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iQ·link®

Quick Start Guide

v1.32

April 2020

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1. Introduction

The iQ·link software design focuses on data integrity, to facilitate superior network designs. iQ·link is utilized by multiple domestic and international customers in the designing of over 40,000 operating microwave links where integrity of the data is of utmost importance.

To achieve this high level of data integrity, iQ·link employs a highly relational Oracle database with many built-in integrity checks, to ensure users avoid mistakes. For example, iQ·link will not allow you to assign a 23 GHz antenna to a 7 GHz microwave link design.

For this reason, the initial configuration setup of iQ·link is centered on inputting all the equipment data that is required for link designs. Once the initial setup is complete, designing reliable links is easy and efficient.

The intention of this document is to guide the user on how to launch the application successfully, perform the initial setup of the equipment database and designing the network elements.

For additional aspects of iQ·link, including details on the propagation models that are used, please refer to the iQ·link User Guide.

Need help with setup or anything else?

Contact us at iQlink-Support@comsearch.com. Comsearch is pleased to offer customized WebEx-based support sessions with expert engineers for a low cost of $495 for up to 4 hours. Support services include, but not limited too:

- Initial setup of radios, antennas, frequency plans, sites and GIS data
- Getting started training
- Advanced training
- Microwave design advice

Additional FREE support is also available 24x7 via our **iQ·link Support & Microwave Design Forum**. Users will need to register to access the online forum, which contains free tutorial videos in addition to a repository of GIS and Equipment data available to download for free.

2. Outline

The steps below cover the outline of the initial steps from launching iQ·link the first time, to designing your first Microwave Link.

- Create Band/Channels
- Create or Import Radios
- Calculate Interference Objectives
- Create or Import Antennas
- Create Waveguides/Attenuators (optional)
- Create or Import Sites
- Build your first Microwave Link
  - Profile Analysis / Line of Sight check
  - Link Budget (Design) check
  - Interference Analysis
  - Saving your link
- Creating reports

GIS database: minimum requirement to have Digital Terrain Elevation Map, DTEM file(s) to enable creating path profiles. Morphology / Clutter database is also recommended. Using building database, vectors, and maps, satellite images are optional. For detailed information on supported formats please visit the **iQ·link Support & Microwave Design Forum**.

The iQ·link installation package is shipped with demo databases of equipment: Radios, Antennas, Waveguides, Attenuators, Frequency Plans and other related databases. Installation package also contains site data, pre-planned microwave links and GIS data, which is intended for **demonstration purposes only**.

The demonstration database contains "dummy" data that can be used for trying out the features and functions of iQ·link. This demonstration data should not be used for real microwave link / network planning purposes.

3. Starting the application

Start the iQ·link application by clicking on the Windows start menu and selecting “iQ·link” under the list of programs:

Enter your **User Name** and **Password** and press the ***Enter*** key.

Default User Name: **link**
Default Password: **pw**

4. Installing the license

To install your license key, please follow the steps below

1.) Please launch iQ·link
2.) Log in
3.) Click OK to close the license warning message
4.) On the 'Login' window click on the 'About' button
5.) On the 'About' window click on the 'Enter License Key...' button
6.) On the 'License DB Interface' window select the line with the host ID shown on the 'About' window
7.) Click on the 'Edit' button
8.) Paste the license key above to the 'License String' field
9.) Click OK to close the 'Edit' window
10.) Click OK on the 'Update License Key' warning message
11.) Click Cancel to close the 'License DB Interface' window
12.) Click OK to close the 'About' window
13.) Click Quit to close iQ·link
14.) Launch iQ·link and log in again (if previously appeared, the license warning in step 3.) above shouldn't appear, indicating that iQ·link did find a valid license for your system in the destination database)

5. Populating the Equipment Database

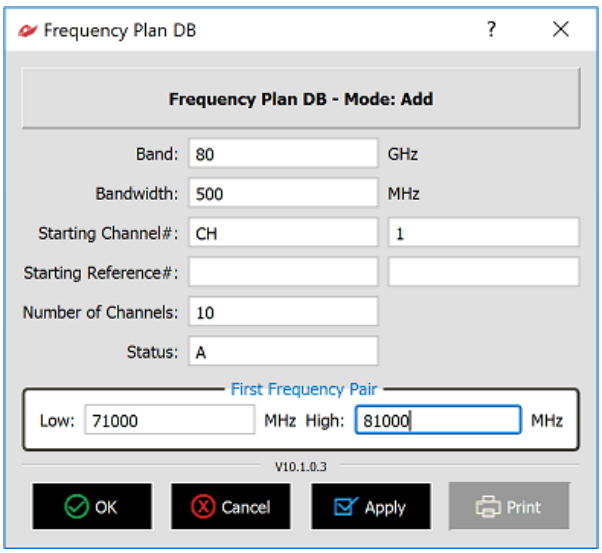
The following sections introduce the main interfaces for the entry of equipment and spectrum data.

5.1. Bands and Channels

In Frequency Plans database you can Add, Edit, View or Delete channels of Frequency Band.

Database → Frequency Plans → Add

IMPORTANT: *When you want to make link plans in a new frequency band you must define channels of new frequency band first.*



The above example will add the 80GHz band if it doesn't exist, and 10 frequency pairs, separated by the bandwidth of 500 MHz, with channel numbers starting with CH01 through CH20:

Channel	Low Frequency	High Frequency
CH01	**71000**	**81000**
CH02	**71500**	**81500**
…	**…**	**…**
CH10	**75500**	**85500**

5.2. Radios

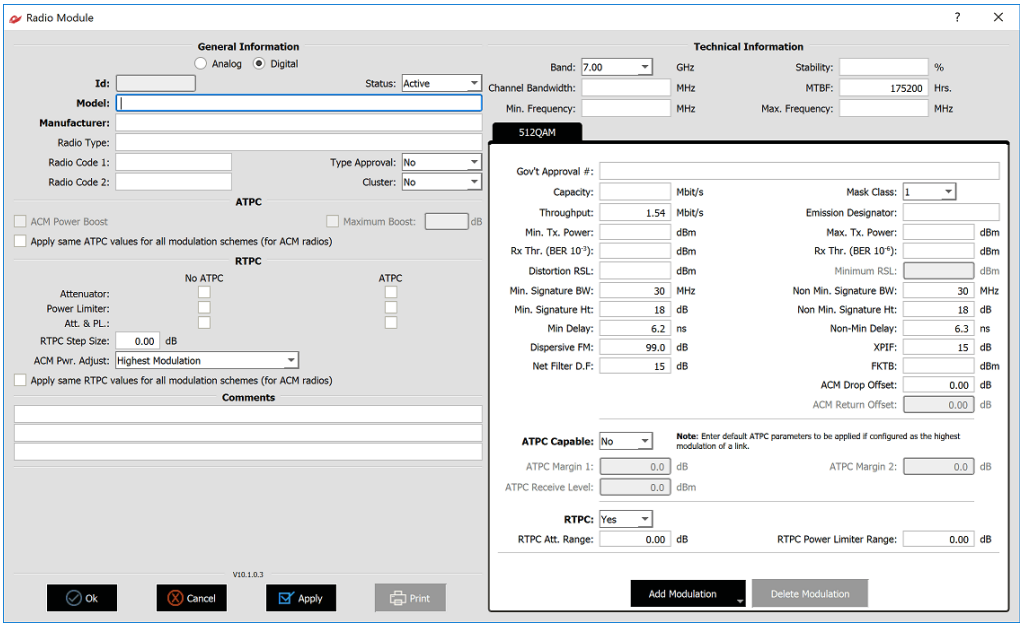
Radios can be entered manually into iQ·link using the Radio Database Interface (Database > Radios) or imported using the Radio Import Utility (Utilities > Radio Import).

NOTE: You may add new Radios into database only in the frequency band defined in the Frequency Plans database described in section 5.1.

On how to import radios into iQ·link, please visit the **iQ·link Support & Microwave Design Forum**.

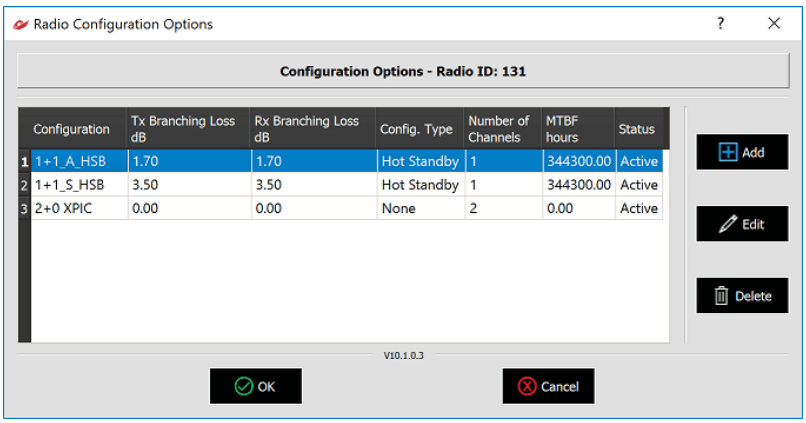
5.2.1. Main Radio Details

Database → Radios → Add



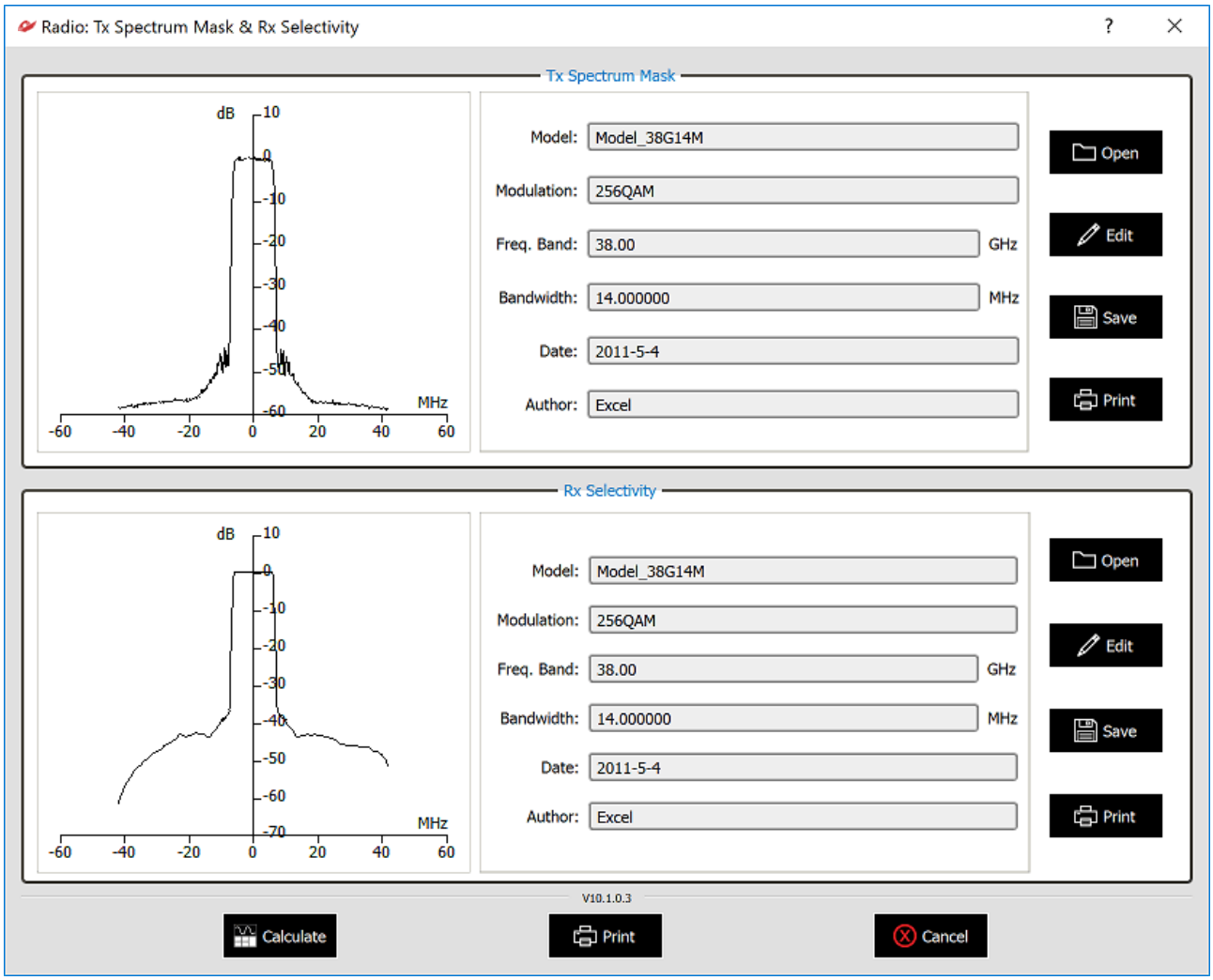
5.2.2. Radio Configuration Options

Database → Radios → Options → Configuration …



5.2.3. Radio Tx/Rx Curves

Database > Radios > Options > Tx Spectrum Mask Rx Selectivity > Single Calculation …



The **Single Calculation** option allows you to import curves, if the Tx and Rx data is provided by the manufacturer, it can be imported from a text file using the **Open** button or press Edit to enter values manually. Alternatively use the **Calculate** button at the bottom of the window to enter ETSI parameters for the system and fill up transmitted spectrum and receiver filter curves. The **Calculate button starts the Calculator,** creates curves based on pre-populated ETSI values. The **Calculator** creates Rx Selectivity curves based on various parameters including the Tx Spectrum Mask limits. Typically, ETSI values are used here, but it is by no means limited to these.

NOTE: If ADM radio is selected, then table of used modulation types is appearing to select modulation type you want to see.

Whilst the **Batch Calculation** creates curves based on pre-populated ETSI values, calculating Tx Spectrum Mask and Rx Selectivity curves in batch mode automatically.

5.2.4. IRF (Interference Reduction Factor) Curves

For accurate interference calculation results, after adding/importing a new radio, the Interference Reduction Factor curves need to be calculated by iQ·link. For that the IRF Objectives interface should be started…

Database → IRF Matrix

The band needs to be selected…

Options → Band → XX GHz

IRF matrix of selected band shows "X" marks if IRF data exists belonging to a pair of radio types. Radio ID is shown in column and row headers (place mouse over Radio IDs in header to see Radio Model name.)

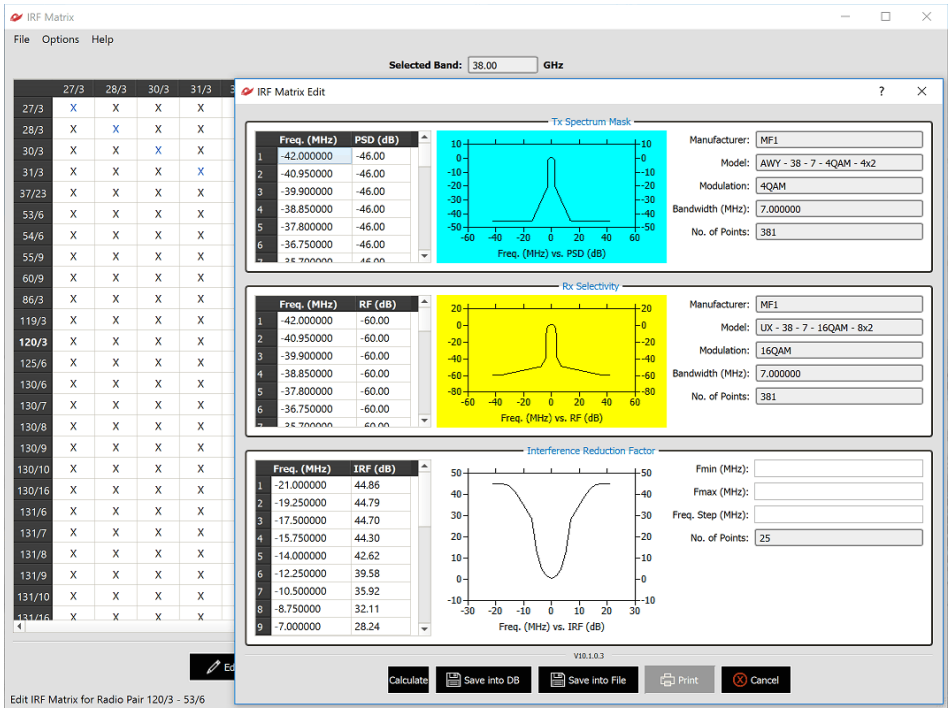
NOTE: If ADM radio is used, then Modulation ID also displayed ("/" sign used as separator)

By selecting an "X" and click on **Edit** data can be revised and overwritten or single calculation can be performed by clicking Calculate button

Batch Calculation should be launched…

Options → Batch Calculation

During the Batch Calculation process, iQ·link will check all Radio/Modulation combinations within the selected band, and if finds a combination where no IRF curve is available, but Tx and Rx curves exist, it will calculate the IRF curve automatically.



NOTE: If you use the C/I Method for evaluating interference objectives, you may use the Radio Import Utility to convert the IRF curves to C/I curves:

On how to convert IRF to C/I curves, please visit the **iQ·link Support & Microwave Design Forum**.

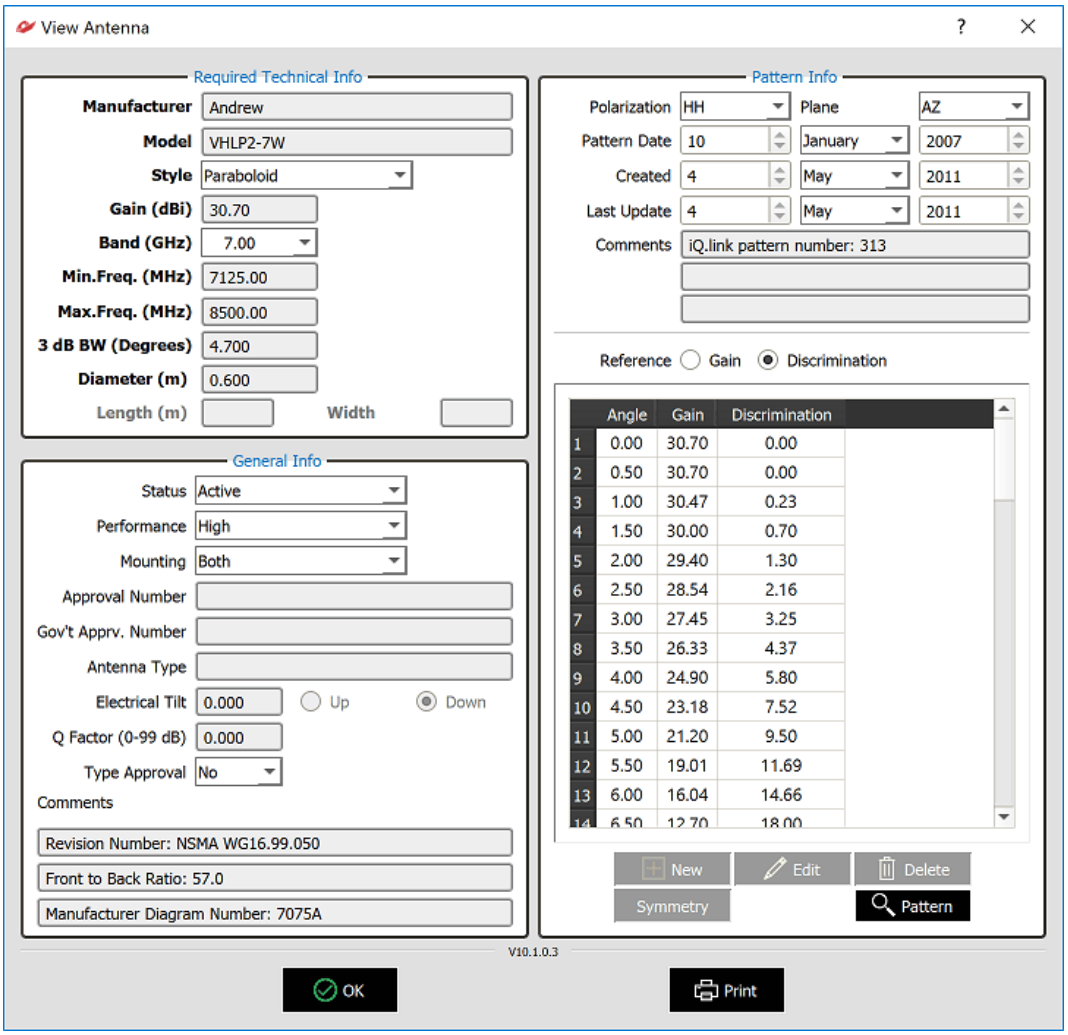
5.3. Antennas

Antennas can be entered manually into iQ·link using the Antenna Database Interface (Database > Update/Search > Antennas) or imported using the Import Antenna Utility (Utilities > Import Antenna).

On how to use Import antenna utility, please visit the **iQ·link Support & Microwave Design Forum**.

IMPORTANT: *Please make sure to always have pattern data for all 4 polarization combinations (HH, HV VH, VV)*

Database > Antennas



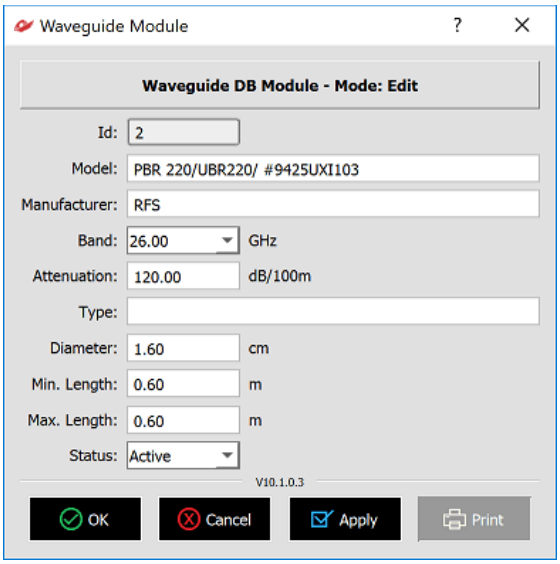
In Pattern Info tab HH, HV, VH, VV patterns can be selected by clicking Polarization drop down box.

In this tab Elevational antenna patterns also can be entered or viewed by using Plane drop down box. If Elevational antenna characteristics are not filled up, then iQ·link will be using the default Azimuthal patterns instead of Elevational by 3D antenna pattern calculations of Interference Analysis.

By using Pattern button selected antenna pattern can be viewed.

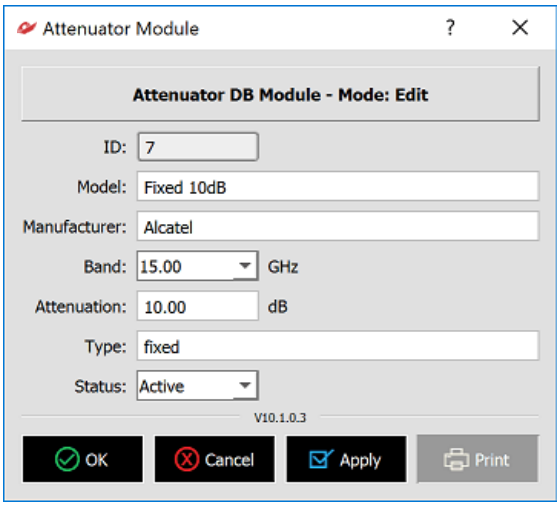
5.4. Waveguides

Database → Waveguides



5.5. Attenuators

Database → Attenuators



6. Creating Network Elements

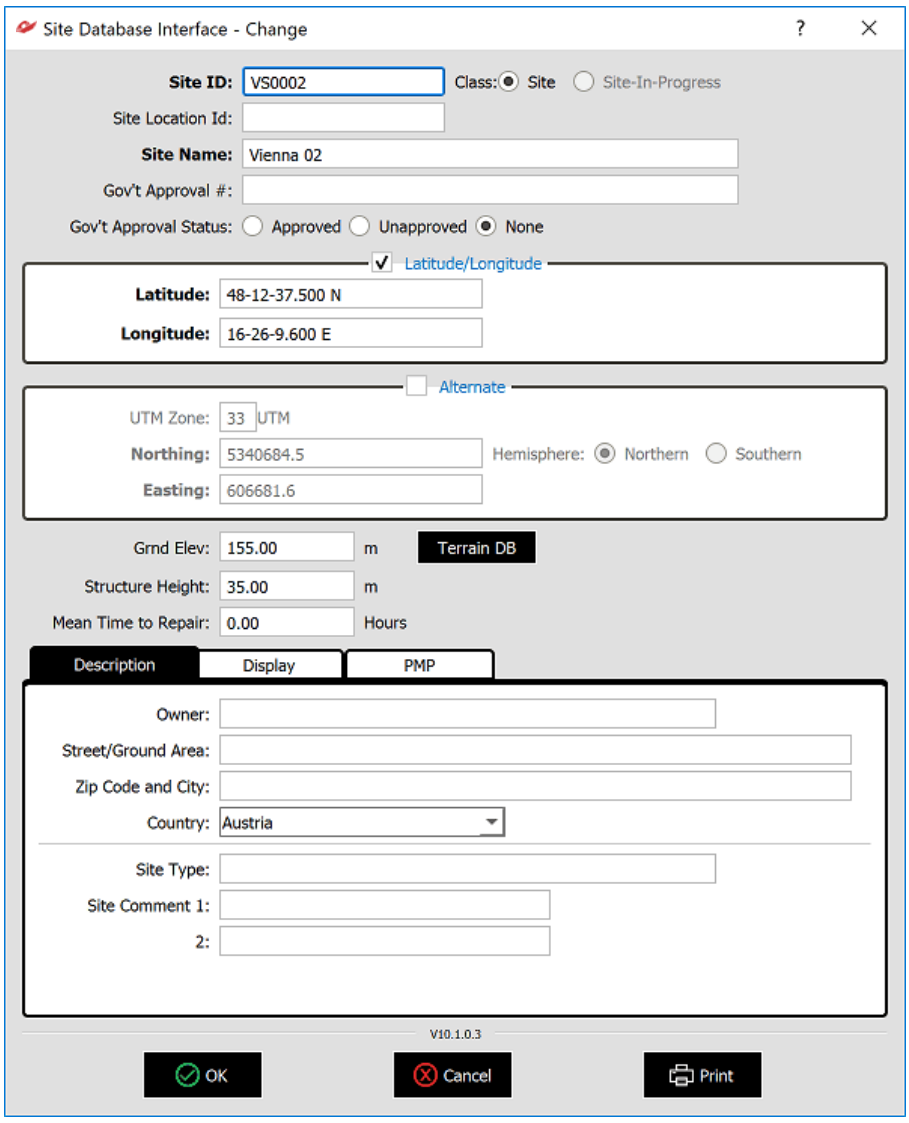
6.1. Sites

Sites can be entered manually into iQ·link using the Site Database Interface (Database > Update/Search > Sites) or imported using the Import Site Utility (Utilities > Import Site).

On how to import sites into iQ·link, please visit the **iQ·link Support & Microwave Design Forum**.

IMPORTANT: *Please make sure to have reference base of site coordinates on the same ellipsoid like the GIS data, for accurate overlay.*

Database > Sites > Add, Change, Delete, View



NOTE: Mandatory fields for a site are the ID, Name and a set of coordinates (labeled in bold). If you leave ground elevation empty, or set it to 0, the ground elevation will be automatically determined from the GIS data at the given location.

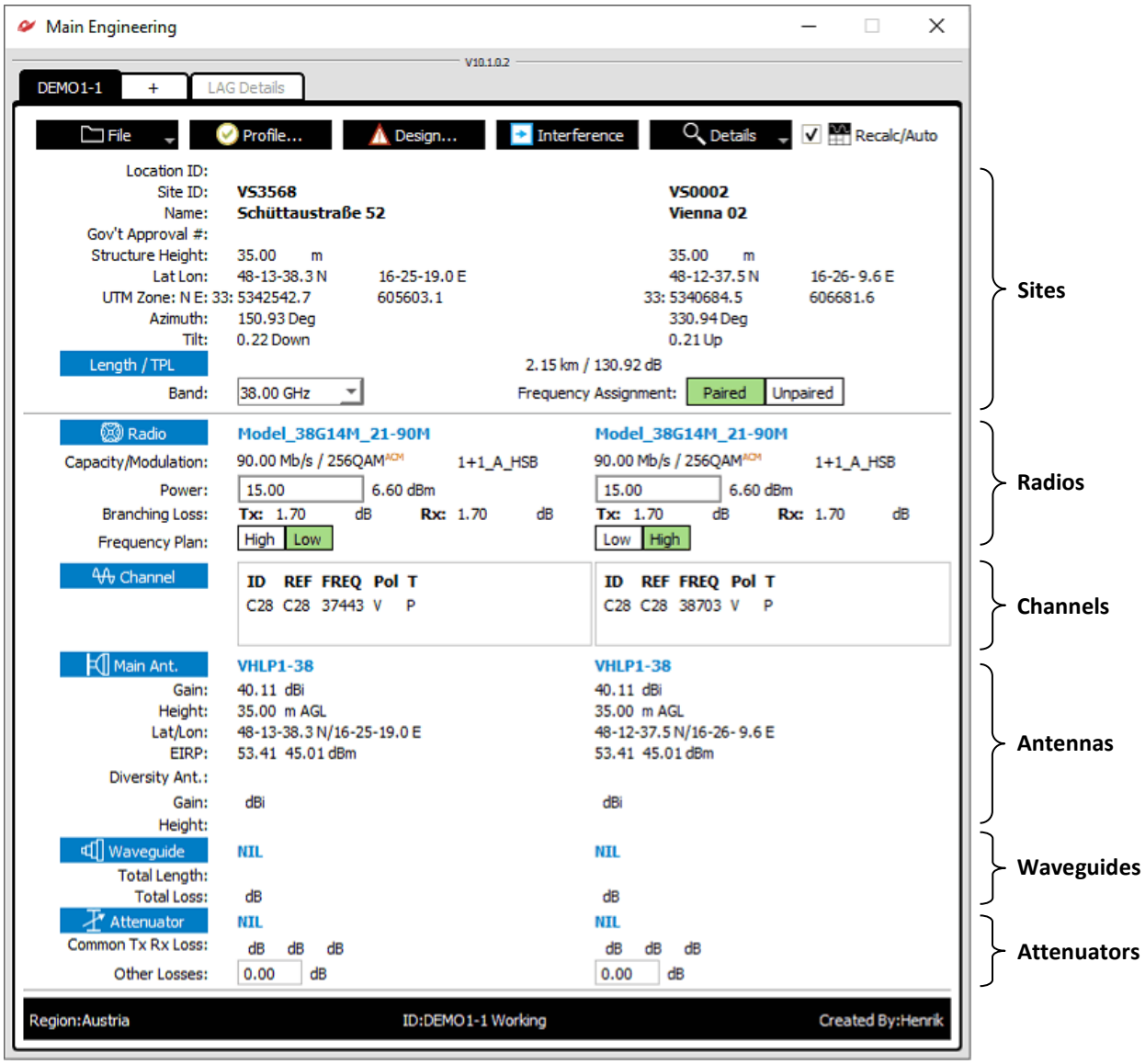
6.2. Links

Links are Created in iQ·link with the help of the Main Engineering Window…

Main Engineering → Files → Create Link

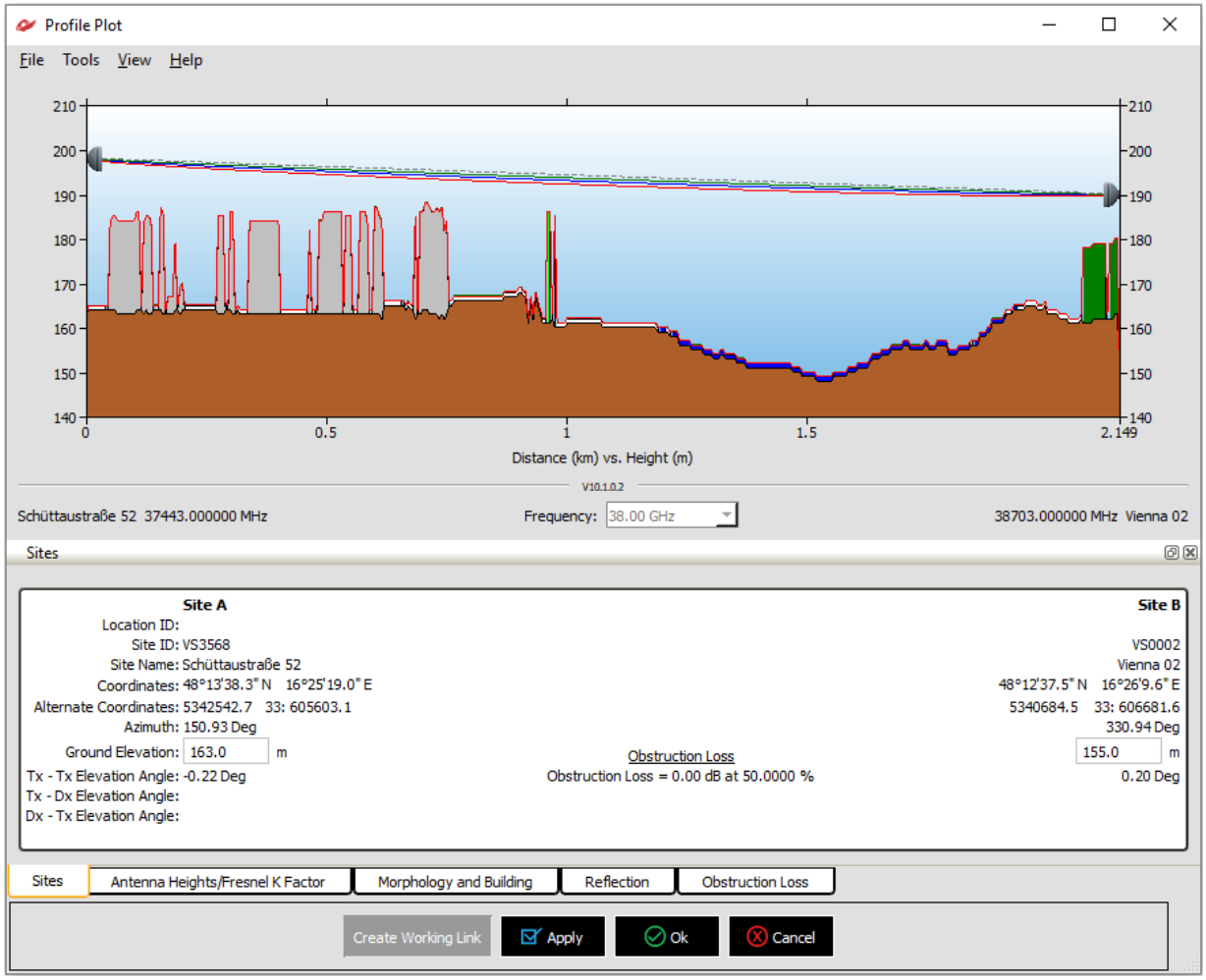
Here are the basic steps: Select/apply the end Sites, select the Band, choose the required radios and antennas (optionally waveguides and attenuators).

NOTE: Channels don't need to be pre-selected, when the link is created. Interference Analysis will help to select an interference free channel at a later stage.



6.2.1. Profile Analysis

Main Engineering → Profile…



In Profile Menu antenna heights can be optimized, terrain and morphology data revised or modified. Reflection and Anti-Correlation analysis for Space Diversity system design can be performed.

6.2.2. Design (Outage/Unavailability Prediction)

Main Engineering → Design…

6.2.2.1 Propagation Models

- ITU-R P.530-6 through to ITU-R P.530-17
- Vigants
- Galuner

The newest reliability model is the P.530-17 model. This does not require any user input while determining the value of the geoclimatic factor. To find the proper geoclimatic factor for the earlier versions of the P.530 reliability model, the geoclimatic Factor Calculator may be used. Setting the default value of the geoclimatic factor is possible in the System Administration Utility (Utilities > Sys Admin).

NOTE: For different versions of the P.530 recommendation series the value and definition of the geoclimatic factor is also different.

6.2.2.2 Objective Models

For link performance calculation following Objective Models can be selected from drop down box:

- ITU-T G.826
- ITU-T G.821
- General

Interference Analysis

Main Engineering > Interference

iQ·link supports two Interference Calculation Methods, which need to be pre-selected in the System Administration Utility.

The IRF method users interference reduction factor calculated by iQ·link from the Tx Spectrum Mask / Rx Selectivity curves of the radio, to normalize all interference to co-channel, then to determine the Threshold Degradation of the victim based on the noise increase.

The C/I method compares the calculated T/I (when carrier faded to Threshold) against the objective provided by the manufacturer of the victim radio, depending on the frequency separation. If the calculated T/I is missing the objective provided by the manufacturer, the case is reported.

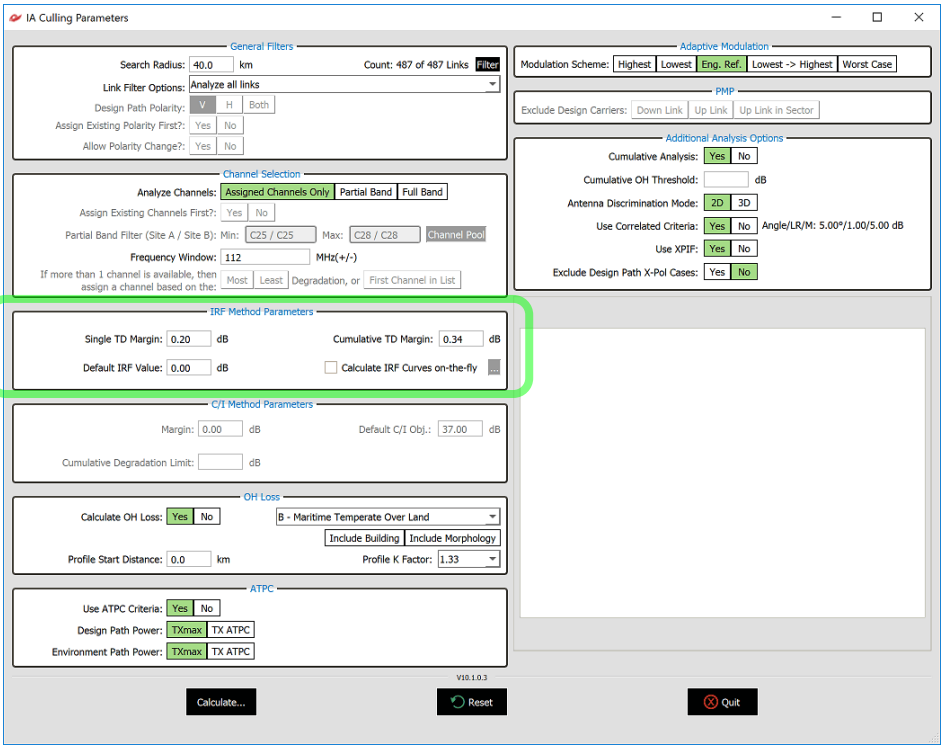
It is recommended to use the method which is also used by the regulator of the country the link is designed in.

6.2.2.3 IRF Method

6.2.2.3.1 Analysis Parameters

Set and select the appropriate parameters for the interference analysis.

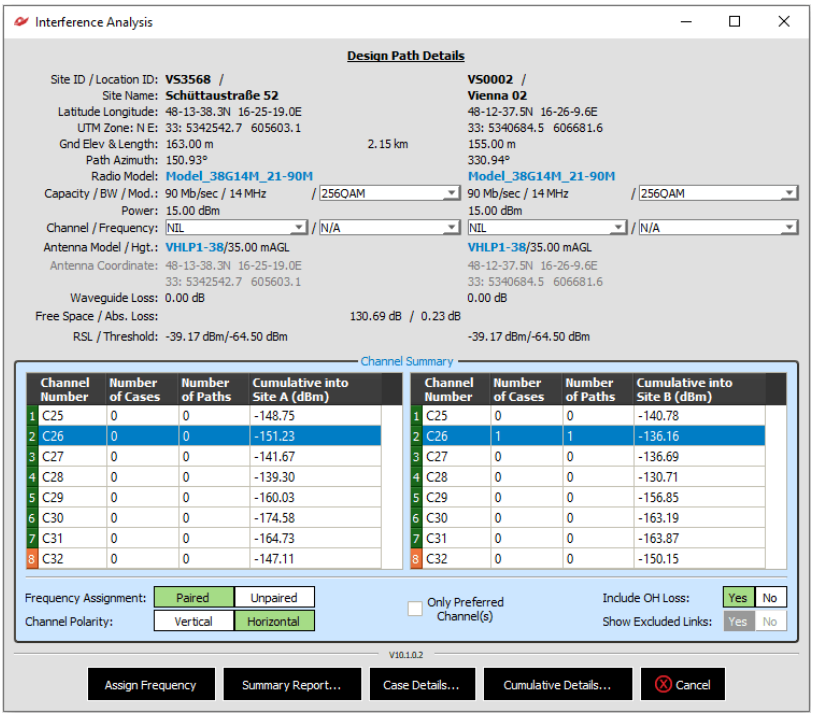
*NOTE: Please pay attention to all the calculation parameters, in particular the Search Radius (Coordination distance), as this has a dramatic affect on the results. For more information on this and the rest of the options below, please refer to the **iQ·link Support & Microwave Design Forum** for further details.*



6.2.2.3.2 Analysis Summary

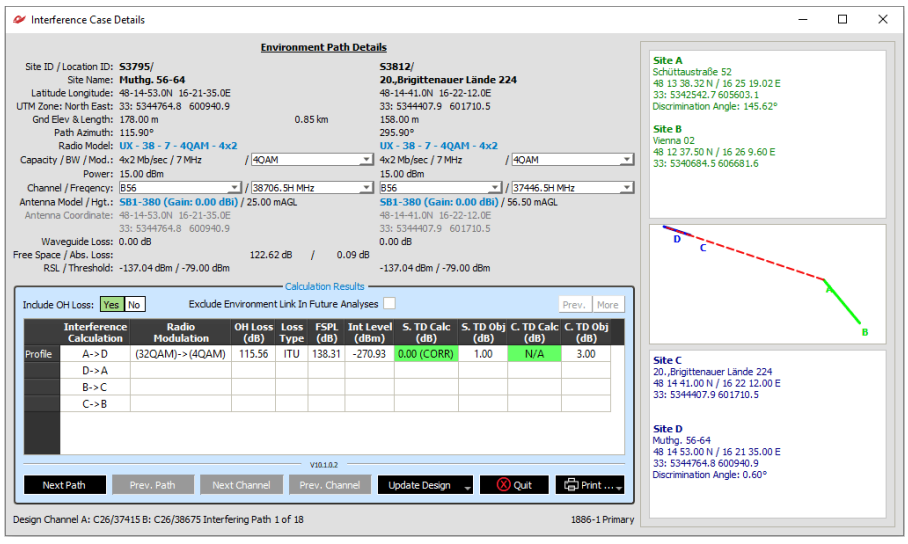
With the *Full Band* option selected as *Search Frequency* on the window above, after completing the analysis, the *summary* window below will list all channels available for the radio, with the number of interference cases into and from each end.

To select an interference free channel, just choose a line where the *Number of Cases* is 0 for both ends and click *Assign Frequency*.



6.2.2.3.2.1 Case Details

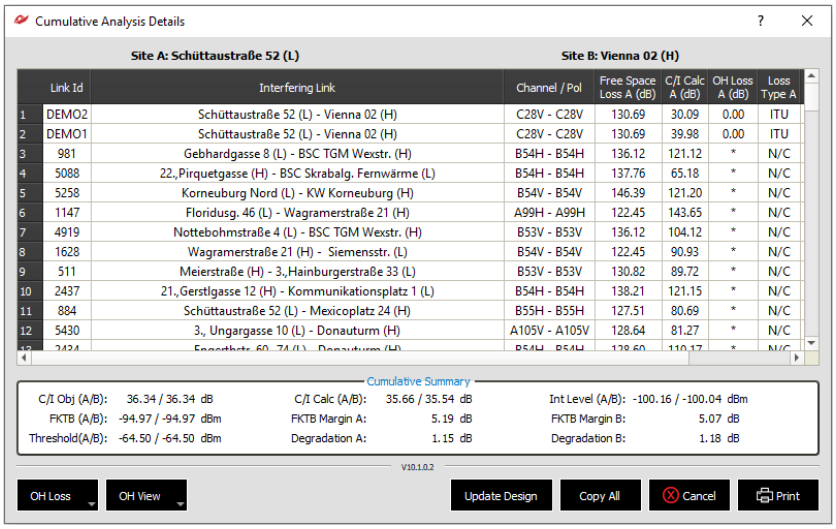
Further details of the interference cases are also available.



If the **calculated** Single or Cumulative Threshold **Degradation exceeds** the predefined **objective**, the case is reported as an interference case.

6.2.2.3.2.1.1 Cumulative Details

The Cumulative Details shows the list of links contributing to the cumulative threshold degradation.

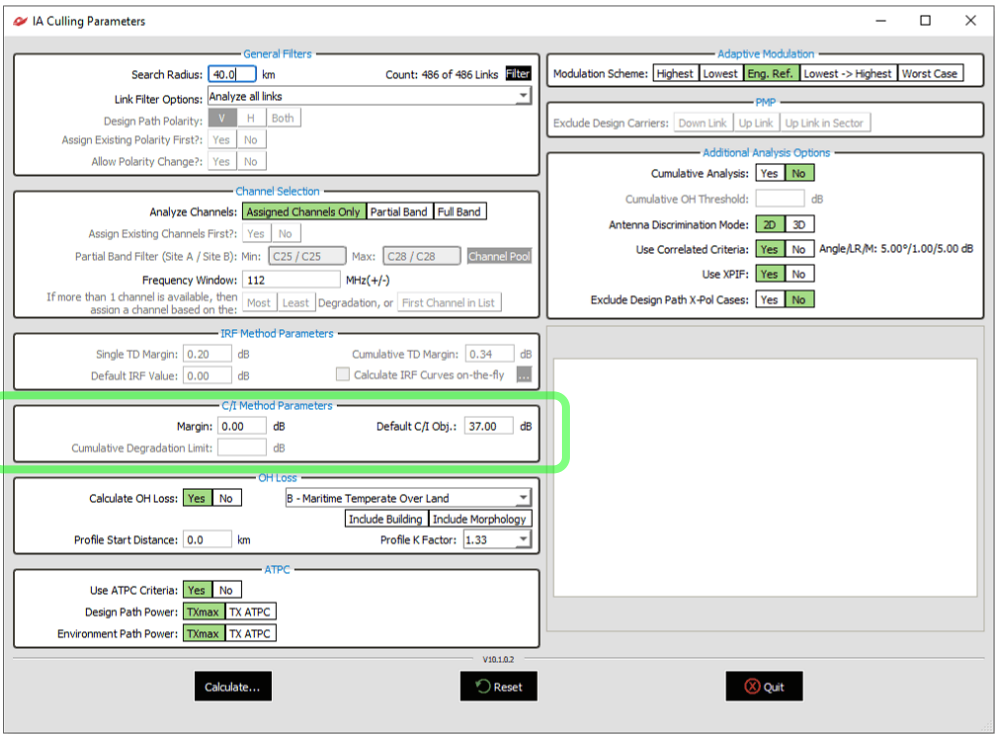


6.2.2.4 C/I Method

6.2.2.4.1 Analysis Parameters

Set and select the appropriate parameters for the interference analysis.

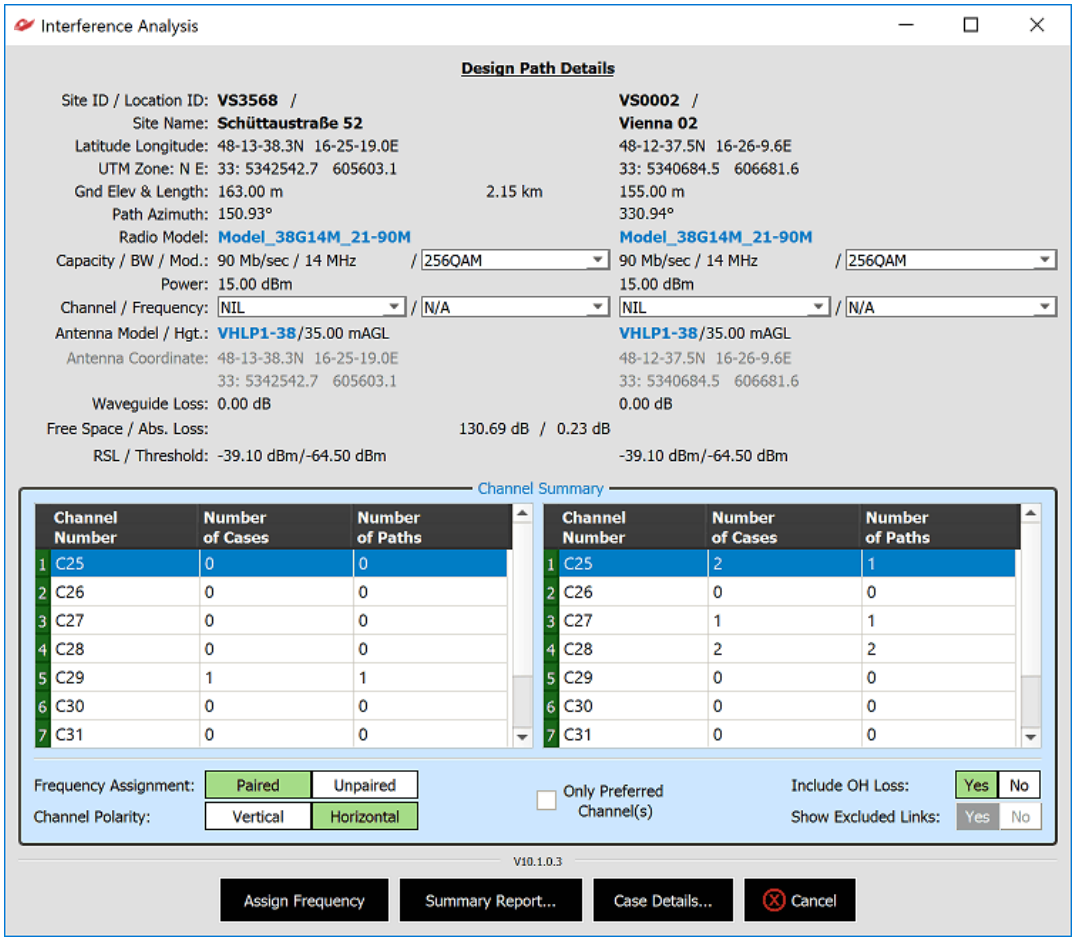
*NOTE: Please pay attention to all the calculation parameters, in particular the Search Radius (Coordination distance), as this has a dramatic affect on the results. For more information on this and the rest of the options below, please refer to the **iQ·link Support & Microwave Design Forum** for further details.*



6.2.2.4.2 Analysis Summary

With the *Full Band* option selected as *Search Frequency* on the window above, after completing the analysis, the *summary* window below will list all channels available for the radio, with the number of interference cases into and from each end.

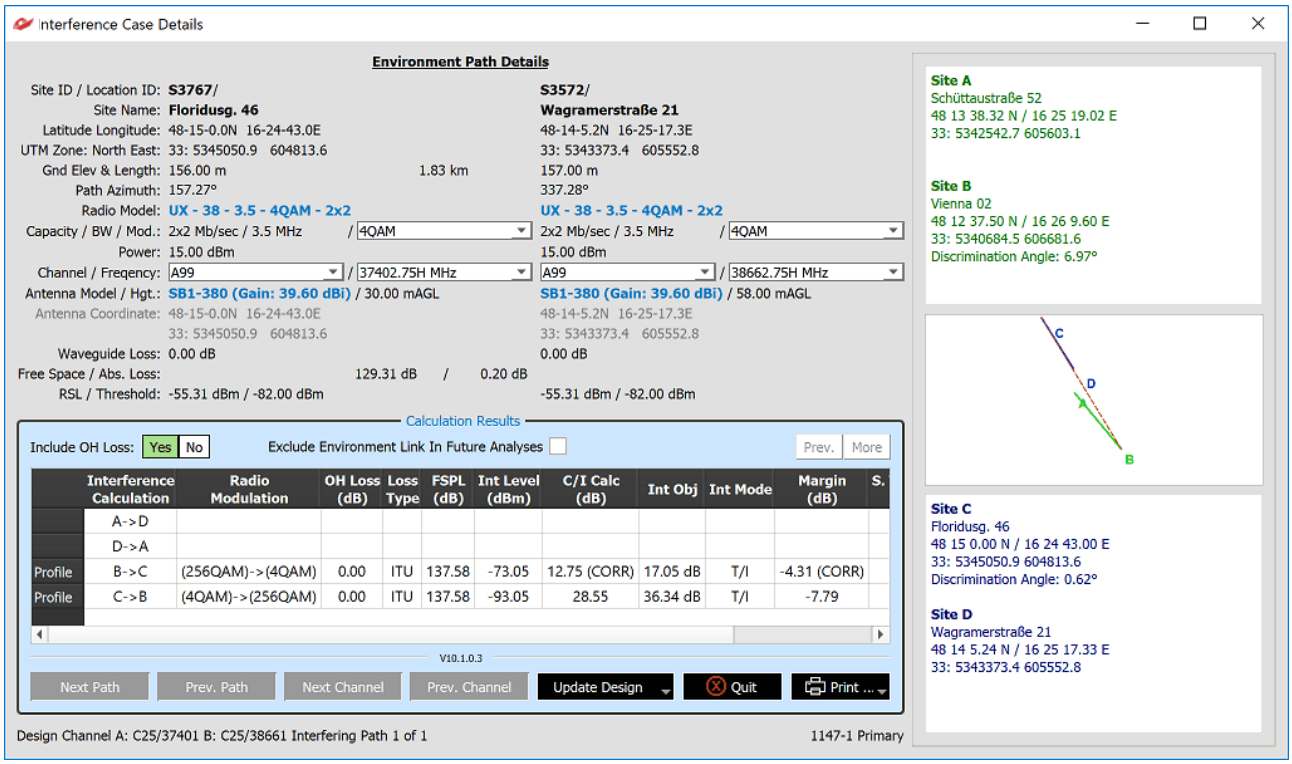
To select an interference free channel, just choose a line where the *Number of Cases* is 0 for both ends and click *Assign Frequency*.



You can choose between the ***Case Details*** and ***Cumulative Details*** by clicking on the appropriate button at the bottom of this screen.

6.2.2.4.2.1 Case Details

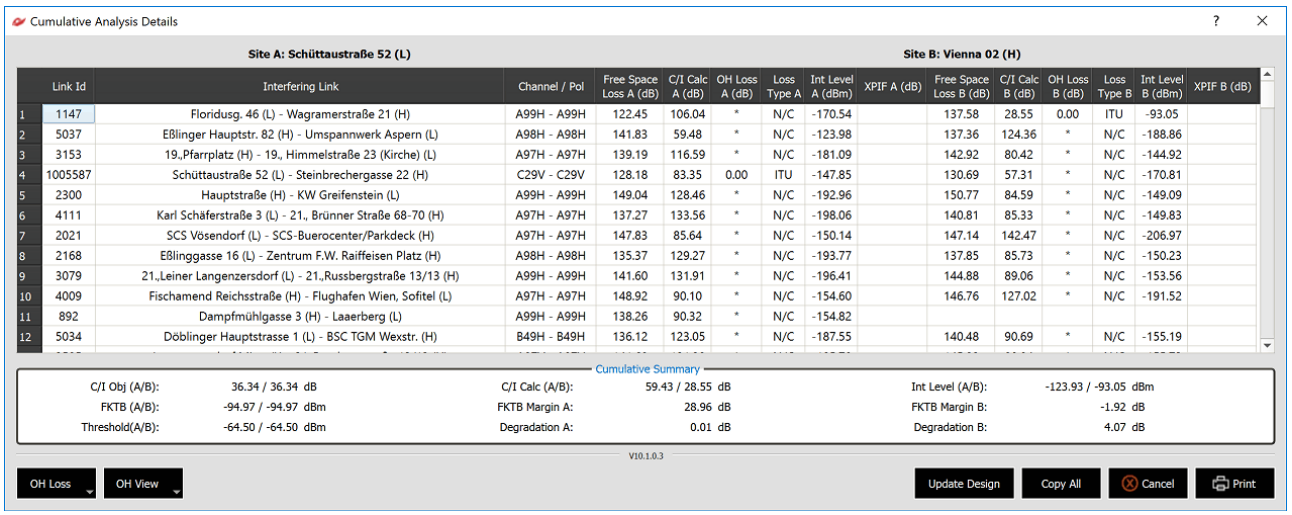
Further details of the interference cases are also available.



NOTE: Negative Margin (dB) indicates possible interference.

6.2.2.4.2.2 Cumulative Details

To see additional details for a particular channel, highlight the channel and click on the **Cum Details...** button:



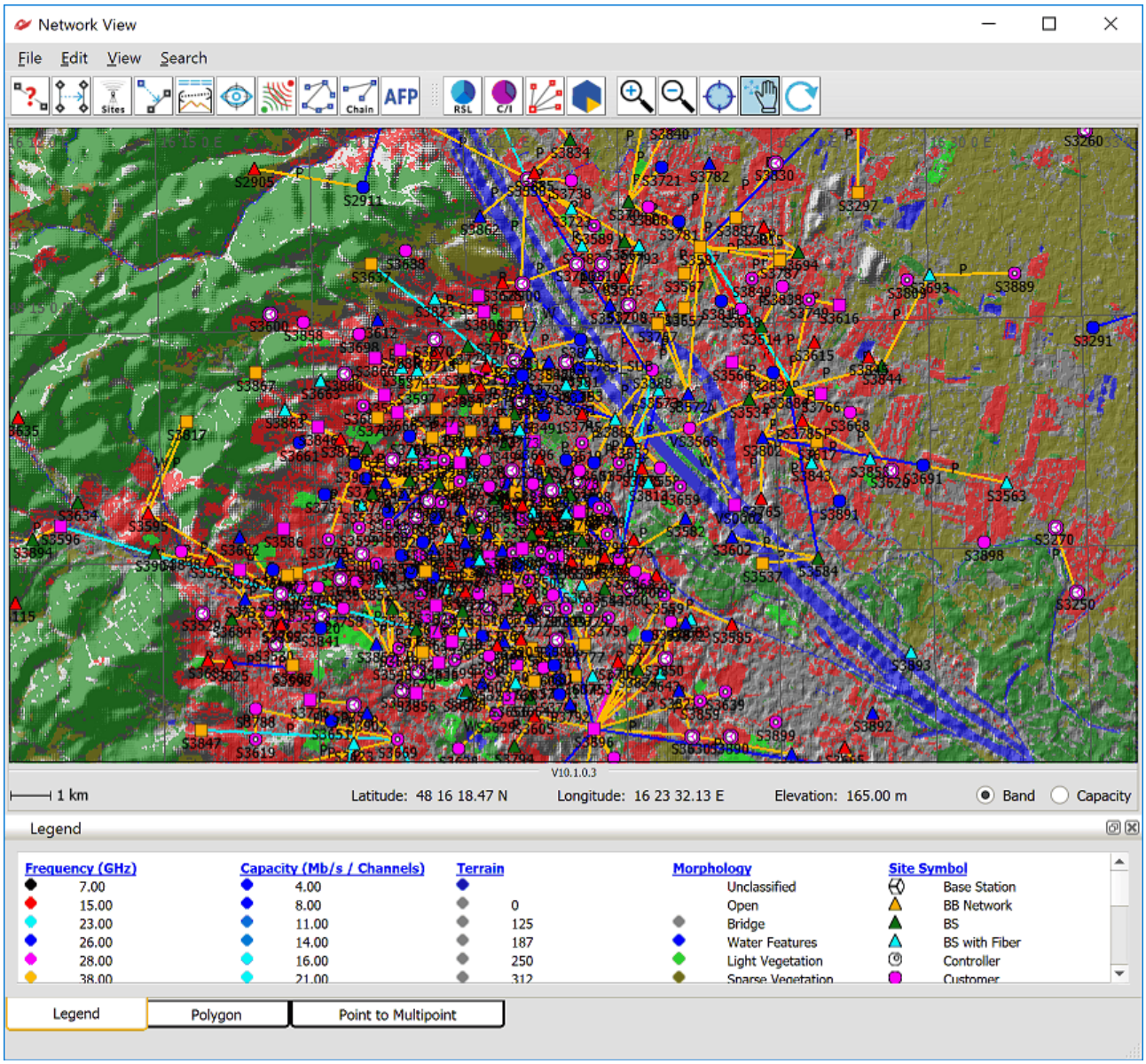
The above window shows each link that contributes to the total interference into the design link.

7. Network Visualization

7.1. Network View

Utilities → Network View

This is the graphical network display window. For a further detailed description, please refer to the **iQ·link Support & Microwave Design Forum**.



Below is a brief description of each button:

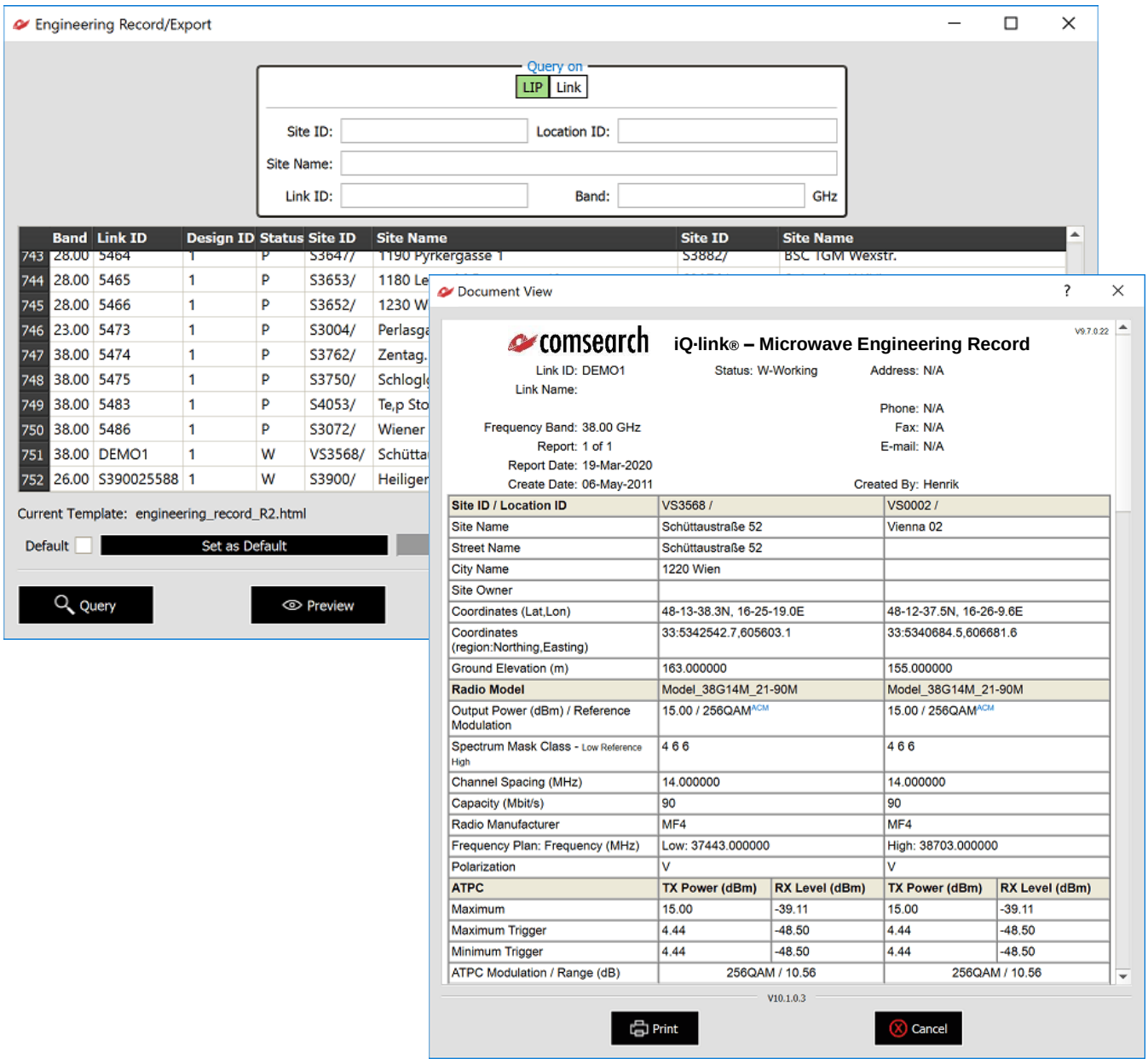
 **Link Info**	Click this button, then click on a link to see basic link details.
 **Copy Link**	Click this button, then click on a link, then use File > Paste Link in the Main Engineering window, to work on an existing link.
 **Site Info /Create Site**	Click this button, then click on a site to see basic details, or click on an empty area to create a new site.
 **Copy Site**	Click this button, then click on a site, then use File > Paste as Site A/B in the Main Engineering window, to use a site in a link.
 **Detailed Profile**	Click this button, then use your mouse to draw a line, and check the profile between the end-points.
 **Line-of-Sight Analysis**	Click this button, then click on a point or a site to check LOS for the surrounding region (Radial mode) or sites (Selective mode).
 **Overlap Analysis**	Used to check line-of-sight from two sites. Repeater sites can be placed to the locations where both sites have line-of-sight.
 **Clusters**	Used to create/manage groups of links for display purposes
 **Chain Reliability**	Used to check end-to-end reliability between a set of links.
 **Automatic Frequency Planning**	Batch Interference Calculations (see more details in the User's Manual).
 **Zoom In**	Increase magnification.
 **Zoom Out**	Decrease magnification.
 **Re-Center**	Reset main focal point.
 **Pan**	Hold and drag to move freely.
 **Refresh**	Update page results.

8. Reporting and Exporting Data

8.1. Engineering Record / Export

You may export all or portions of your link data, including the reliability calculations to a text file or to a formatted HTML report using the Engineering Record report:

Database → Engineering Record / Export



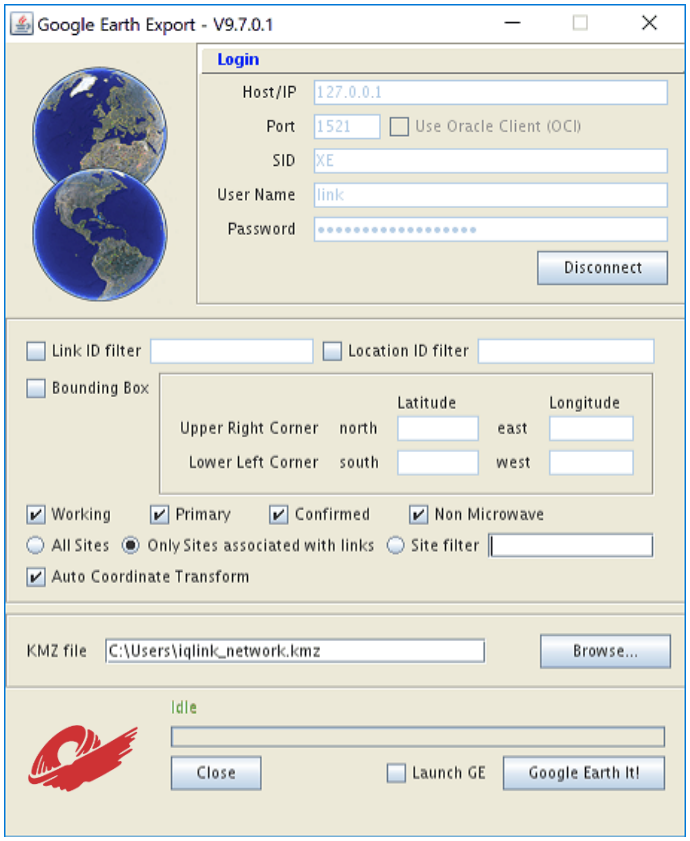
NOTE: Further report templates can be created by using a HTML editor.

8.2. Google Earth Export

You may export your entire network stored in iQ·link into a KMZ file which can be opened in Google Earth.

For more details on the Google Earth Export Utility, please visit the **iQ·link Support & Microwave Design Forum**.

Utilities → Google Earth Export



9. Google Earth Connectivity

Google Earth Connectivity tool provides a detailed network overview using Google Earth application.

Windows Start Menu → iQ·link → Google Earth NetView

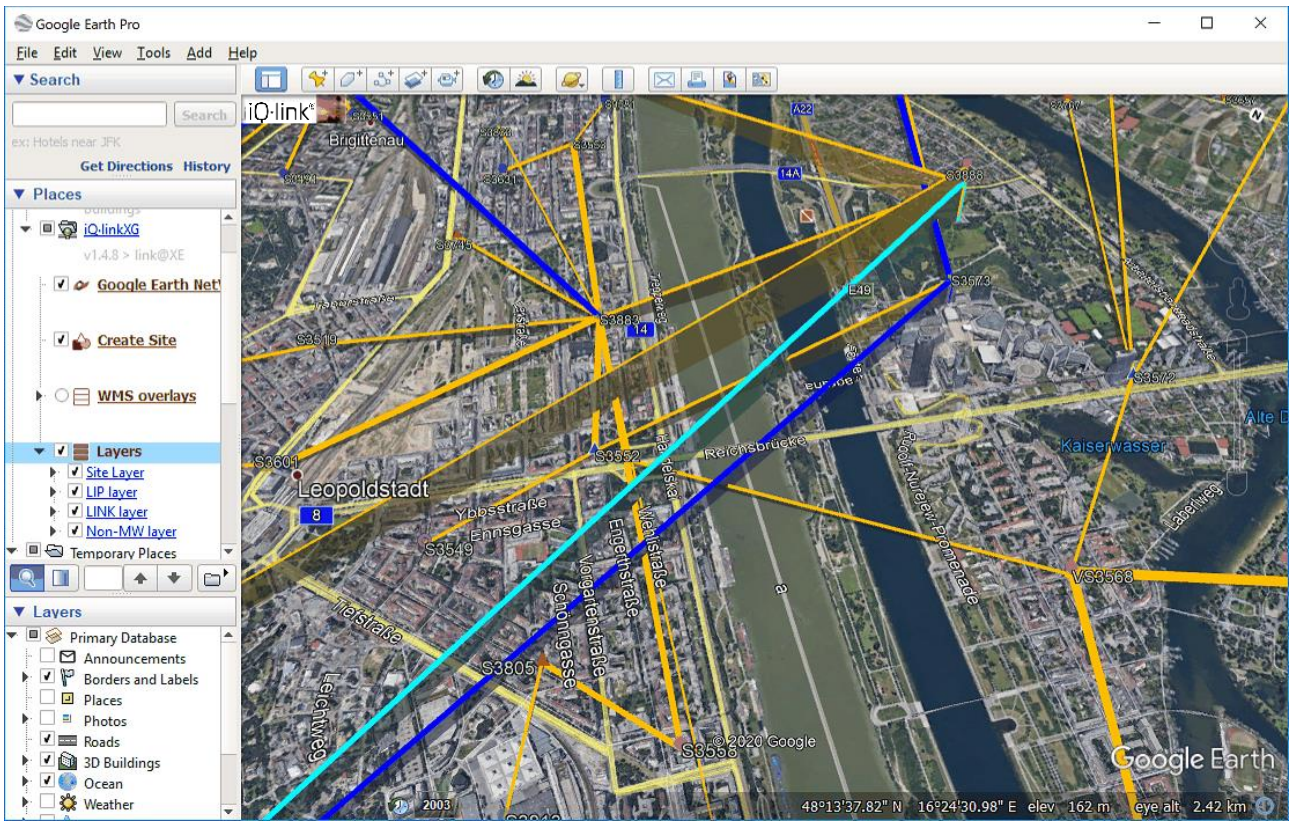
To use Google Earth Connectivity, you must have Google Earth installed.

iQ·link (see: earth.google.com) Google Earth Connectivity overlays Site, Microwave Link and Non-Microwave Link database of iQ·link, as well as makes toggle on/off Map Layer defined under iQ·link. Function can be found in Google Earth's Places window, under Temporary Places/ iQ·link folder.

For further detailed information on Google Earth Connectivity, please visit the **iQ·link Support & Microwave Design Forum**.

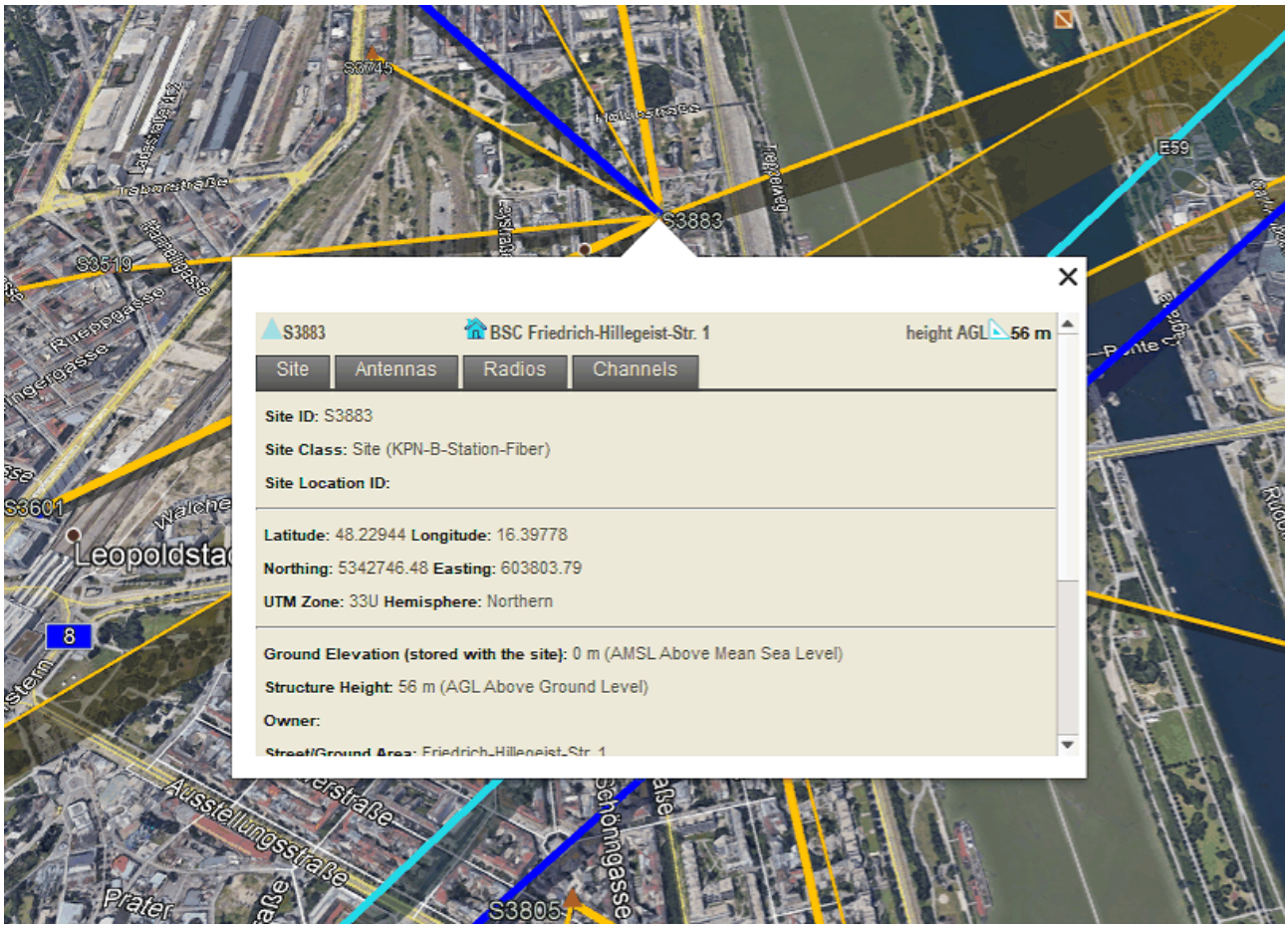
IMPORTANT: *Google Earth Connectivity tool makes no data available on internet!*

Site, Microwave, Non-Microwave Link data and Map data will be NOT shared on internet through Google Earth application; all overlaying data are stored on your local computer only.



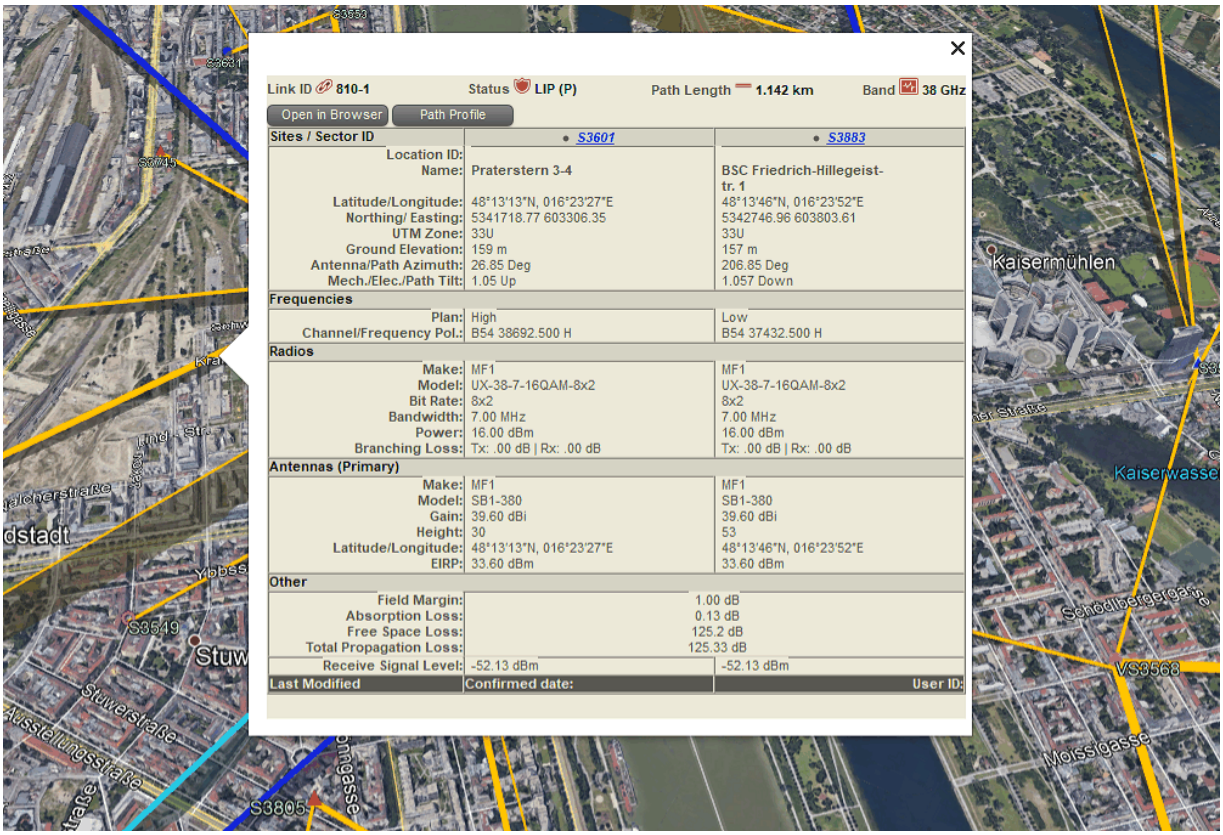
9.1. Sites

By clicking on a site, the basic Info window appears with tabs of Site, Antennas, Radios and Channels tabs:

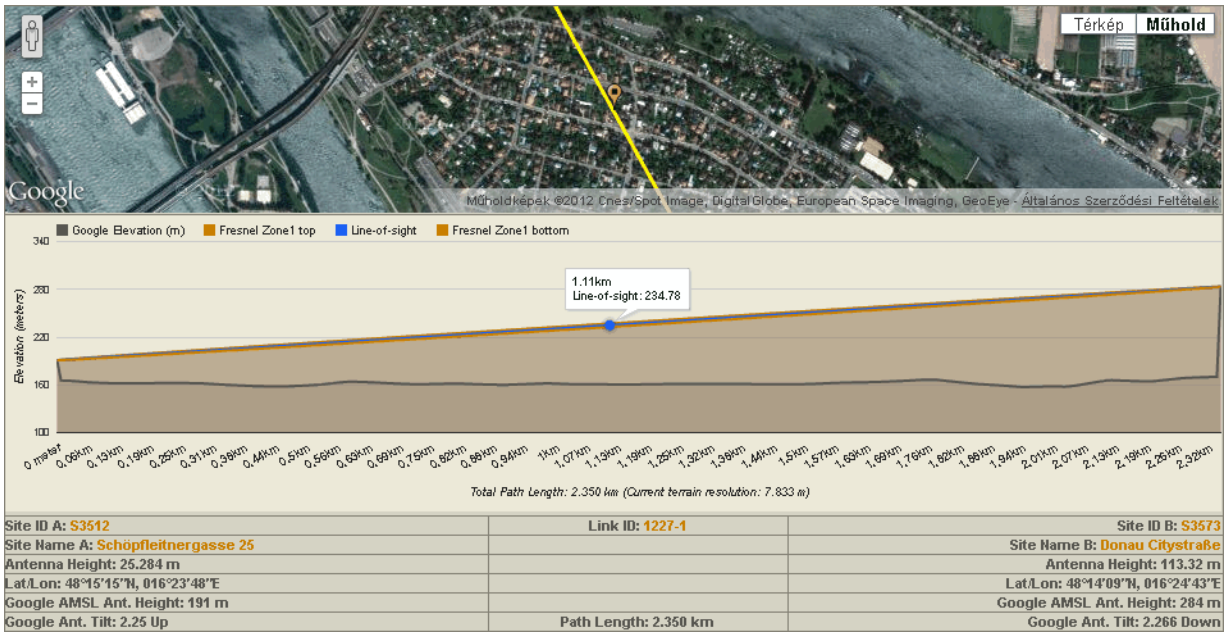


9.2. Microwave Links and Non-Microwave Links

By clicking on a Microwave (or Non-Microwave) Link basic Link Info window appears:

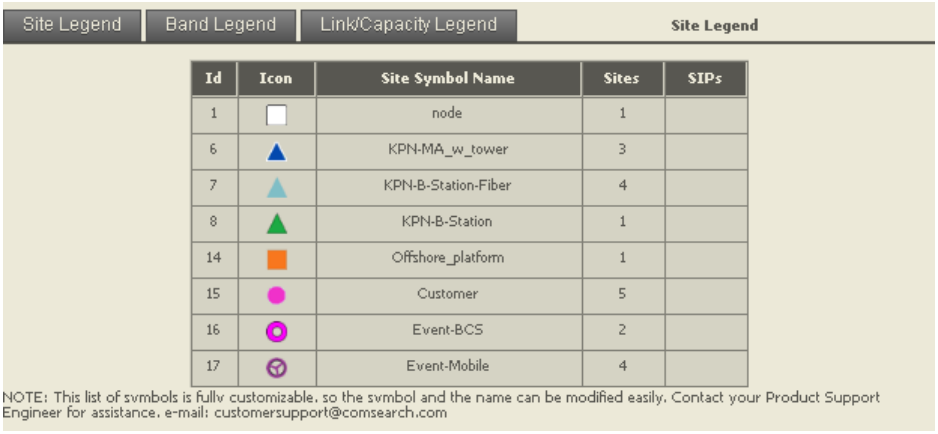


Click on Path Profile button to see profile of selected link. Profile data are obtained online, 100% of 1st Fresnel-zone and Line-of-Sight between sites are displayed. Actual height data on profile and marker on overlay map will be show when cursor moves along profile.



9.3. Legends and Statistics

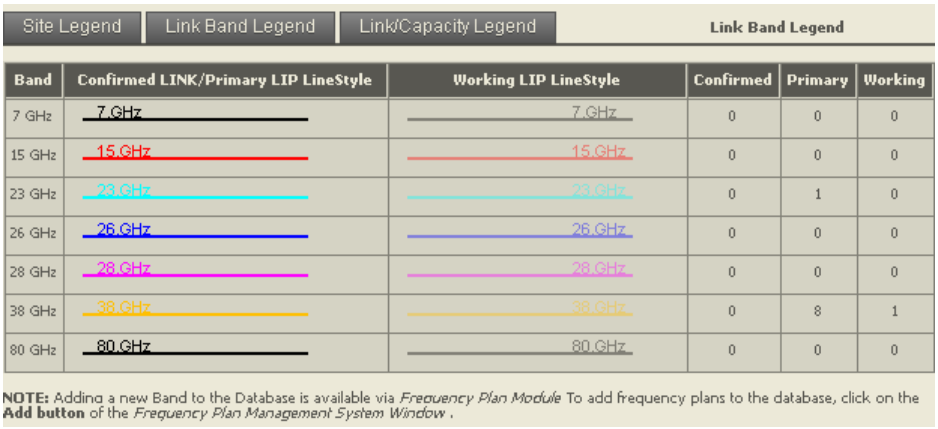
When Site, Microwave or Non-Microwave Link Layer subfolder are clicked in iQ·link folder a window appears with Site Symbol, Link Frequency Band, Link Capacity Legends and Statistics



Site Legend | Band Legend | Link/Capacity Legend — **Site Legend**

Id	Icon	Site Symbol Name	Sites	SIPs
1		node	1	
6		KPN-MA_w_tower	3	
7		KPN-B-Station-Fiber	4	
8		KPN-B-Station	1	
14		Offshore_platform	1	
15		Customer	5	
16		Event-BCS	2	
17		Event-Mobile	4	

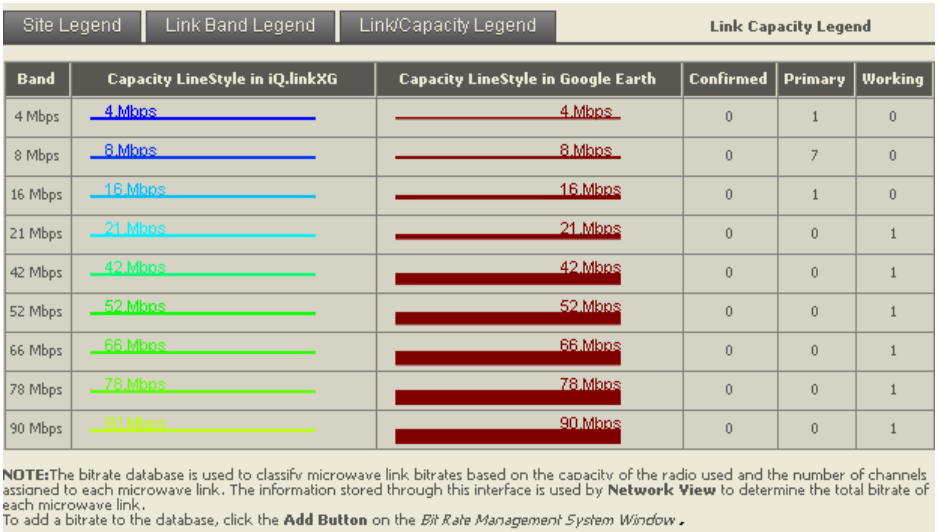
NOTE: This list of symbols is fully customizable, so the symbol and the name can be modified easily. Contact your Product Support Engineer for assistance. e-mail: customersupport@comsearch.com



Site Legend | Link Band Legend | Link/Capacity Legend — **Link Band Legend**

Band	Confirmed LINK/Primary LIP LineStyle	Working LIP LineStyle	Confirmed	Primary	Working
7 GHz	7.GHz	7.GHz	0	0	0
15 GHz	15.GHz	15.GHz	0	0	0
23 GHz	23.GHz	23.GHz	0	1	0
26 GHz	26.GHz	26.GHz	0	0	0
28 GHz	28.GHz	28.GHz	0	0	0
38 GHz	38.GHz	38.GHz	0	8	1
80 GHz	80.GHz	80.GHz	0	0	0

NOTE: Adding a new Band to the Database is available via *Frequency Plan Module* To add frequency plans to the database, click on the **Add button** of the *Frequency Plan Management System Window* .

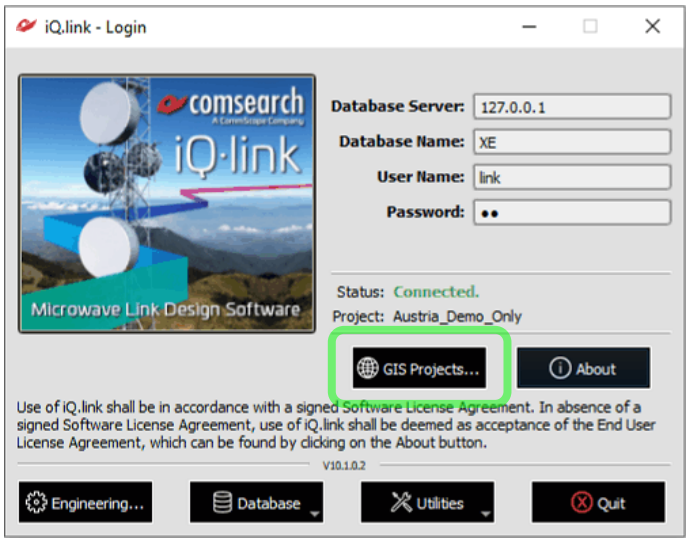


Site Legend | Link Band Legend | Link/Capacity Legend — **Link Capacity Legend**

Band	Capacity LineStyle in iQ.linkXG	Capacity LineStyle in Google Earth	Confirmed	Primary	Working
4 Mbps	4.Mbps	4.Mbps	0	1	0
8 Mbps	8.Mbps	8.Mbps	0	7	0
16 Mbps	16.Mbps	16.Mbps	0	1	0
21 Mbps	21.Mbps	21.Mbps	0	0	1
42 Mbps	42.Mbps	42.Mbps	0	0	1
52 Mbps	52.Mbps	52.Mbps	0	0	1
66 Mbps	66.Mbps	66.Mbps	0	0	1
78 Mbps	78.Mbps	78.Mbps	0	0	1
90 Mbps	90.Mbps	90.Mbps	0	0	1

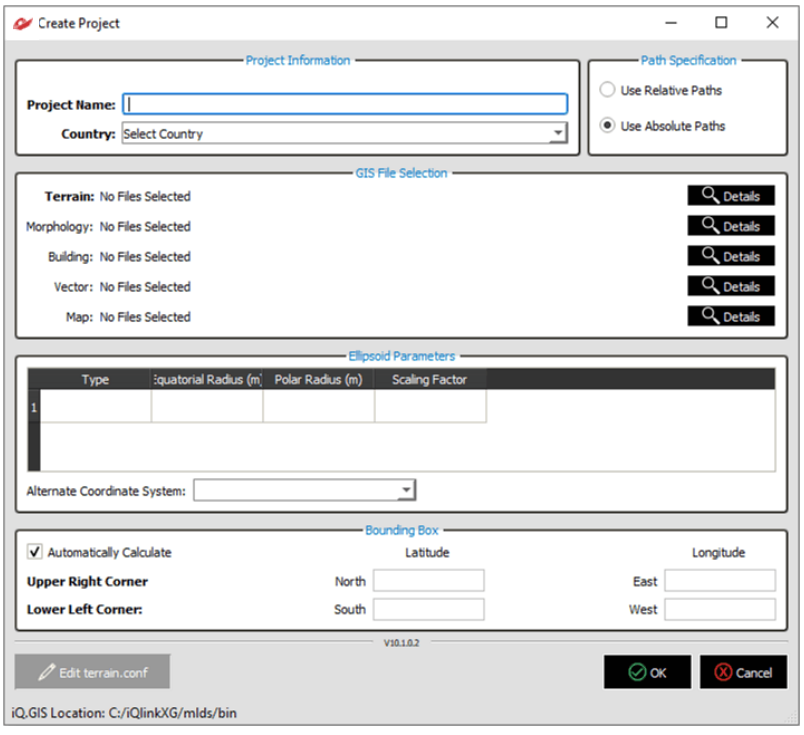
NOTE: The bitrate database is used to classify microwave link bitrates based on the capacity of the radio used and the number of channels assigned to each microwave link. The information stored through this interface is used by **Network View** to determine the total bitrate of each microwave link.
To add a bitrate to the database, click the **Add Button** on the *Bit Rate Management System Window* .

10. Projects



Projects button can be found on the Login window. You may define projects located in different countries and set up GIS database as necessary for each project individually.

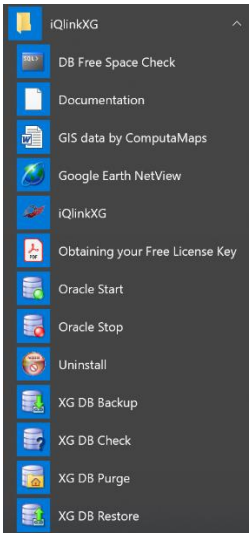
Click on Create, to set up a new project. Select Country from the drop-down list, and use the Details buttons to define location of Terrain, Morphology (clutter), Building, Vectors and 2D Map GIS data you would like to configure for your project:



Saved Projects can be activated by clicking *Make Current* button. For more details on the Project feature, please refer to the **iQ·link Support & Microwave Design Forum**.

11. Database Maintenance Operations

A basic set of database utilities are available in Windows Start Menu / iQ·link / DB Admin subfolder for maintaining the Oracle database used by iQ·link. Further information is available on the **iQ·link Support & Microwave Design Forum**.

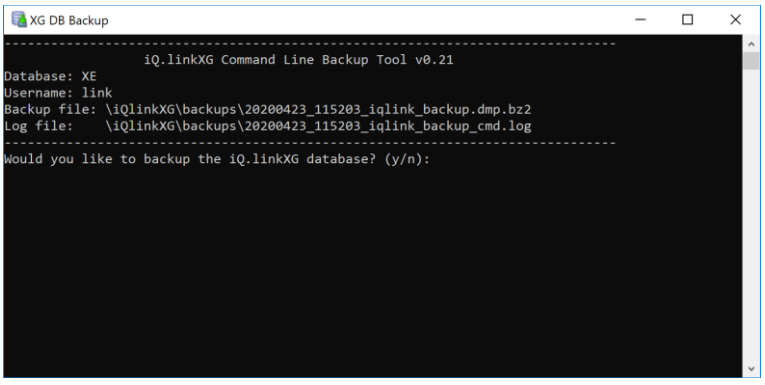


11.1. Database Backup

Database backup utility can be used for backing up your database, storing all equipment, site and link details in the backup file. GIS database will be NOT saved.

Windows Start Menu → iQ·link → DB Admin → XG DB Backup

By starting *XG DB Backup* application a CMD window appears. Here hit “y” to start creating backup file. Backup file location is fixed, can not be changed.

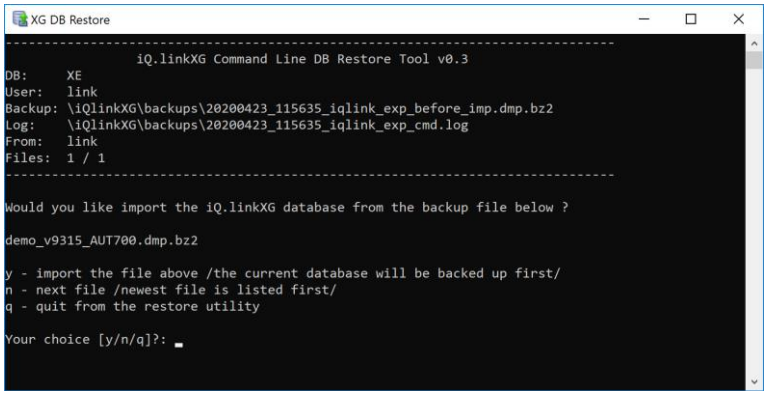


11.2. Database Restore

Database restore utility can be used to restore your database from previously backed up files. Restore utility loads into database saved dump file of all equipment, as well as site and link data.

Windows Start Menu → iQ·link → DB Admin → XG DB Restore

By starting XG DB Restore application a CMD window appears, hit “n” for select next file and hit “y” to start process restoring from selected file. Restore file location is fixed, can not be changed.



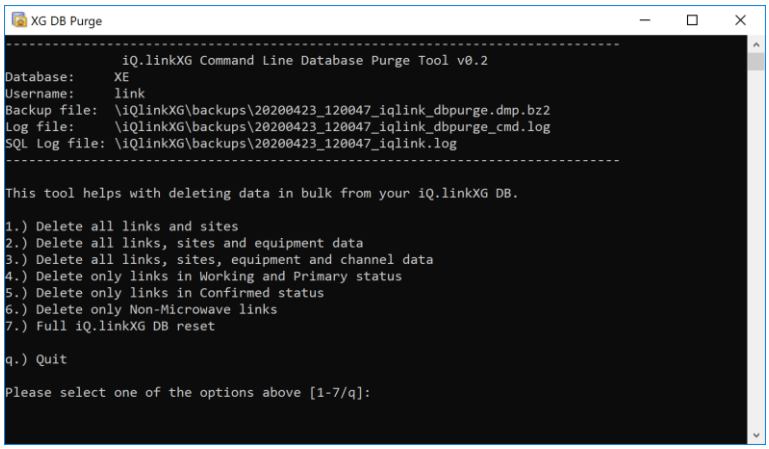
11.3. Database Purge

Database Purge utility can be used for cleaning your database from unnecessary data. Main purpose of this utility to remove the DEMO objects shipped with iQ·link installation package.

IMPORTANT: *By using XG DB Purge utility all records of the selected object types will be deleted, selecting a subset of objects is NOT possible.*

Windows Start Menu → iQ·link → DB Admin → XG DB Purge

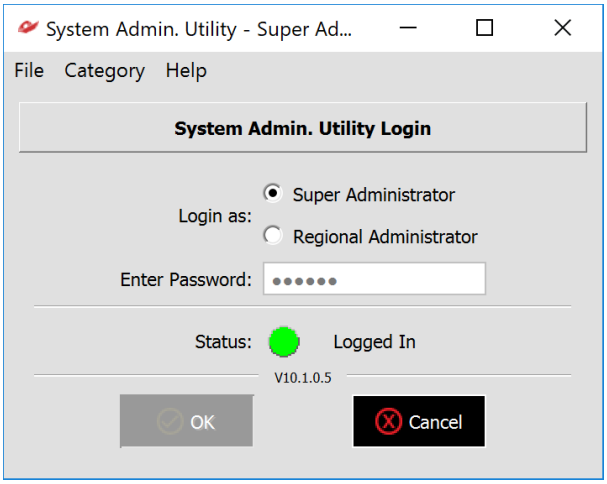
By starting XG DB Purge application a CMD window appears, hit “1” to remove all link and site data OR hit “2” to remove link, site, all equipment and frequency channel data.



12. iQ·link System Administration Utility

Utilities → System Admin

The System Administration Utility is to control iQ·link application settings and certain defaults.
Rights of setting defaults are divided to Super Administrator and Regional Administrator parts. Both for Super Administrator and Regional Administrator default password is: **iqlink**



When a Database Purge is performed it is important to set up new equipment defaults after new antennas and radios were imported.

IMPORTANT: *Parameter setting made in System Administration Utility can cause vital impact on link design. For details, please visit the* ***iQ·link Support & Microwave Design Forum****.*