

# Microwave link “Line of sight” survey

## Step-by-step guide

Procedure requires qualified personnel with 2 teams and voice communication equipment.

### Necessary equipment

- SAF Spectrum Compact (SC) - Signal Analyzer device
- SAF SG Compact - Signal Generator device
- 2x Antennas
- 2x SMA cable
- 2x Compass
- 2x Spirit level tool
- 2x Waveguide adapter (optional)

### Preparation

- Calculate path budget with a professional radio link design and planning tool to determine important values, such as: Azimuth, Elevation, Frequency, polarization and target received signal level. Use SG-Compact's output power, particular antenna gain and frequency parameters in the calculations.
- Determine the direction towards the other site before climbing the tower. Use a compass to find the right Azimuth angle and look for something in the environment as a reference point. It will help you to align the antenna when up in the tower.

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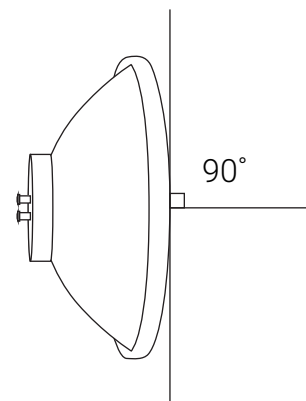
Please note! Metallic structures such as a telecom tower may affect compass accuracy. It is advised to perform Azimuth measurements on ground level, a reasonable distance away from the tower.

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### Survey

#### Installation and configuration

1. Climb the tower.
2. Install the antenna at chosen height and polarization.
3. Adjust the horizontal direction of the antenna according to Azimuth angle and the object in environment that was chosen as a Reference point.
4. It is highly recommended to use a spirit level tool to adjust the vertical angle of the antenna to be at 90° to ground level. This way you will ensure that the antenna is pointing straight and thus it is a good starting position for the alignment process.



Picture 1. Antenna angle to ground level

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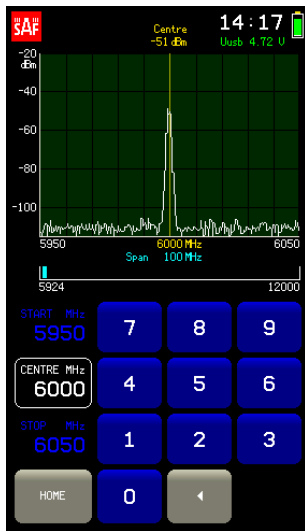
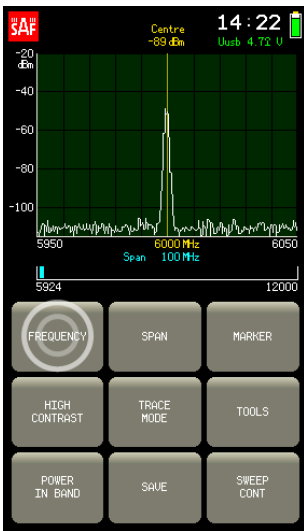
Please note! Perform steps 1-4 for both sites.

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5. Connect SG-Compact via SMA cable to antenna at one of the sites, (make sure that both sites are installed on the same polarization),
6. Set center frequency and power on SG-Compact unit the same as in calculations.

Picture 2. SG-Compact frequency and power menu



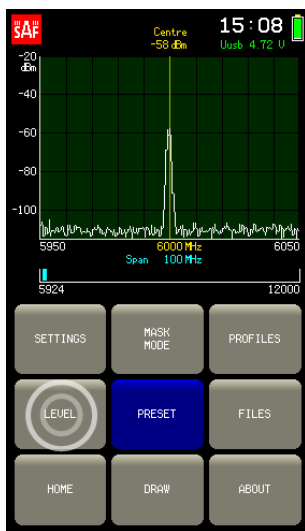
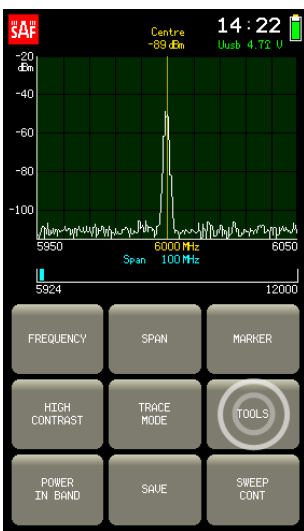
- Connect Spectrum Compact via SMA cable to antenna at the other site.
- Set center frequency on Spectrum Compact according to the center frequency on SG and adjust SPAN to minimum.

Please note! SC and SG frequency settings must match.

How to set frequency on SC: Frequency -> center MHz -> (your frequency) -> Enter

Picture 4. SC entering centre frequency

Picture 3. SC entering frequency menu



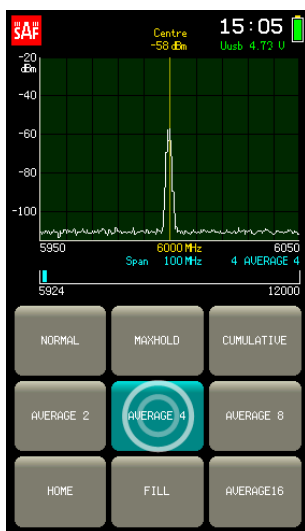
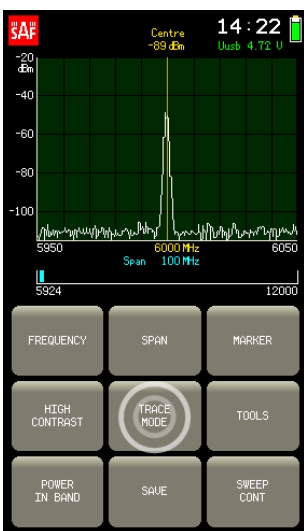
- If initial rough alignment was done correctly, signal trace should appear on the SC display similar to the one in picture Nr. 4.

Please note! If the calculated target received signal level is below -80 dBm, then use LEVEL function on SC to zoom in scale for better signal visualization.

How to set LEVEL on SC: Tools -> LEVEL -> set MAX and MIN dBm

Picture 6. SC entering level menu

Picture 5. SC entering tools menu

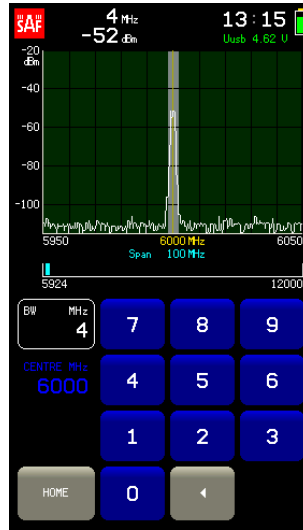
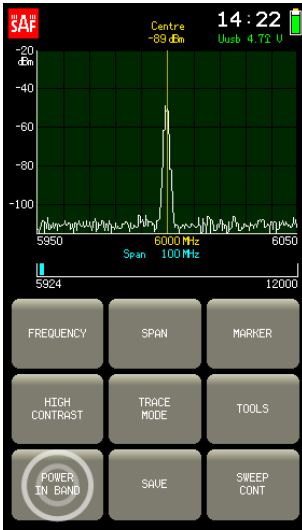


Use AVERAGE mode for reducing noise effects. Recommended setting for LoS survey: Average 2 or Average 4

How to set AVERAGE mode on SC: TRACE MODE -> AVERAGE 2/4

Picture 8. Entering average trace mode

Picture 7. SC entering trace mode



- To measure the input power for desired bandwidth (BW) push the button POWER IN BAND and set the necessary bandwidth in 4 MHz by entering a value via numpad

Picture 10. Power in Band menu

Picture 9. Entering Power in Band

## Fine tuning

- Begin on SC site. Adjust the horizontal alignment to find maximum received signal level. Once found, fix the current position.
- Proceed with horizontal alignment on SG site and fix the antenna at maximum level.
- When the horizontal fine alignment is completed, align the antennas vertically in the same manner.

Please note! Be aware of mistaken antenna alignment due to side lobes. In addition to a prominent main lobe, radiation patterns also have smaller side lobes.

For example: If the received signal is 20dB or lower than the calculated RSL, you may have found a side lobe. Continue sweeping slowly beyond that lobe to see if you can find the main lobe.

- If the maximum achieved received signal level is +/- 3dB from the calculated value, that indicates there are no significant signal losses across the path, therefore the line of sight can be considered to be clear.