Characterization of an antenna for RFID systems

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*Nomarski photos taken by **S. Cantu'** (INAF/OAB)*

*Zeiss profiles taken by **F. Mazzoleni e S. Basso** (INAF/OAB)*

*Mitutoyo profiles taken by **S. Cantu'** (INAF/OAB)*

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1. Introduction

Fig.1: Photograph of the antenna.

2. Nomarski microscope photos

The Nomarski optical microscope amplifies the surface details contrast by means polarized light. The polarized light beam passes through a Wollaston prism that splits it in two beams orthogonally polarized each other. The light beams are focused onto the sample surface sideways each other, after the surface reflection they pass through the Wollaston prism (once again) and are recombined. The image is produced analysing the phase deviations of the reflected beams.
With this instrument it is possible to see any kind of structure that present height, slope or refraction index variations because they introduce a difference in the optical path of the beams.
This microscope has a lateral resolution of some microns and sub-nanometrical height resolution, but without numerical information.
Hereafter some images of the antenna, taken with different magnifications, concerning the areas marked in figure 1.

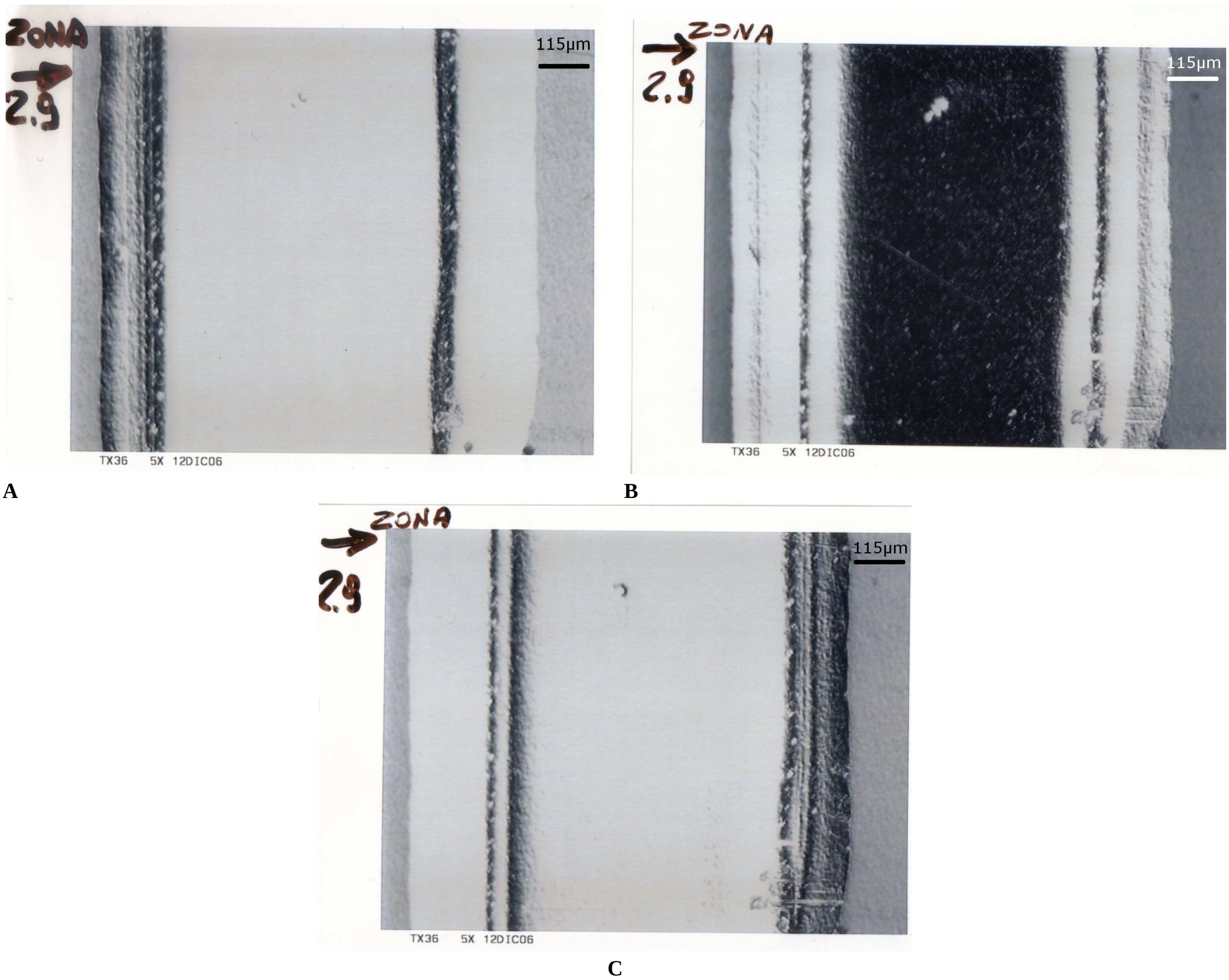


Fig. 2: Nomarski photos of the area marked with 2.9 in figure 1. The sequence highlight the left edge (A), the centre (B) and the right edge (C) of the metallic track.

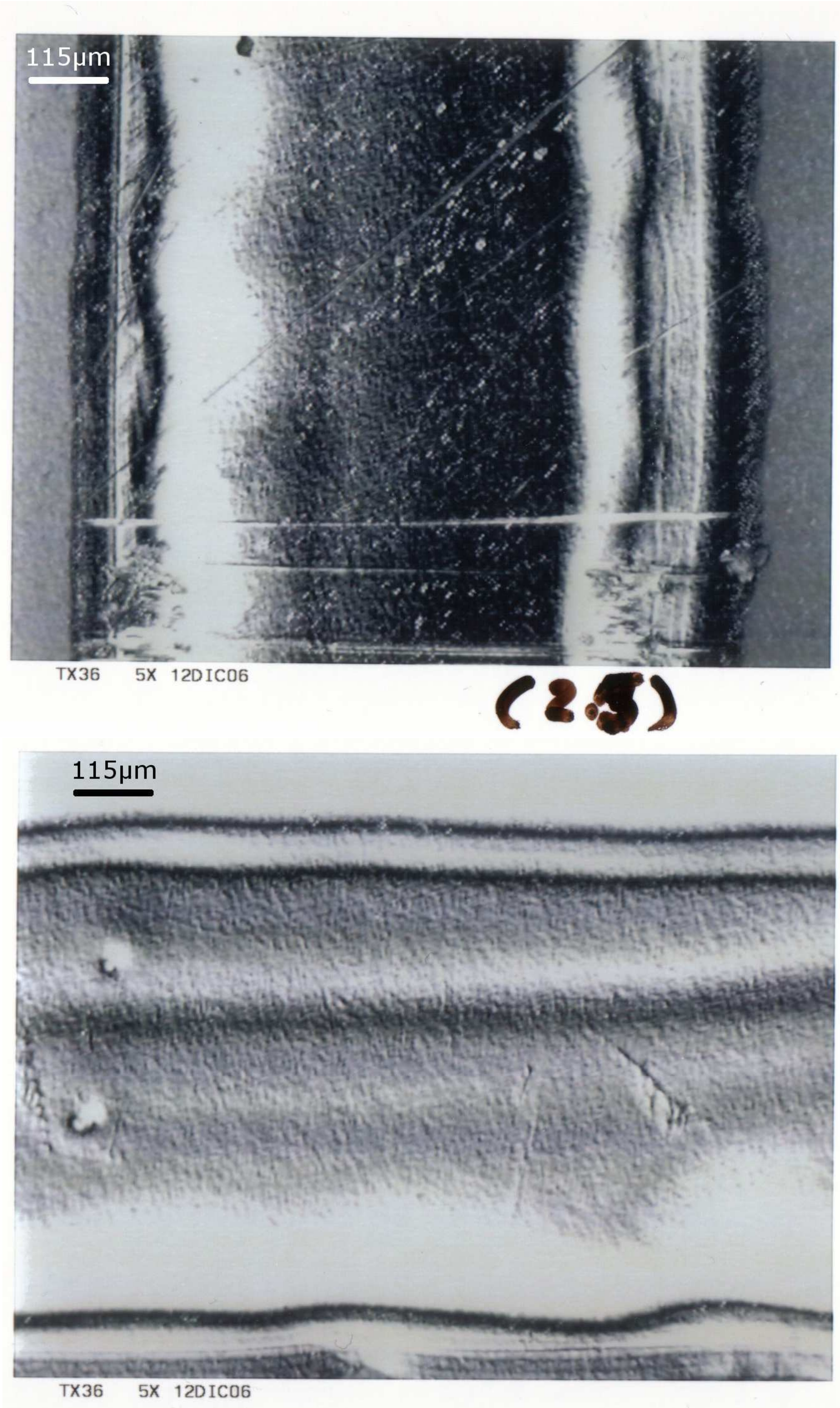


Fig. 3: Nomarski photos of the area marked with 2.5 in figure 1.

3. Zeiss CMC profilometer scans

The Zeiss CMC profilometer is a contact instrument able to measure sample profile up to 40 cm long. In the past it was used to calibrate the mandrels for the X-ray optics of the XMM mission.
The measure is performed by a movable cart with two little sphere in contact one with a reference bar and the other with the sample surface. Each sphere is furnished by a capacitive transducer connected together that convert the height variation in voltage ones. The transducer signal of the reference bar is used to avoid errors inclusion due to cart vibrations. The sample is mounted on a micrometrical tuneable support to align the reference-bar\sample surfaces.
The measure accuracy is of 10 nm in the height determination with a maximum deviation of ±20 μm and the minimum sampling step is 10 μm.

Fig. 4: Photo of the sample with profile position marked.

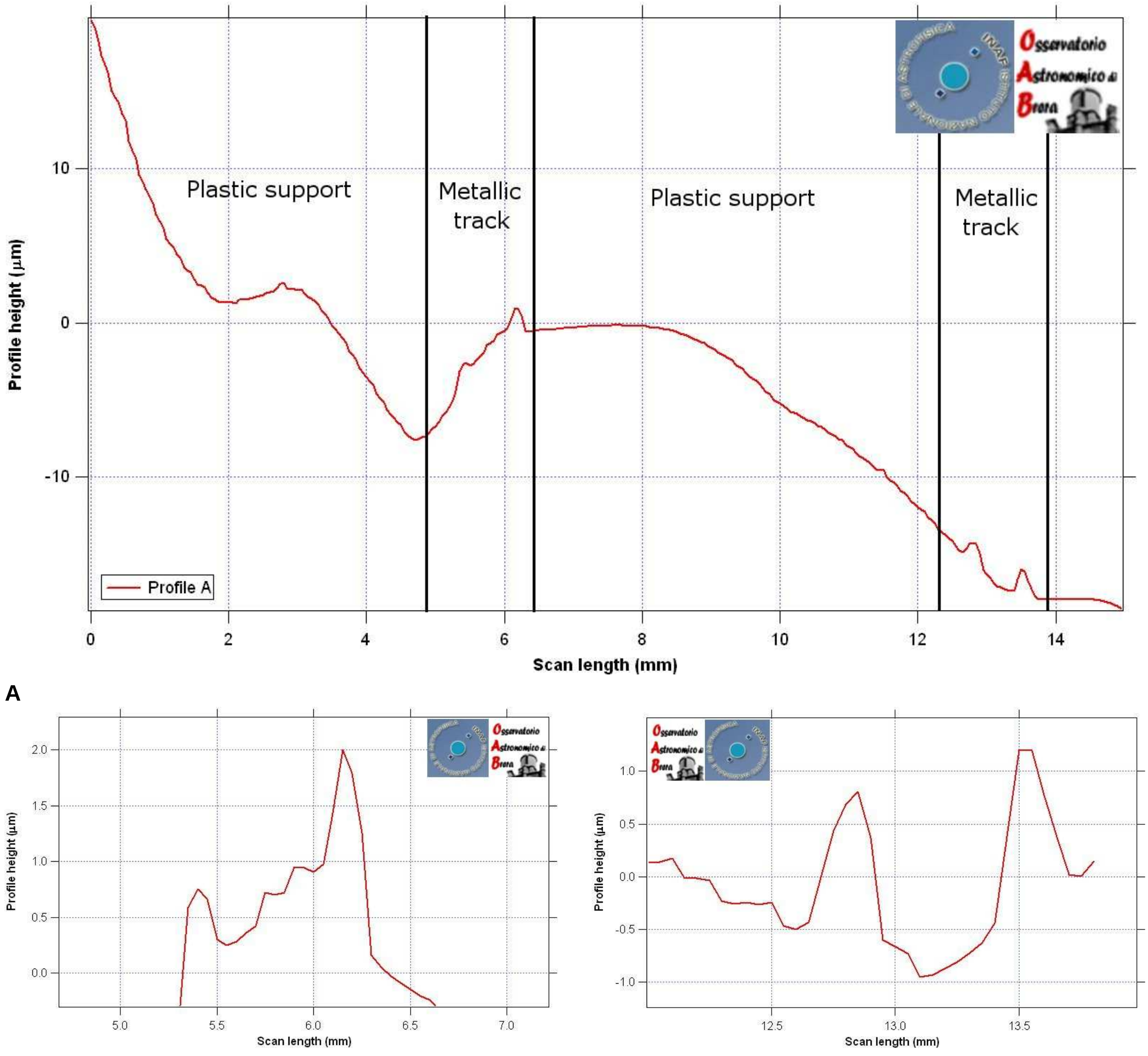
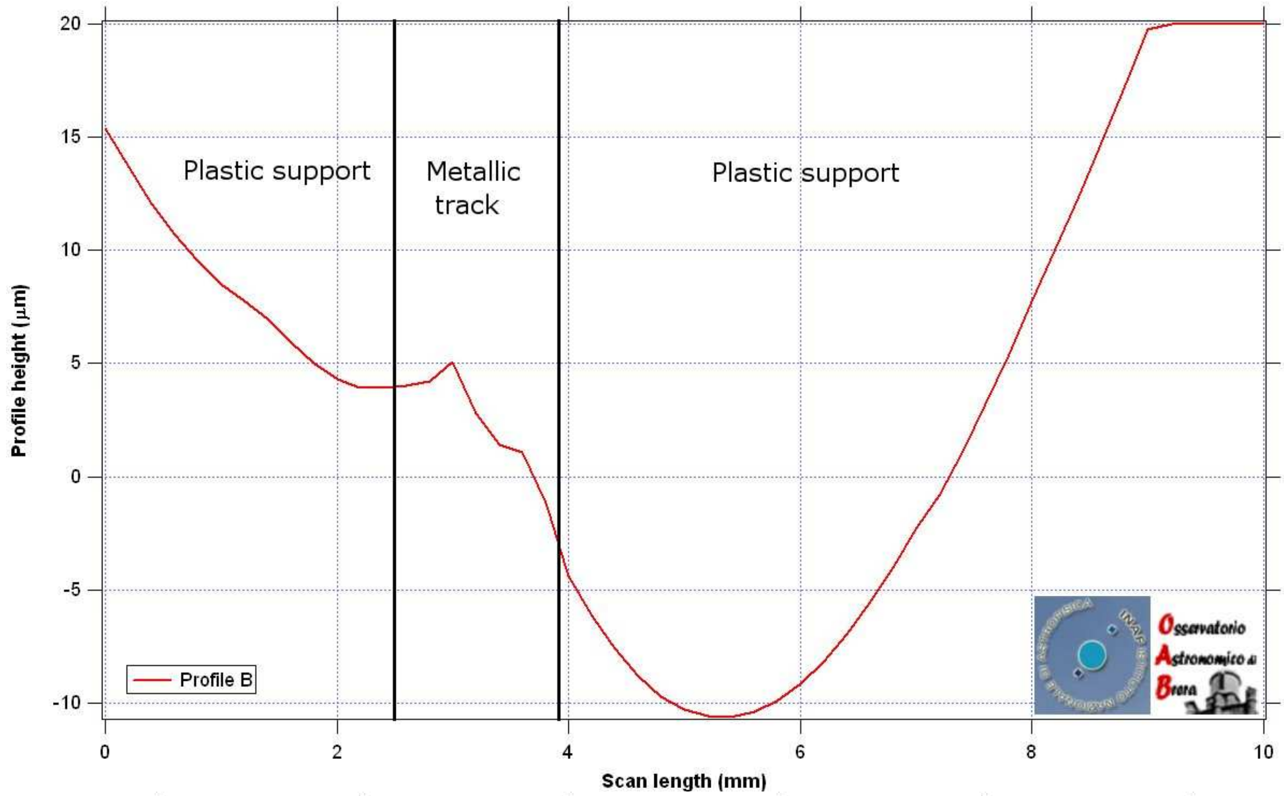


Fig. 5: Profile A measured with the Zeiss profilometer available in INAF/OAB. The plots B-C are a zoom of the plot A around the metallic track position.



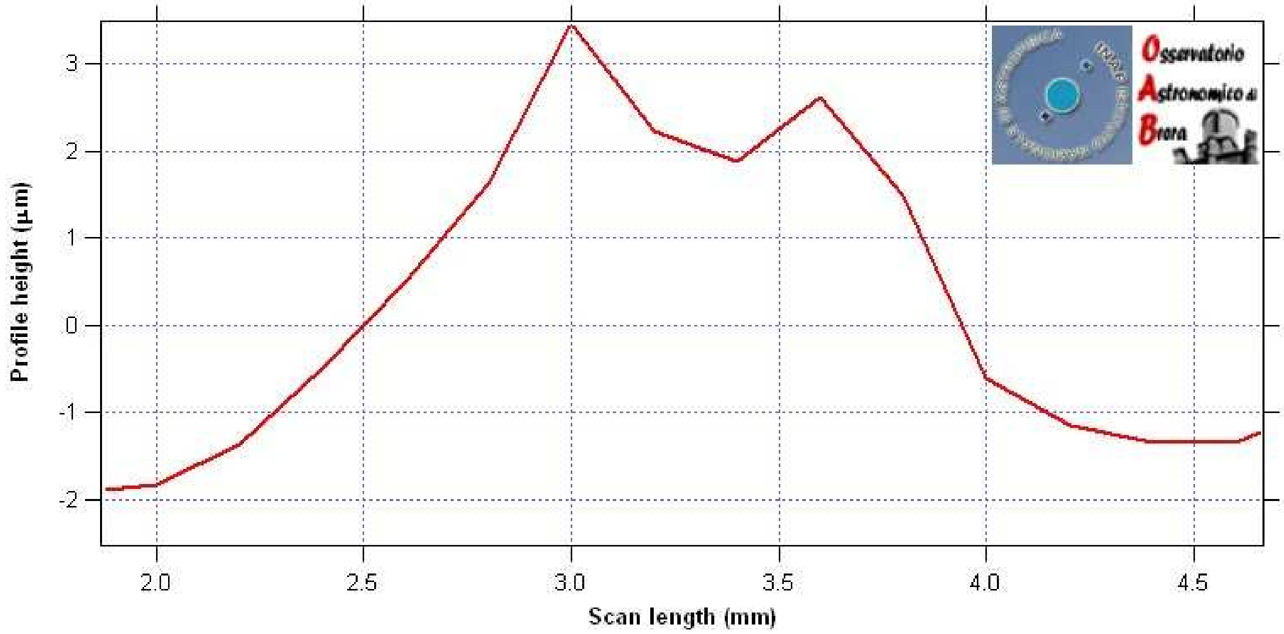


Fig. 6: Profile B measured with the Zeiss profilometer available in INAF/OAB. The bottom plot is a zoom of the top plot around the metallic track position.

4. Mitutoyo profilometer scans

The Surftest 301 is a easy-to-use and portable surface roughness tester that make use of a contact stylus to measure the sample profile. Other than the profile, the Mitutoyo can give a large number of surface parameters like RMS, arithmetic mean deviation, PV of the profile and others. The acquired data are than printed on a paper roll.

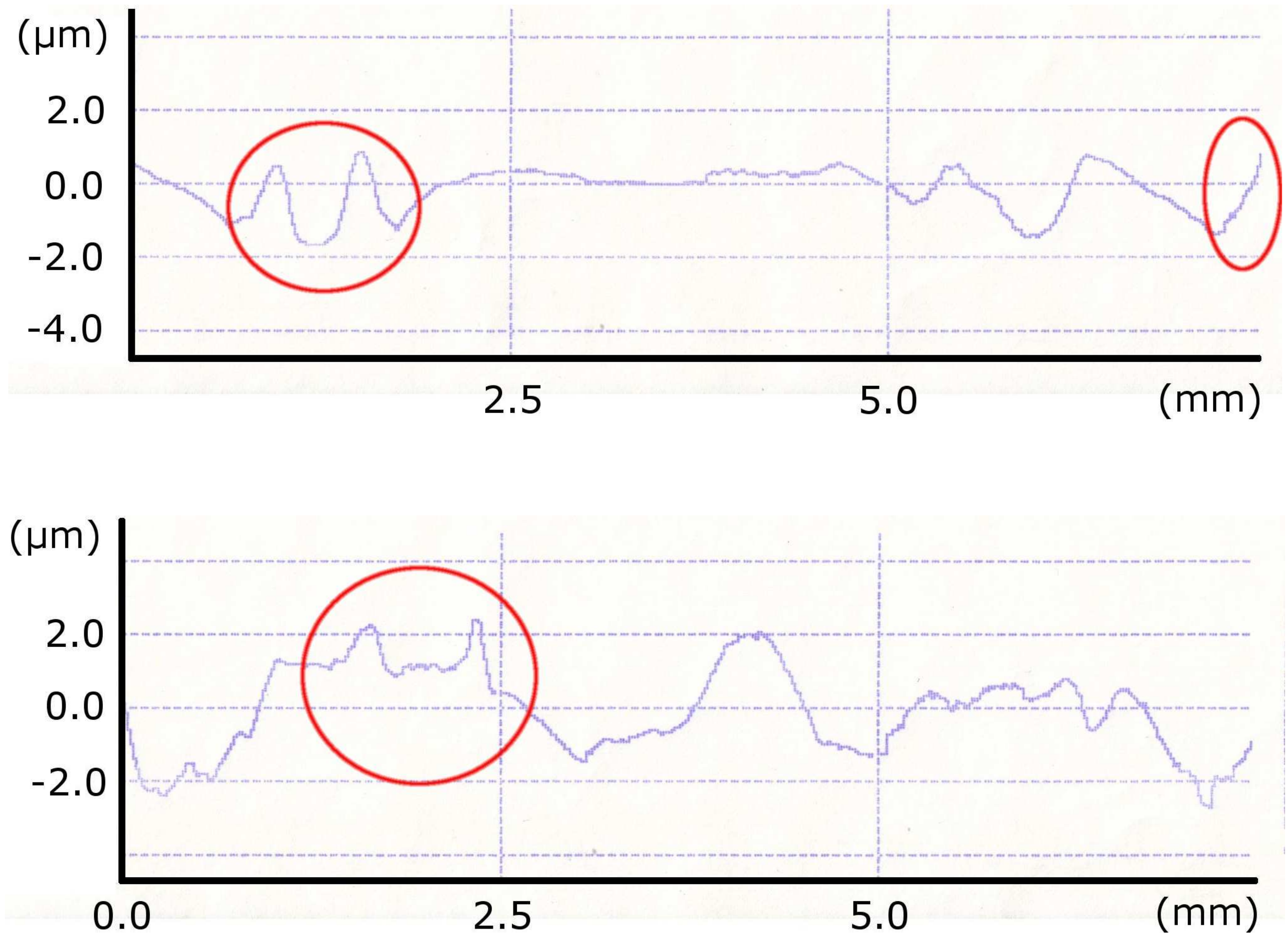


Fig. 7: Surface profiles of a part of the antenna measured with the Mitutoyo profilometer. For the top profile we measure PV=1.8 μm and Ra=0.47 μm. For the bottom one: PV=4 μm and Ra=1.01 μm.

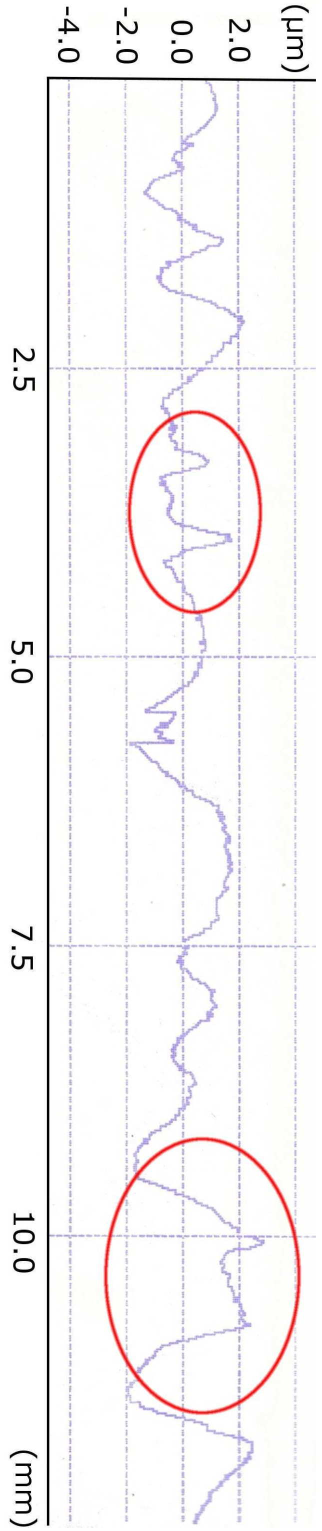


Fig. 8: Surface profile of a part of the antenna measured with the Mitutoyo profilometer. For this profile we measure PV=3.8 μm and Ra=0.92 μm.

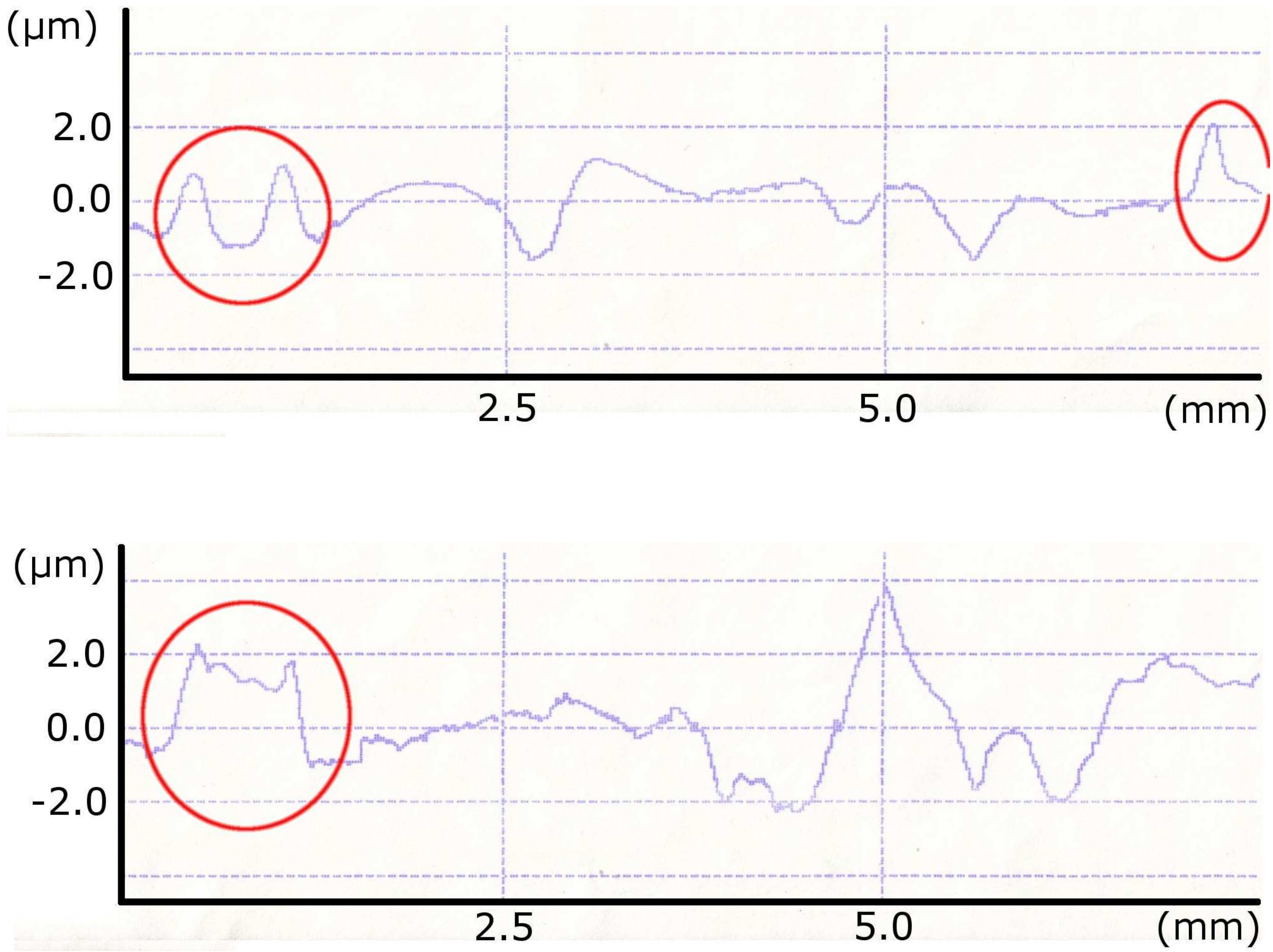


Fig. 9: Other surface profiles of a part of the antenna measured with the Mitutoyo profilometer. For the top profile we measure PV=2.9 μm and Ra=0.53 μm. For the bottom one: PV=5 μm and Ra=1.0 μm.