



RF ELECTRIC FIELD REPEATED MEASUREMENTS IN URBAN ENVIRONMENT

The city of Aosta is placed in a valley surrounded by high mountains: this particular location makes it possible to install all the antennas for radio - television broadcasting signal outside the municipal area, in locations at high altitudes from which the signal can be spread easily on the town and also on all neighbouring municipalities: in the town area there aren't radio-TV broadcast antennas.

The most common family of radiofrequency systems in Aosta, then, is constituted by base stations for mobile telephones (BTS). The configuration of BTS is continuously evolving, due to the introduction of new services, i.e. UMTS, and to the increase in the use of those already existing, GSM 900 and 1800 MHz. ARPA Valle d'Aosta has carried out an activity, since the year 2003, aimed at relieving of radiofrequency electromagnetic background in Aosta



Background electromagnetic relief on Aosta

The activity was accomplished in three stages run in parallel:

1) broadband measures over a dense grid of 606 points at ground level throughout the town



2) long time acquisitions in some areas near the electromagnetic sources



3) narrowband measures at several floors in buildings close to telephone antennas



Broadband measures on the road grid and continuous monitoring provide information on instantaneous exposure of people walking in the street and on long time exposure of those living near the measuring point.

With narrow-band measurements, the maximum exposure conditions can be evaluated: on recorded data an extrapolation is done to estimate the exposition in case that all channels of all BTS are transmitting with the maximum radiating power. According to this conservative approach ARPA evaluates the respect of exposure limits fixed in the Italian laws.

ARPA knows all technical data and evolution of radio transmitting plant, because a regional law requires that all TLC operator submit the plan of their apparatus for the recording in a regional register.

Broadband repeated measures over time

When the electromagnetic background evaluation was accomplished the photography on the field distribution in 2003 on the entire town area was clear. This result was important but it wasn't enough. The radio stations are in continuous evolution due to the increase in service demand and to the technological evolution. In 2003 in Italy UMTS services were starting to develop. It was clear that the photography should be updated frequently: every year in the same season, June/July, broadband measurement in a subset of the original 606 points are repeated. Firstly, 78 points were identified as representative of the whole set, then, due to the installation of new BTS, in 2008 9 more points were added to the list.

For each annual set of data, a geographical interpolation was performed on the 87 field values to obtain a map of the field distribution on the town. The interpolations were done as if buildings were transparent to electric field: absorption and reflection weren't taken into account. The results are shown, in sequence, in Figure 1: the following maps are very small and differences aren't so noticeable, maps of a specific area can be drawn so that differences appear clearly. In Figure 2 and 3 a detail relating the field distribution in 2003 and 2010 in the centre town is shown: the control points, are thicker in the centre of the city and thinner on the outskirts, therefore the interpolations have a more precise significance in the central area.

Figure 1: broadband measures interpolation from 2003 to 2010

E (V/m)		E (V/m)	
0 - 0.2	0.2 - 0.4	0.6 - 0.8	0.8 - 1.0
0.4 - 0.6	0.6 - 0.8	1.0 - 1.2	

Figure 2: broadband measures interpolation in centre town in 2003

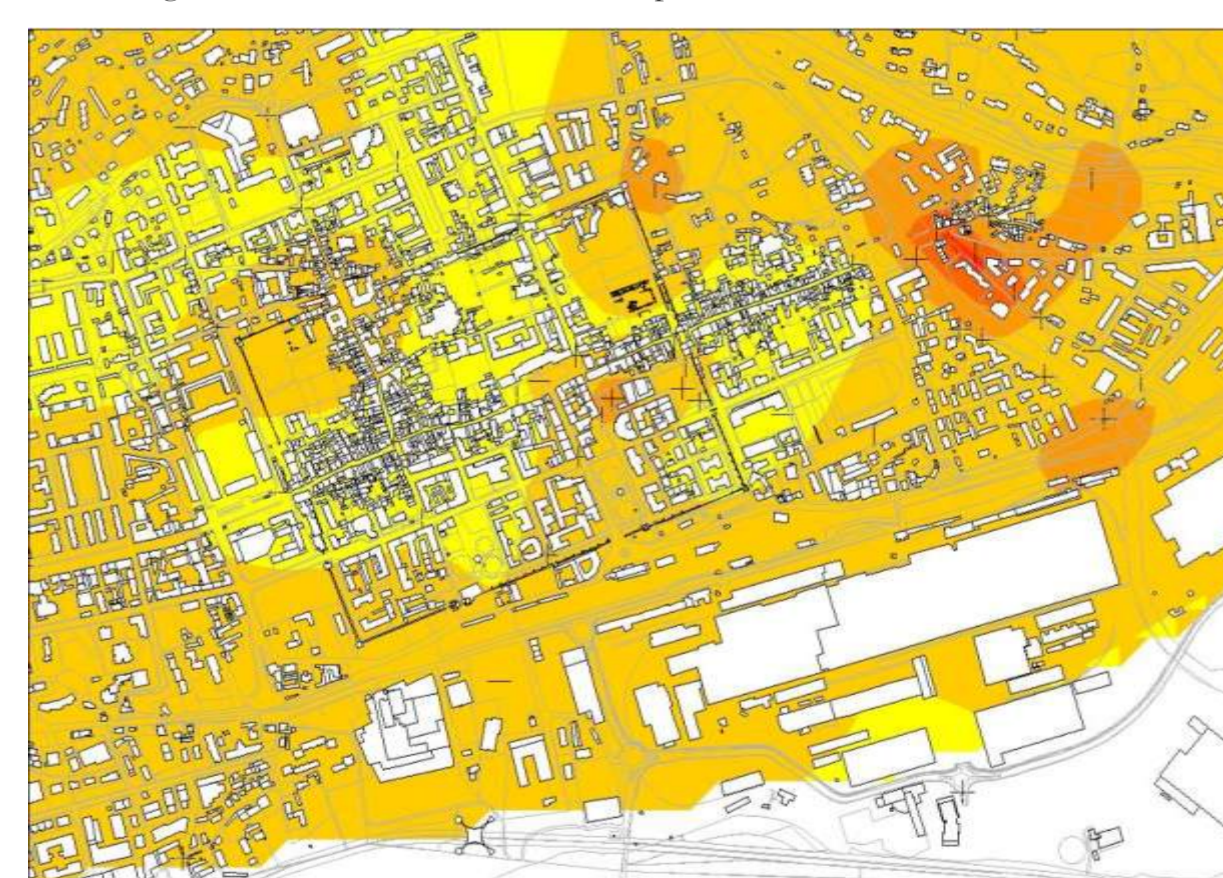
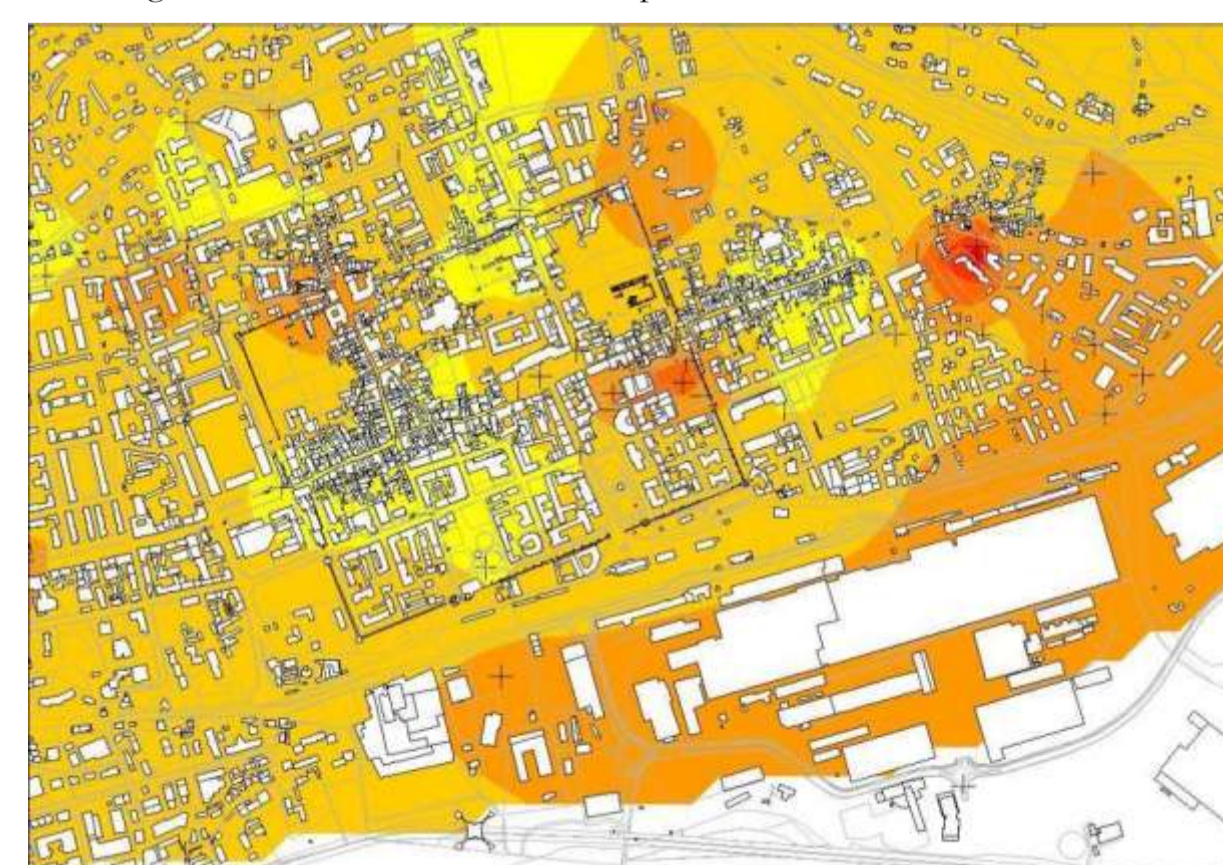


Figure 3: broadband measures interpolation in centre town in 2010



Comparisons between simulation and design data

In parallel with measurements and interpolations, simulation of electric field levels were performed on the basis of the plant technical data supplied by the operators. Data recorded in the regional register permits the comparison between field distribution simulation in 2003 and in 2010 in centre town. In this 7 years time period quite a big difference in the number and transmitted power of the BTS is noticeable: in Figures 4 and 5 BTS synthetic data are shown respectively for 2003 and 2010.

Figures 6 and 7 show the simulation results for 2003 and 2010 in free field. In each image two different graphic information are reported:

- the first is the isolevel curves distribution of the electric field at ground level on a 2D map
- the second is the 3D simulation taking into account the elevation of the building

Figure 4: BTS position and radiated power in Aosta centre in 2003

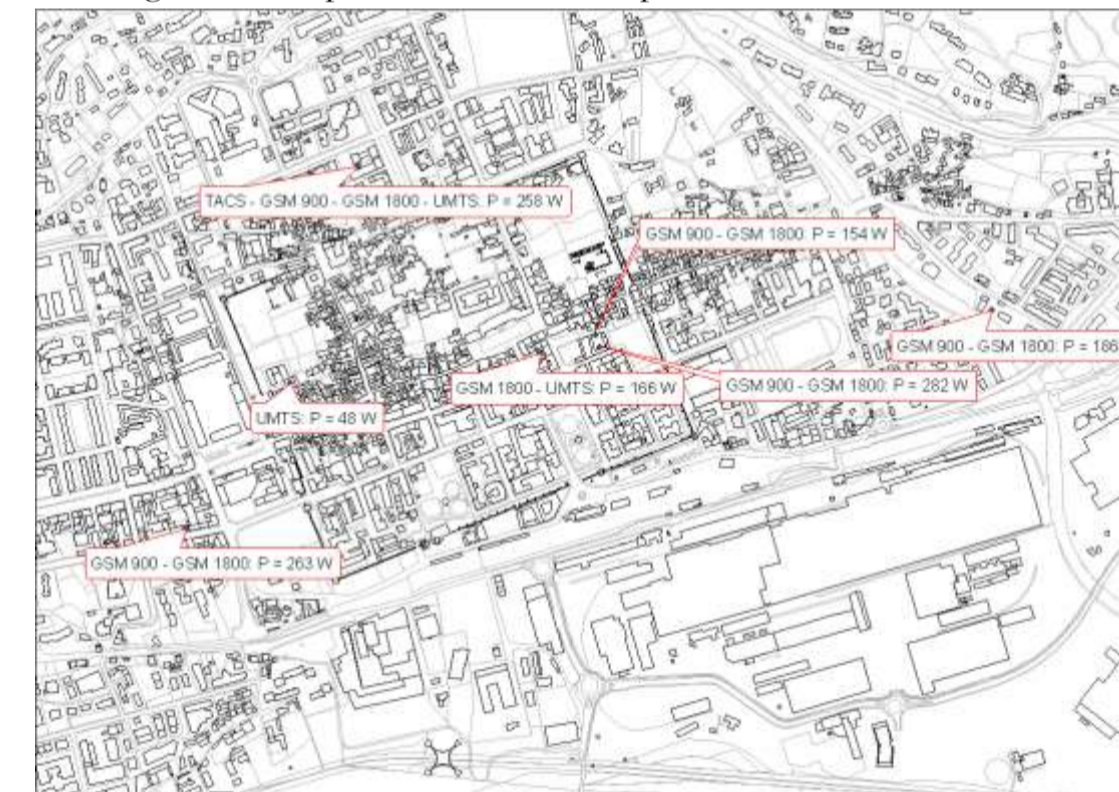


Figure 5: BTS position and radiated power in Aosta centre in 2010

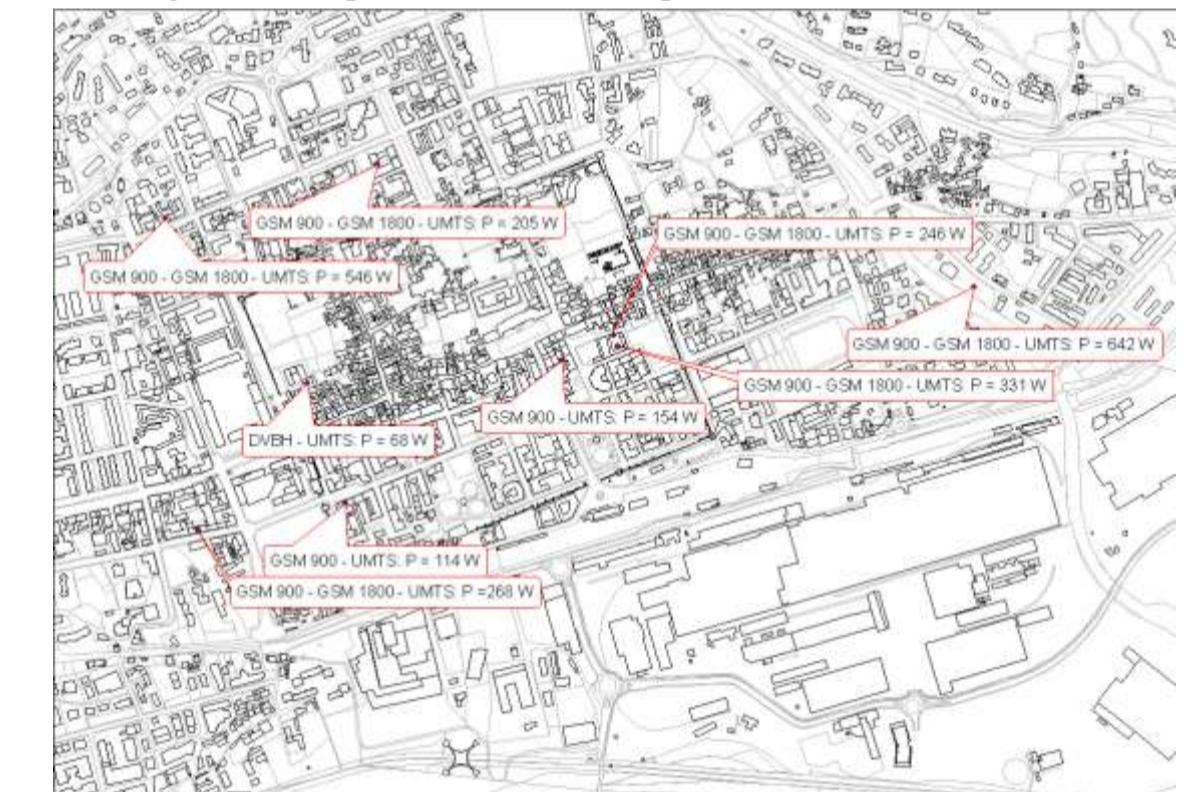


Fig.6 Field distribution numerical simulation in 2003

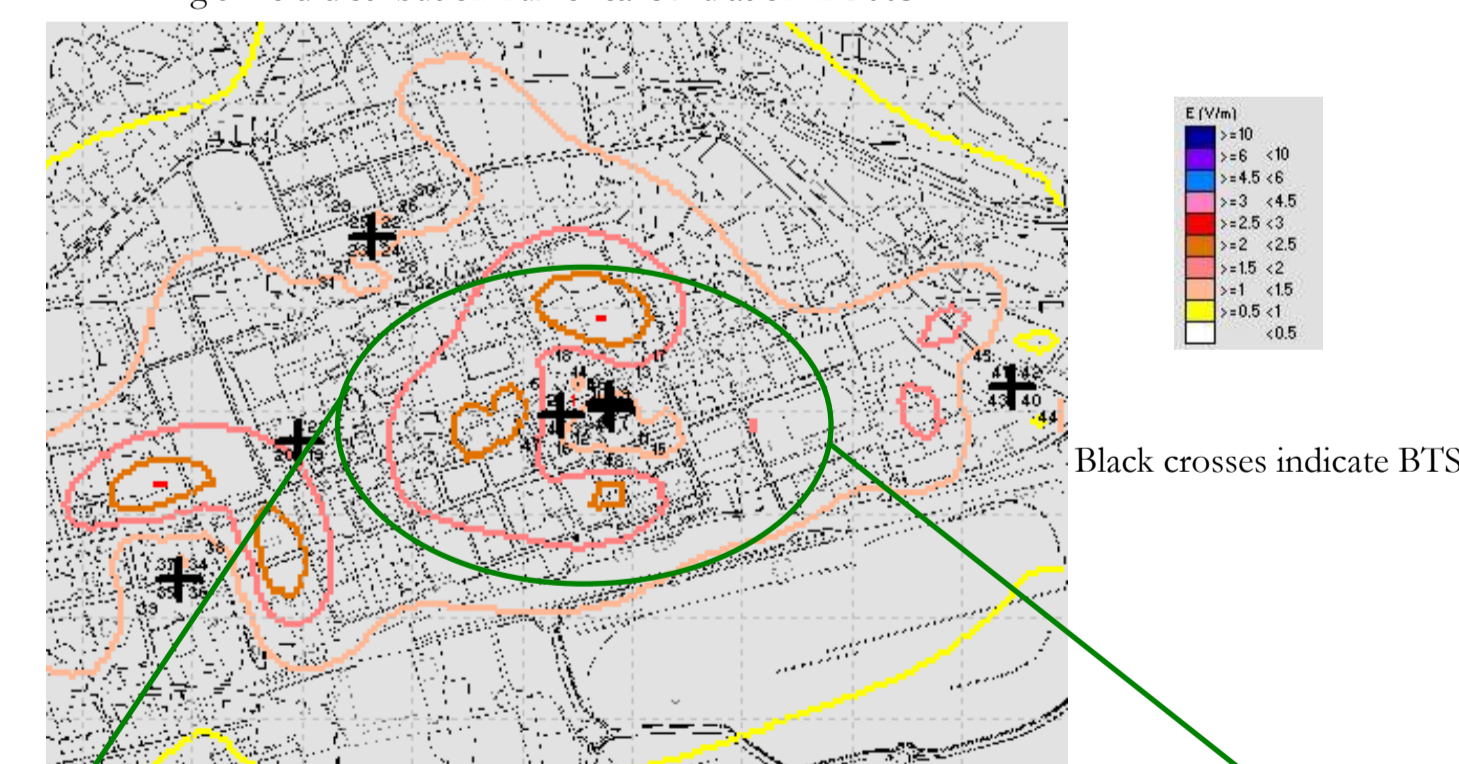
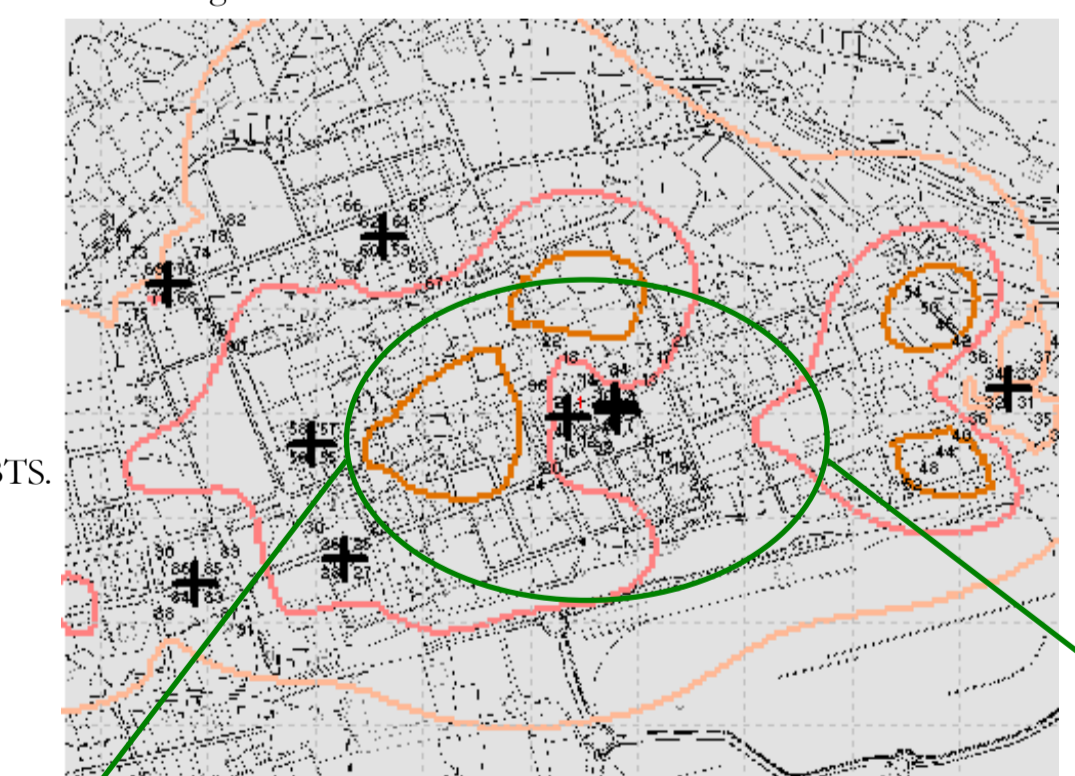


Fig.7 Field distribution numerical simulation in 2010



Black crosses indicate BTS.

