**Antenna system properties**

Both transmitting and receiving antennas are Cassegrain with a diameter of 500 mm. The antenna systems include a feedhorn, a main dish, and a subreflector holded by 4 thin metal struts. Both feedhorns have circular aperture. The transmitter horn has a rectangular feed in order to emit linear polarization. The receiver horn has a circular feed because it receives both orthogonal components of the incoming wave. Feedhorn losses were estimated using the calibrated network analyser R&S ZVA40. A metal plate was placed right in front of the tested feedhorn in order to reflect all the emitted signal back to the horn. The reflected signal was measured by the network analyzer. The difference between initial power and the reflected one was equal to the two-way feedhorn loss. The estimated one-way loss is about 0.25 dB. The subreflector blockage was calculated and estimated to be 10.8 %.

Antenna pattern was measured using the Sun radiation. During a clear sky day the radar was installed on a precision scanning unit. The radar transmitter was switched off while the active receivers were measuring the sky brightness temperature. The scanner was performing slow scans in azimuth and elevation relative to the Sun position. The angular resolution of the scans was in the order of 0.05˚. The results of such scans are shown in Figs. 3 and 4.

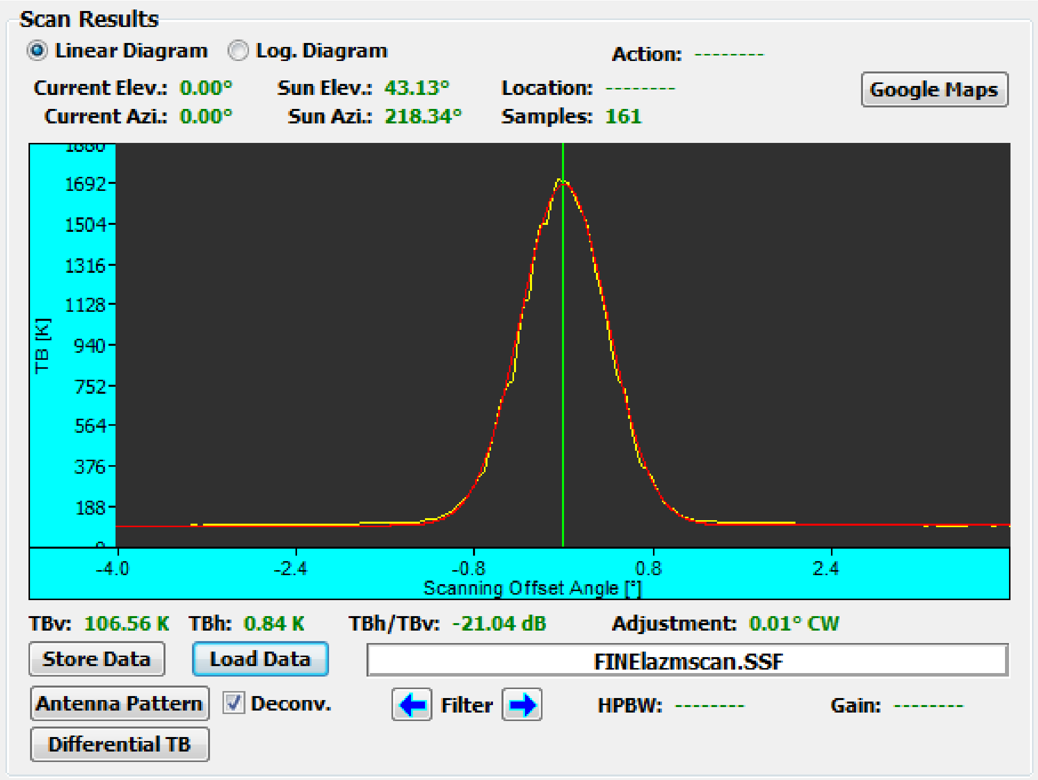


Fig. 3 – Azimuthal solar scan. Measurements are shown by the yellow line. The red line represents a Gaussian approximation.

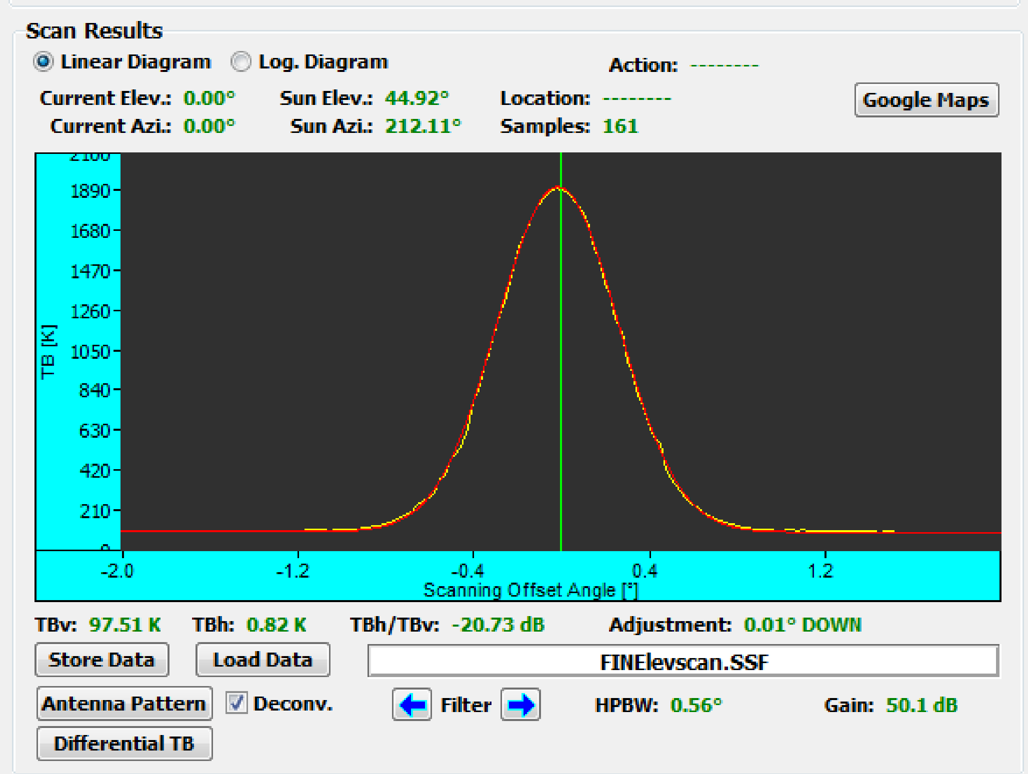


Fig. 4 – Elevation solar scan. Measurements are shown by the yellow line. The red line represents a Gaussian approximation.

The scan measurements represent a convolution of real antenna patterns and the solar radiation diagram. Therefore, in order to estimate the antenna patterns a deconvolution has to be applied. Nevertheless, the deconvolution will only work for the main beam where the signal-to-noise ratio is relatively high (10-13 dB). We do not expect good deconvolution results for side-lobes where the signal-to-noise ratio is very low. Therefore, in order to estimate level of sidelobes, the scans shown in Figs. 3 and 4 were normalized by the corresponding maximum and plotted in the logarithmic scale, no deconvolution was applied. The results are presented in Figs. 5 and 6. It can be seen that, "shoulders" and the first sidelobes are below -20 dB.

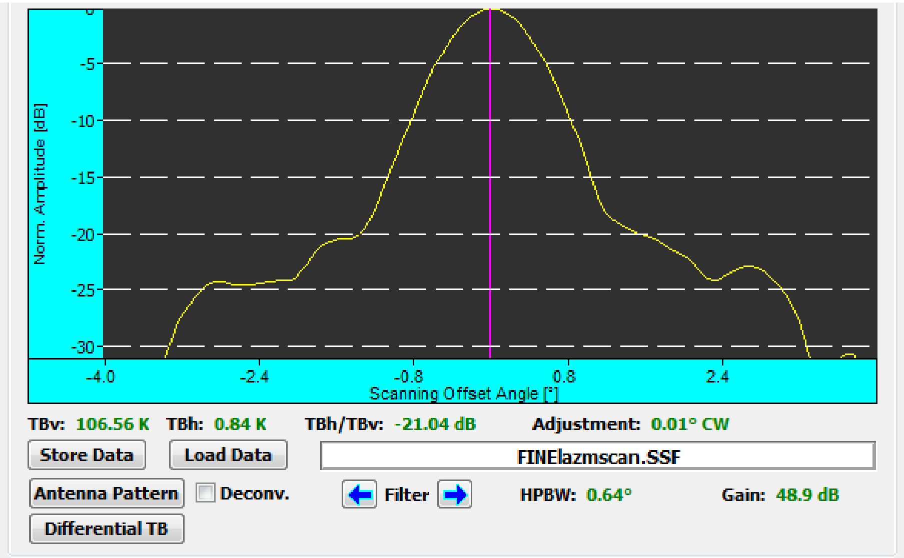


Fig. 5 – Azimuth pattern without deconvolution

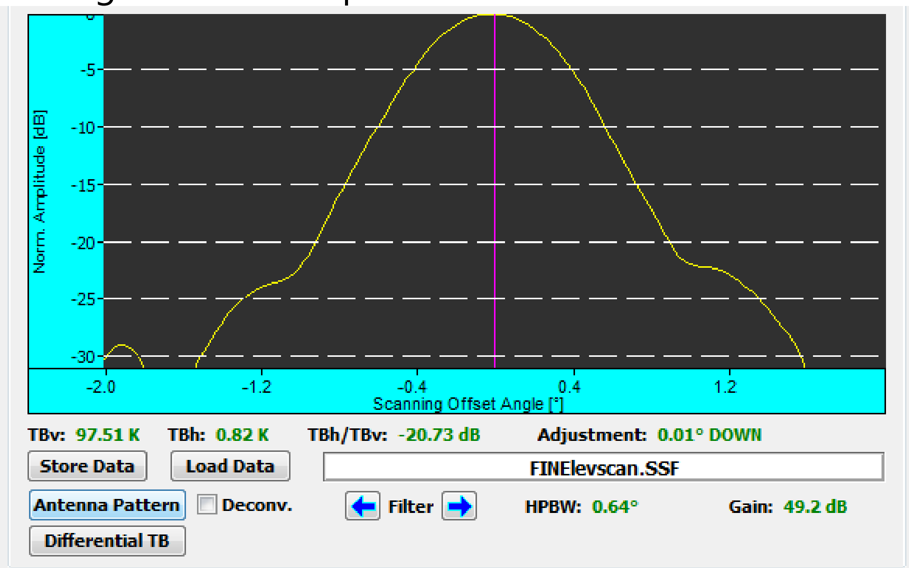


Fig. 6 – Elevation pattern without deconvolution

The estimated antenna patterns after the deconvolution are shown in Figs. 7 and 8.

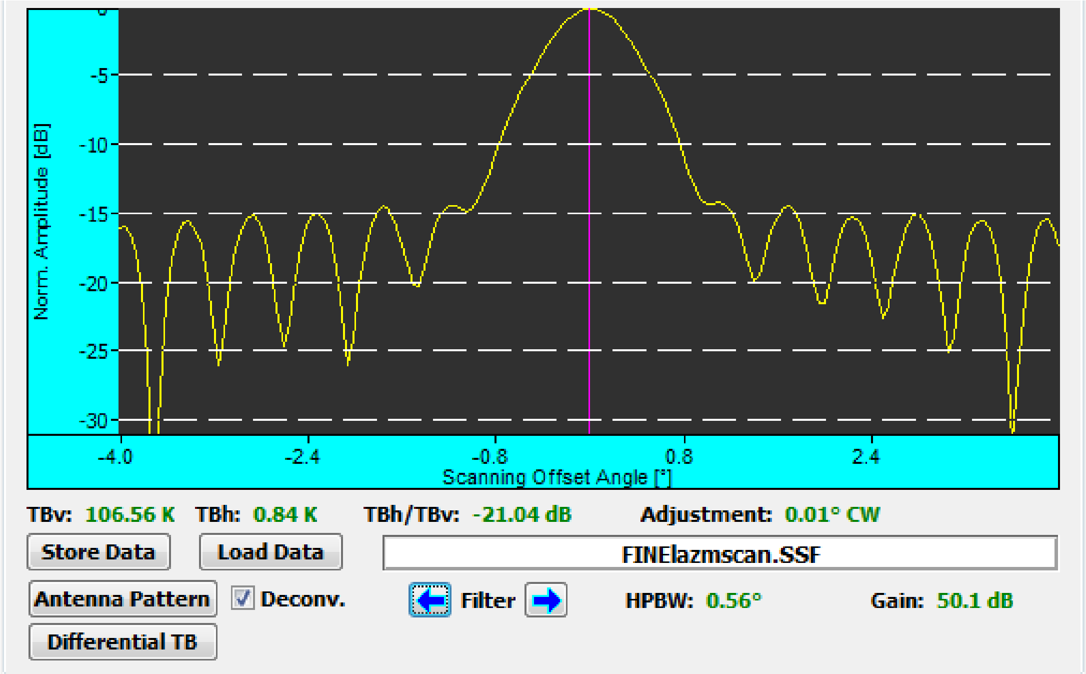


Fig. 7 – Azimuth pattern after deconvolution

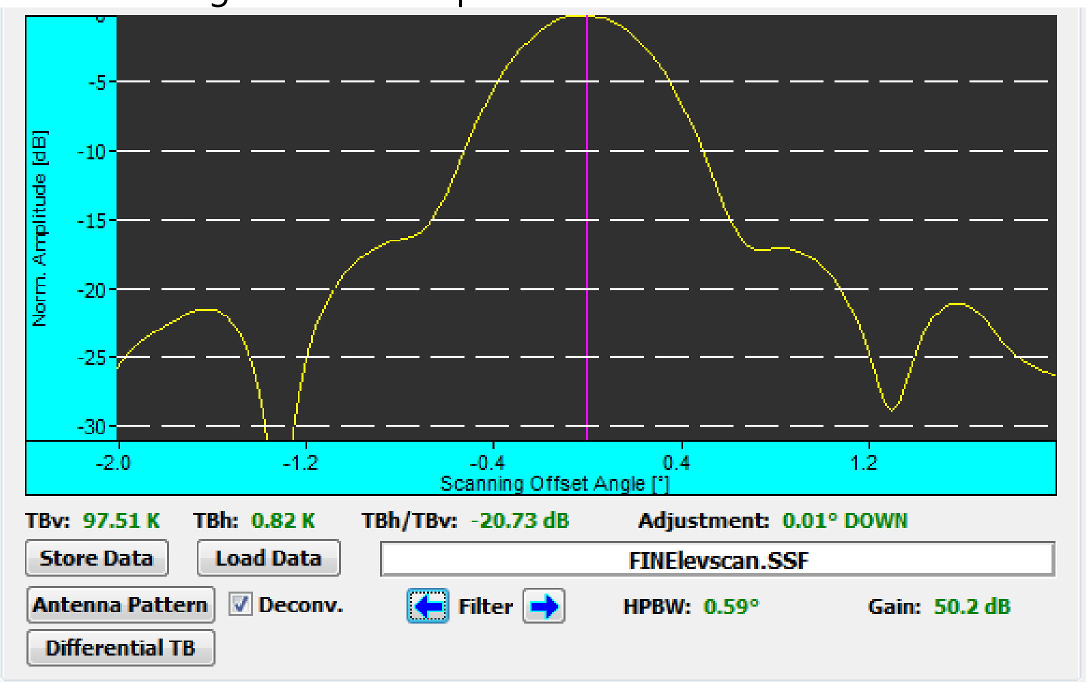


Fig. 8 – Elevation pattern after deconvolution

We estimate the half-power-beam width and the antenna gain to be 0.56±0.05° and 50.1±0.3 dB, respectively.