LOS-Pathprofile

User Guide - Bulk microwave LOS analysis with SRTM terrain, earth curvature, Fresnel clearance, CSV reporting, and Google Earth KML output

A user guide explaining what LOS-Pathprofile Tool does, how to use it, and how to read its results — with a complete worked example

Input	**Output**	**Privacy**
Header-only CSV template with 9 required fields.	LOS_Analysis.csv and LOS_MW_Routes_with_Sites.kml.	CSV is parsed in the browser; only SRTM tiles and usage counters use the Worker.

1. What the Tool Does

LOS-Pathprofile is the **bulk Line-of-Sight (LOS) analyzer** for microwave links. You give it a CSV with many MW links — hundreds at a time — and it tells you, for each one, whether the path is **Clear**, **Critical**, or **Obstructed**.

It does this by combining the geometry of each link with terrain data from public SRTM elevation tiles. Earth curvature (via the K-factor) and the Fresnel zone are included in the calculation, just like any professional planning tool.

Why this matters: Manually checking LOS for each link in a Google Earth takes a long time, especially for early planning runs with many candidates. LOS-Pathprofile gives you a fast first pass in seconds

2. CSV Template and Input Rules

The /sample endpoint downloads a blank CSV template. It contains headers only and no sample link rows, so users are not tempted to leave test data in a production run.

Current template content: NE, FE, NE Lat, NE Long, FE Lat, FE Long, NE Height (m), FE Height (m), Frequency (GHz)

Column	Type	Example	Notes
NE	Text	`SITE_A`	`Near End site name.`
FE	Text	`SITE_B`	`Far End site name.`

NE Lat	Number	24.7136	Near End latitude in decimal degrees.
NE Long	Number	46.6753	Near End longitude in decimal degrees.
FE Lat	Number	24.7510	Far End latitude in decimal degrees.
FE Long	Number	46.7010	Far End longitude in decimal degrees.
NE Height (m)	Number	30	Near End antenna height above ground, not AMSL elevation.
FE Height (m)	Number	25	Far End antenna height above ground, not AMSL elevation.
Frequency (GHz)	Number	15	Used to calculate the Fresnel zone radius.

Input Validation

- The file must be 5 MB or smaller.
- Blank rows are ignored.
- The button enables when at least one valid link row is parsed.
- Rows with bad coordinates, blank site names, invalid heights, invalid frequency, or comma decimals are skipped and shown in the warning table.
- Header matching is tolerant: for example, NE Long and NE Lon are both accepted, but the downloaded template should be used whenever possible.

3. Analysis Parameters

K-factor	4/3 is the default standard-atmosphere case. 2/3 is a pessimistic sub-refractive case.
Fresnel Zone Clearance (%)	Default is 60%. The code calculates the 1st Fresnel radius and uses this percentage as the required clearance.
Minimum Clearance (m)	Extra safety margin after Fresnel clearance. Default is 0 m. It separates Clear from Critical.

4. Calculation Method

For each valid link, the current code performs the following calculation flow:

- Calculate link distance.
- Sample terrain approximately every 0.20 km, with a minimum of 25 and maximum of 250 samples.
- Fetch the required SRTM .hgt tiles through /tile/<tile>.hgt and interpolate elevation values

- Build the direct radio ray from NE antenna top elevation to FE antenna top elevation.
- Add earth curvature bulge to the terrain using the selected K-factor.
- Calculate required Fresnel clearance at every sample point.
- Find the point with the smallest net clearance. This is the worst point.

Direct Clearance	Radio ray elevation - effective terrain elevation, where effective terrain = SRTM terrain + earth bulge.
Required Fresnel	17.32 * sqrt((d1 * d2) / (frequencyGHz * (d1 + d2))) * FresnelPercent / 100.
Net Clearance	Direct Clearance - Required Fresnel. The verdict is based on this value.

5. Verdict Logic

Verdict	KML Color	Rule
Clear	Green	`Minimum net clearance is greater than or equal to Minimum Clearance.`
Critical	Orange	`Minimum net clearance is >= 0 m but below Minimum Clearance.`
Obstructed	Red	`Minimum net clearance is below 0 m, meaning the required Fresnel clearance is not met.`
No Coverage / Error / Invalid	Gray	`Missing SRTM tile, link too short, or processing error.`

Important: Direct Clearance alone is not the final LOS decision. The code uses Net Clearance because it subtracts the Fresnel requirement.

6. Output Files

6.1 CSV Report

The CSV report downloads as LOS_Analysis.csv. It includes a parameter header and one row per processed link.

CSV Field	Meaning
Distance (km)	Distance between NE and FE.
Verdict	Clear, Critical, Obstructed, No Coverage, Invalid, or Error.

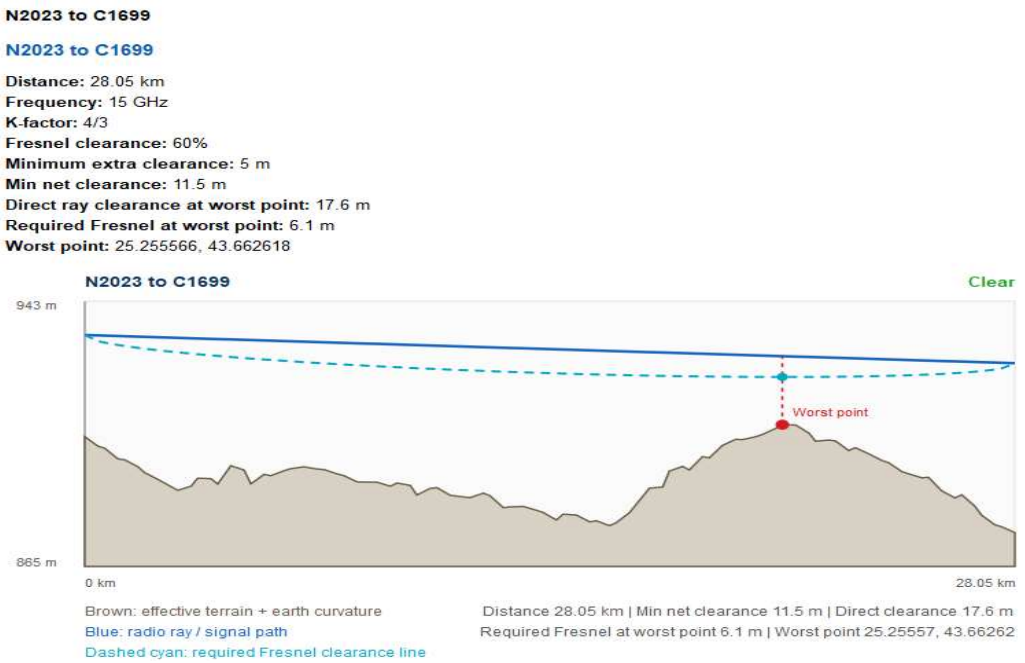
Min Net Clearance (m)	Smallest Fresnel-adjusted clearance along the profile.
Direct Clearance at Worst Point (m)	Ray-to-effective-terrain distance at the worst point before subtracting Fresnel.
Required Fresnel at Worst Point (m)	Fresnel clearance required at the worst point.
Worst Lat / Worst Lon / Worst Terrain	Coordinates and terrain elevation of the limiting point.
Notes	No Coverage, Invalid, or Error explanation when applicable.

6.2 Google Earth KML

The KML downloads as LOS_MW_Routes_with_Sites.kml and is intentionally clean in the Google Earth left sidebar.

- Folder: MW Routes - one placemark per link, named only as NE to FE.
- Folder: Sites - unique blue site pins for all NE and FE sites.
- Route colors: green for Clear, orange for Critical, red for Obstructed, gray for No Coverage “Invalid”.
- Clicking a route opens a popup with distance, frequency, K-factor, Fresnel percentage, minimum clearance, net clearance, direct clearance, required Fresnel, worst point coordinates, and the path-profile chart.

Example of the route popup chart now generated inside the KML:



7. How to Run

1. Open the tool

Go to the LOS Analyzer page hosted by the Worker.

2. Download the CSV template

The template has headers only. Add your own link rows below the header.

3. Upload the CSV

The page validates rows and enables Run Analysis when at least one valid link exists.

4. Set parameters

Choose K-factor, Fresnel percentage, and minimum clearance in metres.

5. Run analysis

The page pre-fetches SRTM tiles, processes links using six parallel workers, then generates CSV and KML outputs.

6. Review in Google Earth

Open the KML. Use MW Routes for link lines and Sites for blue site pins. Click any link to view the profile chart.

8. Limitations and Engineering Notes

Terrain-only model: The tool does not include buildings, trees, towers, clutter, seasonal vegetation, rain fading, multipath, antenna patterns

- SRTM HGT coverage depends on which tiles exist in the Public SRTM. Missing tiles return No Coverage.
- SRTM resolution and vertical accuracy are not a replacement for field verification or high-resolution DEM work “Field Survey is the Must”.
- The CSV remains in the browser, but the browser fetches SRTM tiles from the Public SRTM

Summary: LOS-Pathprofile now provides a clean browser workflow: upload CSV, validate links, calculate Fresnel-aware clearance, download an engineering CSV, and open a Google Earth KML with colored routes, blue site pins, and per-link path-profile charts.

Try it: `los-pathprofile.telecomblueprint.com` **| Other tools:** `telecomblueprint.com`