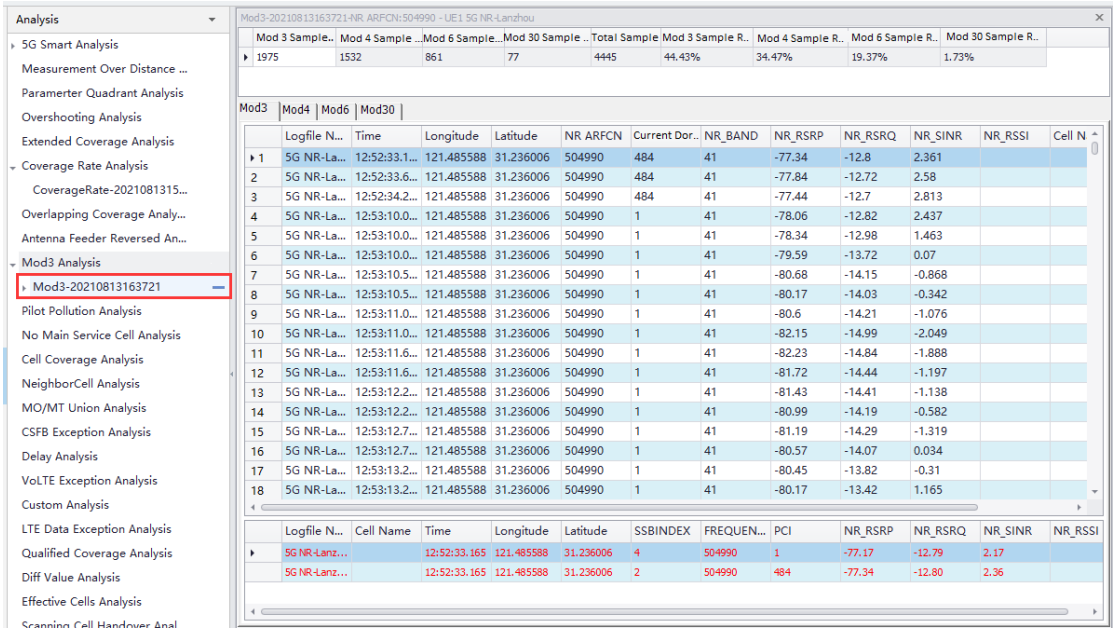
   Figure 4-26 Mod3 Analysis settings page



2. Set analysis name. The software will automatically provide a name. Users may modify it as required.
3. Add data files.

   Users may click **Project Files** to import data files that have been imported into the software, click **Local Files** to import local data files, or click **Delete** to delete selected data files that have been added into the left pane.
4. Set analysis conditions based on the parameter description below:
   - SS RSRP: Set the threshold value for SS RSRP.
   - SS SINR: Set the threshold value for SS SINR.
   - SS RSRP Diff: Set the SS RSRP difference value between the neighbor cell and the serving cell.
   - Filter Frequency SSB: Filter SSB based on the entered value. Multiple SSB values are supported with a comma separated.
   - Site File: Import a cell site database that is corresponding to the logfile.
   - Distance: Set the distance in meter according to the imported cell site database.
5. Generate and view analysis results.
   - Users may click **Analyze** to generate corresponding results, which will be loaded under the **Mod3 Analysis** function node.
   - The analysis result will be automatically displayed by channel number in a Table.

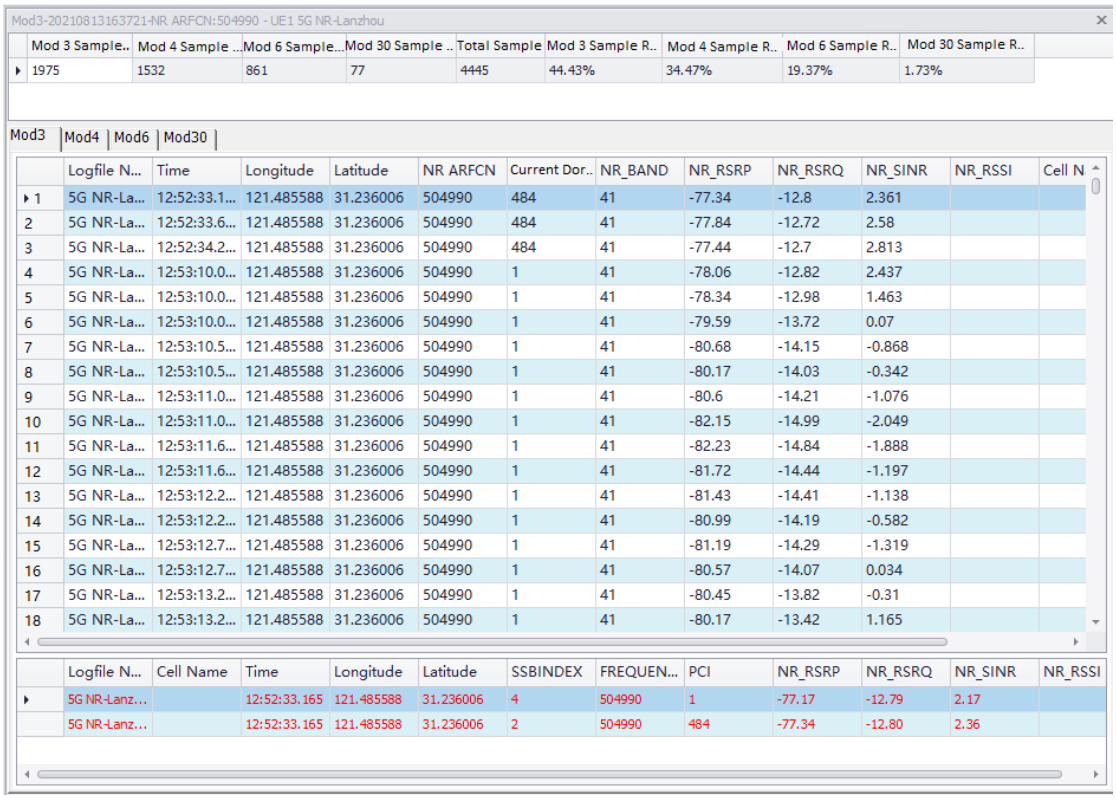
Figure 4-27 Mod3 Analysis result



- Users may right click an analysis result to conduct relevant operations.
  - ✓ Click an analysis result and select **Table** to display the Table window, which includes

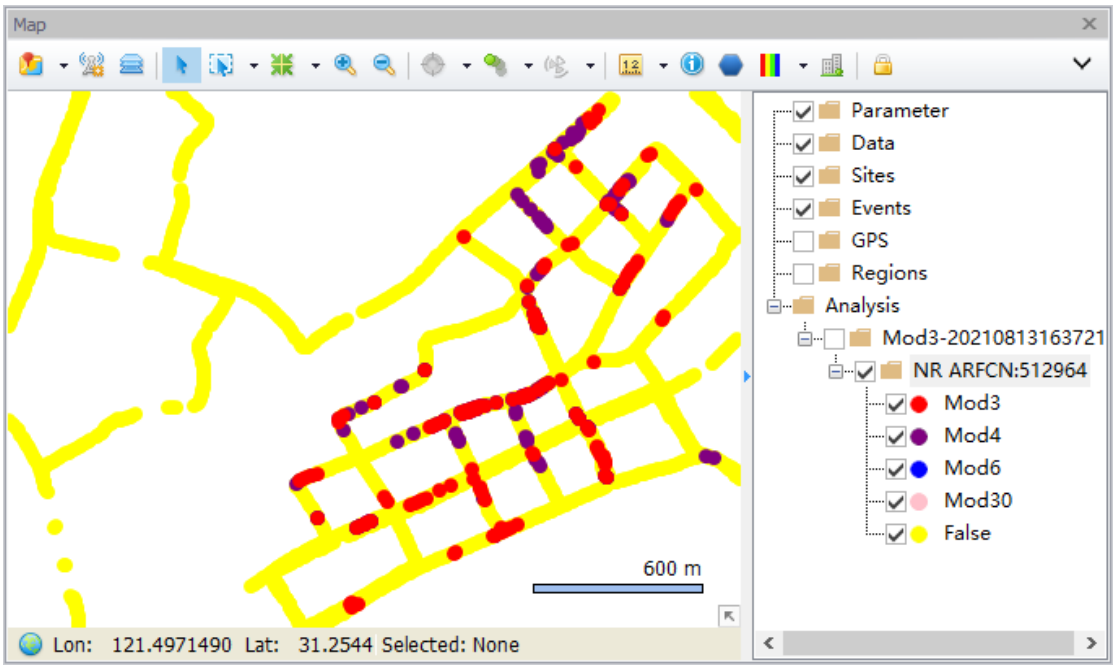
the total sample count and ratio of Mod3, Mod4, Mod6, and Mod 30 and corresponding Mod X analysis details.

Figure 4-28 Table window



✓ Users may right click the analysis result and select **Map** to display the result in the Map window. See the figure below:

Figure 4-29 Map window



4.5 Pilot Pollution Anlaysis

Based on UE or Scanner test data, Pilot Pollution Analysis is used to analyze the signal strength of serving and neighbor cells for 2G/3G/4G/5G network technologies. The function analyzes strong cells or servers that are serving within a given threshold defined by the user for identifying potential polluters. The conditions used to define Pilot Pollution are:

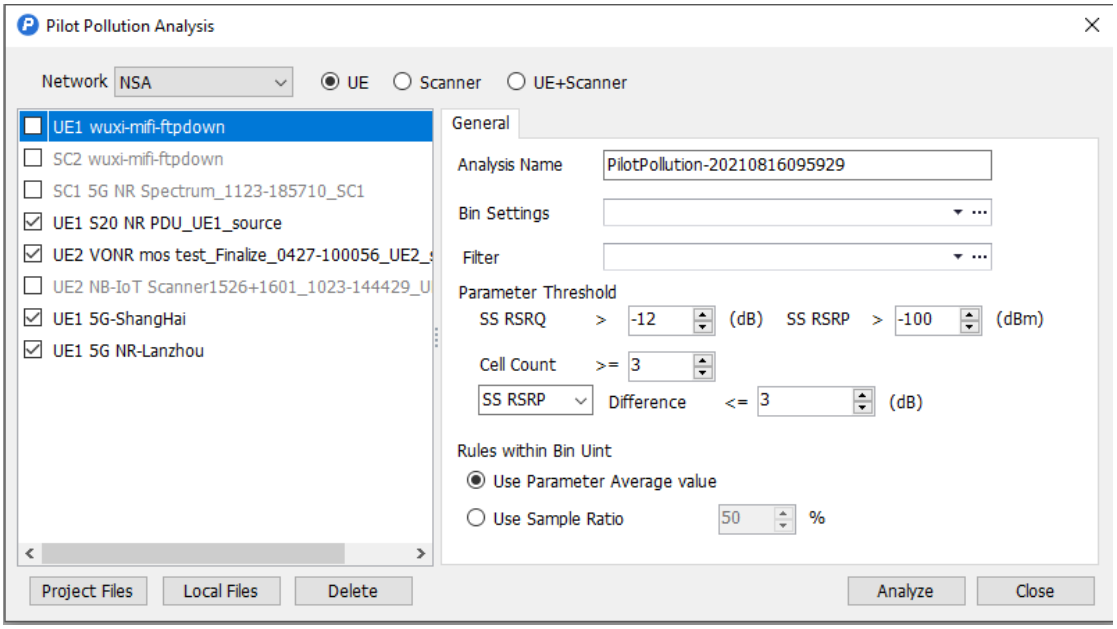
- Condition 1: The signal strength of the cells exceeds a user-defined threshold.
- Condition 2: The signal strength difference among the cells that meets Condition 1 is within a user-defined range.
- Condition 3: The count of the cells that meet Condition 2 exceeds a user-defined value.

Pilot Pioneer Expert supports Pilot Pollution analysis for all network technologies.

Follow the instructions below to perform Pilot Pollution analysis:

1. Double click **Pilot Pollution Analysis** or click the corresponding icon to enter the settings page.

   Figure 4-30 Pilot Pollution Analysis settings page



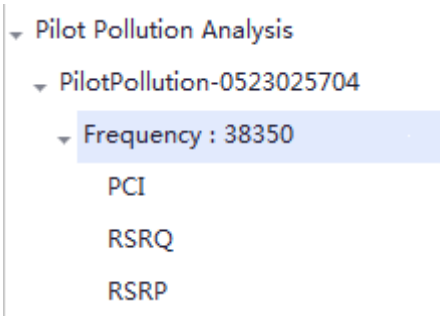
2. Add data files.

   Users may click **Project Files** to import data files that have been imported into the software, click **Local Files** to import local data files, or click **Delete** to delete selected data files that have been added into the left pane.

3. Set **Network**. The software will automatically set the network based on the added data files. Users may select another network type for analysis as required. If the data files do not correspond to the network, they are displayed in grey and unavailable for selection.
4. Select **UE**, **Scanner**, or **UE+Scanner** as the analysis mode based on the actual situation. If **UE** is selected, Scanner data files in the data list will be unavailable and displayed in grey.
5. Set analysis conditions based on the parameter description below:
   a. Analysis name: Set an analysis name.
   b. Bin Settings: Click ··· beside **Bin Settings** to enter **Bin Template** window where users may set Bin type to **Time**, **Distance**, or **Grid** as required, enter a Bin size, and select the parameter value to **Average**, **Min** or **Max**.
   c. Filter: Click ··· beside Filter and select a filtering type to filter data with multiple predefined conditions based on the parameter, time, region, state, service, cell, combination and condition range.
   d. Parameter Threshold:
      - RSRP: Set the threshold value of RSRQ.
      - SINR: Set the threshold value of RSRP.
      - Cell count: Set the cell count threshold that meets the previously defined conditions.
      - Difference: Set the difference in value between the neighbor cell and the serving cell based on the selected parameter (e.g. RSRQ.)

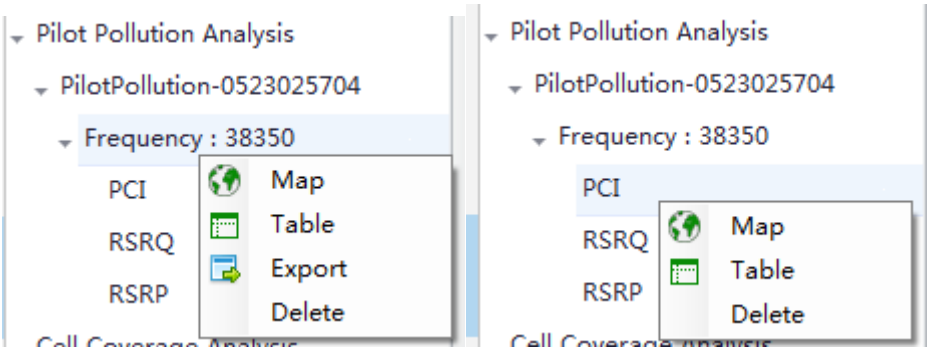
      Note: The parameters displayed under **Parameter Threshold** differ based on the selected network.
   e. Rules within Bin Unit:
      - Use Parameter Average value: use parameter average value to evaluate if pilot pollution exists in the Bin unit.
      - Use Sample Ratio: use the ratio of samples with pilot pollution to evaluate if pilot pollution exists in the Bin unit.
6. Click **Analyze** to generate the analysis results, which will be loaded under the **Pilot Pollution Analysis** function node.

Figure 4-31 Analysis result



- The analysis result will be automatically displayed in a table.
- Users may right click an analysis result and select **Map** or **Table** to view the analysis result in the Map or Table window, select **Export** to export the analysis results, or select **Delete** to delete the analysis result. For different nodes, the right-click functions may be different.

  Figure 4-32 Right click functions



- Users may right-click the **Frequency** node and select **Map** to display the information about polluted cells. Right-click a parameter under **Frequency** and select **Map** to display the values of the specific parameter. See Figure 4-32.

Figure 4-33 Polluted cells

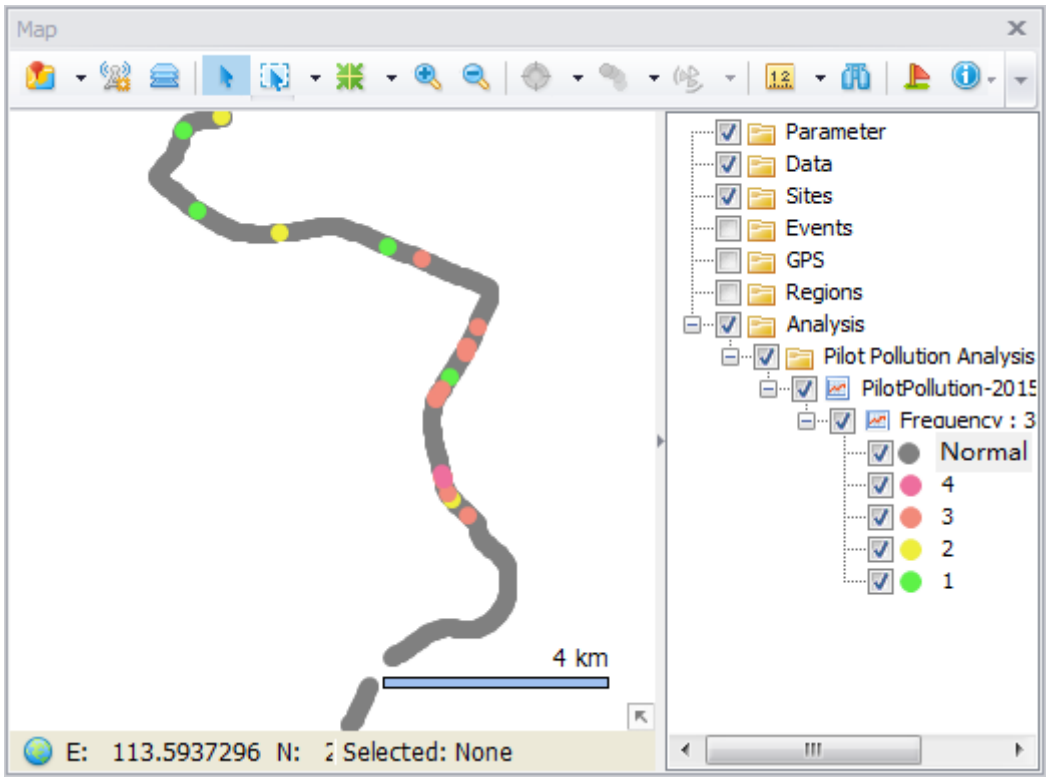
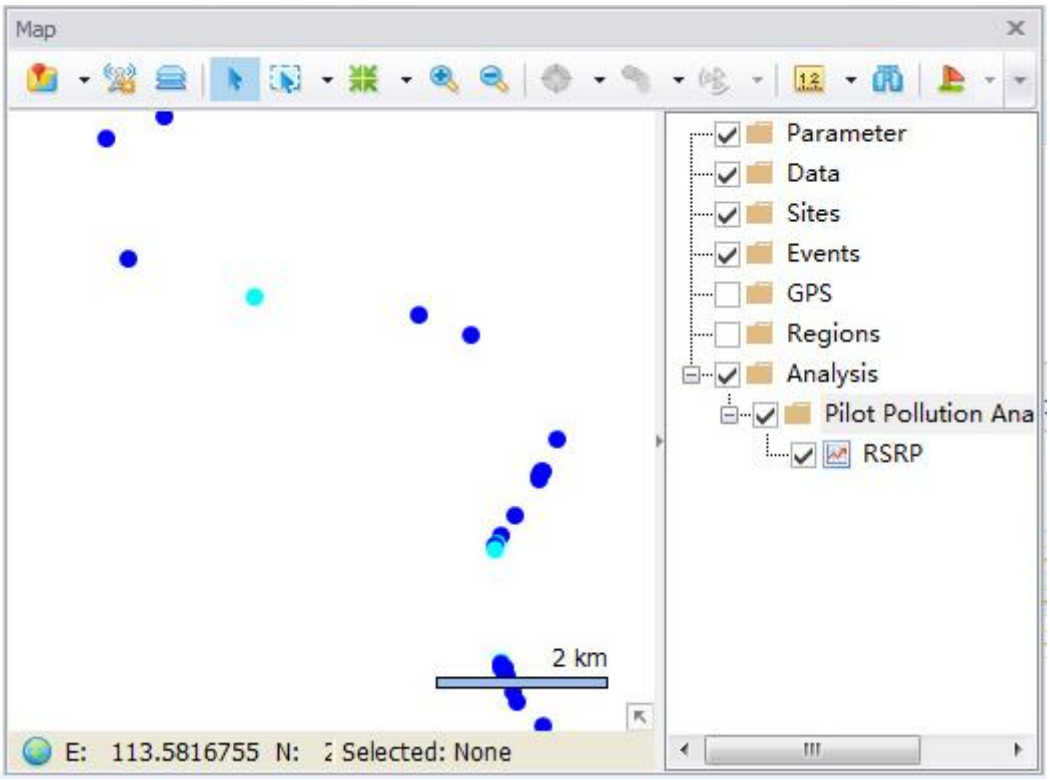


Figure 4-34 Parameter value



- Users may right-click the **Frequency** node and select **Table** to display the total pollution

rate, pilot polluted area information, and detailed information about polluted cells. Right-click a parameter under **Frequency** and select **Table** to display the average value of the specific parameter corresponding to the polluted points.

Figure 4-35 Analysis result details

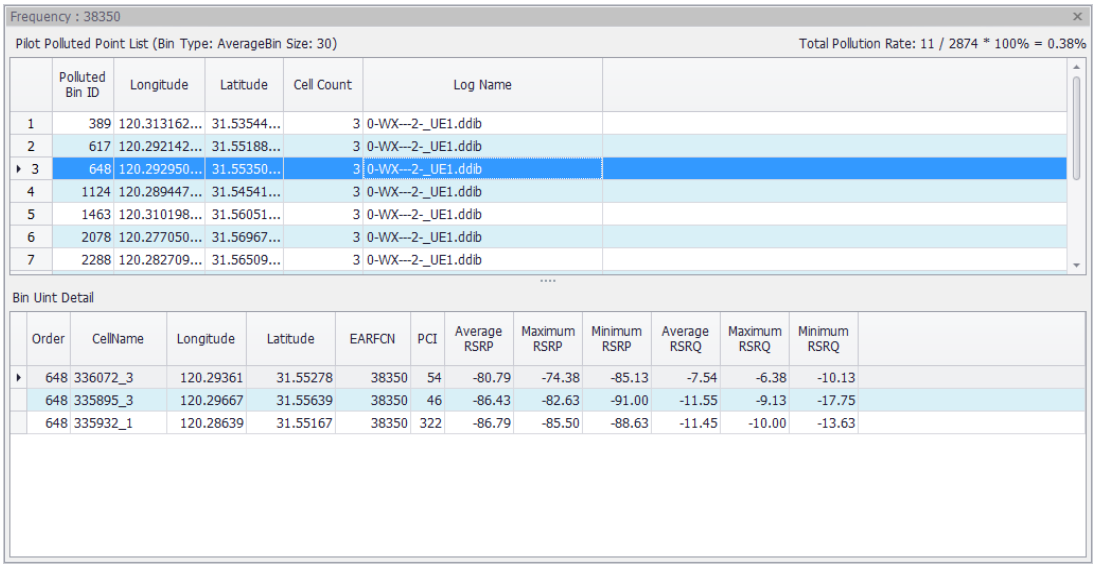
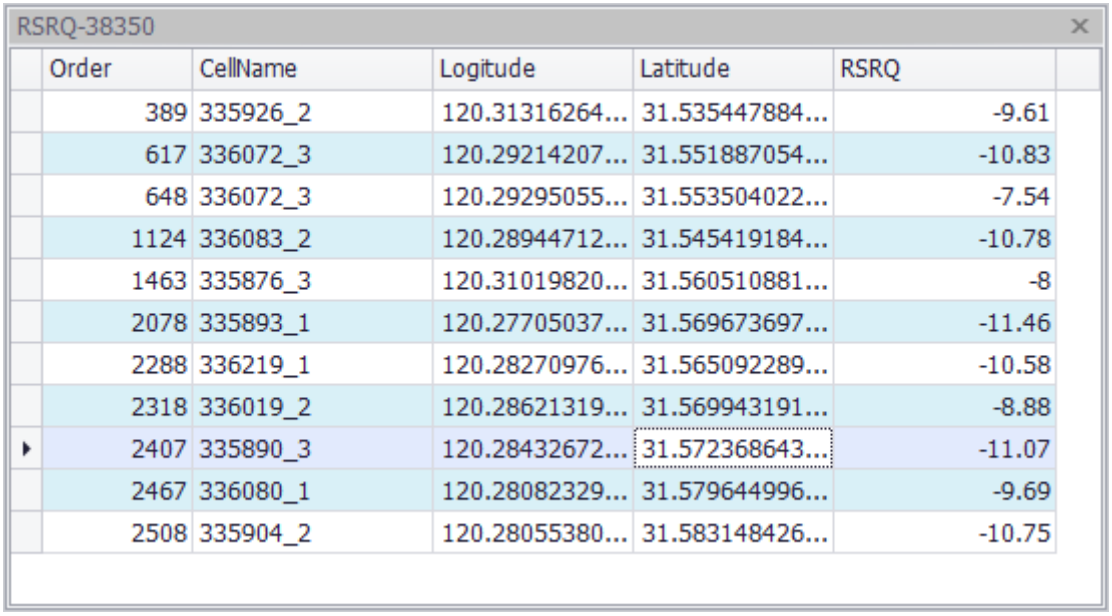


Figure 4-36 Maximum average value of RSRP



4.6 Cell Coverage Analysis

Based on UE or Scanner test data, Cell Coverage Analysis is used to analyze the signal strength of cells. The cell coverage is verified through the statistics and analysis of parameters such as BSIC, PN, PSC, CPI, and PCI. There are three statistics results, including Parameter, TopN, and Serving

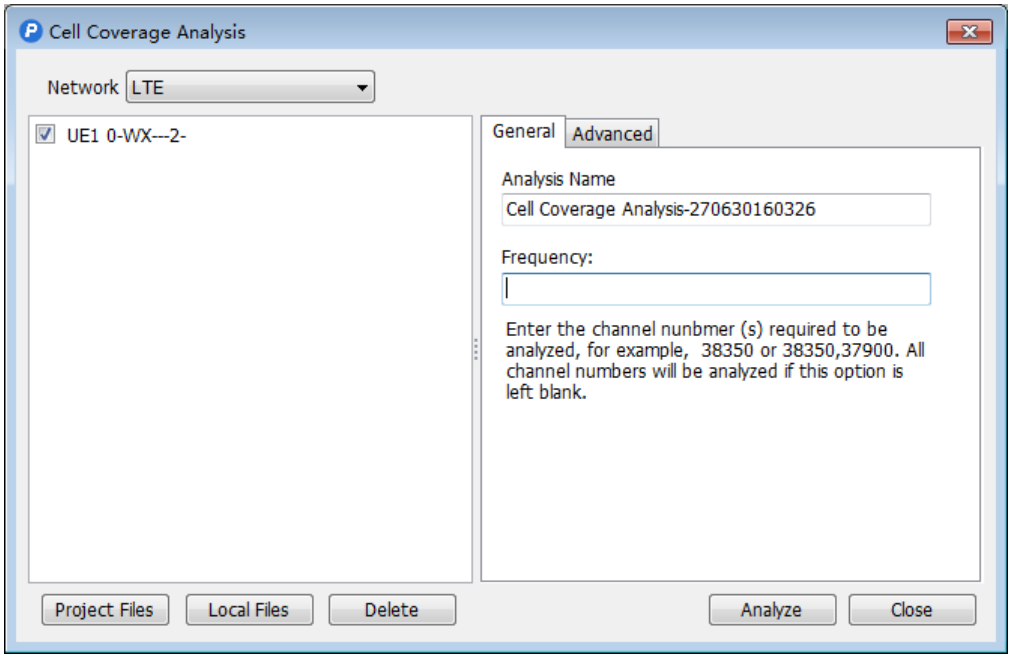
Neighbor (only for UE). For UE data, separate serving cell and neighbor cell coverage analysis results can be displayed under **Serving Neighbor**.

The statistics results can be displayed by table, map, and chart.

Follow the instructions below to perform Cell Coverage Analysis:

1. Double click **Cell Coverage Analysis** or click the corresponding + icon to enter the settings page.

Figure 4-37 Cell Coverage Analysis settings page



2. Add data files.

   Users may click **Project Files** to import data files that have been imported into the software, click **Local Files** to import local data files, or click **Delete** to delete selected data files that have been added into the left pane.

3. Set **Network**. The software will automatically set the network based on the added data files. Users may select another network type for the analysis as required. If the data files do not correspond to the network, they are displayed in grey and unavailable for selection.

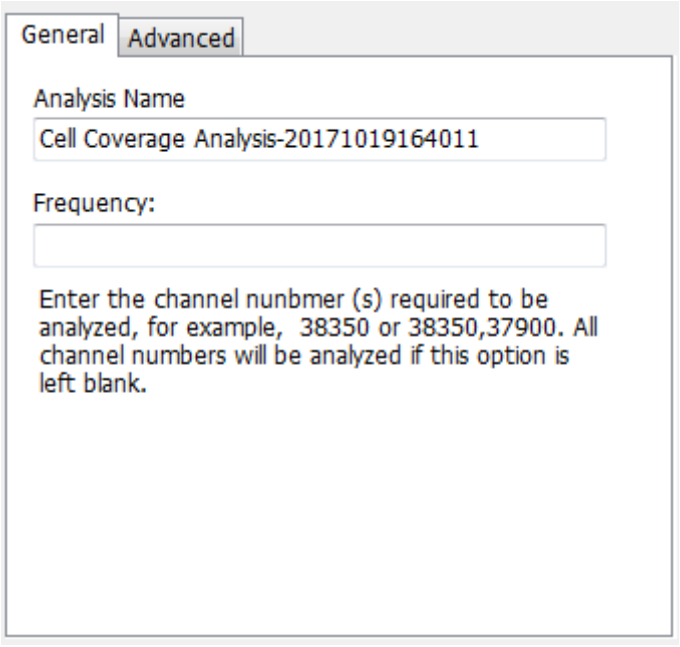
4. Set analysis conditions.

   a. Click the **General** tab to set analysis name and frequency.

      Note: **Frequency** is optional. If this option is left blank, the analysis result includes cells corresponding to all frequencies in the data file. If specific frequency information (for

example, **38350**) is entered, the analysis result includes only the cells corresponding the specific frequency. Users need to use a comma (,) to separate multiple frequency numbers (for example, **38350,37900**). See the figure below:

Figure 4-38 Analysis conditions settings

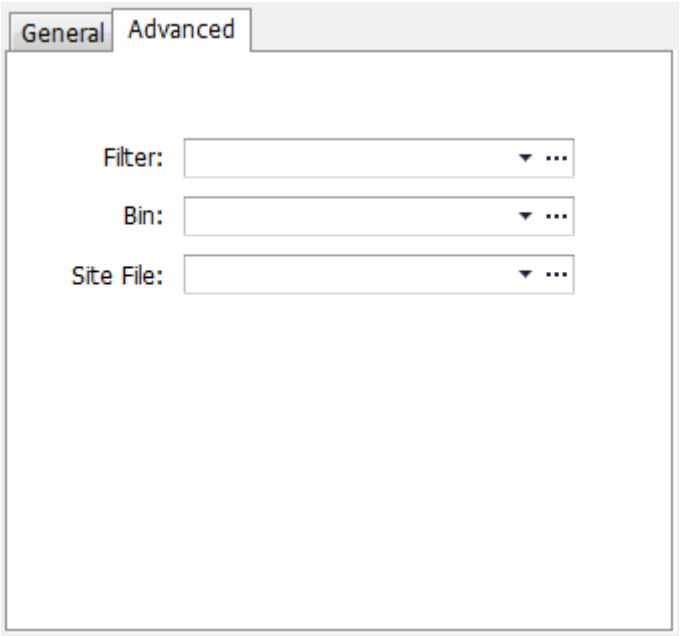


b. Click **Advanced** to set **Filter** and **Bin**.

For detailed information about the settings of filtering and bin, see section 5 and 6.

Users may click the drop-down arrow beside **Site File** and select a site file that has been imported into the software for cell site related analysis.

Figure 4-39 Advanced tab page



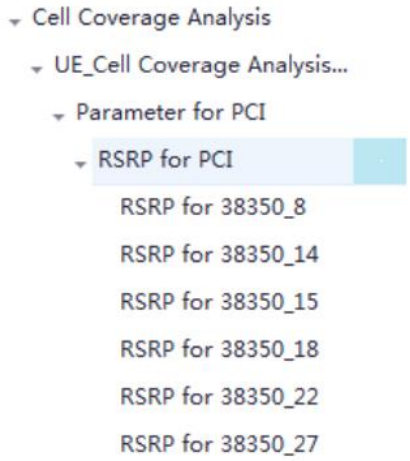
5. Click **Analyze** to generate the analysis result, which will be loaded under the **Cell Coverage Analysis** function node.

   a. The analysis result will be automatically displayed.

   b. For UE data analysis result, there are three types of analysis details. Here we use LTE to illustrate the results.

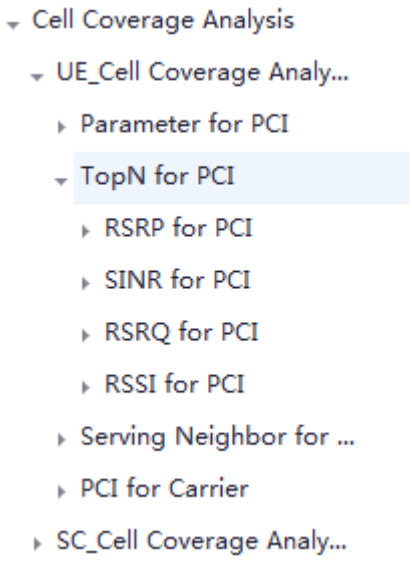
   - Parameter for PCI: List the analysis details by parameters of all cells, which is identified by frequency + scrambling code.

   Figure 4-40 Parameter for PCI



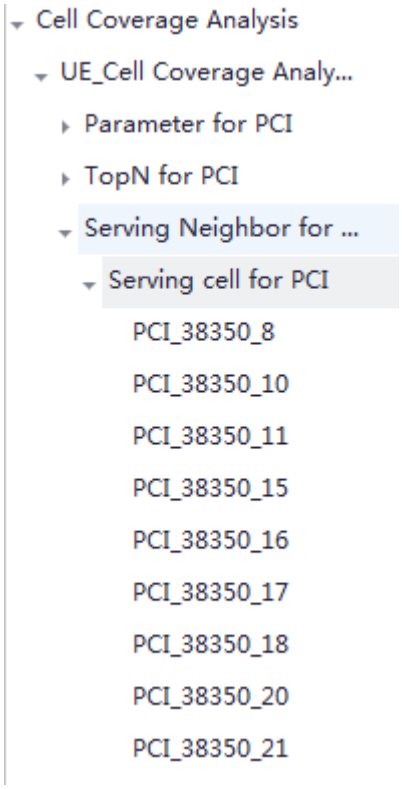
   - TopN for PCI: List the topN (e.g. top 1st , top 2nd , and top 3rd) signal strength by parameter.

   Figure 4-41 TopN for PCI



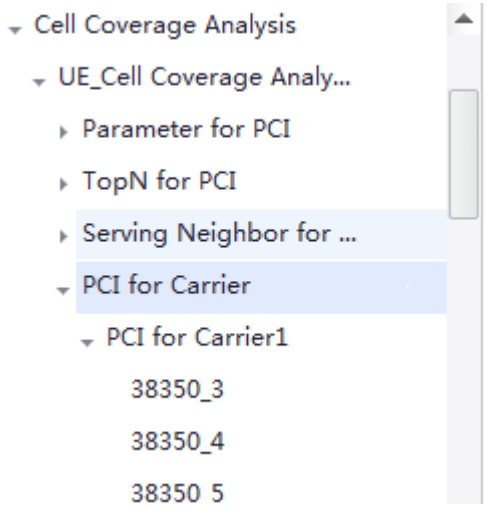
- Serving Neighbor for PCI: List the analysis details for serving cells and neighbor cells.

Figure 4-42 Serving Neighbor for PCI



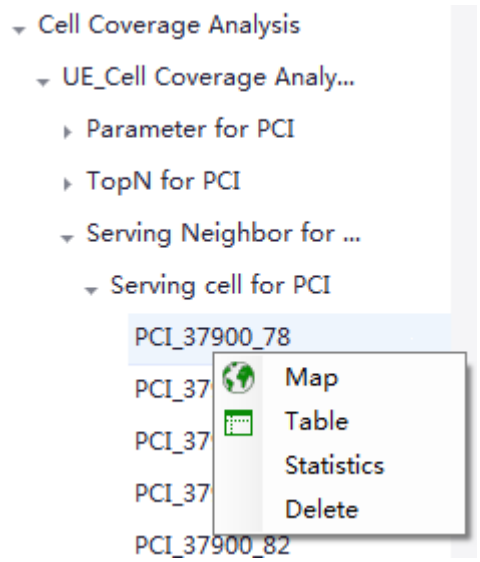
- PCI for Carrier: List the analysis details by RF Channel Number, which is identified by RF channel number + PCI value.

Figure 4-43 PCI for Carrier



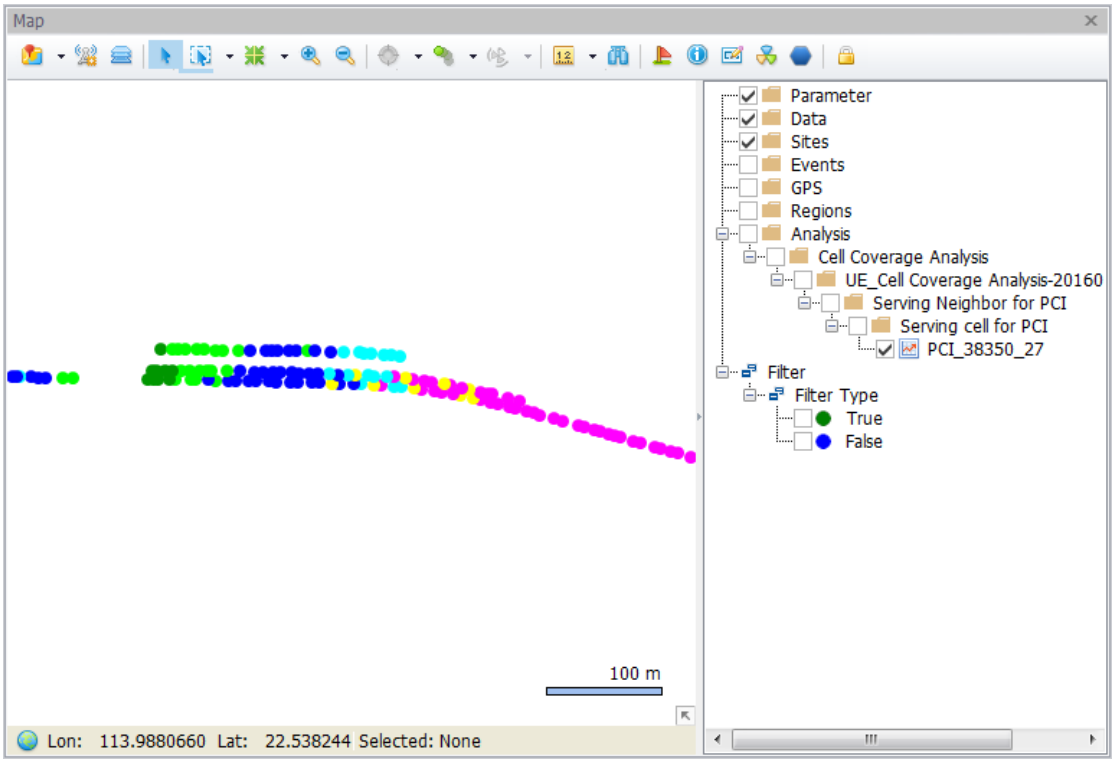
c. Users may right-click a result node and conduct relevant operations as required.

Figure 4-44 Right-click functions



- Right-click an end node and select **Map** to display the analysis result by map.

Figure 4-45 Analysis result by map

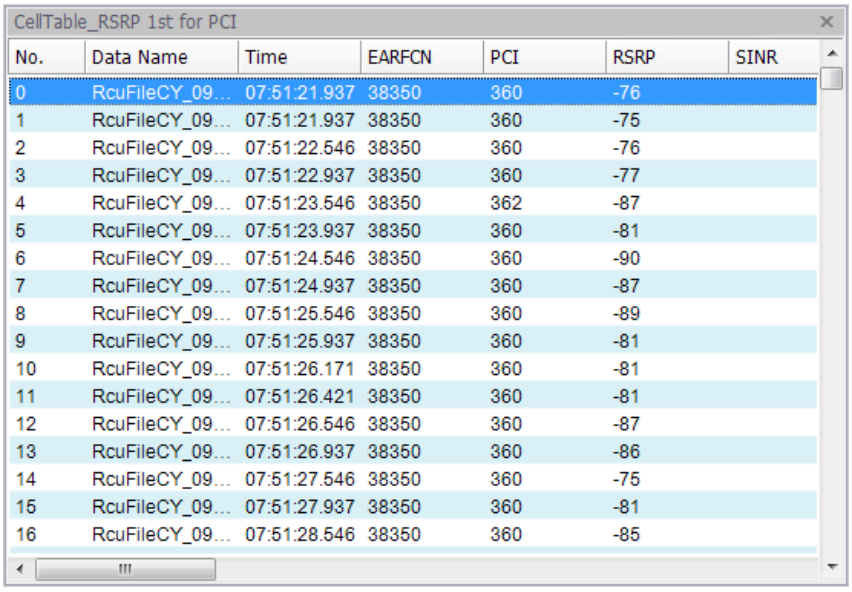


- Right-click an end node and select **Table** to display the analysis result by table.

  There are two kinds of parameters included in the table: primary parameter and secondary parameters. The parameter, which name is the same as the corresponding

node is the primary parameter and other parameter are the secondary parameters. The value of the primary parameter is an actual collected value while the values of secondary parameters may be the actual collected value or a duplicated value from the previous sample.

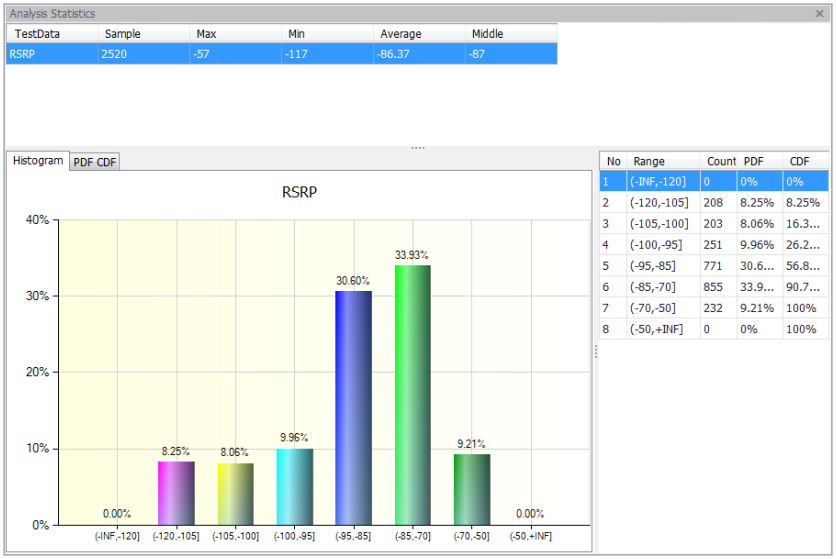
Figure 4-46 Analysis result by table



No.	Data Name	Time	EARFCN	PCI	RSRP	SINR
0	RcuFileCY_09...	07:51:21.937	38350	360	-76	
1	RcuFileCY_09...	07:51:21.937	38350	360	-75	
2	RcuFileCY_09...	07:51:22.546	38350	360	-76	
3	RcuFileCY_09...	07:51:22.937	38350	360	-77	
4	RcuFileCY_09...	07:51:23.546	38350	362	-87	
5	RcuFileCY_09...	07:51:23.937	38350	360	-81	
6	RcuFileCY_09...	07:51:24.546	38350	360	-90	
7	RcuFileCY_09...	07:51:24.937	38350	360	-87	
8	RcuFileCY_09...	07:51:25.546	38350	360	-89	
9	RcuFileCY_09...	07:51:25.937	38350	360	-81	
10	RcuFileCY_09...	07:51:26.171	38350	360	-81	
11	RcuFileCY_09...	07:51:26.421	38350	360	-81	
12	RcuFileCY_09...	07:51:26.546	38350	360	-87	
13	RcuFileCY_09...	07:51:26.937	38350	360	-86	
14	RcuFileCY_09...	07:51:27.546	38350	360	-75	
15	RcuFileCY_09...	07:51:27.937	38350	360	-81	
16	RcuFileCY_09...	07:51:28.546	38350	360	-85	

- Right-click an end node and select **Statistics** to display the analysis result by chart.

Figure 4-47 Analysis result by chart



4.7 Custom Analysis

Pilot Pioneer Expert V10.1 or later version supports custom analysis. Users may set analysis

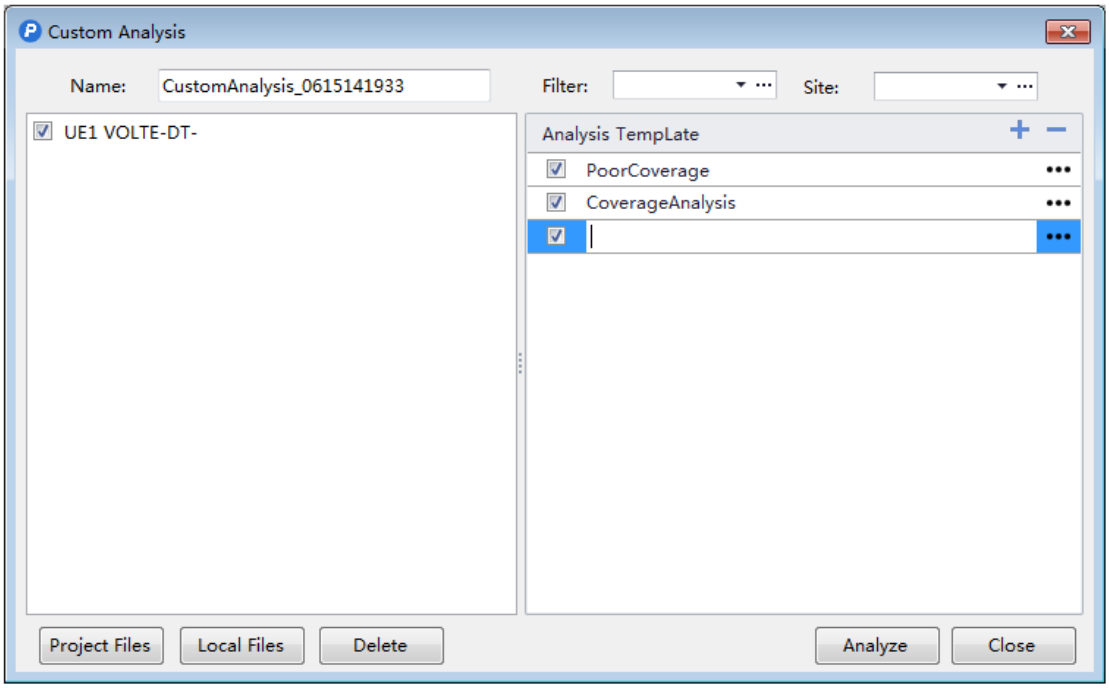
conditions, including parameters, KPIs, etc., as required. The features related to custom analysis are as follows:

- Provides flexible custom analysis.
- This function meets various analysis requirements.
- Users may predefine analysis conditions, e.g. parameters, KPIs, events.
- Built-in **Filter** with conditions for data processing.
- Multiple display modes, e.g. Charts, GIS, etc.

Follow the instructions below:

1. Click **Analysis**, and double-click **Custom Analysis** to enter the settings page. See the figure below:

Figure 4-48 Custom Analysis window



2. Add logfiles.

   Users may click **Project Files** to import logfiles that have been imported into the software, click **Local Files** to import local logfiles, or click **Delete** to delete selected logfiles that have been added into the left pane.

3. **Filter**: Users may click the drop-down arrow beside **Filter** to select a filter template which has been set in **Filter** tab, or click the ··· icon beside **Filter** to define a filter template as required.

4. **Site**: Users may click the drop-down arrow beside **Site** to select a cell site database which has been imported in **Layer** tab, or click the ··· icon beside **Site** to import a site database from local PC.
5. Add analysis template.

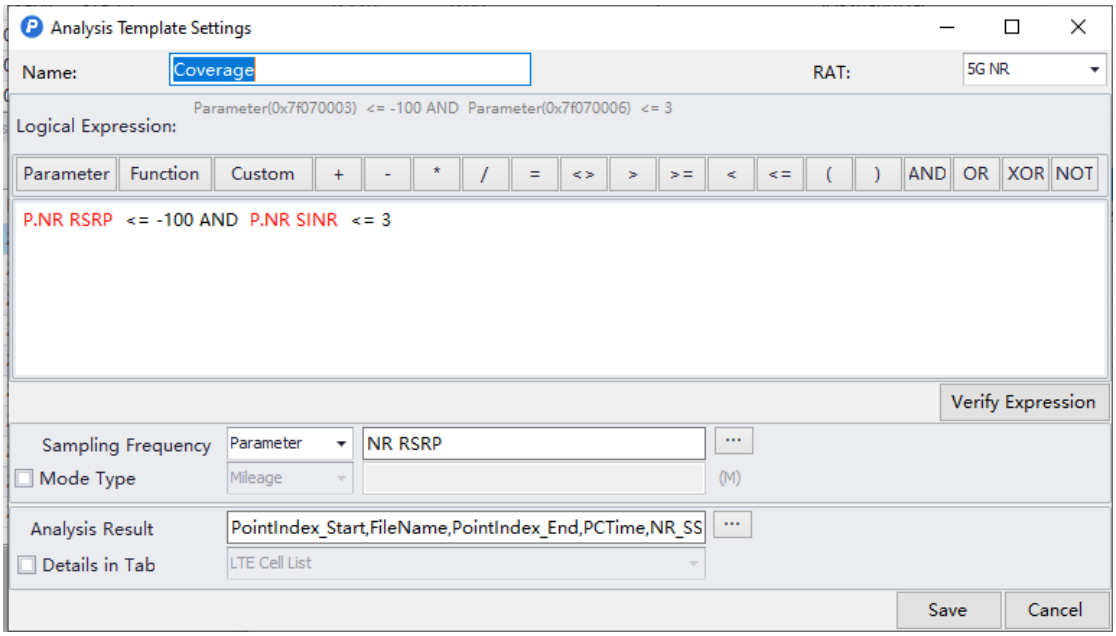
   : Click this to add an analysis template. Users need to enter the template name.

   : Click this to delete the selected template.

   ··· : Click this to enter the analysis template settings window where users can configure the analysis template information, such as the network, logical expression, sampling frequency, etc.

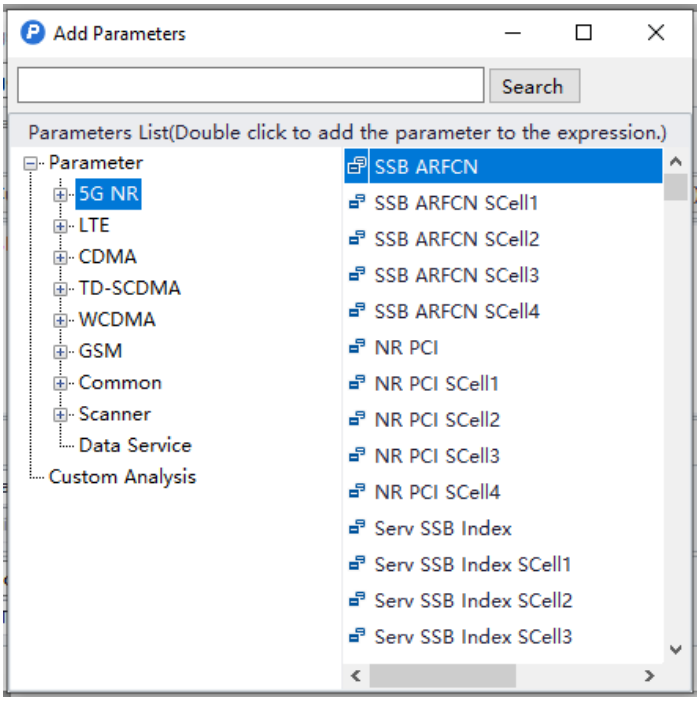
For some analysis templates which need the users to configure cell distance information, users need to import the cell site file to calculate the cell distance.

Figure 4-49 Analysis template settings



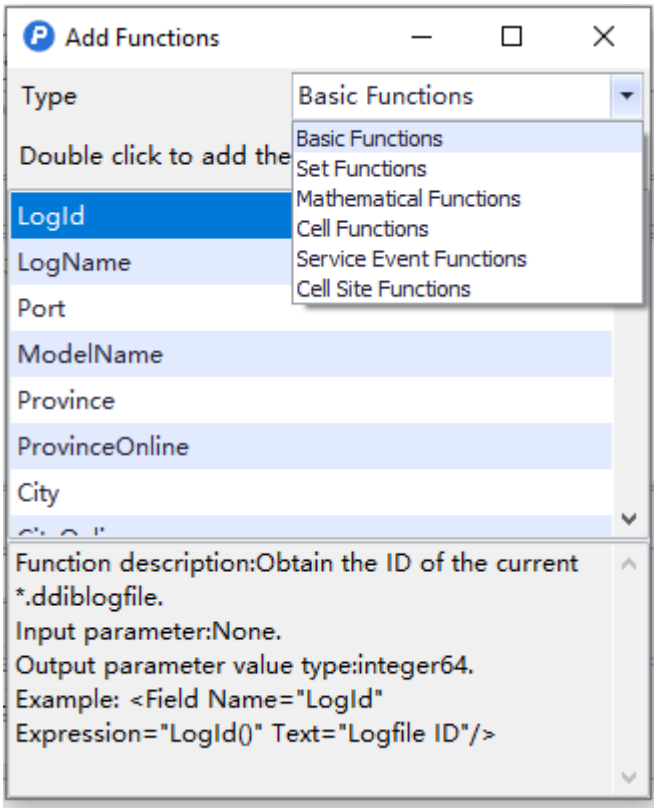
✓ **Parameter**: Click this to enter the **Add Parameters** window where users can select a parameter for logical expression.

Figure 4-50 Add parameters window



✓ **Function**: Click this to enter the **Add Functions** window where users can select a function for logical expression.

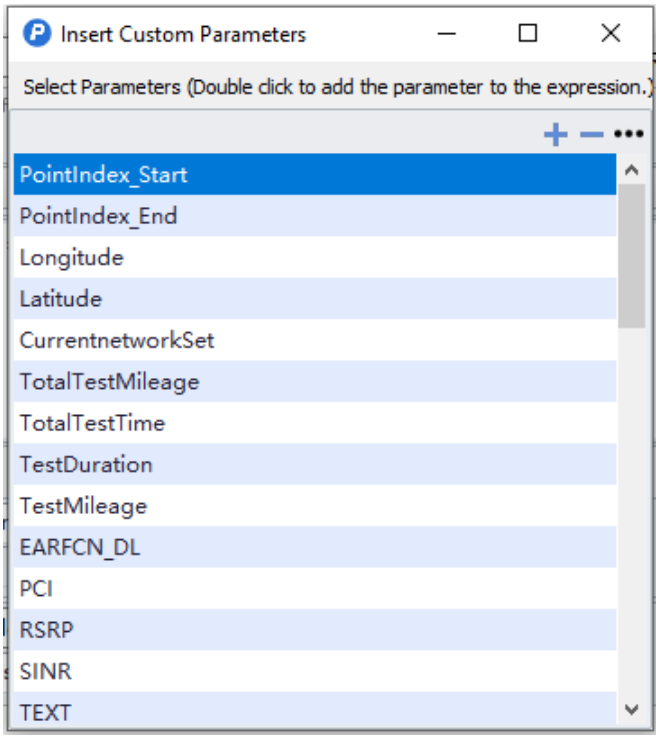
Figure 4-51 Add functions window



- **Type**: Type of function, which includes Basic Functions, Set Functions, Mathematical Functions, Cell Functions, Service Event Functions and Cell Site Functions. Click the drop-down arrow to select a function.
- In the middle pane of the window are variables of the function selected under **Type**, and users may double click a variable to the logical expression for custom analysis.
- In the lower pane of the window is function description which is dependent on the function type selected.

✓ **Custom**: Click this to enter the **Insert Custom Parameters** window where users can select a common parameter that has been configured as required (e.g. PointIndex_Start, PointIndex_End, Longitude, PCI, etc.) for logical expression. Users may also click + to add a parameter as required, click − to delete the parameter selected from custom parameters list or click ••• to edit the parameter selected.

Figure 4-52 Insert custom parameter window



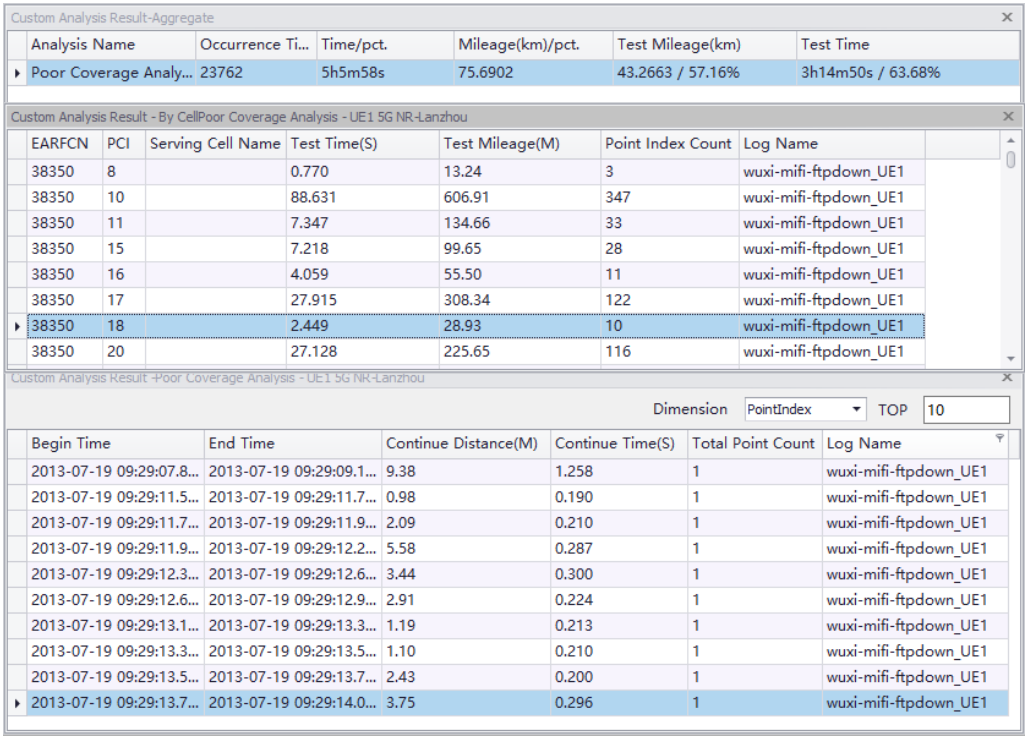
✓ **Logic Symbols**: After selecting a parameter/function variable, users need to select a logic symbol (e.g. +, -, >, AND, OR, NOT, etc.) to customize a logical expression.

✓ **Verify Expression**: Click this to verify whether the logical expression is correct.

- ✓ **Sampling Frequency**: The frequency (or interval in milliseconds) that shall be used to filter the corresponding parameter. For example, if the user selects RSRP (of which frequency is 250 ms) under this option, the software may filter parameters for results statistics every 250 ms.
- ✓ **Mode Type**: Type of parameters, which includes **Time** and **Mileage**. **Time** indicates that the parameters will be filtered within the user-defined time duration. **Mileage** indicates that the parameters will be filtered within the user-defined distance.
- ✓ **Analysis Result**: Click the ... button to select the content that the user wants to display in the result window.
- ✓ **Details in Table**: Select a cell list that belongs to a dedicated network to display neighbour cell details of the selected cell under cell list window on the **Data** tab page.

6. Click **Analyze** to generate custom analysis result, which will be loaded under the **Custom Analysis** node on the navigation pane.
   - The analysis result will be automatically displayed in Table.
   - Users may right click an analysis result and select **Table** to view the analysis result in the Table window, or select **Delete** to delete the analysis result, or select **Statistics** to view statistical analysis result in table format.
   - The **Custom Analysis Result** tab pages include general analysis result and analysis result by cell.

Figure 4-53 Custom analysis result page



- General analysis result page: General information (e.g. begin time, end time, continue distance, continue time, etc.) of the measurement samples will be displayed in general analysis result page by PointIndex, Time and Mileage. One measurement sample's general information will be displayed in one row, but if the data is continued, the continued data information will be displayed in one row. Users may double click the row corresponding to the measurement sample to view its detailed information, such as the PC time, EARFCN_DL, PCI, Longitude, Latitude, etc.
- Analysis result by cell page: Measurement samples analysis results information (e.g. EARFCN, PCI, cell name, test time and test mileage that meets the analysis conditions, samplings count, etc.) will be summarized by cell in this page. Users may double click the row corresponding to the cell that the measurement samples belong to, to view its detailed information, such as the PC time, EARFCN_DL, PCI, Longitude, Latitude, etc.

Figure 4-54 Analysis result by cell and its detailed information

Custom Analysis Result - By CellCoverage - UE2 VOLTE-DT-

EARFCN	PCI	Serving Cell Name	Test Time(S)	Test Mileage(M)	Point Index Count	Log Na
37900	18		17.940	290.86	77	VOLTE
37900	24		21.518	212.39	41	VOLTE
37900	39		7.083	122.18	5	VOLTE
37900	40		14.019	67.61	64	VOLTE
37900	50		45.068	78.06	197	VOLTE

Custom Analysis Result - By CellCoverage-Details Table - UE2 VOLTE-DT-

PC Time	EARFCN_DL	PCI	Longitude	Latitude	Test Duration(S)	Test Mile
2016/4/13	37900	39	115.809199	28.661742	1.872	42.15
2016/4/13	37900	39	115.809583	28.661837	1.201	14.45
2016/4/13	37900	39	115.809736	28.661876	1.303	17.67
2016/4/13	37900	39	115.809891	28.661913	1.381	18.69
2016/4/13	37900	39	115.810580	28.662077	1.326	29.21

- Display analysis results in map window: Users may right click any place in the analysis result window, and select **Map-All Result** to display all analysis results in map window, or select **Map-Selected Result** to display the results corresponding to the row selected in map window.

Figure 4-55 Map-Selected Result

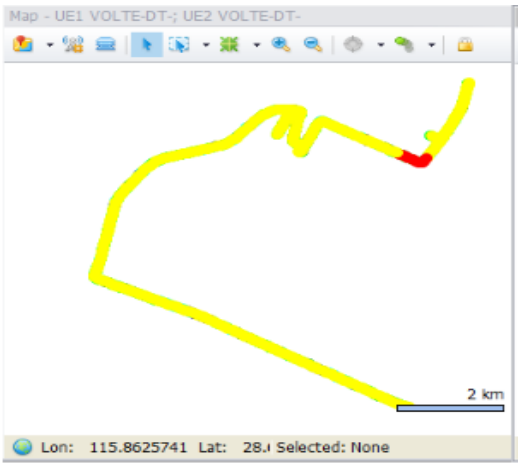
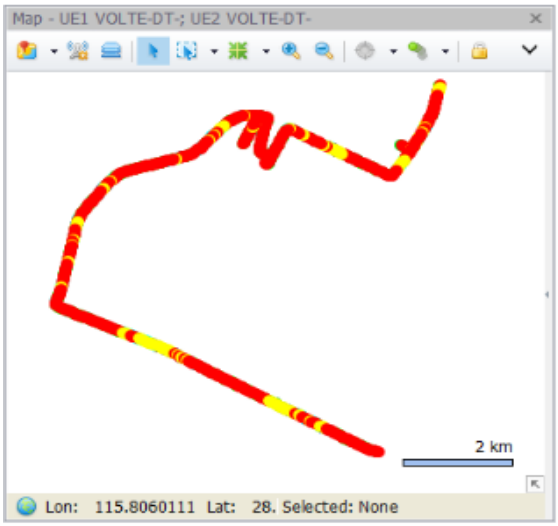


Figure 4-56 Map-All Result



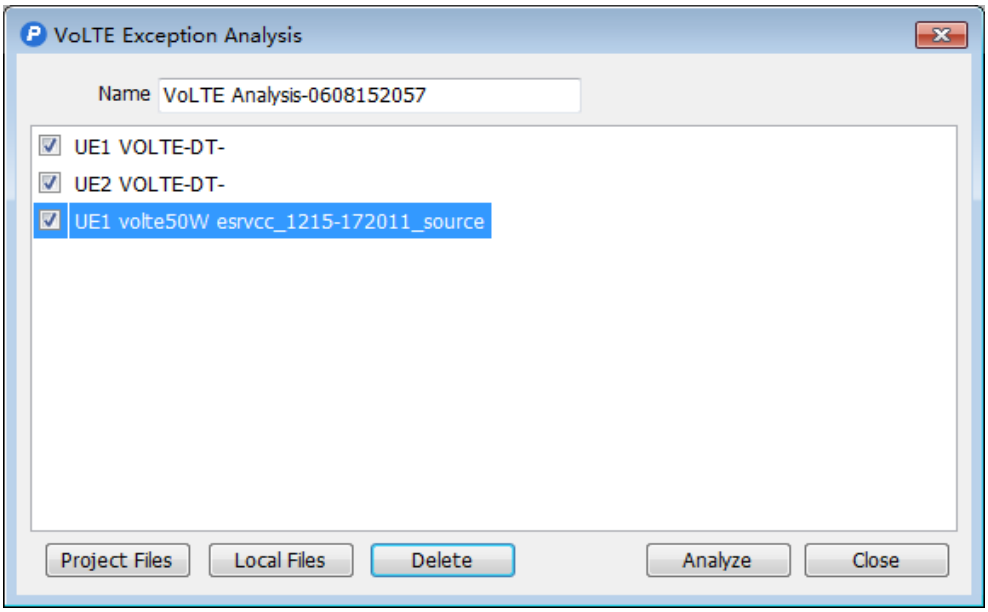
4.8 VoLTE Exception Analysis

VoLTE Exception Analysis is designed to analyze the exceptions detected in every stage of VoLTE service test. Details of VoLTE exceptions analysis, including PC time, abnormal type, brief description, LTE cell name, longitude, latitude and suggestions can be displayed. In addition, the analysis results can be summarized using charts.

Follow the instructions below:

1. Click **Analysis**, and double-click **VoLTE Exception Analysis** to enter the settings page. See the figure below:

Figure 4-57 VOLTE Exception Analysis window



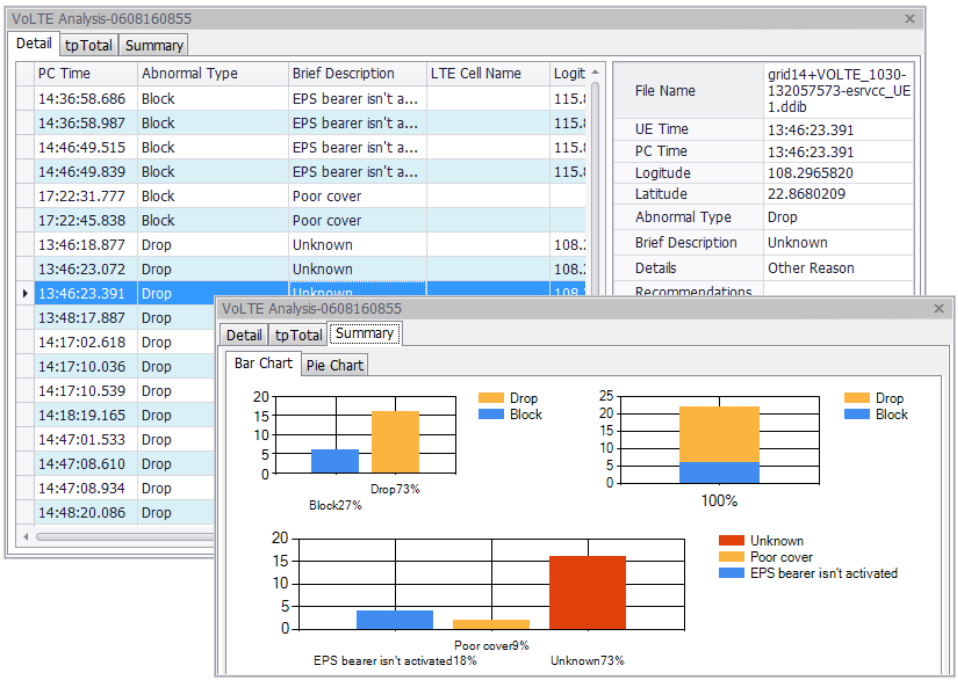
2. Add logfiles.

   Users may click **Project Files** to import logfiles that have been imported into the software, click **Local Files** to import local logfiles, or click **Delete** to delete selected logfiles that have been added into the left pane.

3. Click **Analyze** to generate VoLTE Exception Analysis result, which will be loaded under the **VoLTE Exception Analysis** node on the navigation pane.

   - The analysis result will be automatically displayed in Table.
   - Users may right click an analysis result and select **Table** to view the analysis result in the Table window, or select **Delete** to delete the analysis result.
   - The **Summary** tab page displays summarized analysis result, and supports result display in bar/pie chart or percentage mode.
   - The **Detail** tab page displays the detailed information about each abnormal sampling point, including longitude and latitude, time, cell information before and after the network falls back to 2G/3G network technologies.
   - The **tp Total** tab page displays summarized analysis result, and supports result display in table mode.

Figure 4-58 VoLTE exception analysis result



4.9 LTE Data Exception Analysis

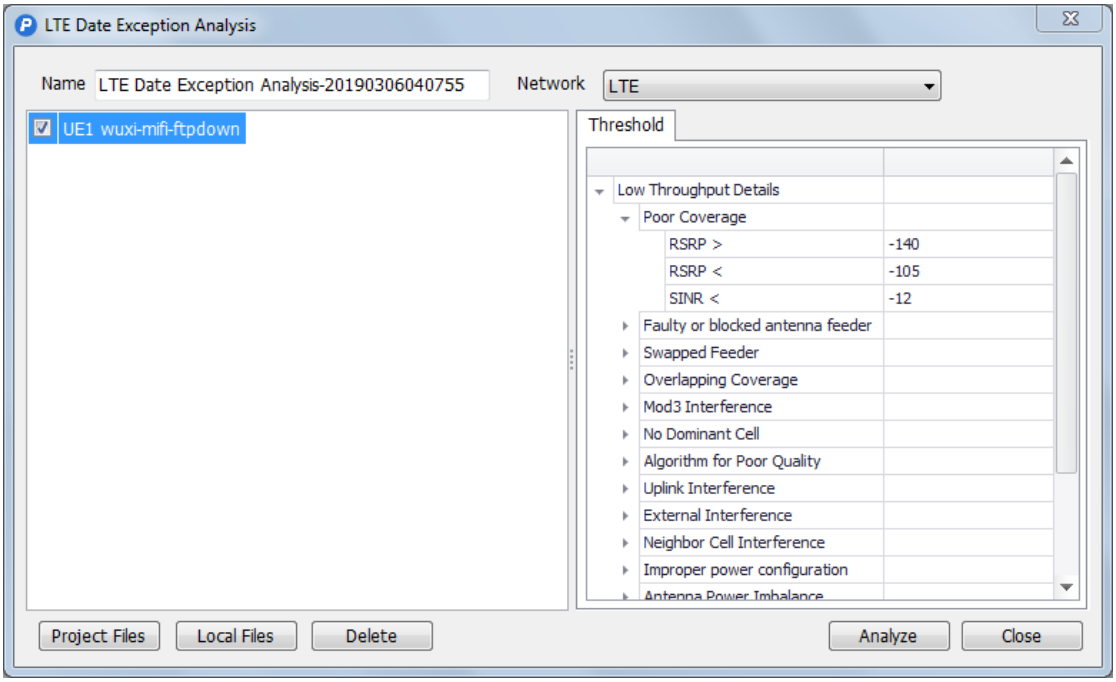
LTE Data Exception Analysis is mainly used to analyze LTE drive test data, identify abnormal events under LTE network and analyze probable root cause based on relevant events or parameters

set in the system. Currently, this function is mainly used for LTE dropped analysis, abnormal throughput analysis and handover exception analysis. The exception causes and corresponding percentages will be displayed using charts.

Follow the instructions below:

1. Click **Analysis**, and double-click **LTE Data Exception Analysis** to enter the settings page. See the figure below:

Figure 4-59 LTE data exception analysis window



On the left pane are the logfiles for statistics generation and on the right pane are the data exception analysis which need to be configured as required.

2. Add logfiles.

   Users may click **Project Files** to import logfiles that have been imported into the software, click **Local Files** to import local logfiles, or click **Delete** to delete selected logfiles that have been added into the left pane.

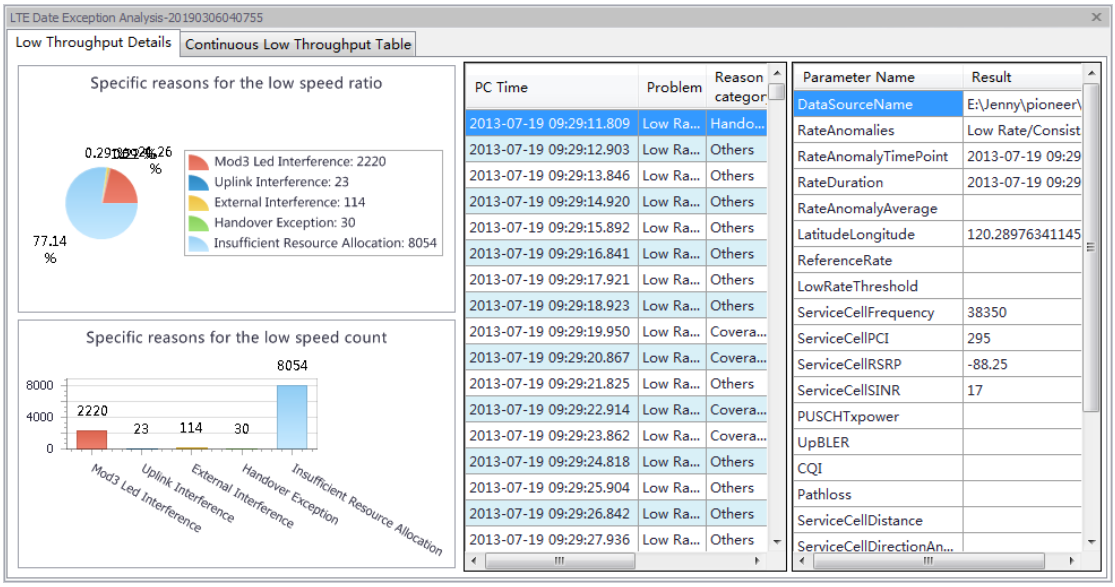
3. Click **Analyze** to generate LTE data exception analysis result, which will be loaded under the **LTE Data Exception Analysis** node on the navigation pane.

- The analysis result will be automatically displayed in Table.
- Users may right click an analysis result and select **Table** to view the analysis result in the Table

window, or select **Delete** to delete the analysis result.

- The **Low Throughput Details** tab page displays the detailed information about each low throughput, including problem, time, reason category, brief reason, specific, etc. When users click one low throughput record on the middle pane, such parameters as service cell RSRPS, serving cell PCI, latitude and longitude, etc. of the record will be displayed on the right pane. On the left pane are the bar charts which display the low throughput reasons' ratio and count. See the figure below:

Figure 4-60 LTE data exception analysis result

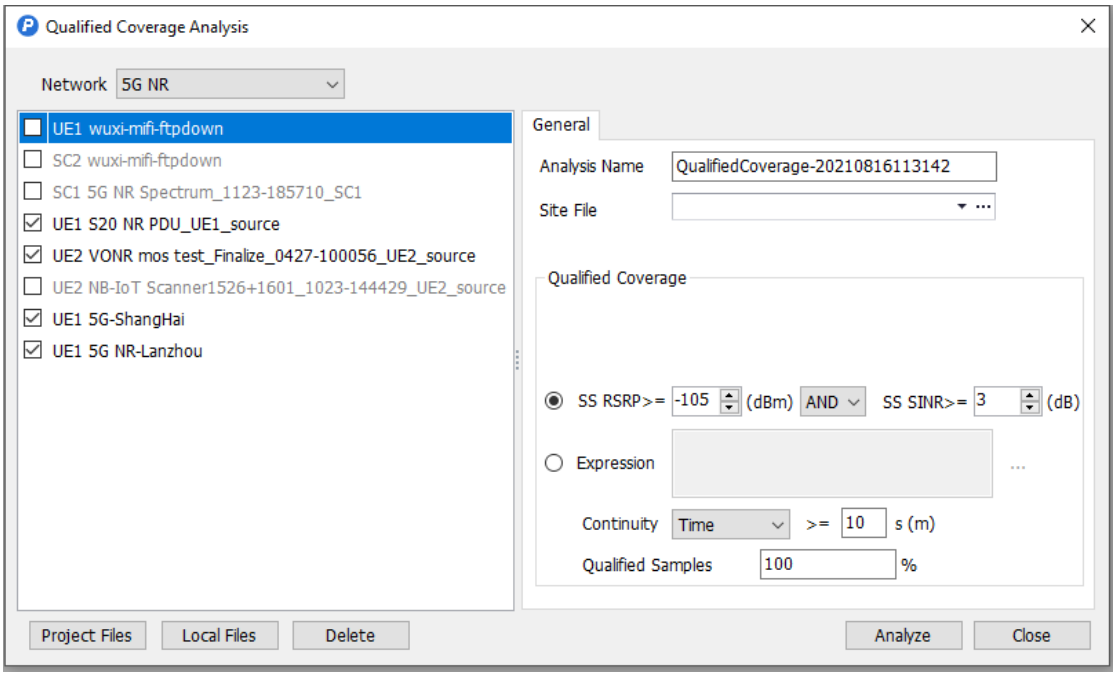


4.10 Qualified Coverage Analysis

Based on UE or Scanner TopN test data, Qualified Coverage Analysis is used to analyze the test area that satisfy the user-defined coverage and interference conditions for 2G/3G/4G network technologies. Follow the instructions below:

1. Click **Analysis**, and double-click **Qualified Coverage Analysis** or click the corresponding icon to enter the settings page. See the figure below:

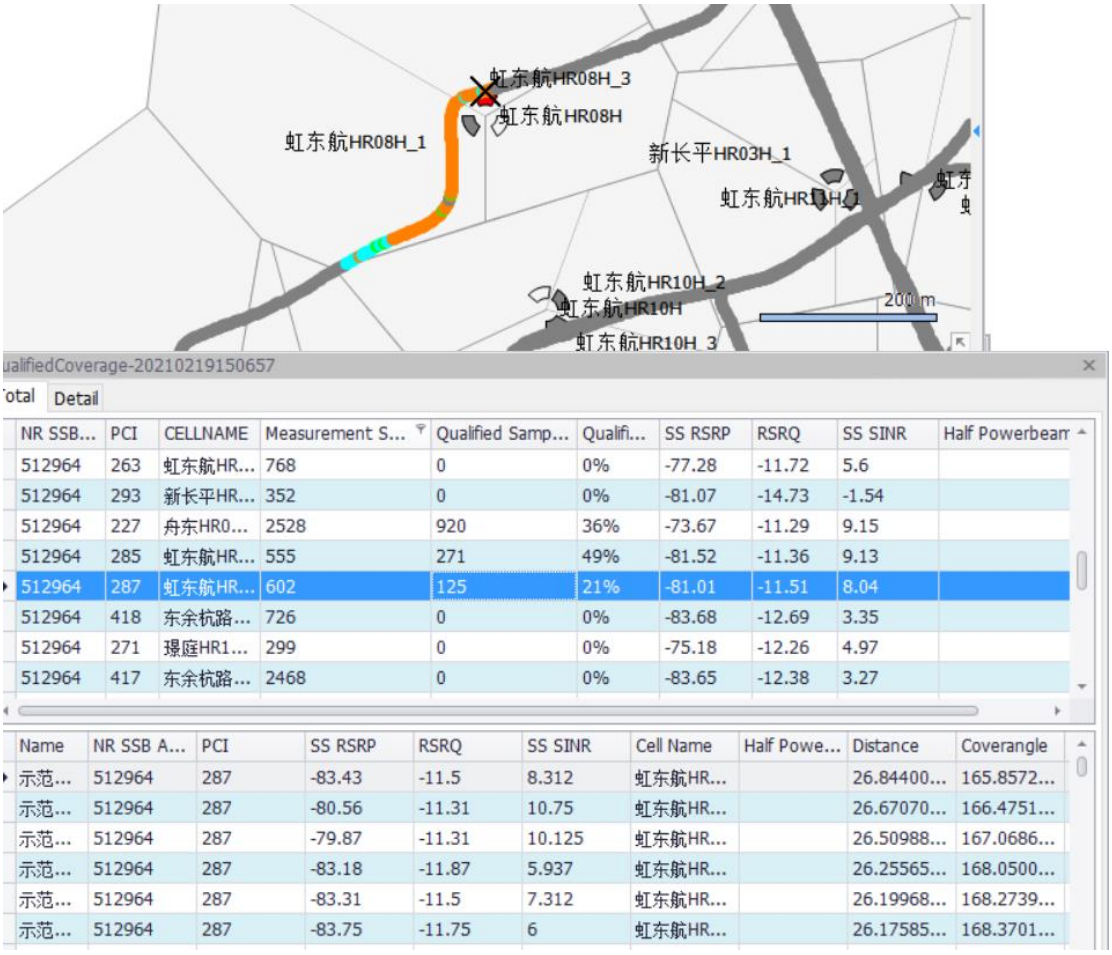
Figure 4-61 Qualified coverage analysis window



2. Select site file corresponding to the test data.
3. Set analysis conditions based on the parameter description in section 18.19 in the documentation of *A1.Pilot Pioneer Expert User Manual V10.5*.
4. Generate and view analysis results. In the table are the statistical and detailed analysis results of the test area and serving cell that satisfies the analysis conditions. In the map window is the visual presenation of the cell and test route analysis results.

   In the map window, the grey route indicates the test route and the grey cell indicates the serving cell of the test data. Click the grey cell to highlight the test area and samples in test route that satisfy the network coverage conditions.

Figure 4-62 Analysis results



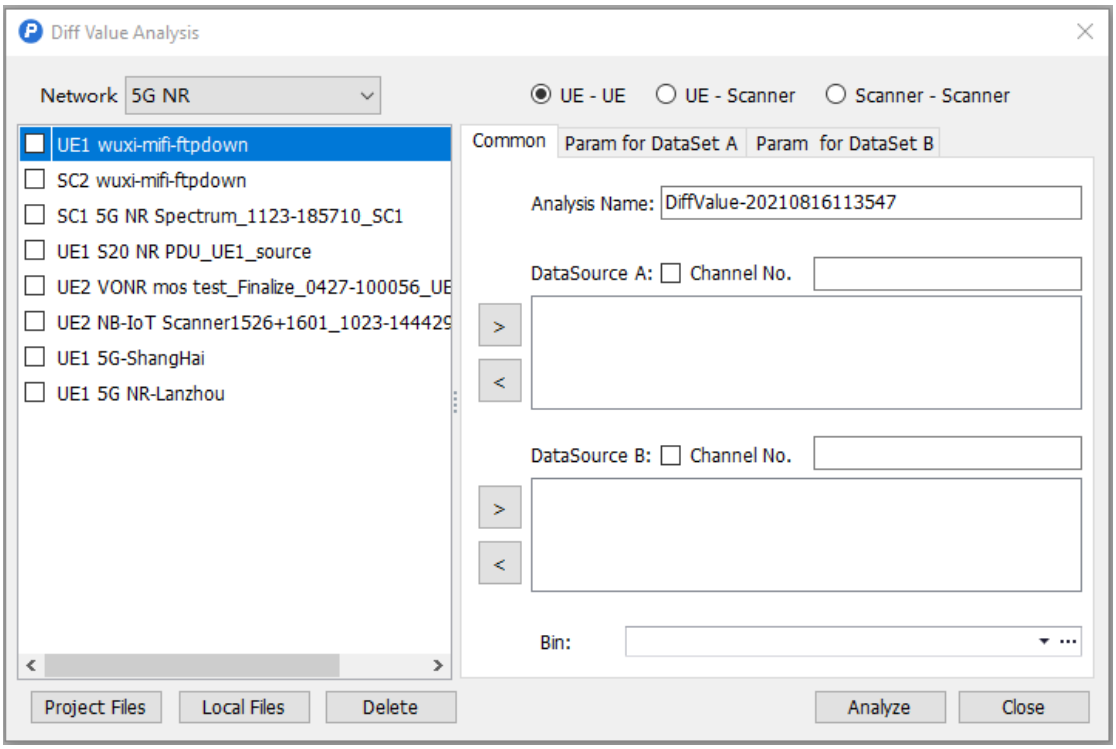
4.11 Difference Value Analysis

Difference Value Analysis is mainly used to compare and analyze the measurement value difference between two data files that have been through the same test route, e.g. the difference value between RSRP and SINR, etc. This may help customers to compare and analyze the performance of different terminals, bands, cells and operators, etc. The function is applicable to UE and Scanner based measurement data.

Follow the instructions below:

1. Click **Analysis**, and double-click **Diff Value Analysis** or click the corresponding + icon to enter the settings page. See the figure below:

Figure 4-63 Difference value analysis window



2. Select **UE-UE**, **UE-Scanner**, or **Scanner-Scanner** as the analysis mode based on the actual condition.

   Click icon to import two logfiles that need to be compared to **DataSource A/B** from data list on left pane, Select **Channel No.** and enter the channel number for filtering if necessary, and select the binning template in **Bin,** or click ··· to add **Bin** template.

3. Select a parameter or multiple parameters that need to compare in two logfiles under **Param** page.

4. Set analysis conditions based on the parameter description in section 18.20 in the documentation of *A1.Pilot Pioneer Expert User Manual V10.5*.

5. Generate and view analysis results.

   The **Table** window displays the actual values of the two logfiles (in the same grid) and its difference.

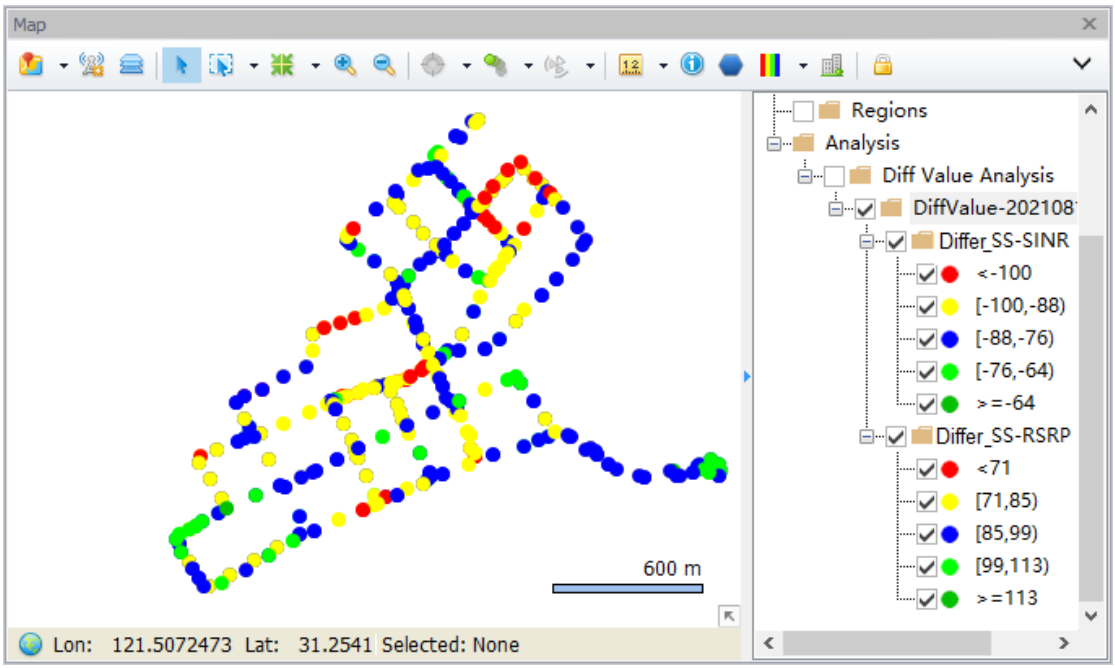
   Map window: Select **Map** to display the measurement value difference between two logfiles along with test route presentation on the map window.

Figure 4-64 Analysis results (table)

DiffValue-20210816113547-DiffValue-20210816113547 - UE1 5G NR-Lanzhou

	A_SS-SINR	B_SS-RSRP	Diff_SS-RSRP	A_SS-RSRP	B_SS-SINR	Diff_SS-SINR	Point Index	Longitude	Latitude	Computer Time
1	9.95	-69.98	79.93	-74.76	10.71	-85.47	0			2019-08-08 08:26:33.61
2	10.52	-75.09	85.62	-74.11	5.55	-79.66	1589	121.5090533	31.2529700	2019-08-08 08:26:40.07
3	9.10	-76.08	85.18	-74.65	3.26	-77.91	4115	121.5090567	31.2529733	2019-08-08 08:26:50.01
4	8.83	-76.62	85.45	-75.21	3.76	-78.98	6659	121.5090600	31.2529767	2019-08-08 08:27:00.06
5	10.76	-75.45	86.21	-73.93	4.69	-78.62	9195	121.5090315	31.2529648	2019-08-08 08:27:10.06
6	11.15	-80.47	91.62	-72.59	1.77	-74.36	11757	121.5090232	31.2529552	2019-08-08 08:27:20.09
7	7.71	-76.11	83.82	-73.12	4.95	-78.07	14270	121.5092005	31.2529751	2019-08-08 08:27:30.06
8	10.11	-77.75	87.86	-70.08	6.19	-76.28	16874	121.5096397	31.2530688	2019-08-08 08:27:40.05
9	12.75	-82.68	95.43	-68.18	3.58	-71.75	19415	121.5100235	31.2531500	2019-08-08 08:27:50.09
10	14.57	-93.33	107.90	-65.81	-1.54	-64.27	21953	121.5101854	31.2530793	2019-08-08 08:28:00.08
11	11.59	-84.65	96.24	-72.82	5.48	-78.30	24459	121.5105319	31.2529650	2019-08-08 08:28:10.02
12	11.42	-82.59	94.01	-69.78	6.17	-75.95	26997	121.5106293	31.2531455	2019-08-08 08:28:20.02
13	12.33	-79.76	92.09	-68.28	1.06	-69.34	29531	121.5105433	31.2533084	2019-08-08 08:28:30.00
14	9.25	-77.54	86.79	-68.26	-10.92	-57.34	32094	121.5105413	31.2533083	2019-08-08 08:28:40.09
15	7.24	-83.57	90.81	-66.79	-2.15	-64.64	34401	121.5104997	31.2533420	2019-08-08 08:28:50.04
16	7.04	-78.65	85.68	-69.73	4.24	-73.97	35778	121.5102888	31.2534467	2019-08-08 08:29:00.02
17	4.92	-73.96	78.89	-71.64	8.63	-80.26	37223	121.5098493	31.2533429	2019-08-08 08:29:10.06

Figure 4-65 Analysis results (map)

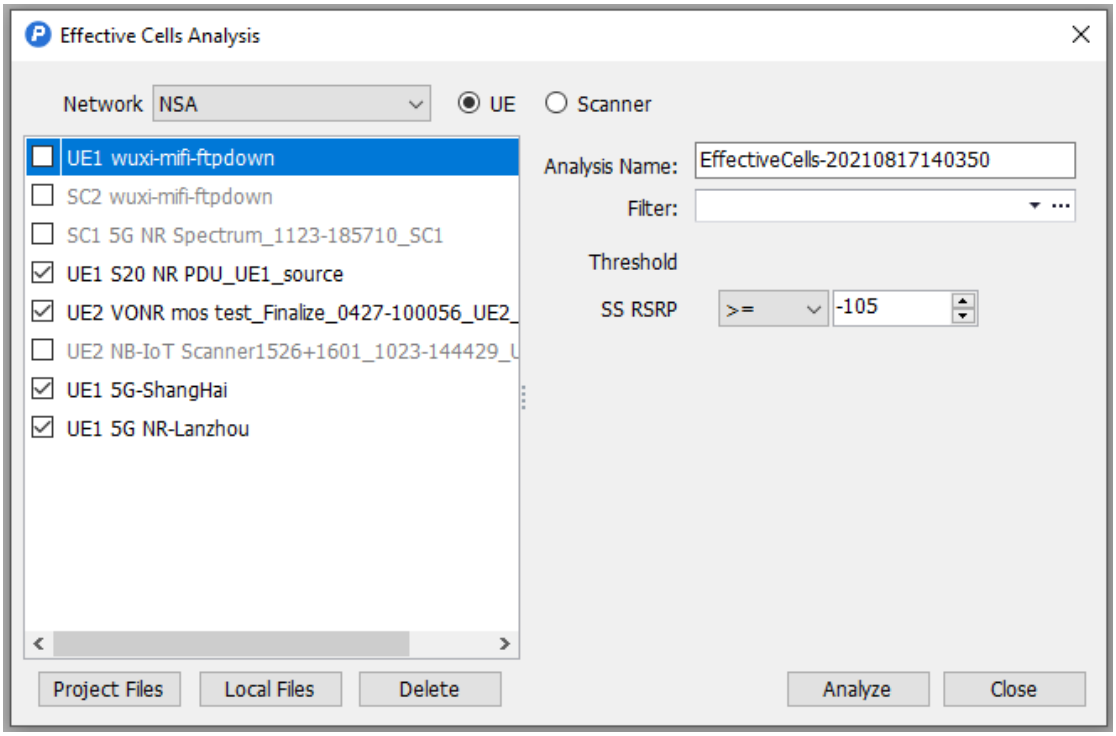


4.12 Effective Cells Analysis

Statistical analysis of cells count that satisfy the user-defined coverage and interference thresholds is supported. This function provides customers with detailed analysis results from scanners' and terminals' TopN measurement. Ths analysis result may be used to determine whether further overlapping and poor coverage analysis needs to be conducted. Follow the instructions below:

1. Click **Analysis**, and double-click **Effective Cell Analysis** or click the corresponding + icon to enter the settings page. See the figure below:

Figure 4-66 Effective cells analysis



2. Follow the instructions of section 18.21 in the documentation of *A1.Pilot Pioneer Expert User Manual V10.5*.

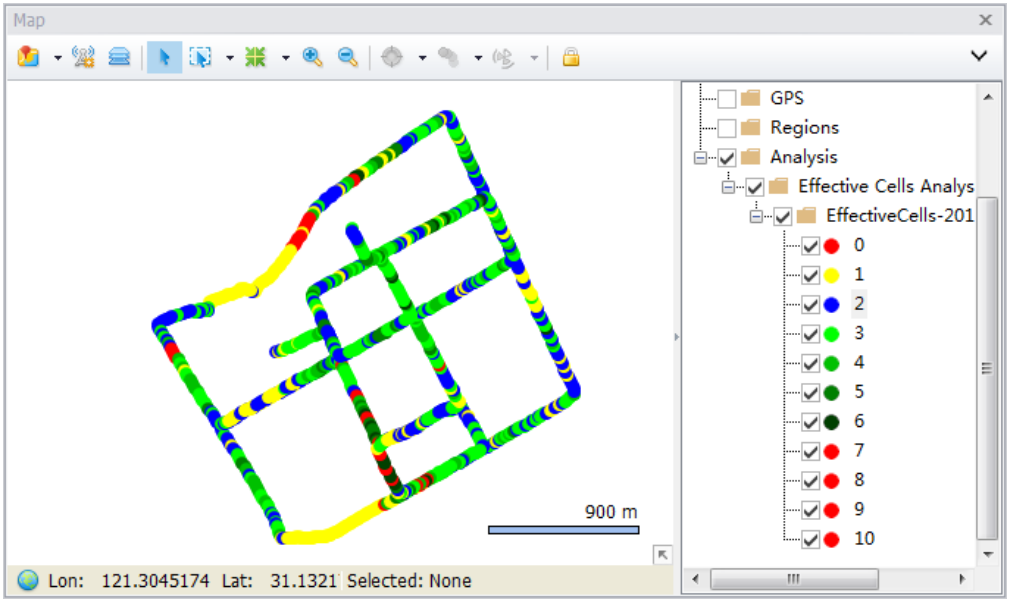
3. Generate and view analysis results

The **Table** window displays the analysis results of samples. If users click a sample, the cell information that satisfies the user-defined conditions will be displayed in the table below. See the figure below:

Map window: Select **Map** to display the effective cells with test route presentation.

Figure 4-67 Analysis results (table)

Figure 4-68 Analysis results (map)



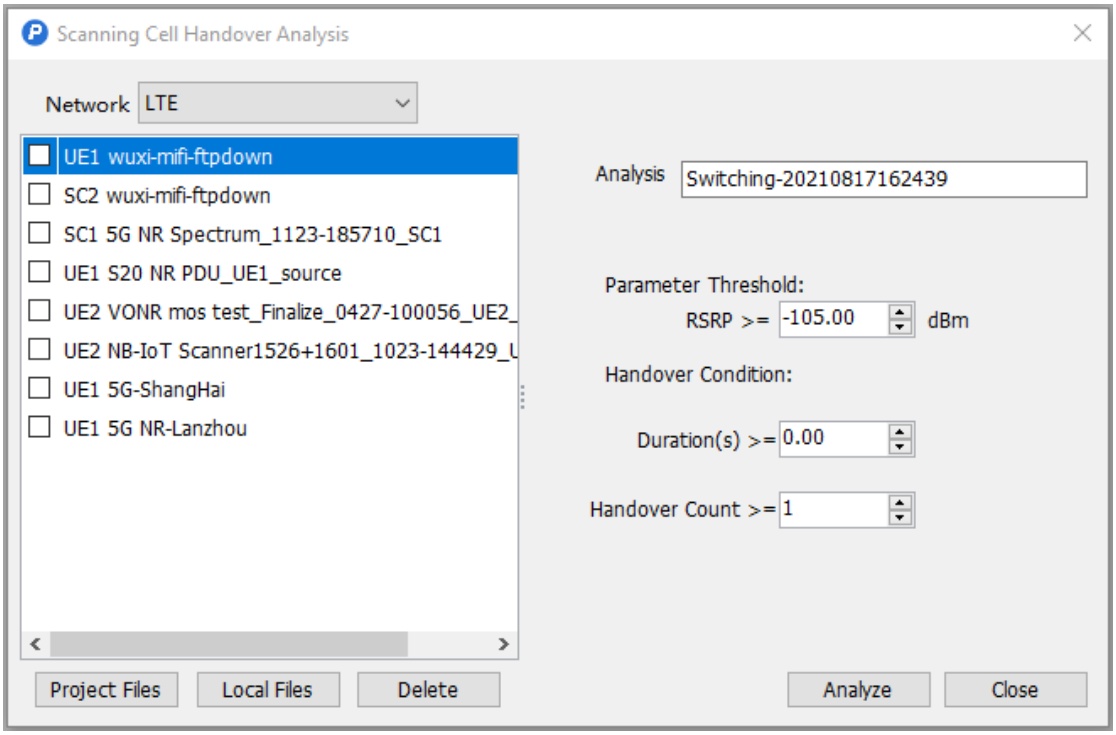
4.13 Scanning Cell Handover Analysis

The analysis enables customers to analyze and summarize the cell handover information, such as the changes in distance, parameters (e.g. EARFCN, PCI, RSRP, SINR, etc.) value, duration, etc. when a handover is performed. This function provides the customers with statistical analysis results from scanner measurement TopN data. It is applicable for mobile network coverage and mobility analysis. Follow the instructions below:

1. Click **Analysis**, and double-click **Scanning Cell Handover Analysis** or click the

corresponding + icon to enter the settings page. See the figure below:

Figure 4-69 Cell handover analysis

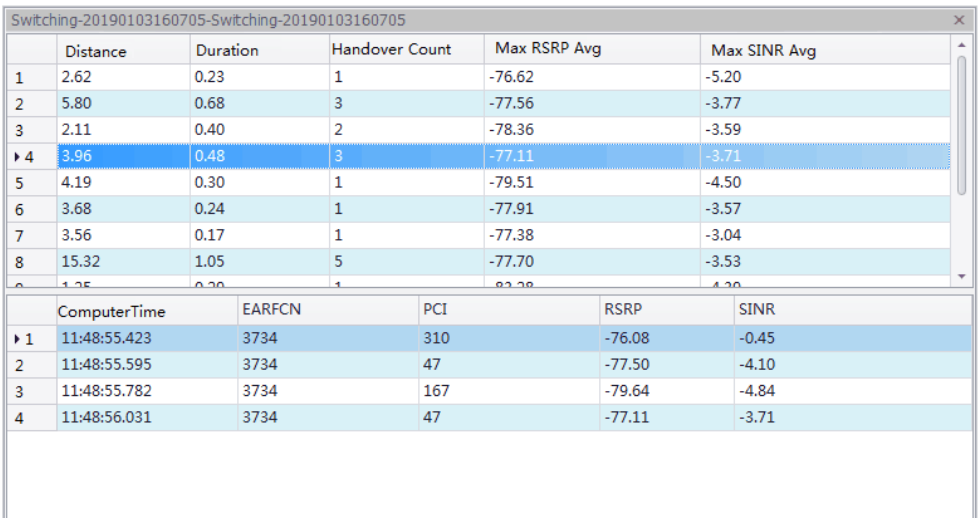


2. Follow the instructions of section 18.22 in the documentation of *A1.Pilot Pioneer Expert User Manual V10.5*.

3. Generate and view analysis results

The **Table** window displays information about cell handover statistics and details.

Figure 4-70 Analysis results (table)



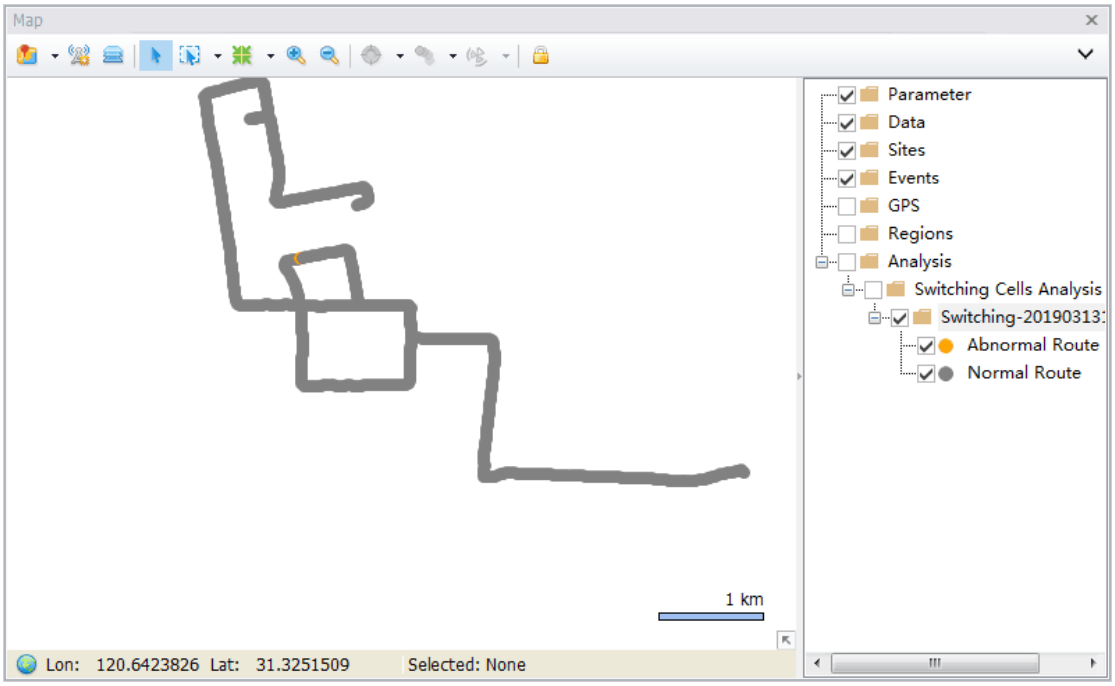
	Distance	Duration	Handover Count	Max RSRP Avg	Max SINR Avg
1	2.62	0.23	1	-76.62	-5.20
2	5.80	0.68	3	-77.56	-3.77
3	2.11	0.40	2	-78.36	-3.59
4	3.96	0.48	3	-77.11	-3.71
5	4.19	0.30	1	-79.51	-4.50
6	3.68	0.24	1	-77.91	-3.57
7	3.56	0.17	1	-77.38	-3.04
8	15.32	1.05	5	-77.70	-3.53

	ComputerTime	EARFCN	PCI	RSRP	SINR
1	11:48:55.423	3734	310	-76.08	-0.45
2	11:48:55.595	3734	47	-77.50	-4.10
3	11:48:55.782	3734	167	-79.64	-4.84
4	11:48:56.031	3734	47	-77.11	-3.71

Map window: Select **Map** to display the cell handover analysis results with test route presentation.

The samples that meet the analysis conditions will be displayed as Abnormal Route; otherwise, displayed as Normal Route.

Figure 4-71 Analysis results (map)



4.14 Spectrum Analysis

An extensive 5G spectrum clearance test is required to analyze the signal activity and occupancy during the network pre-rollout stage. Pilot Pioneer Expert analyzes the spectrum interference based on the spectrum scan data. This is further enhanced with flexible settings such as user-defined frequency range and different analysis mode.

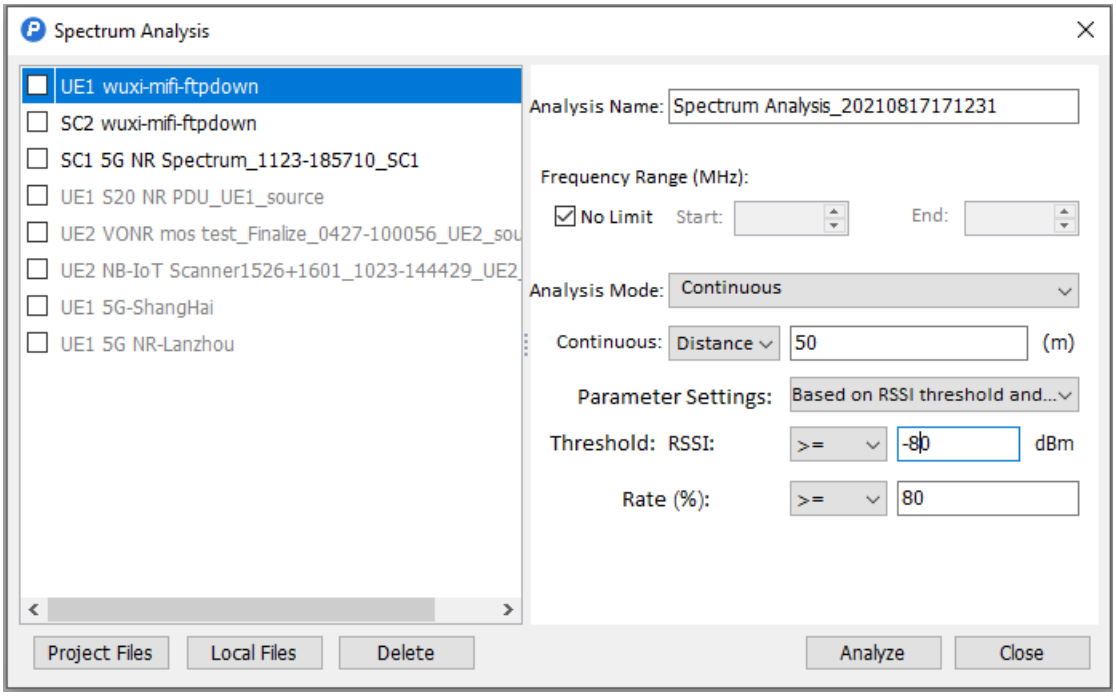
Please follow the operation below:

1. Set the frequency range to be analysed in the analysis settings window, or select **No Limit** to the range.

2. Select **Original Parameter** or **Continuous** for **Analysis Mode**.

3. Set the mode and threshold for the Original Parameter. As shown below, the **Parameters Settings** mean that the frequency with RSSI >= -80 accounts for 80% or more of the total number of frequencies at this measurement sample, then this measurement sample is defined as a problem measurement sample.

Figure 4-72 Spectrum Analysis



4. The Analysis Results window includes three parts.

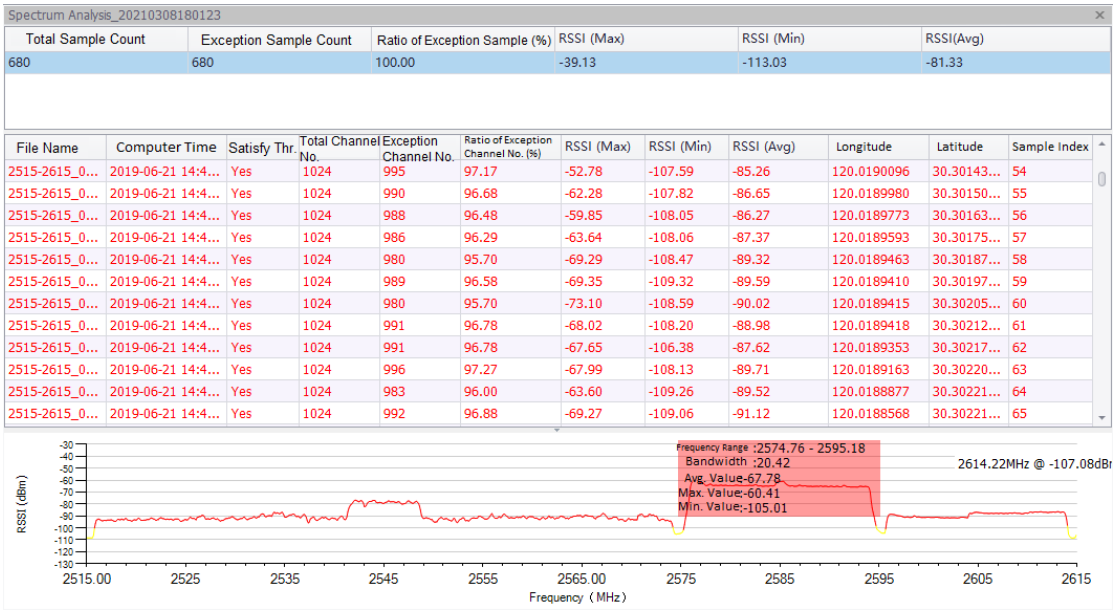
The first part is the summary table, which summarizes the total measurement sample count and the exception measurement samples.

The second part is the details of measurement samples, which display whether the measurement sample satisfies the threshold value of exception samples, and display the exception channel number and other information.

The third part is the line chart about the signal strength of a dedicated measurement sample in the second part.

The frequency range, bandwidth, maximum and minimum mean values of the signal are available for a particular frequency segment by clicking it with the mouse.

Figure 4-73 Analysis results



4.15 Failure Cause Analysis

Failure Cause Analysis can be used to analyze the cause of recurring low throughput, recurring poor coverage, NR dropout and other problems to check whether there are coverage distance problems, poor coverage, no coverage, antenna feeder problems, overlapping coverage, Mod3 interference, external interference and other causes for the exception routes.

Please follow the operation below:

1. After selecting the data, set thresholds for recurring low throughput and poor coverage on the right pane; set thresholds for each exception and cause; select or import site files; and then click **Analyze** button.

2. The analysis result window provides detailed information of exception (i.e. low throughput, coverage and NR dropped), which includes but not limited to, signal strength, interference, power within that road section, percentage of overlapping coverage of 3 or more, average distance of the serving cells, distance and angle between the exception sample and the serving cell, NR drop cause code and other information.

3. Right click the analysis result node on the navigation pane and select **Map** to display the exception (i.e. low throughput, coverage and NR dropped) on the map window.

Figure 4-74 Failure Cause Analysis

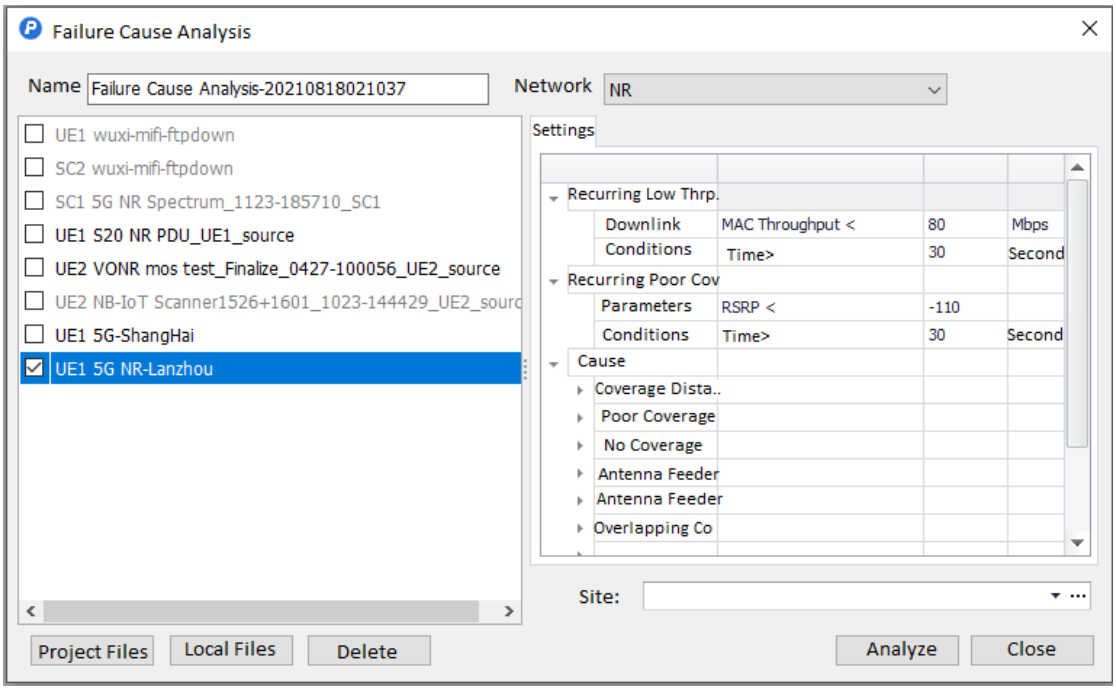
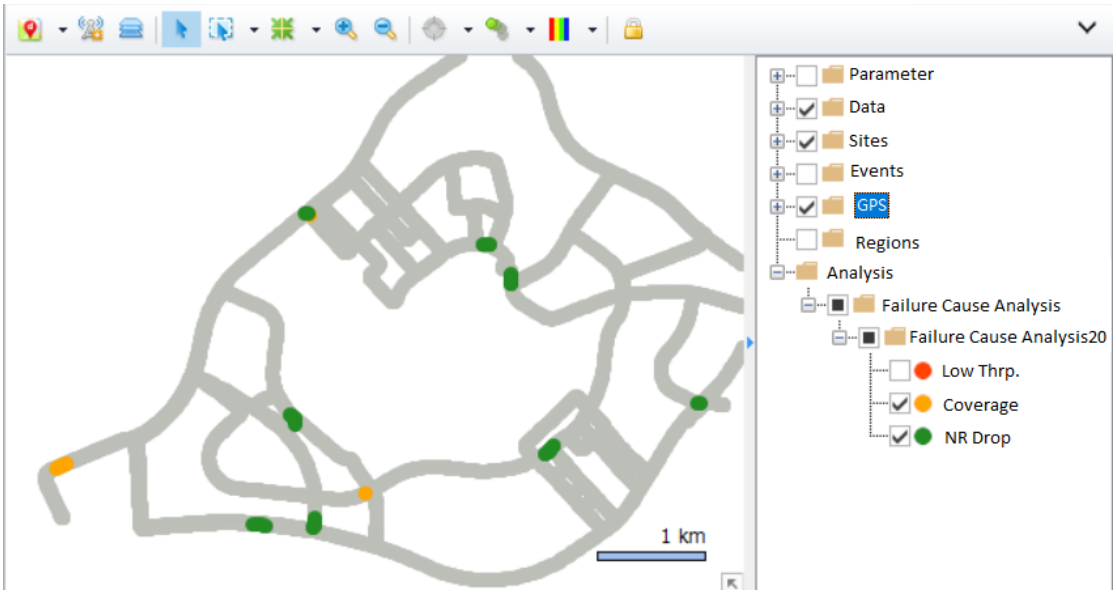


Figure 4-75 Analysis results (table)

Low Thrp. Summary | Coverage Summary | NR Dropped S

	Logfil	Low Thrp. Cause	Low Thrp. Time	Low Thrp. Longit..	Low Thrp. Latitu..	Average Thrp. Value (Mbps)	Serving Cell RSRP	Serving Cell SINR	UE Transmission	Uplink BLER	CQI
1	Guan.	Uplink Interferen..	10:28:45.751	113.3765300	23.0603783	0.29	-72.66	23.40	20.05	3.09	13.79
2	Guan.	Uplink Interferen..	10:30:24.847	113.3765845	23.0603238	0.20	-86.61	4.08	20.19	3.98	11.75
3	Guan.	Uplink Interferen..	10:30:49.069	113.3763118	23.0604913	0.50	-77.26	17.83	19.73	4.39	12.84
4	Guan.	Uplink Interferen..	10:31:05.791	113.3754395	23.0613255	0.29	-84.13	13.58	16.93	4.86	13.09
5	Guan.	Uplink Interferen..	10:33:55.636	113.3796600	23.0631600	0.27	-69.64	22.51	17.34	5.10	13.87
6	Guan.	Uplink Interferen..	10:36:24.942	113.3766635	23.0600522	0.17	-78.84	17.53	20.04	5.19	13.18
7	Guan.	Uplink Interferen..	10:36:49.395	113.3754450	23.0613600	0.24	-90.80	10.43	20.00	7.22	12.70
8	Guan.	Uplink Interferen..	10:39:19.858	113.3753740	23.0613793	0.24	-98.47	4.31	20.00	8.02	13.49
9	Guan.	Uplink Interferen..	10:40:47.200	113.3723151	23.0614712	0.26	-75.82	15.07	16.36	4.89	13.67
10	Guan.	Uplink Interferen..	10:45:44.065	113.3603409	23.0402748	0.24	-73.80	21.51	18.79	8.79	14.26
11	Guan.	Uplink Interferen..	10:49:03.635	113.3692699	23.0393940	0.49	-100.63	-1.31	20.00	8.96	13.13
12	Guan.	Uplink Interferen..	10:49:34.386	113.3728280	23.0390574	0.29	-94.88	8.45	20.00	8.04	12.99

Figure 4-76 Analysis results (map)

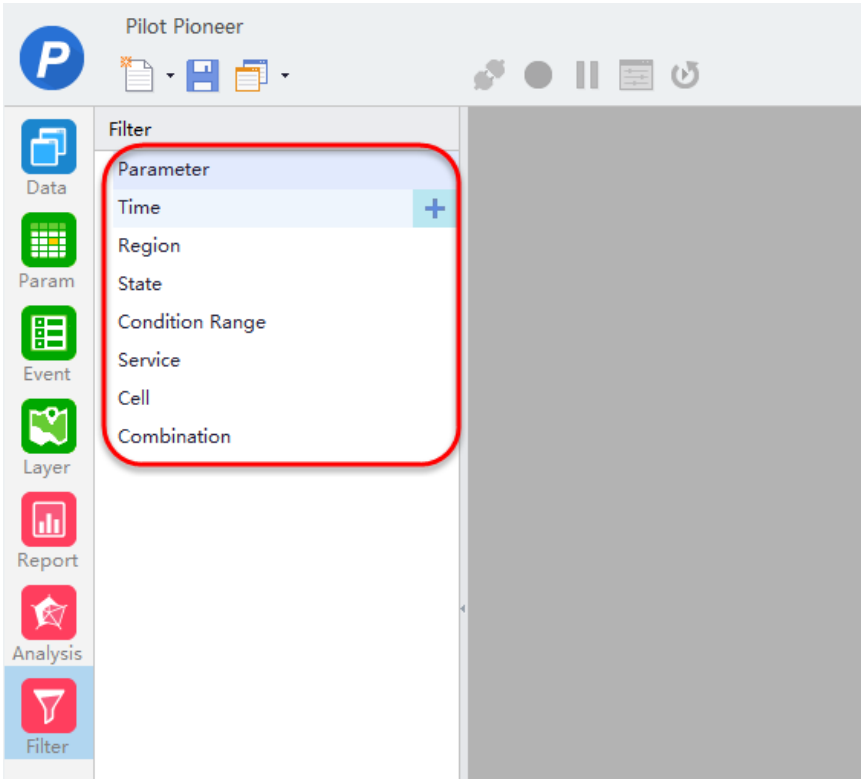


5 Data Filtering

5.1 Overview

This function is used to filter data with multiple predefined conditions based on parameter, time, region, state, service, cell, combination and condition range. This greatly facilitates data analysis.

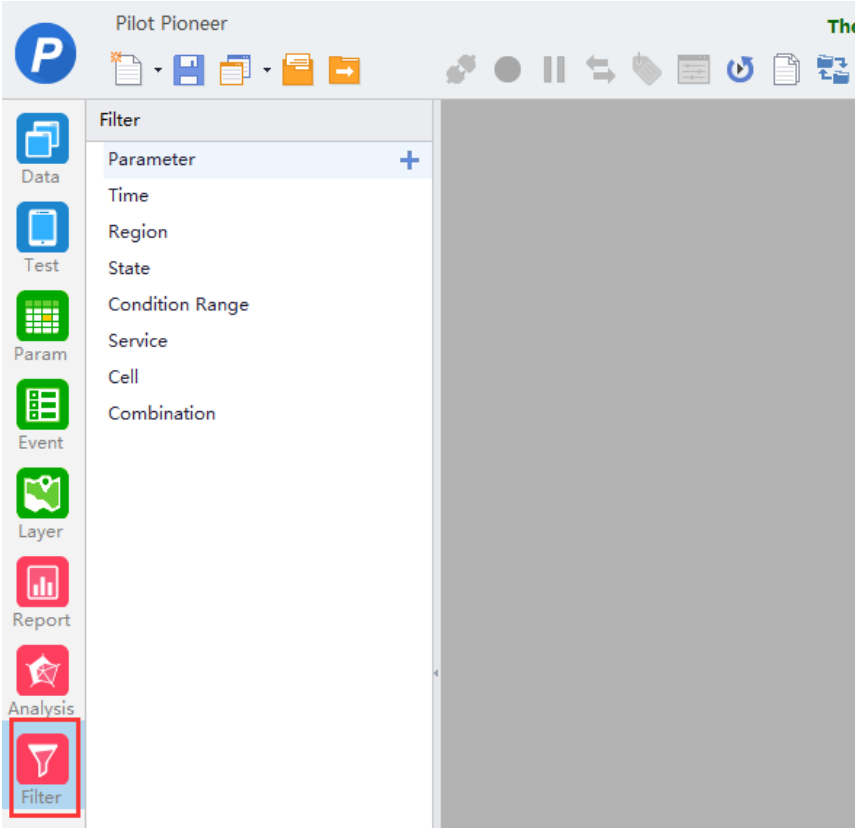
Figure 5-1 Filter



5.1.1 Add a Filter

Users may click Filter to enter **Filter** window. See the figure below:

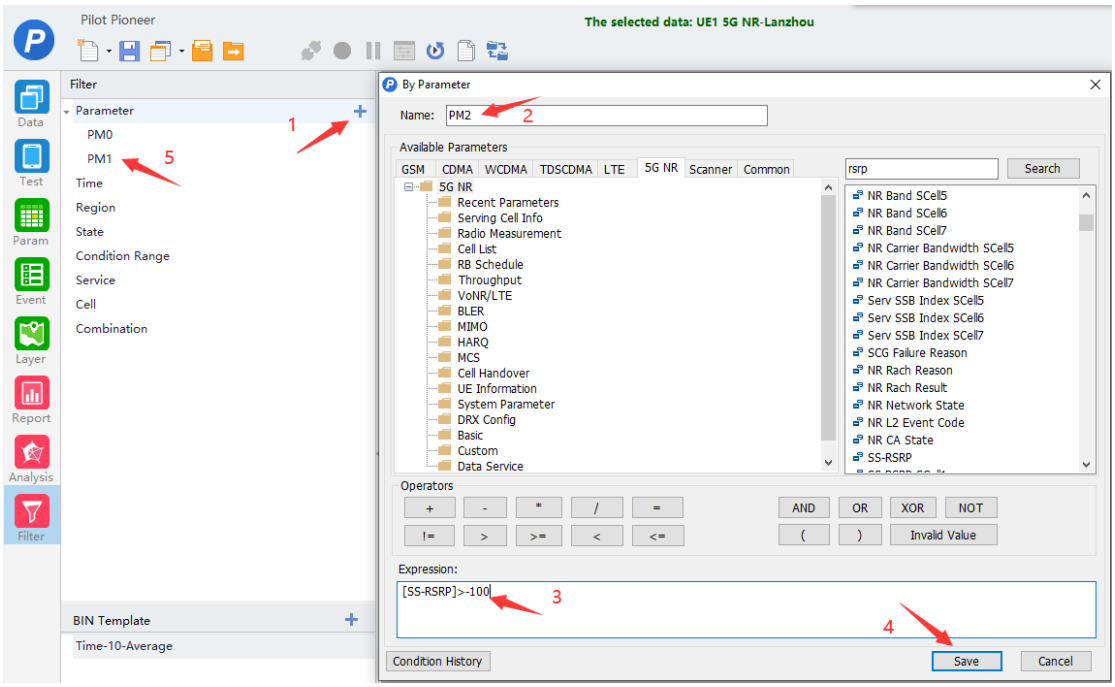
Figure 5-2 Filter



To define a filter, follow the instructions below:

1. Doulbe-click **Parameter** or hover the cursor over **Parameter** and click the icon in the position marked as **1** in the figure below.
2. Define filter conditions as required in the page that appears, e.g. define the filter name in the position marked as 2 and define the expression as the filter condition in the position marked as 3.
3. Click **Save** to save the settings. The defined conditions will be dispalyed in the position marked as **5** in the figure below.

Figure 5-3 Define filter conditions

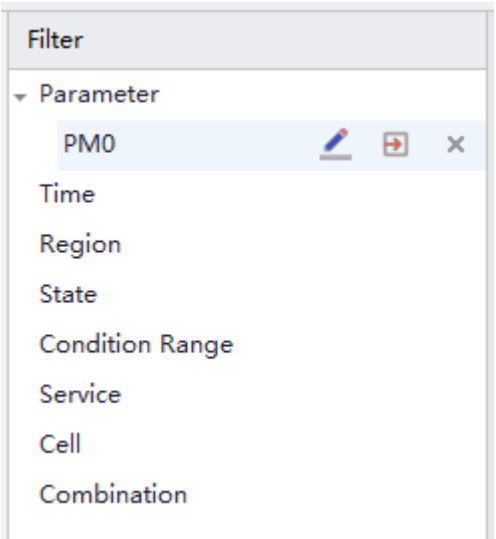


Users may repeat the steps above to define filters by other conditions, e.g. time, state, etc.

5.1.2 Filter Management

Users may edit or delete a created filter.

Figure 5-4 Filter management



1. Edit: Double-click or click the icon to edit the filter conditions. If users change the filter name, a new filter will be generated and displayed under Parameter.

2. Delete: Click the icon to delete the selected filter.

5.2 Condition Types

Users may define a filter based on seven condition types, including

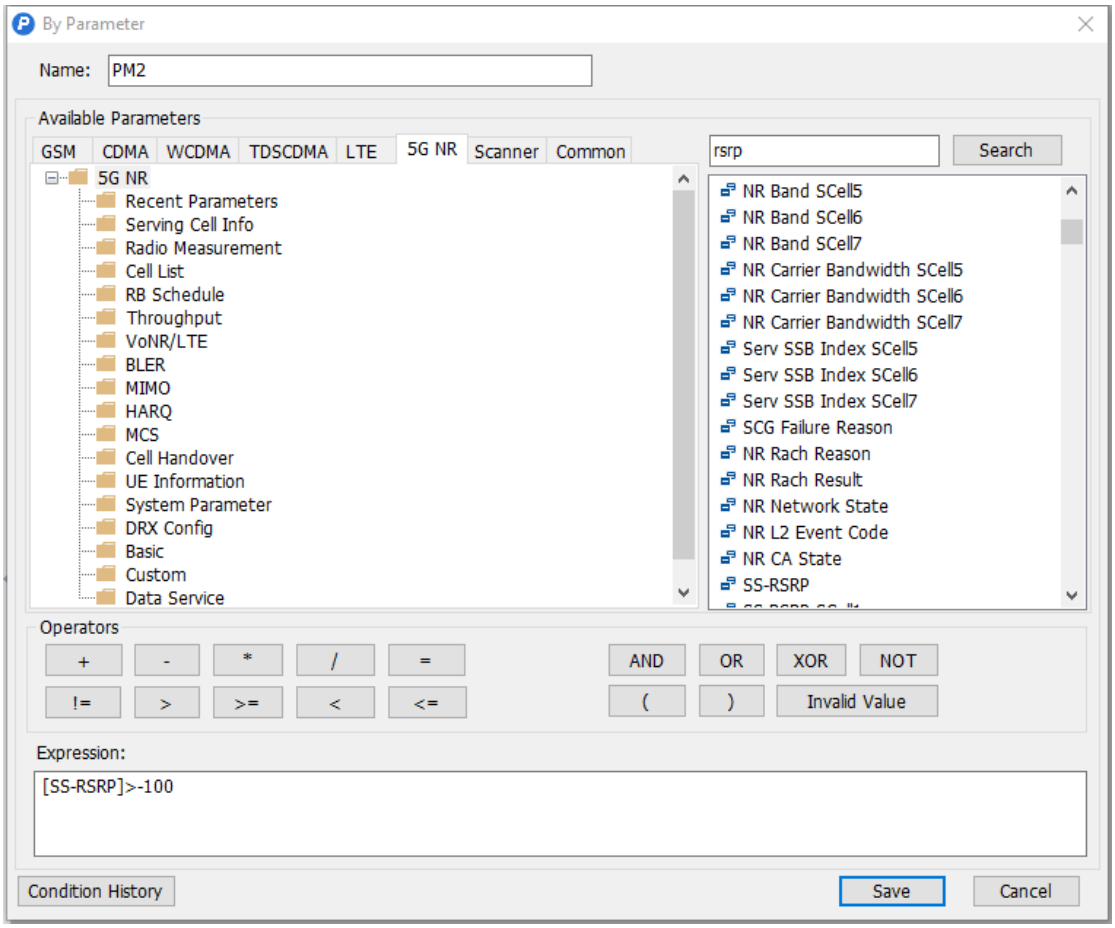
- By Parameter
- By Time
- By Region
- By State
- By Condition Range
- Service
- Cell
- Combination

5.2.1 Parameter

This type is to filter data based on parameter value range. For example, users may filter data based on the condition "RSRP>-100" or "RSRP>-100 AND RSRQ>-12".

Users may click the icon to enter the settings page. See the figure below:

Figure 5-5 Filter by parameter



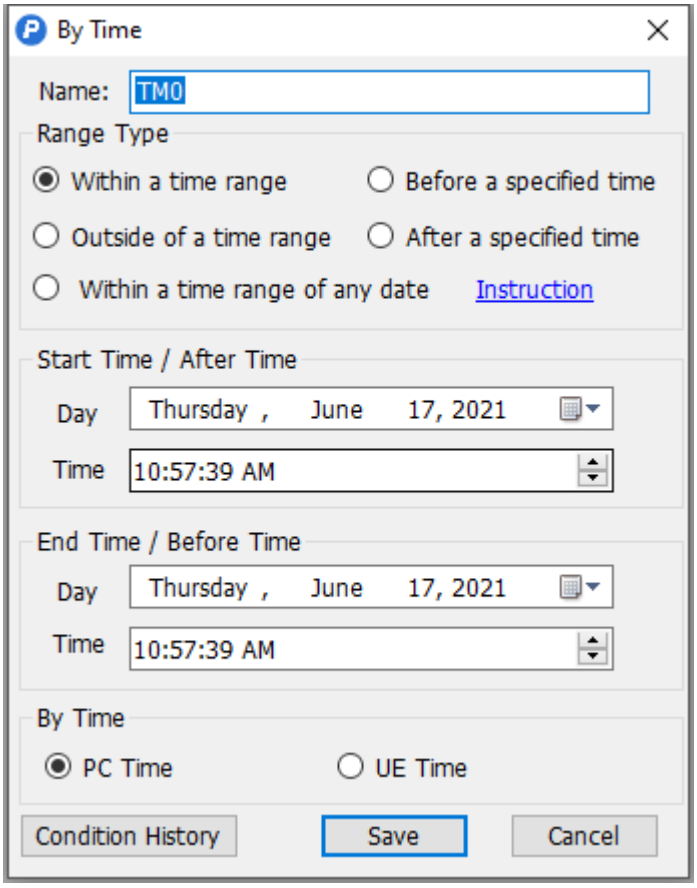
1. Name: The name set here will be displayed in the filter list on the **Filter** window. The software will provide a default name, and users may change it as required.
2. Available Parameters: All supported parameters are listed under **Available Parameter** based on network technology. Users may enter keywords to search parameters, and double-click a parameter to add it into the pane under **Expression** to define condition.
3. Operators:
   - Simple operational symbols: +, -, *, /, =, >, <, >=, <=
   - !=: not equal to
   - AND: means "together". Example: If **A** is **TRUE** and **B** is **TRUE** at the same time, then "**(A)AND(B)**" is **TRUE**. In any other case, "**(A)AND(B)**" is **FALSE**.
   - OR: means "any". Example: If any of **A** or **B** is **TRUE**, then "**(A)OR(B)**" is **TRUE**. If both **A** and **B** are **FALSE**, the "**(A)OR(B)**" is **FALSE**.
   - XOR: If both **A** and **B** are **FALSE** or **TRUE** at the same time, then "**(A)XOR(B)**" is **FALSE**. Otherwise, "**(A)XOR(B)**" is **TRUE**.
   - NOT: means opposite or contrary. Example: If **A** is **TRUE**, then "**NOT(A)**" is **FALSE e**; If **A** is **FALSE**, then "**NOT(A)**" equals is **TRUE**.
   - Invalid Value: means no value. For example, no value is obtained for some parameters at the start of the data file. Please note that invalid value is different from parameter value "**0**". Invalid value is displayed as "-9999" in the software.
4. Logical expression: The logical expression consists of parameters, operational symbols (such as "+", "-", and "="), comparison operators (such as ">", "<", and ">="), logical operators (such as "AND", "OR", and "NOT"), etc. Examples:
   - ([SS RSRP]>-100)AND([SS RSRQ]>-12): to filter data where the **SS RSRP** value is greater than **-100** and the **SS RSRQ** value is greater than **-12**.
   - (([SS RSRP]>=-110)AND([SS RSRP]<=-80))AND(([SS RSRQ]>=-14)AND([SS RSRQ]<=-8)): to filter data where the **SS RSRP** value is greater than **-100** but less than **-80** and the **SS RSRQ** value is greater than **-14** but less than **-8**.

5.2.2 Time

This type is to filter data based on time range (UE time or PC time). Users may set the start date/time and end date/time for data filtering.

Users may click the icon to enter the settings page. See the figure below:

Figure 5-6 Filter by time



1. Name: The name set here will be displayed in the filter list on the **Filter** window. The software will provide a default name, and users may change it as required.

2. Range Type:

   - Within a time range: Data collected within a specified time range (month/date/year, hour:minute:second)will be valid, while data outside of the time range will be invalid.
   - Before a specified time: Data collected before a specified time (month/date/year, hour:minute:second) will be valid.
   - Outside of a time range: Data collected outside of a specified time range (month/date/year, hour:minute:second) will be valid, while those within the time range will be invalid.
   - After a specified time: Data collected after a specified time (month/date/year, hour:minute:second) will be valid.
   - Within a time range of any date: Data collected within a specified time range (hour:minute:second) will be valid. This indicates that data collected within the specified time range of any day will be valid.

   Note: Users may click **Instruction** to view the description about each type.

3. Start time/After time: Users may set the start time for data filtering. All data after this specified time will be filtered.

4. End time/Before time: Users may set the end time for data filtering. All data before this specified time will be filtered.

   Note: Users need to set the start time and end time at the same time and the end time cannot be earlier than the start time.

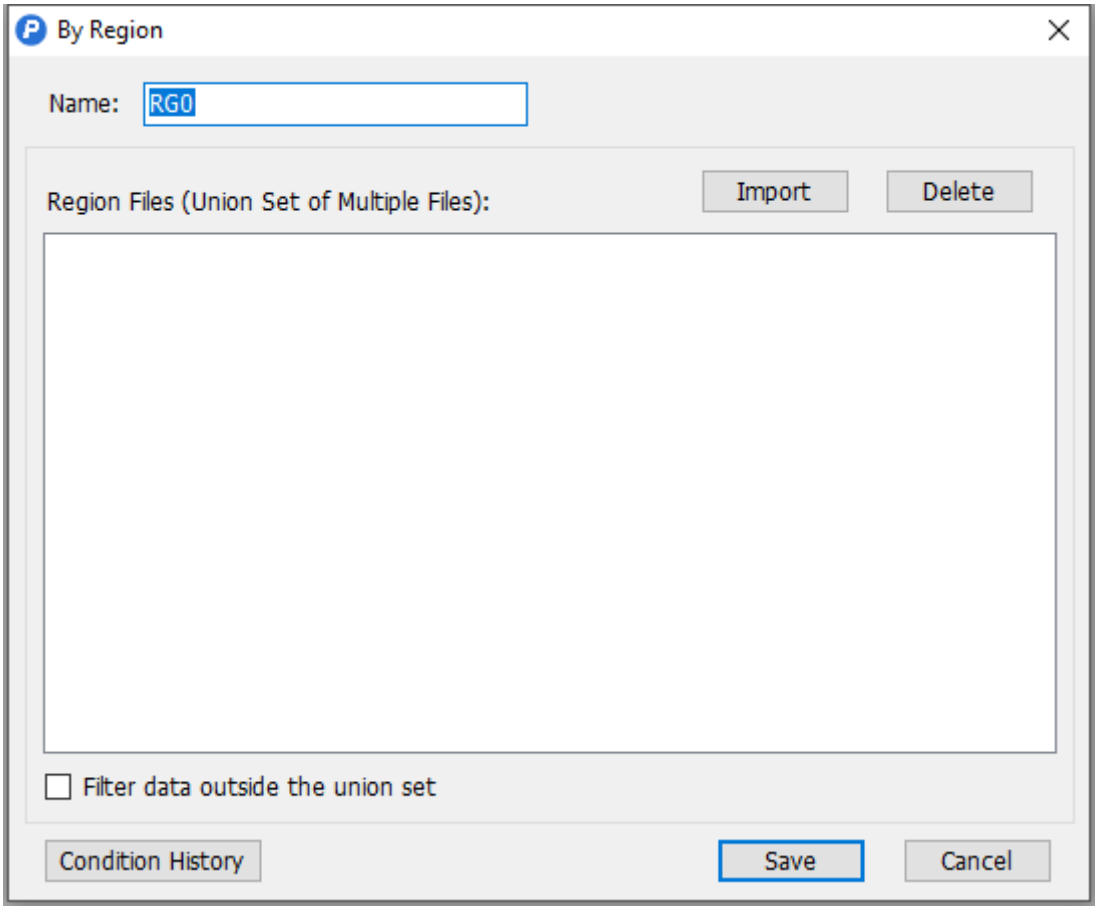
5. By Time: Select either UE time or PC time as there are two time properties for sampling points (UE time and PC time).

5.2.3 Region

This type is to filter data based on region files (*.zdf, *.Kml, or*.Kmz format). Users may filter data within or outside the selected region.

Users may click the icon to enter the settings page. See the figure below:

Figure 5-7 Filter by region



1. Name: The name set here will be displayed in the filter list on the **Filter** window. The software will provide a default name, and users may change it as required.

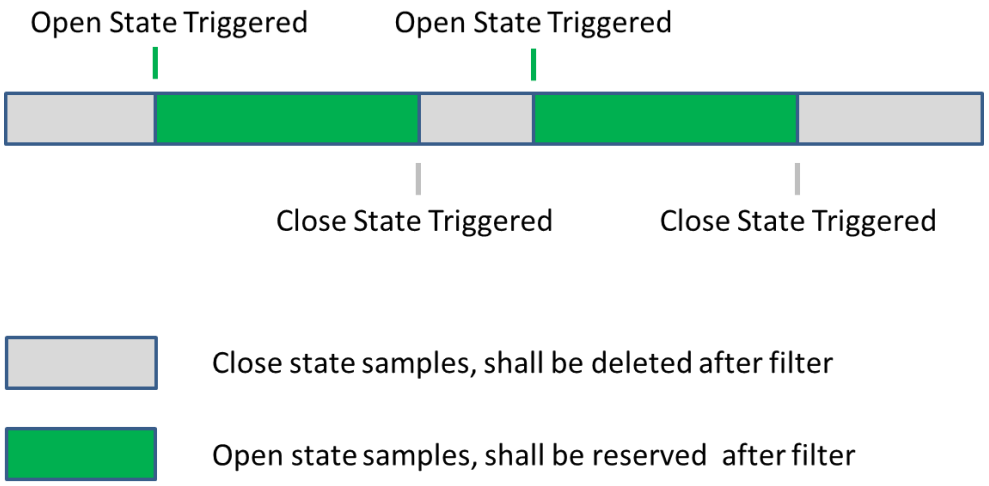
2. Region Files: Users may click **Import** to import one or more region files (***.kml**, ***.kmz**, and ***.zdf** files). Pilot Pioneer Expert will find the union set of the files and filter data based on the union set.
3. **Filter data outside the union set**: Users may select this option to filter data outside the union set. Pilot Pioneer Expert filter data within the union set by default.

   Note: Union set indicates the set of all distinct elements in the collection. For example, the union set of two region files A and B is the collection of regions which are in A or in B or in both A and B.

5.2.4 State

Users may define conditions (with events, parameters, or messages) and specify the state of a main condition as **Open** or **Close**. If a main condition specified as **Open** is triggered, then the software begins to filter data based on the condition and stop filtering data when a main condition specified as **Close** is triggered.

Figure 5-8 Open and Close state



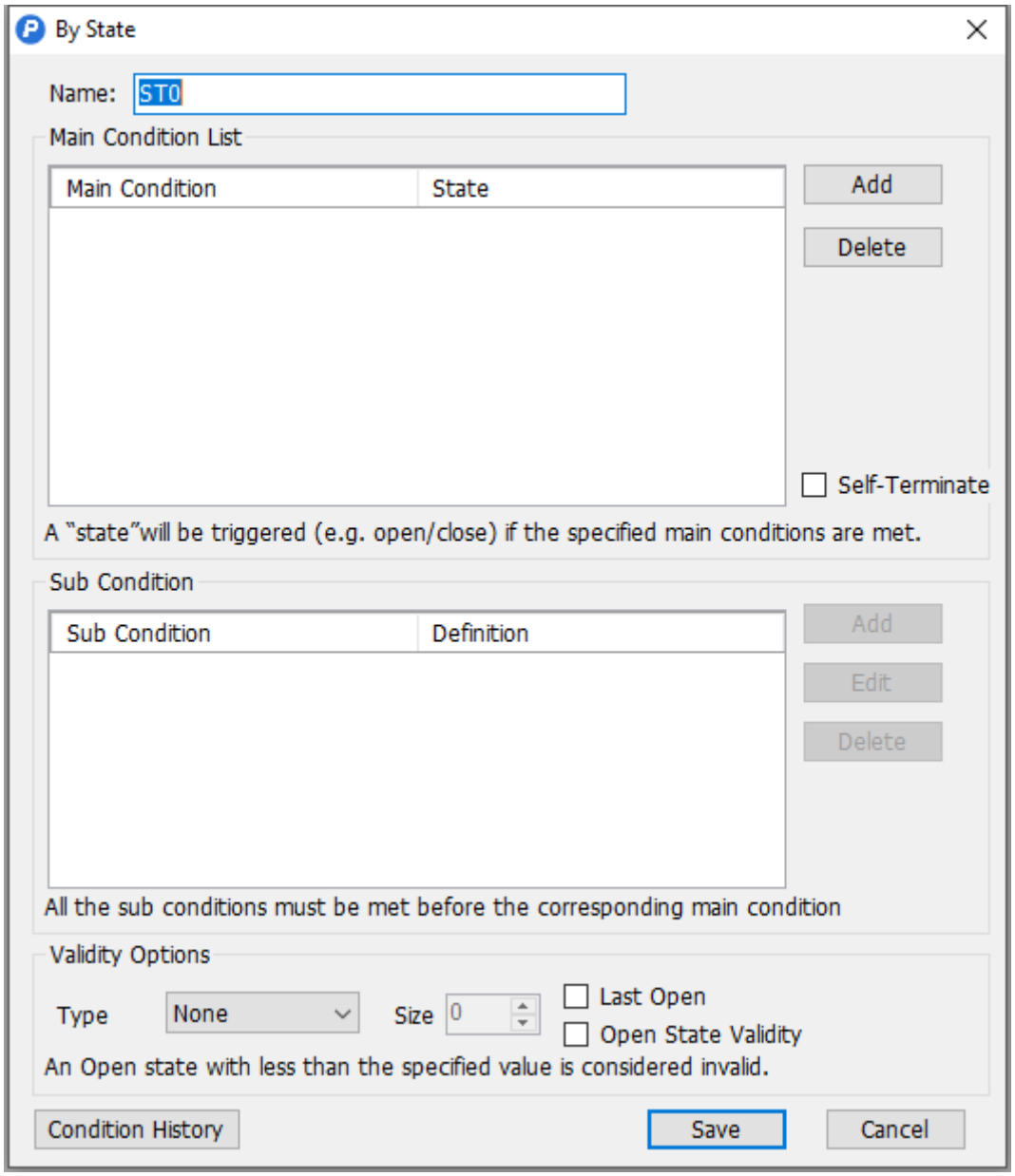
Note: The default state of a condition is **Close**.

There are two kinds of conditions: Main condition and sub condition. One main condition may consist of multiple sub conditions. Users may add multiple main conditions and specify their statuses as **Open** or **Close**. A "state" will be triggered (e.g. open/close) if all the specified main

conditions are met.

Users may double click **State** or click the icon to enter the settings page. See the figure below:

Figure 5-9 Filter by state



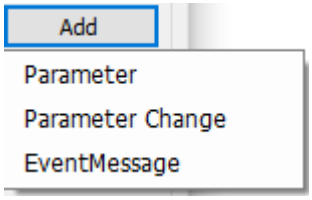
1. Name: The name set here will be displayed in the filter list on the **Filter** window. The software will provide a default name, and users may change it as required.
2. Main condition: Users may add multiple main conditions and specify their statuses as **Open** or **Close**.

- Add: to add a main condition.
- Delete: to delete a main condition. All the sub conditions included in this main condition will be deleted.
- Self-Terminate: If this option is selected, the main condition state will be automatically changed to **Close** when a main condition is not met any more. In this case, users do not need to specify a **Close** state with conditions.

3. Sub condition: Only when all sub conditions are met can the specified state of the corresponding main conditions be valid.

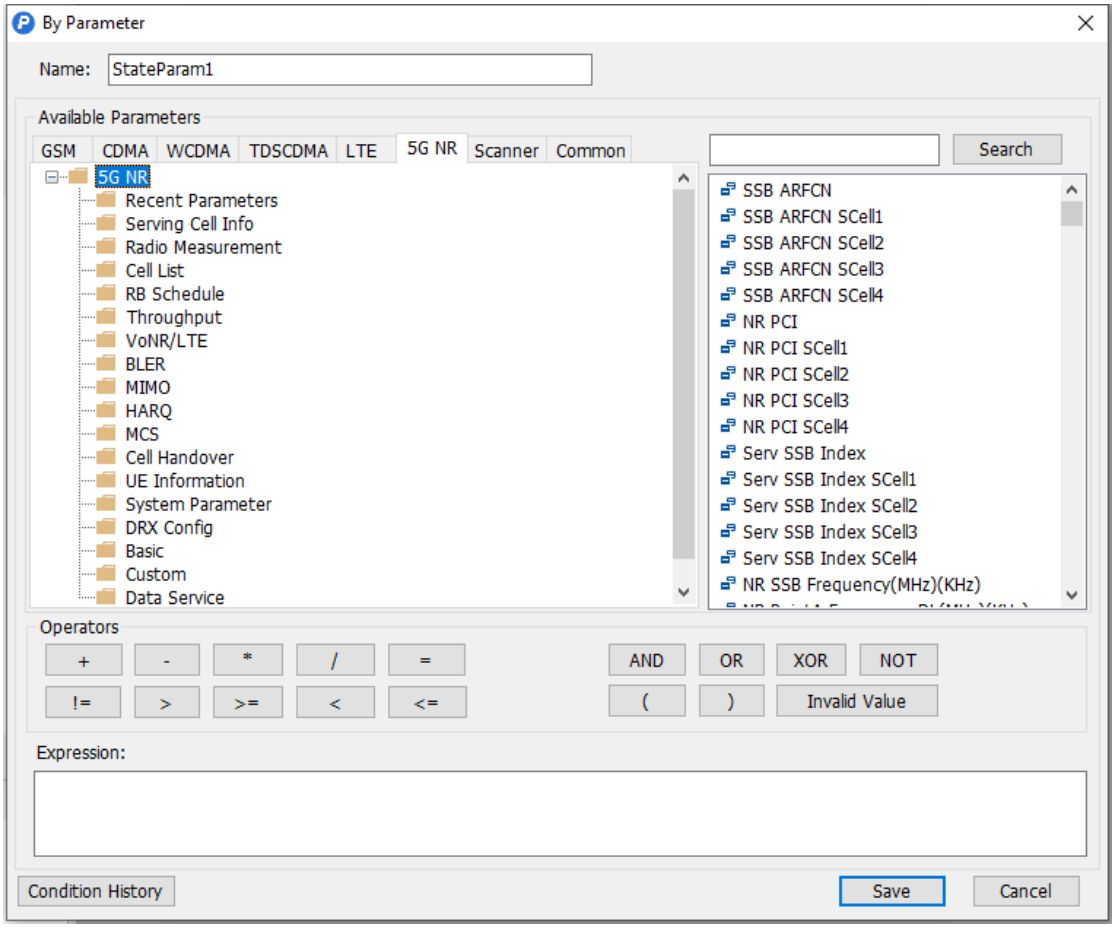
   Users may click the **Add** button and add three kinds of sub conditions:

   Figure 5-10 Sub conditions types



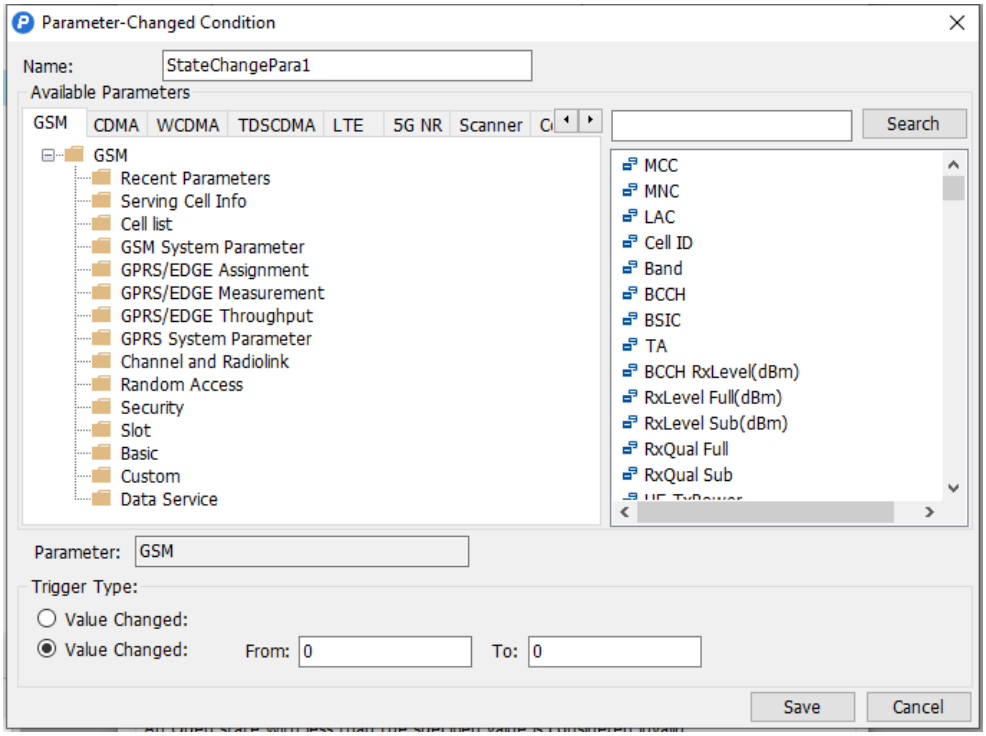
- Parameter: to add conditions based on logical expressions with parameters. Users may refer to section 5.2.1 to add a condition based on parameters.

Figure 5-11 By parameter



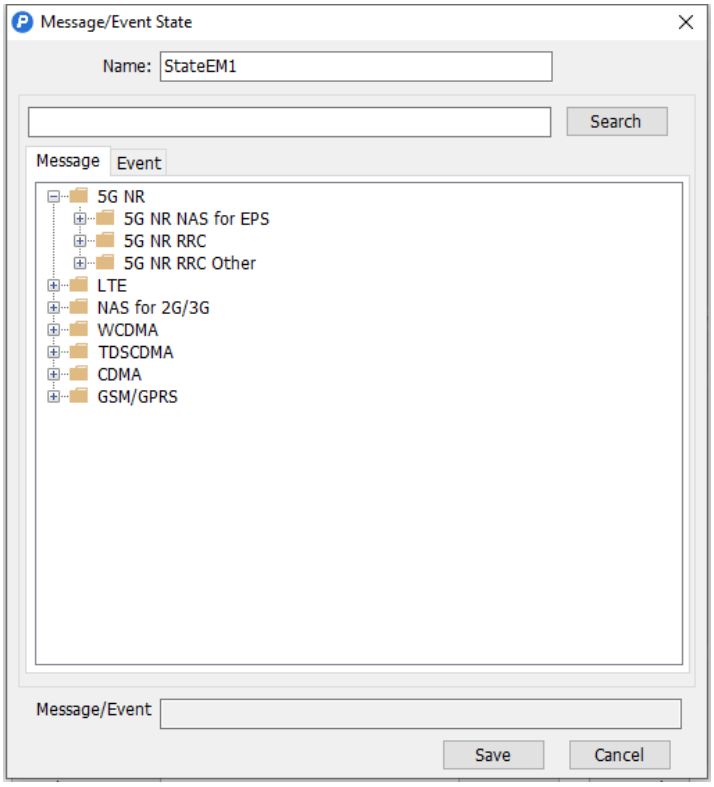
- Parameter change: to add conditions based on parameter value change or parameter value change from one specified value to another specified value.

Figure 5-12 Parameter change condition



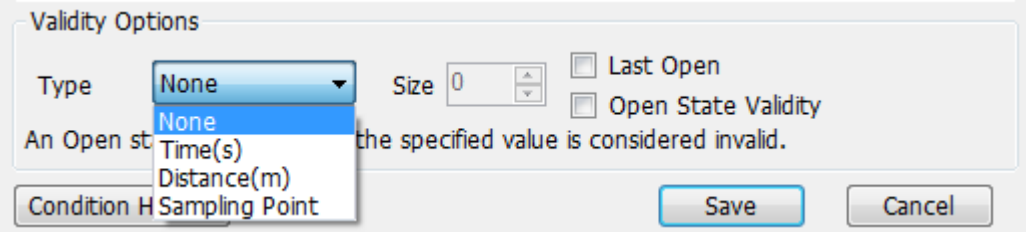
- Event and message: to add conditions with single message or event.

Figure 5-13 By message/event



4. **Validity Options**: If the duration of an **Open** state's main condition is less than the value specified by this option, the **Open** state will be considered invalid. For example, if users set the main condition as **RxLevel Sub > -85**, and **Type** under **Validity Options** to **Time**, **Size** to **10**, then only when the parameter value is more than **-85** for at least **10** seconds, can the specified state be valid.

Figure 5-14 Validity options



Note: If **NONE** is selected, there will be no limitation on the duration of a state.

When setting conditions by state, users need to pay attention to the following items:

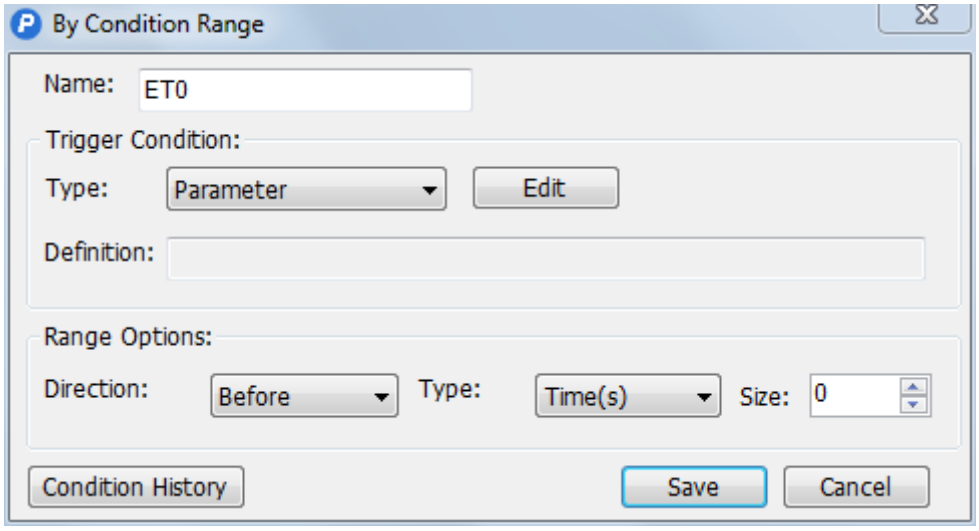
- If multiple main conditions are defined as **Open**, only the one that is closest to the main condition defined as **Close** takes effect.
- Users need to define a main condition as **Close** or select **Self-Terminate**. Otherwise, the filter will not filter the data.
- If users add a condition based on parameter value, the state can be triggered only when the value changes from the situation where the value does not to meet the specified condition to the situation where the value meet the specified condition.
- **Last Open**: Select this to trigger the position as the start position. The position should meet the following conditions:
  1) it's triggered as "Open";
  2) it is closest to the position triggered as "Close".
- **Open State Validity**: Select this to indicate that the conditions are met in the whole time range or distance range (which is selected under **Type** and set under **Size** option).

5.2.5 Condition Range

This is to filter data based on specified condition range (before, after, or after and before a specified condition, which is similar as the sub conditions in the State type).

Users may click the icon to enter the settings page. See the figure below:

Figure 5-15 Filter by Condition Range



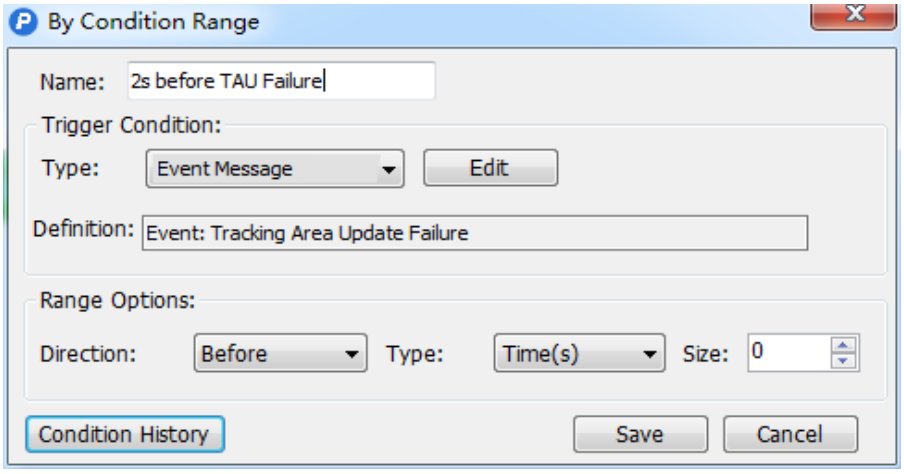
1. Name: The name set here will be displayed in the filter list on the **Filter** window. The software will provide a default name, and users may change it as required.
2. Trigger Condition: Users may select a type (e.g. Event Message) and then click **Edit** to add a condition. Users can add only one condition type here. This operation is similar with that for adding a sub condition in section 5.2.4. Users may refer to the section for more information.
3. Range Options: Users may specify the condition's range after the trigger condition is defined.
   - Direction: specifies direction. Options, Before, After, After & Before.
   - Type: specifies unit. Options: by Sampling Point, Time, or Distance.
   - Size: specifies time/distance/sampling point size based on the specified **Type**.

   Example:

   To filter all sampling points 2 seconds before Tracking Area Update Failure, users need to set **Type** under **Trigger Condition** to **Event Message**, click **Edit** to select **Tracking Area Update Failure**, set **Direction** to **Before**, **Type** under **Range Options** to **Time**, and **Size** to **2**.

   See the figure below:

Figure 5-16 Set conditions



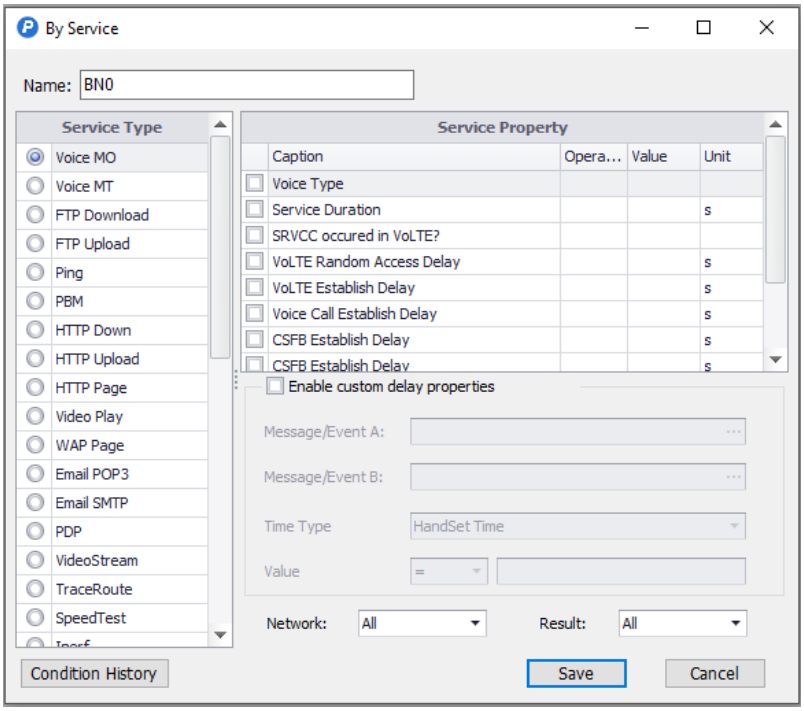
Note: If a defined trigger condition (e.g. RSRP < -100) is met within a duration, the software will filter data before or after the duration based on the specified direction (e.g. Before or After), but not before or after a specific sampling point that meets the condition.

5.2.6 Service

This type is to filter data based on test services (e.g. FTP Download) or test services with additional conditions (FTP Download & FTP DL Throughput > 10 Mbps).

Users may click the icon to enter the settings page. See the figure below:

Figure 5-17 Filter by service



1. Name: The name set here will be displayed in the filter list on the **Filter** window. The

software will provide a default name, and users may change it as required.

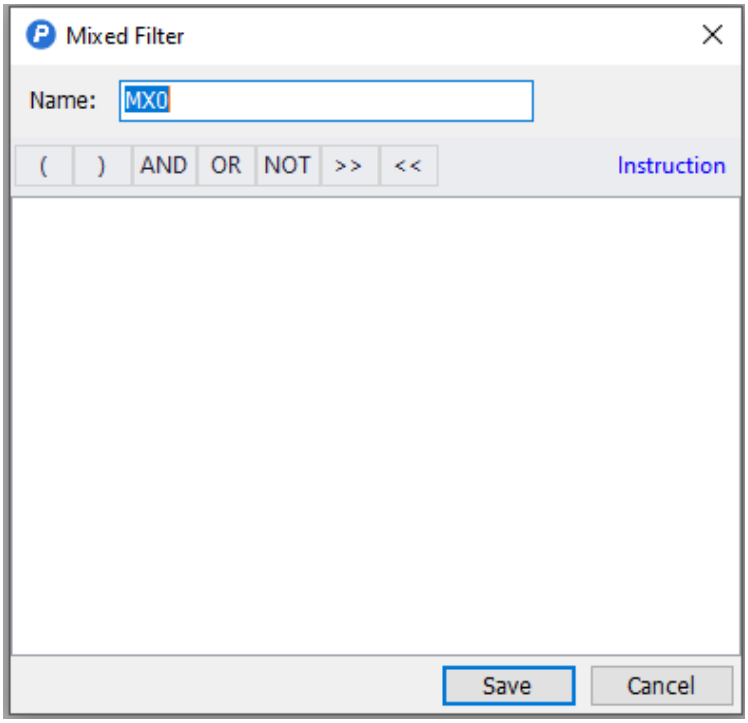
2. Service Type: Select a detailed test service for data filtering, e.g. Voice MO, Voice MT, etc.
3. Service Property: Define an additional condition for data filtering, e.g. ***Service Duration*** < ***180s***. This is optional. Users may filter data only based test service.
4. Enable custom delay properties: Click the ... icon to select two messages/events and customize the time interval between the messages/events for data filtering.
5. Network: Select a network as the additional condition for the data filtering. The option **All** indicates no limitation on the network technology.
6. Result: Select a service test result (e.g. success, dropped) as the additional condition for the data filtering. The option **All** indicates no limitation on the service test result.

5.2.7 Combination

This is to conduct comprehensive data filtering based on combined conditions, e.g. Parameter + Time + Service.

Users may click the + icon to enter the settings page. See the figure below:

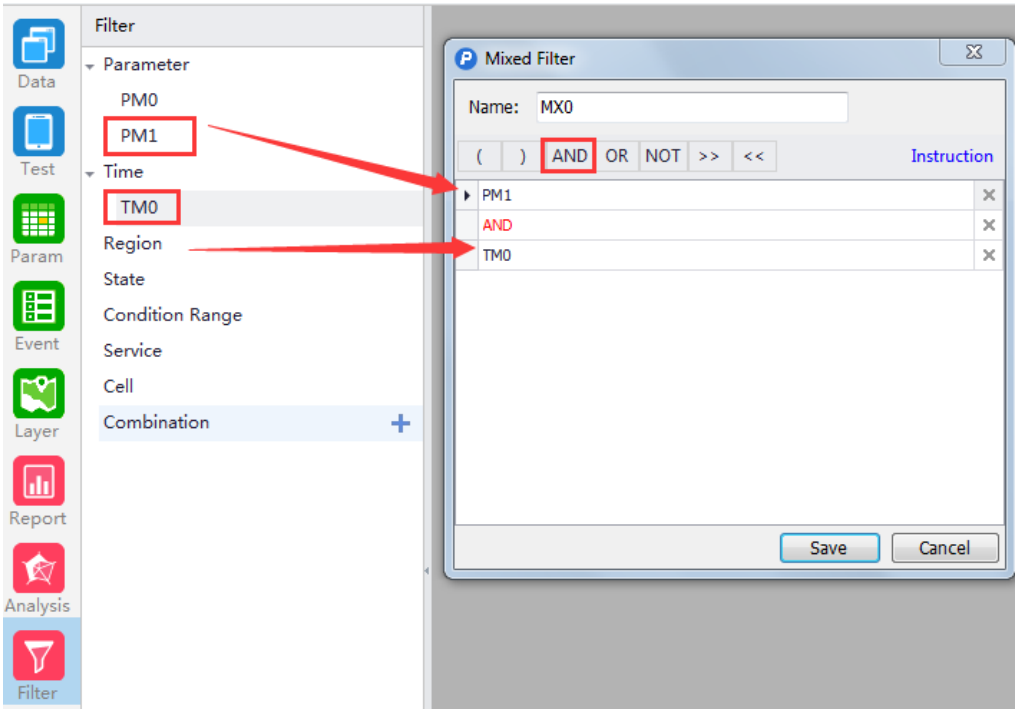
Figure 5-18 Filter by combined conditions



1. Name: The name set here will be displayed in the filter list on the **Filter** window. The software will provide a default name, and users may change it as required.

2. Logical operators: Logical operators to define the relationship between different filter conditions, including "(", ")", "AND", "OR", ">>", "<<", and "NOT". Users may click Instructions to view the detailed description of these operators.
3. Define combined conditions: Users may directly drag filters (e.g. **PM1** under **Parameter**, and **TM0** under **Time**) to the blank pane here, and click **AND** to define the relationship between the filter **PM1** and filter **TM0**. The modifications on the original conditions (PM1 and TMO) have no impact on the conditions added here, and vice versa.

Figure 5-19 Define combined conditions

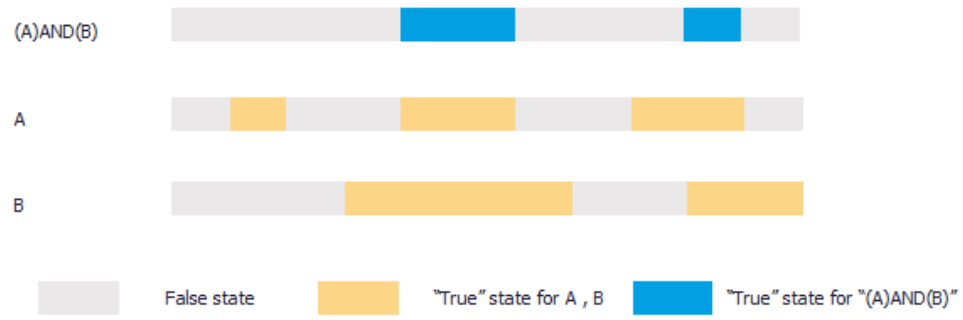


5.2.8 Logical Operators

There are several logical operators including AND, OR, >>, <<, and NOT.

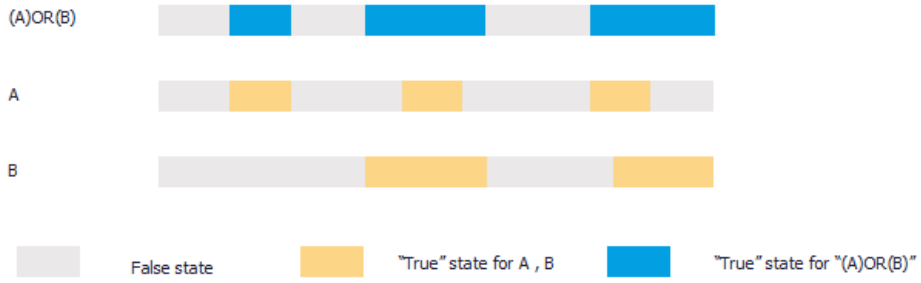
1. AND: means "together". Example: If **A** is **TRUE** and **B** is **TRUE** at the same time, then "**(A)AND(B)**" is **TRUE**. In any other case, "**(A)AND(B)**" is **FALSE**.

Figure 5-20 Operator description-AND



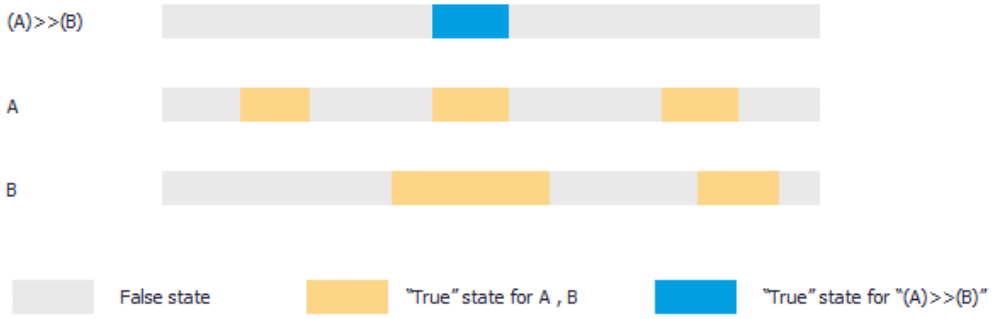
2. OR: means "any". Example: If any of **A** or **B** is **TRUE**, then "**(A)OR(B)**" is **TRUE**. If both **A** and **B** is **FALSE**, the "**(A)OR(B)**" is **FALSE**.

Figure 5-21 Operator description-OR



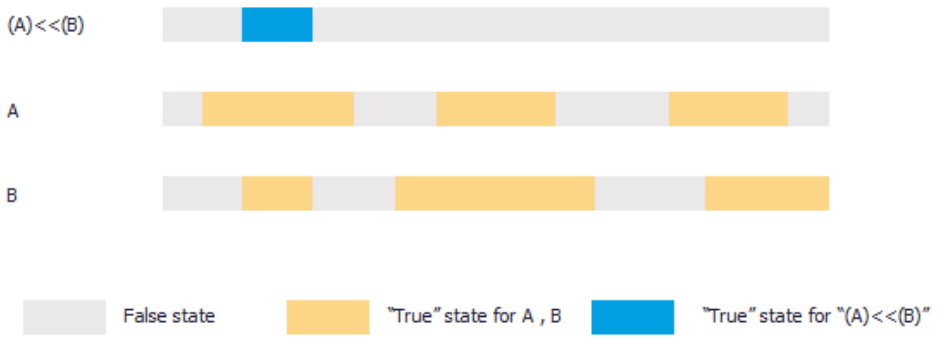
3. >>: means the left set shall be subset of the right set. If a **True** set of **A** is a subset of **True** set of **B**, then this **True** set of **A** will be the one **True** set of "**(A)>>(B)**". See the figure below:

Figure 5-22 Operator description->>



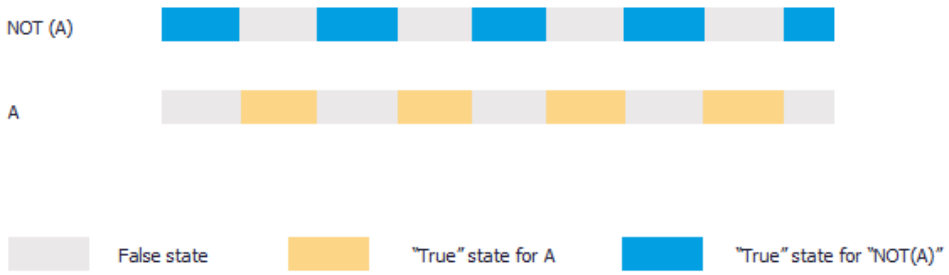
4. <<: means the right set shall be subset of the left side set. If a **True** set of **B** is a subset of **True** set of **A**, then this **True** set of **B** will be the one **True** set of "**(A) << (B)**". This way, the result of "**(A)<<(B)**" equals to that of "**(B)>>(A)**". See the figure below:

Figure 5-23 Operator description-<<



5. NOT: means opposite or contrary. Example: If **A** is **TRUE**, then "**NOT(A)**" is **FALSE**; If **A** is **FALSE**, then "**NOT(A)**" is **TRUE**.

Figure 5-24 Operator description-NOT



From the description above, we can see that the logical operators ">>" and "<<" are used to obtain the intersection of two sets.

For example, if users need to filter the sampling points two seconds before LTE Handover Request, where all RSRP values must be larger than -100 at the same time, users may define the condition "2 seconds before the event LTE Handover Request" using Condition Range. This is followed by defining the condition "RSRP>-100" using Parameter, and use the logical operator ">>" between two conditions.

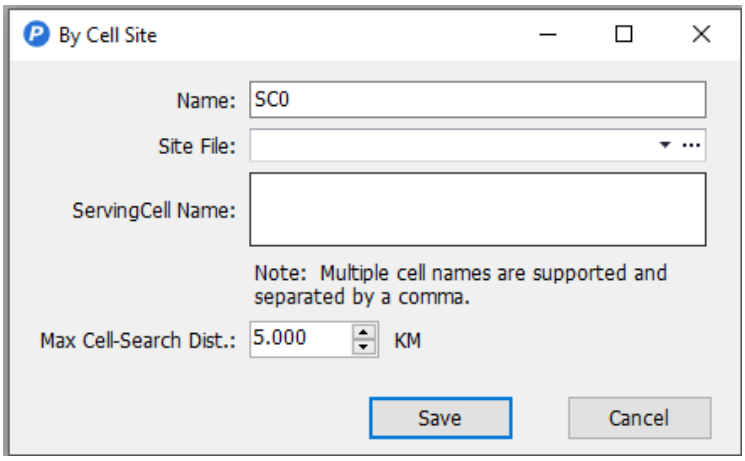
5.2.9 Cell

This type is to filter data based on serving cell name and maximum cell link distance. For example, users may filter data based on the condition "Serving Cell Name: RRU3168-fa" or "Max Cell-Search Dist.: 5.000KM".

Users may double click **Cell** or click the icon to enter the settings page. See the figure below:

Set the information based on option description in section 19.2.8 in the documentation of *A1.Pilot Pioneer Expert User Manual V10.5*.

Figure 5-25 Filter by cell



5.3 Use Filters

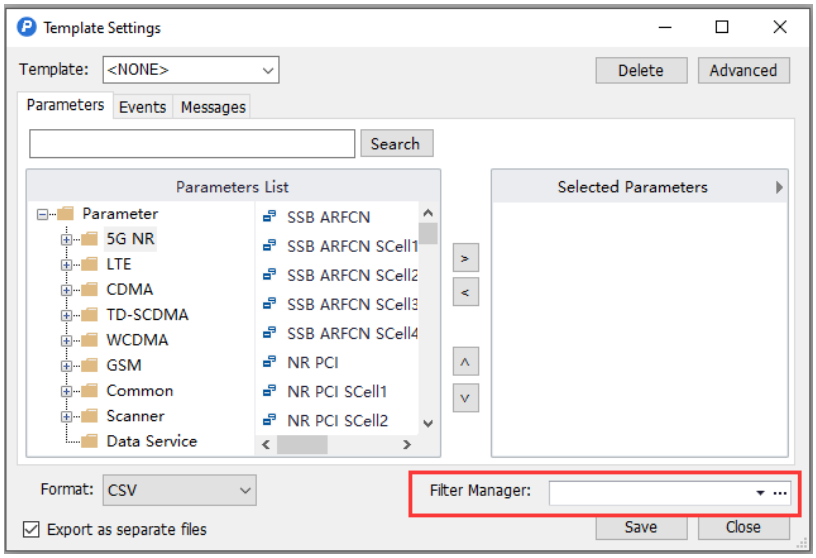
1. Users may use filters in Table, map, statistics, report, analysis, and export data window. In the window above, there may be Filter Manager or Filter option where users may select a filter or add a filter.

   Take Export Data as an example to illustrate how to use filter:

   1) Open data export window, click the drop-down arrow beside Filter Manager to select a filter or click ··· to add a filter.

   2) The software will filter the sample points based on the filter and then export the data files based on other settings.

   Figure 5-26 Select a Filter



2. Users may click the icon in the **Filter** window to directly generate filtered data and load the data to Pilot Pioneer Expert. The generated data include the information about the filter name and generated time.

Figure 5-27 Generate filtered data files

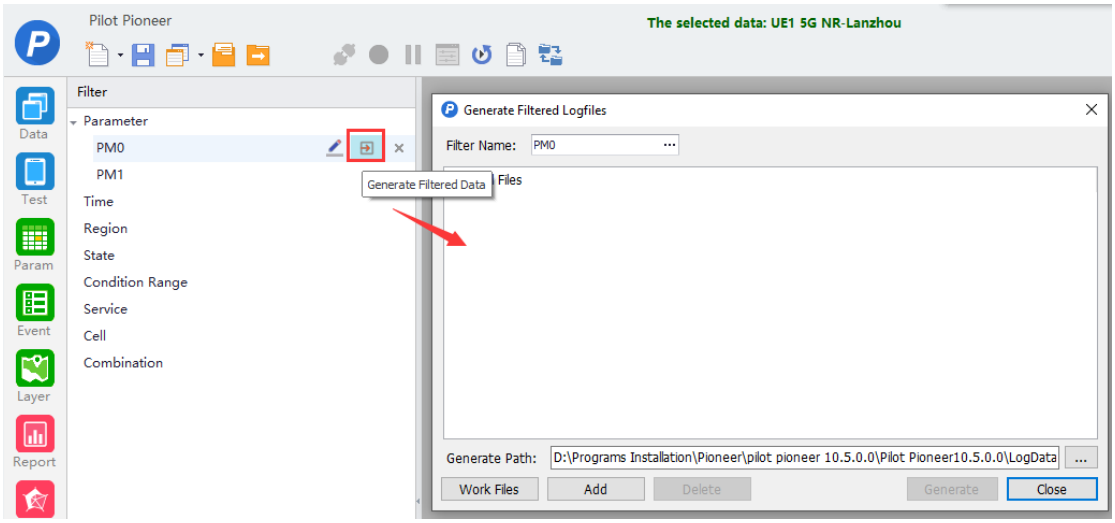
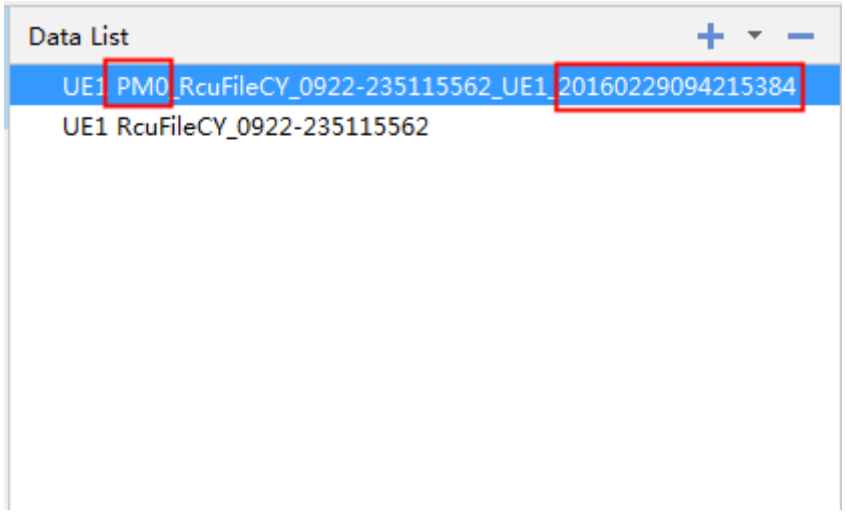


Figure 5-28 Load the filtered data to the data list



6 Data Binning

6.1 Overview

This function is used to group a number of data values into a smaller number of "bins", and obtain average (recommended), maximum, or minimum value as required. Users may bin data based on time, distance, grid, message, etc., and define the unit of Bin (e.g. 50 meters, 1 second) as required. Users may directly bin data in different windows such as Map, Table, Statistics windows for data display, or generate binned data first, and then view corresponding data in different windows.

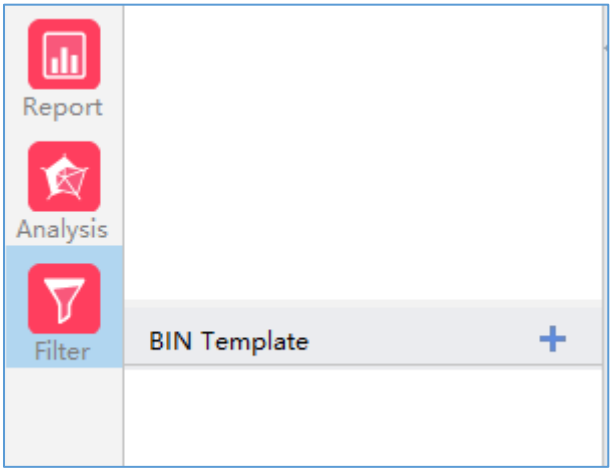
6.2 Define Data Binning Template

Users need to define a template before data binning, which includes Bin unit, Bin size, and Bin value mode. Users may reuse the same template in future.

Follow the instructions below to define a data binning template:

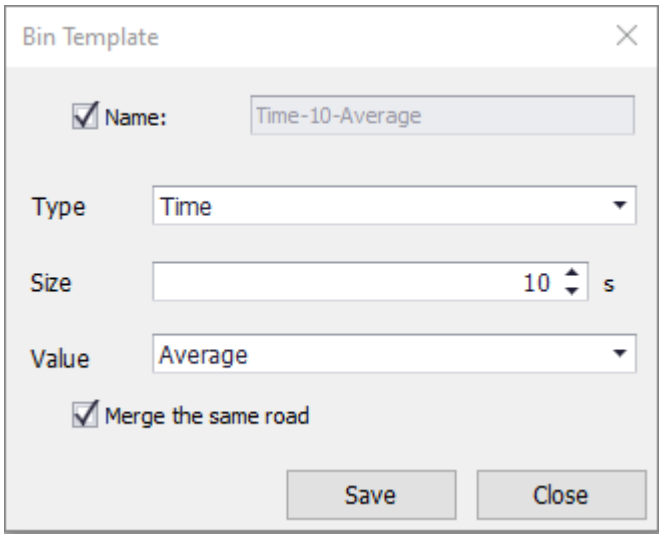
1. Click **Filter** to find **Bin Template** at the left bottom.

Figure 6-1 Bin Template



2. Click the + icon to open the template settings page.

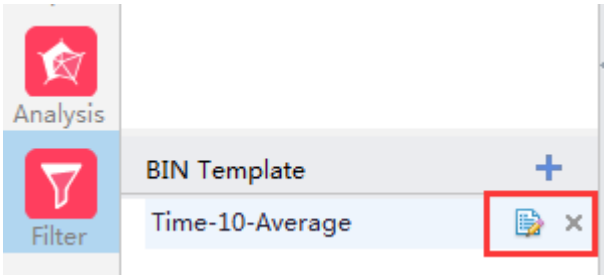
Figure 6-2 Bin template settings page



3. Conduct settings as required, and click **Save**.

Users may hover the cursor over a Bin template, and click the or icons to edit or delete the template. See the figure below:

Figure 6-3 Edit or delete a template



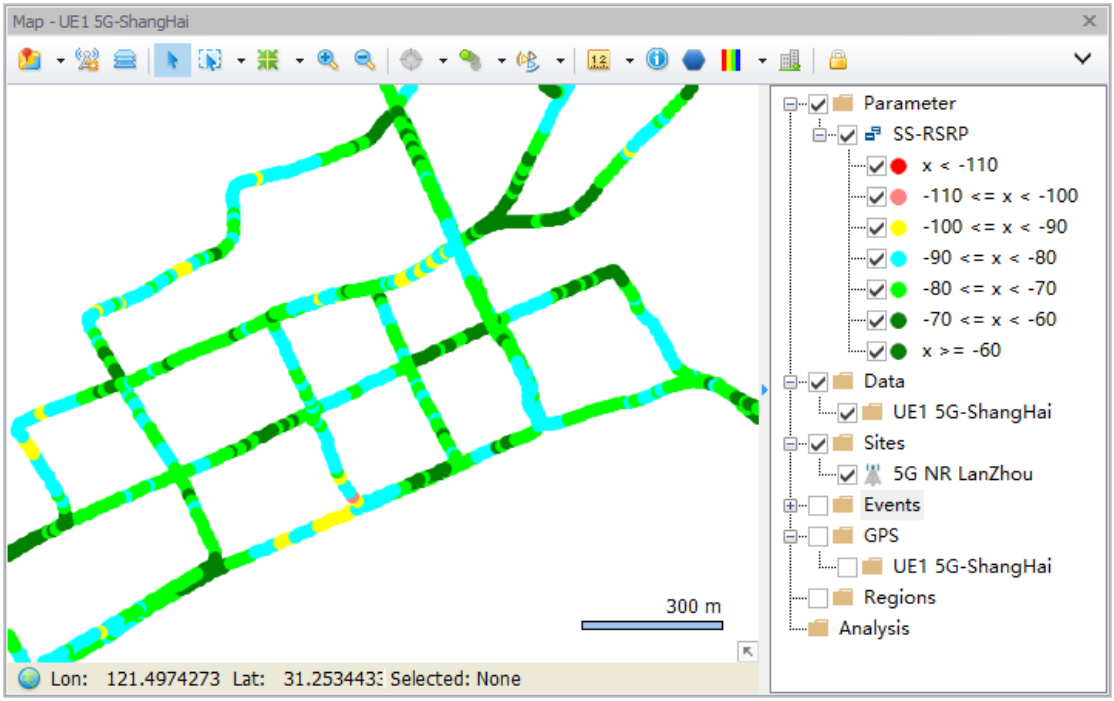
6.3 Generate Files After Data Binning

6.3.1 Bin Data in the Map Window

Follow the instructions below to generate files after binning in the Map window:

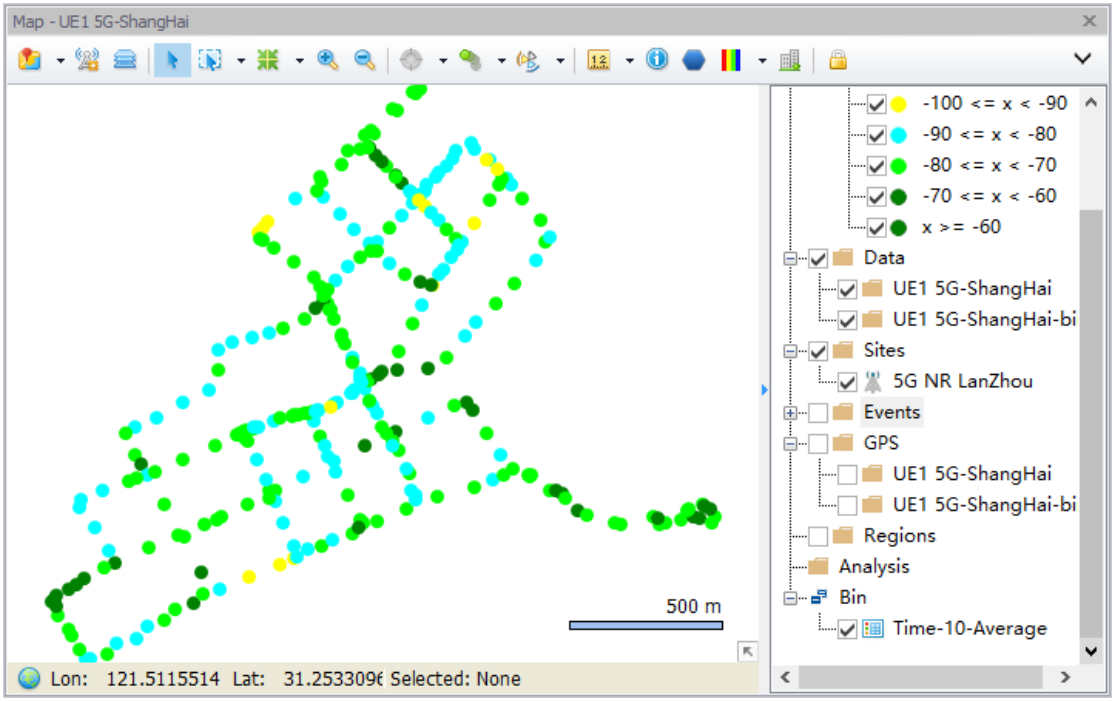
1. Load data files for binning to the Map window.

Figure 6-4 Load data files



2. Drag a Bin template to the Map window and then the data display after binning will be updated in the Map window.

Figure 6-5 Data display after binning

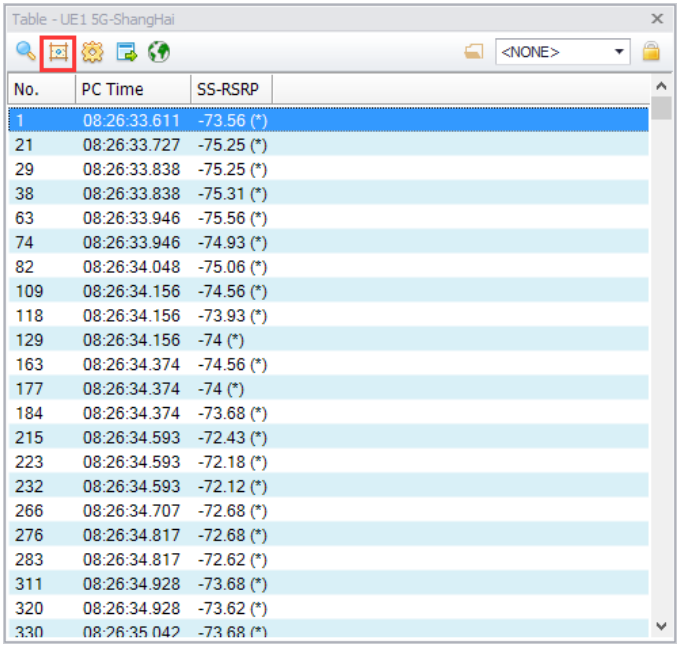


6.3.2 Bin Data in the Table Window

Here the Table window refers to the Table window opened with a right-click function. Follow the instructions below to generate files after binning in the Table window:

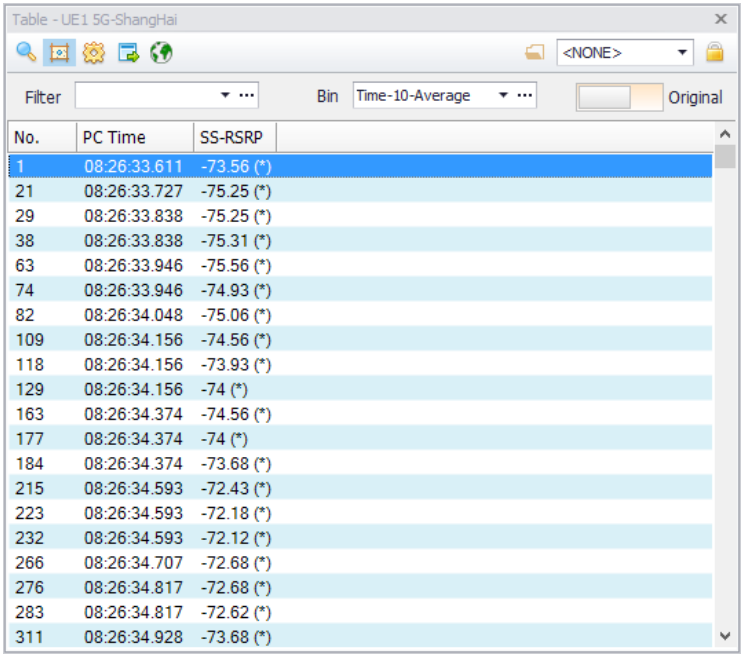
1. In the Table window, click the icon in the rectangle as shown in the figure below to display the **Filter** and **Bin** bar.

Figure 6-6 Table window



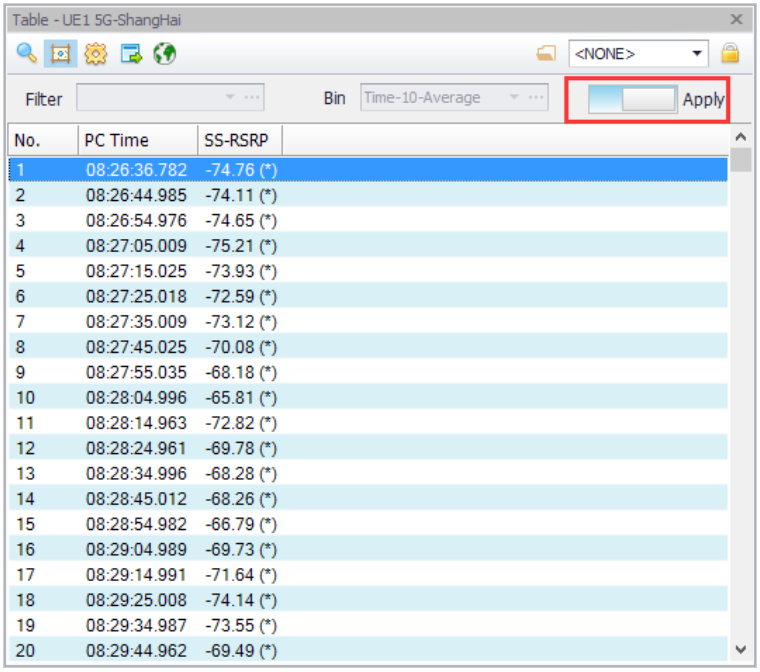
2. Click the drop-down arrow besides **Bin** to select a Bin template.

Figure 6-7 Select a Bin template



3. Click the button besides **Original** to display the data after binning. During this time **Original** changes to **Apply**. Users may click the button again to view the original data display.

Figure 6-8 Display original data or data after binning

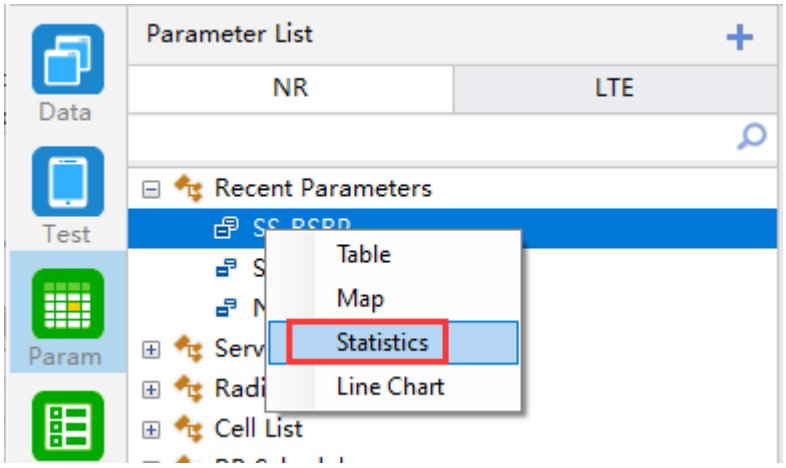


6.3.3 Bin Data in the Statistics Window

Here the Statistics window refers to the Statistics window opened with a right-click function.

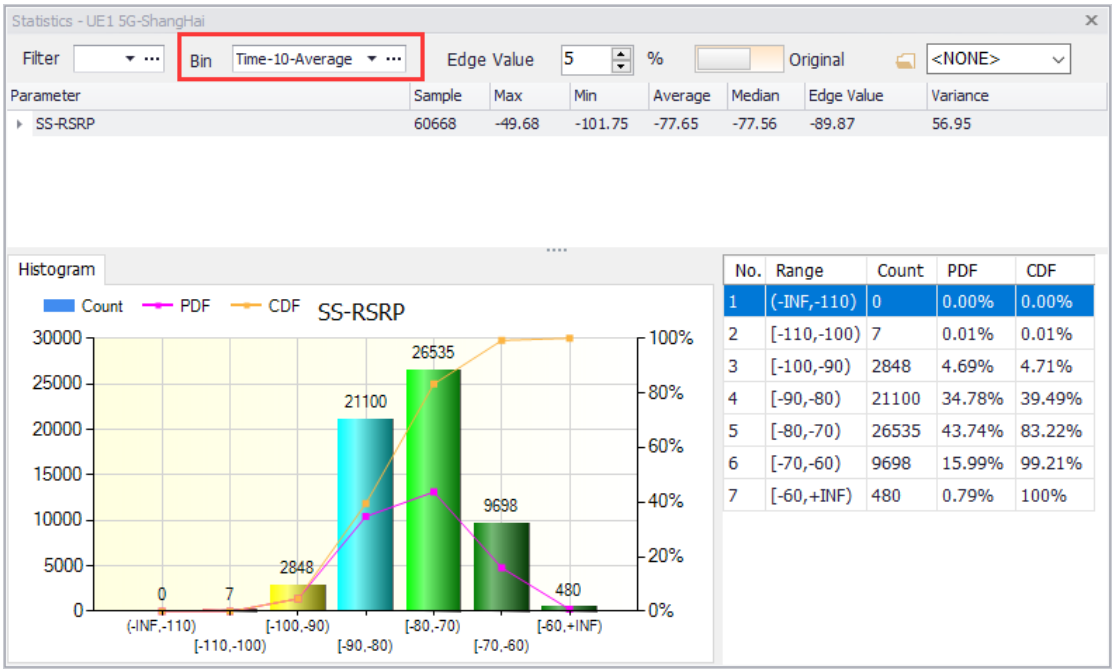
Follow the instructions below to generate files after binning in the Statistics window:

Figure 6-9 Right-click functions



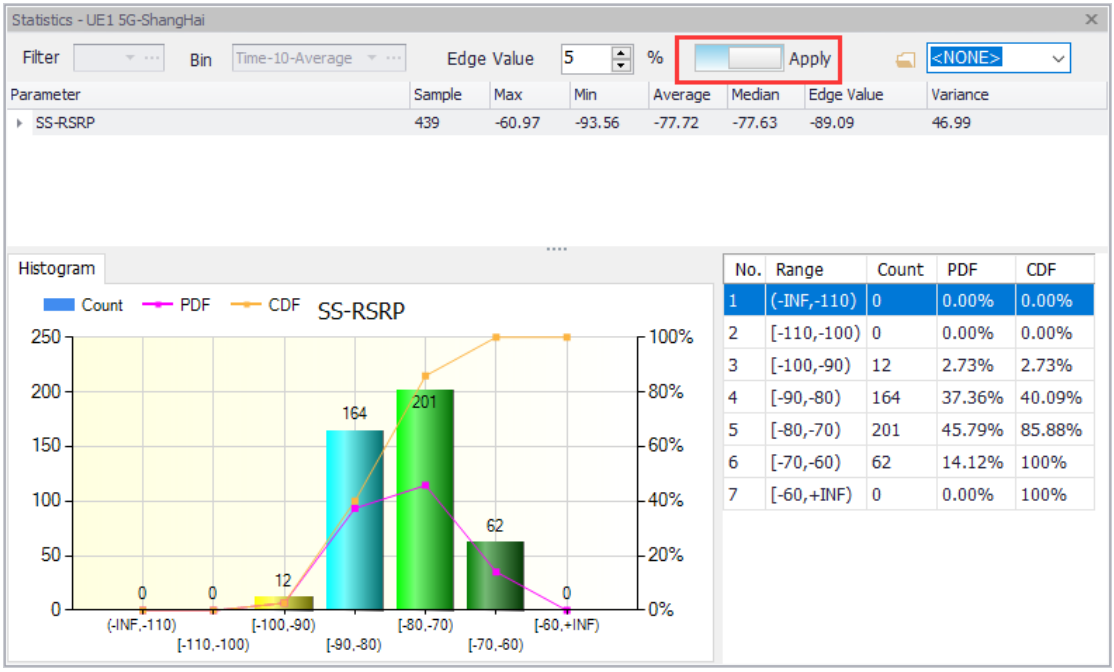
1. Click the drop-down arrow besides **Bin** to select a Bin template.

Figure 6-10 Select a Bin template



2. Click the button besides **Original** to display the data after binning. At the same time **Original** changes to **Apply**. Users may click the button again to view the original data display.

Figure 6-11 Display original data or data after binning



7 Technical Support and Contact Information

7.1 Technical Support

For any product usability issues encountered during operation, please refer to the user manual. If the issue cannot be solved or information is not available, please contact us via the following contact information:

Area	E-mail
Global	support@dingli.com

7.2 Link to DingLi

For more product information or service and technical support, please visit us at www.dingli.com.

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