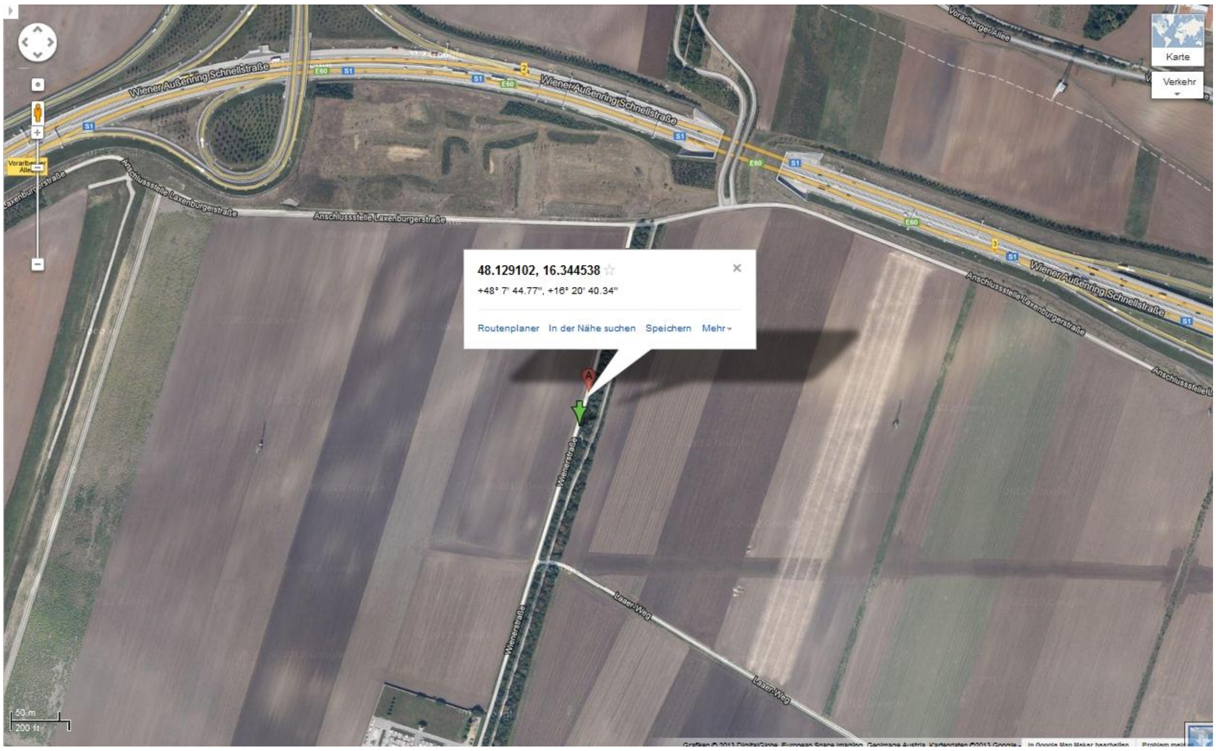
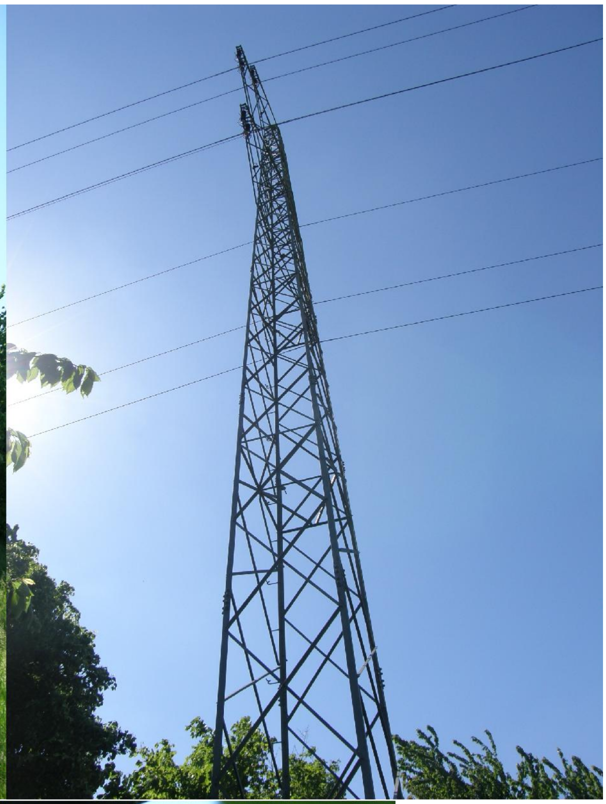
Report of pylon measurement on 15.05.13 in Vösendorf, Austria

Pylon location: Vösendorf, Austria; coordinates: +48° 7' 44.77", +16° 20' 40.34"

Weather conditions: Sunny, but slightly wet; Temp. approx. 25°C; last rain fall: 14.04.13 (night before measurement)





1) Checking selective passive currents

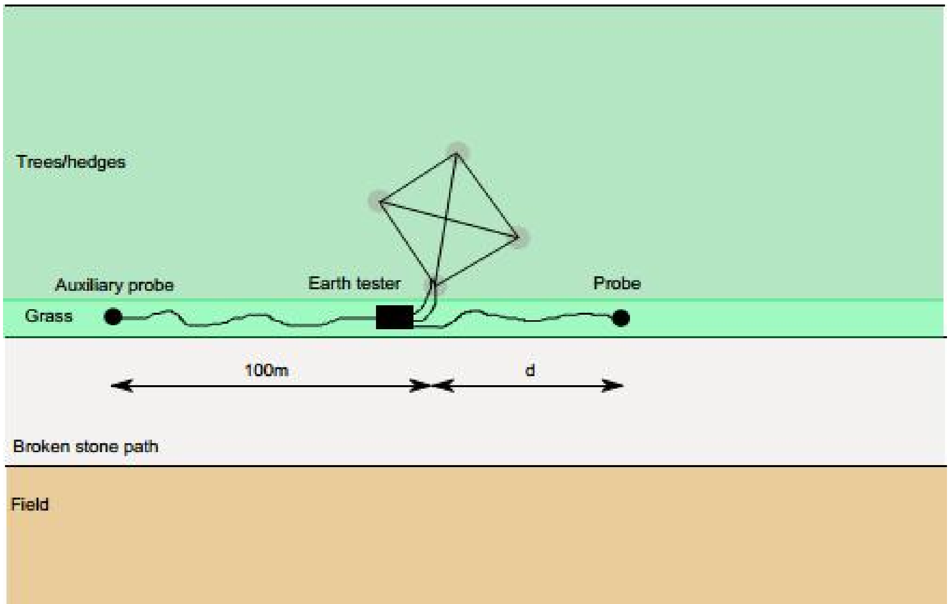
Selective passive current measurements of pylon legs with Ampflex gave (noise frequency was 50Hz):

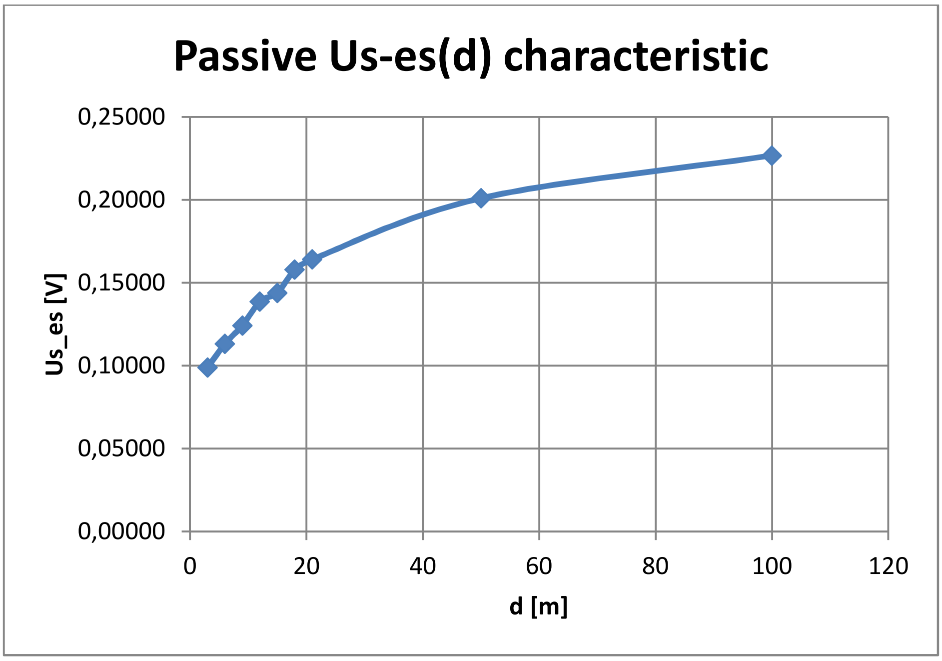
- I1 = 630mA
- I2 = 500mA
- I3 = 630mA
- I4 = 666mA
- Overall current: 200mA

The single currents don’t cancel each other completely; this means that current is also flowing into the **earth rope at the pylon top**, which therefore **must be connected**.

2) Checking if probes out of potential funnels

Configuration see picture; for the auxiliary probe 3 rods in parallel where used, where for the probe only 1 rod was driven into ground.

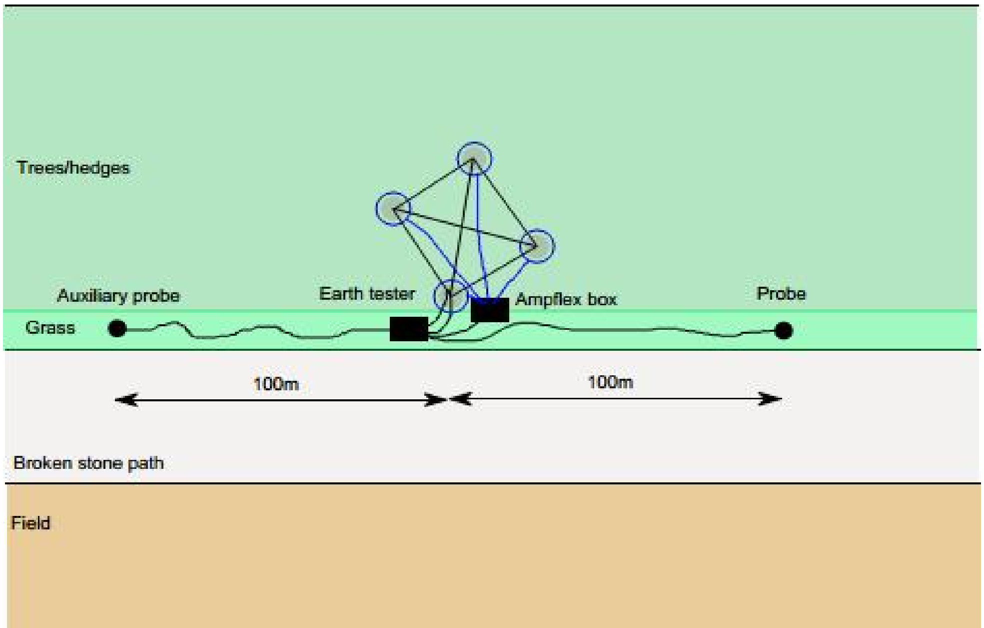


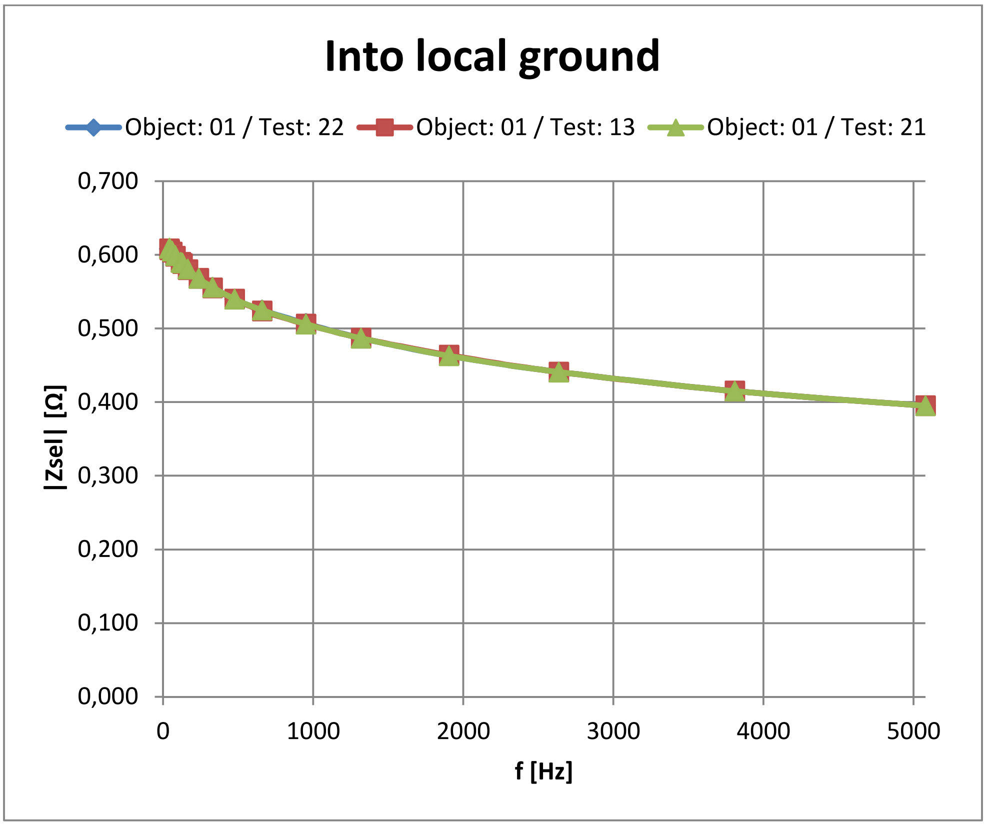


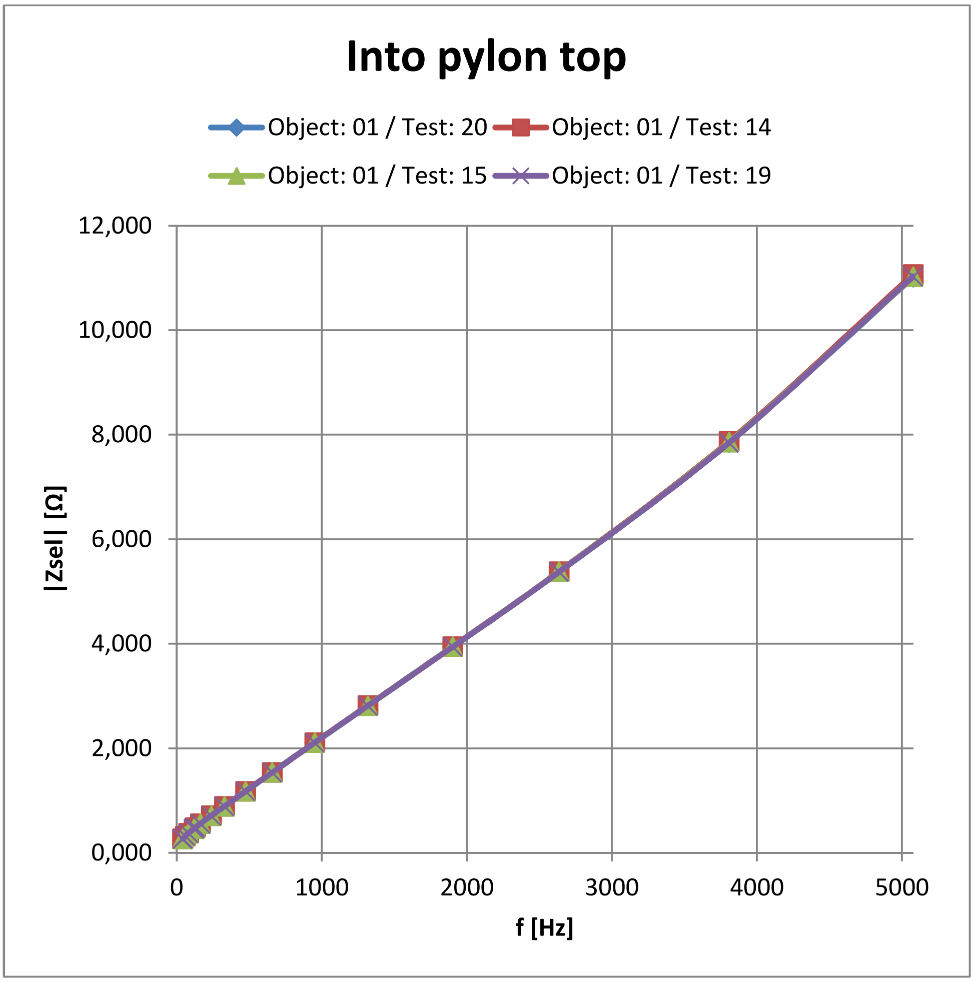
Uh-e remained quite constant when relocating the probe, Us-es rose with distance from pylon (Obj. 1/Tst. 2+5-12). This could mean that there was less ground resistance north of the pylon (maybe due to buried tubes or cables?) and that the **potential funnel of the pylon for the 50Hz noise currents reached even beyond 100m south of the pylon**. The low Us-es value in Obj01/Tst13 was probably a measurement error (compare with Obj01/Tst21+22)…

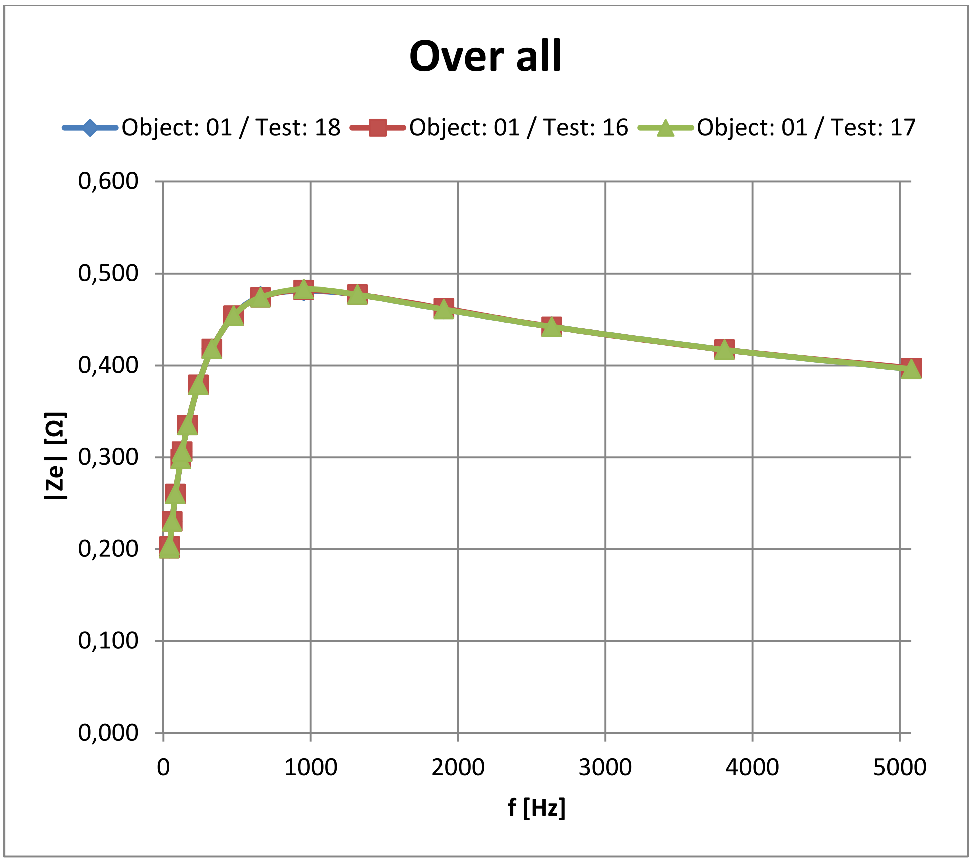
3) Pylon measurement

Configuration see picture; for the auxiliary probe 3 rods in parallel where used, where for the probe only 1 rod was driven into ground.


Trees/hedges
Auxiliary probe
Earth tester
Ampflex box
Probe
Grass
100m
100m
Broken stone path
Field


Into local ground
Object: 01 / Test: 22
Object: 01 / Test: 13
Object: 01 / Test: 21
0,700
0,600
0,500
0,400
0,300
0,200
0,100
0,000
|Zsel| [Ω]
0
1000
2000
3000
4000
5000
f [Hz]

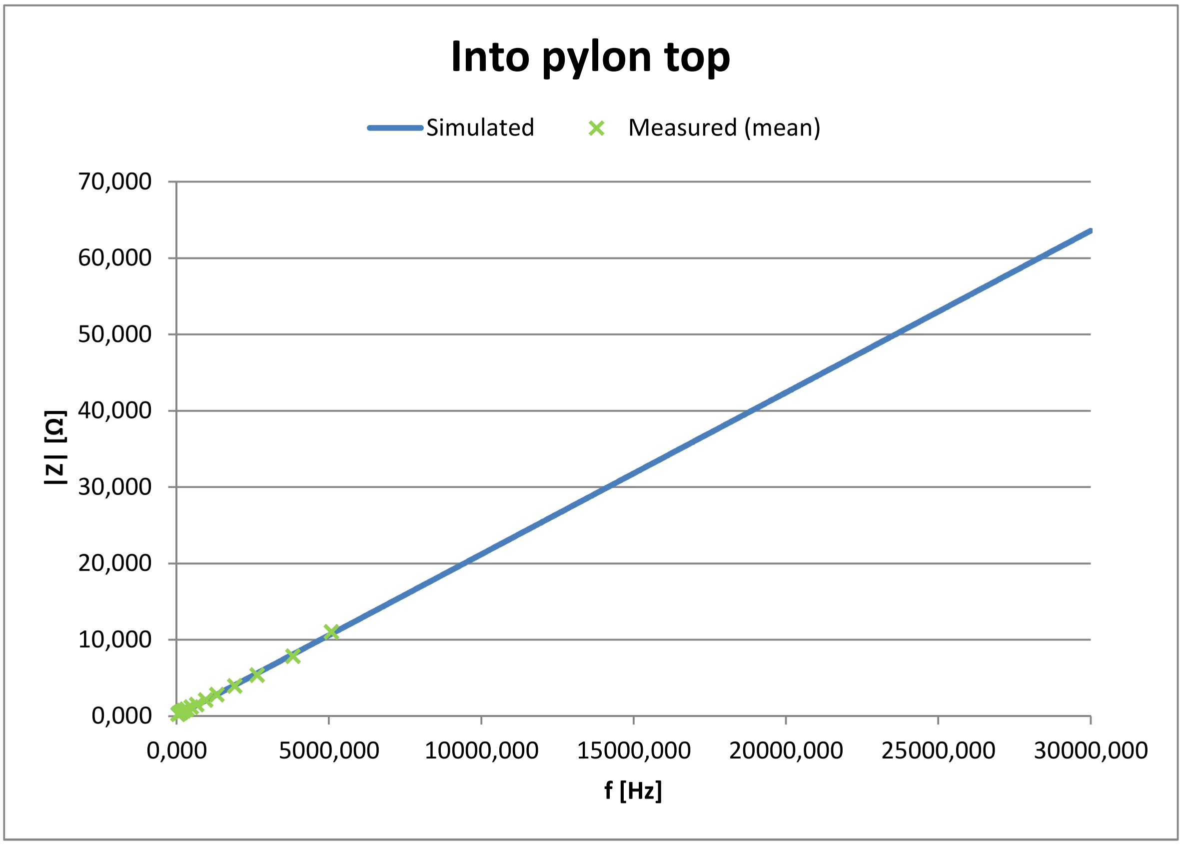

Into pylon top
Object: 01 / Test: 20
Object: 01 / Test: 14
Object: 01 / Test: 15
Object: 01 / Test: 19
12,000
10,000
8,000
6,000
4,000
2,000
0,000
|Zsel| [Ω]
0
1000
2000
3000
4000
5000
f [Hz]

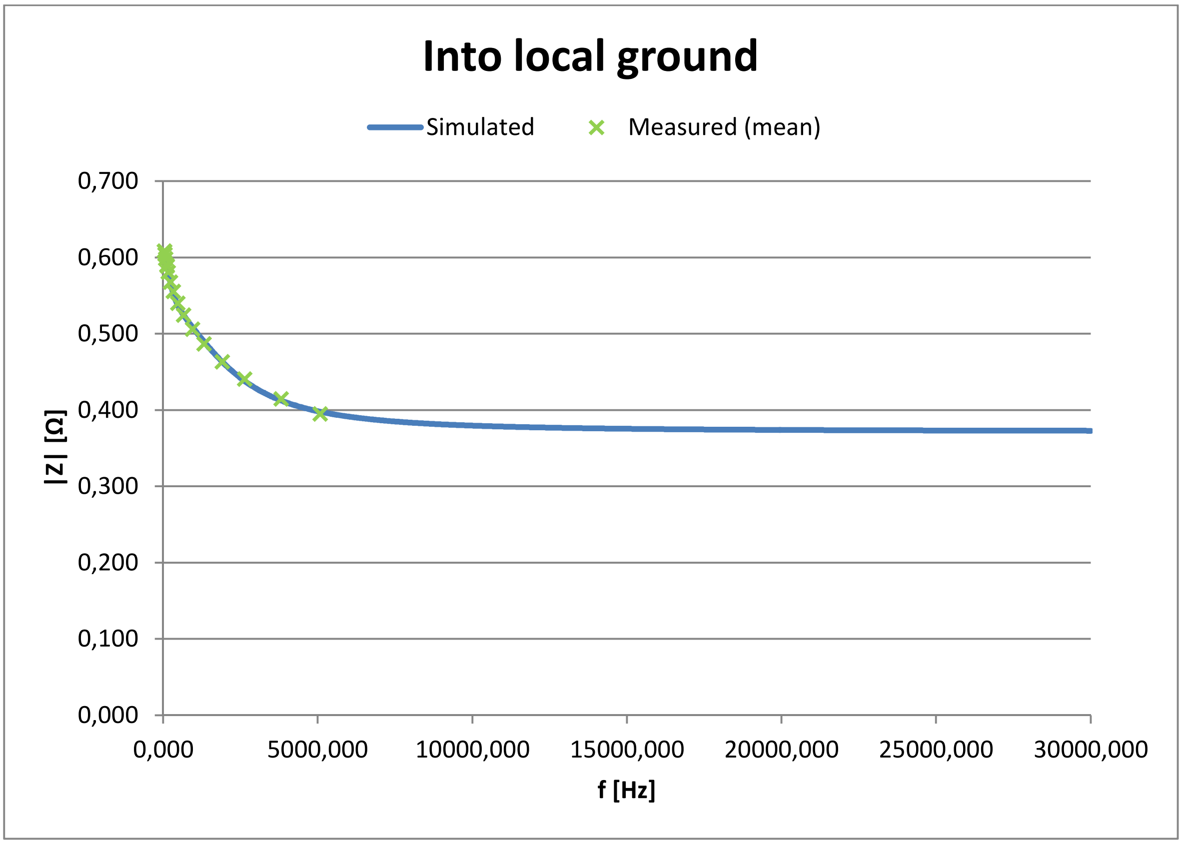

Over all
Object: 01 / Test: 18
Object: 01 / Test: 16
Object: 01 / Test: 17
0,600
0,500
0,400
0,300
0,200
0,100
0,000
|Ze| [Ω]
0
1000
2000
3000
4000
5000
f [Hz]

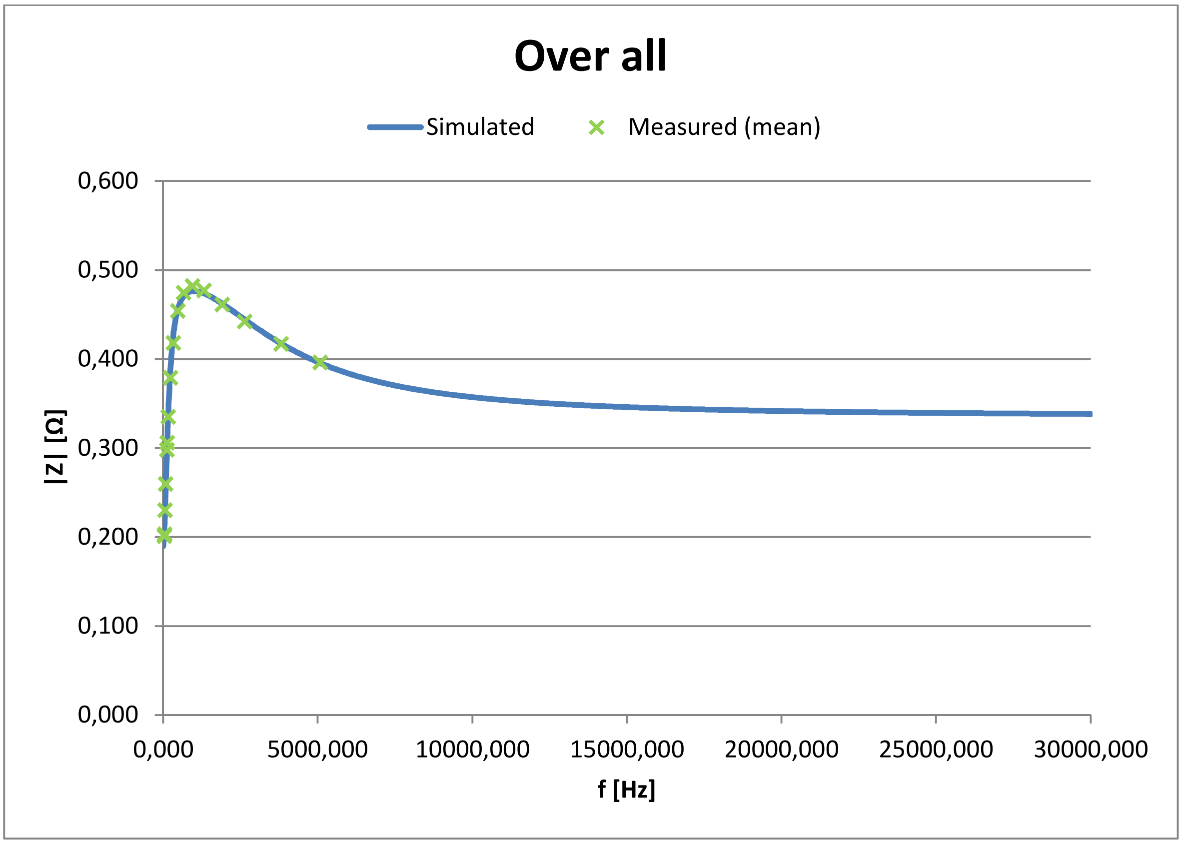
MABR, 21.05.13

The selective measurements into pylon top and ground are all reproducible and show smooth curves, speaking of the quality of the measurement. The curves into the top earth rope are almost linear, showing very nice the inductance of the earth rope. **Local earth resistance is approximately 0.4 Ohms**, which is quite good.

4) Simulation results:



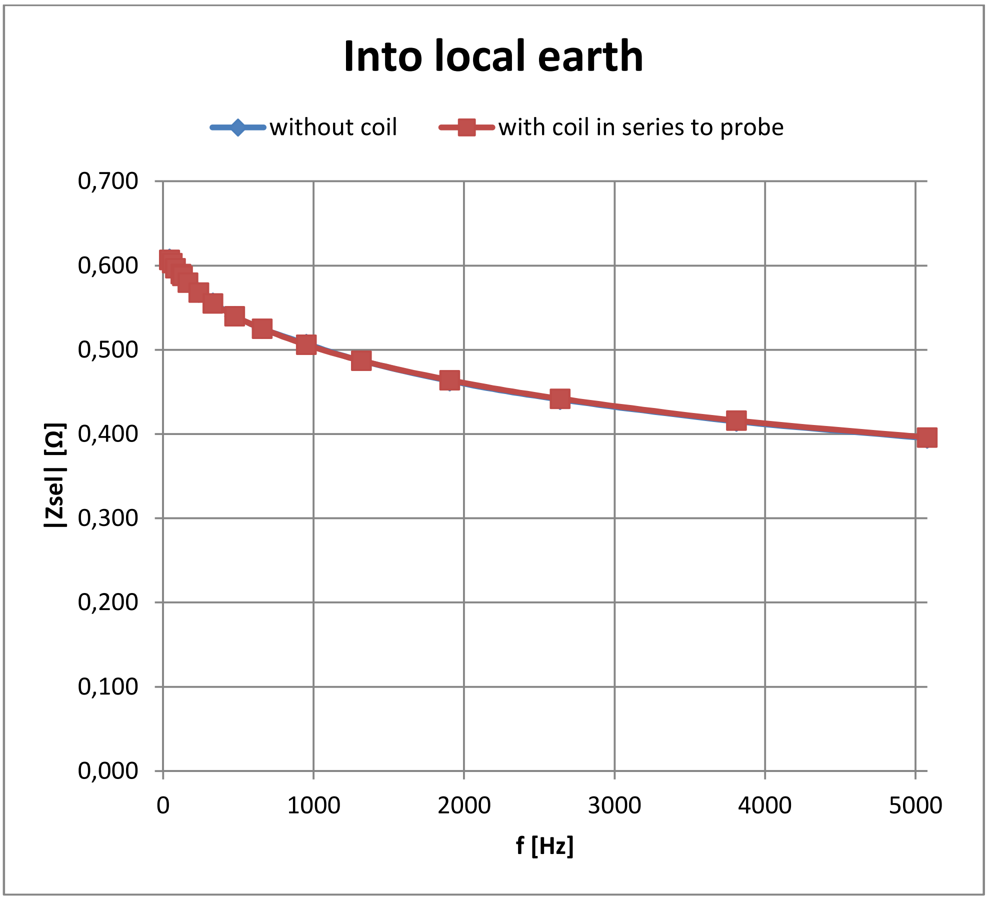


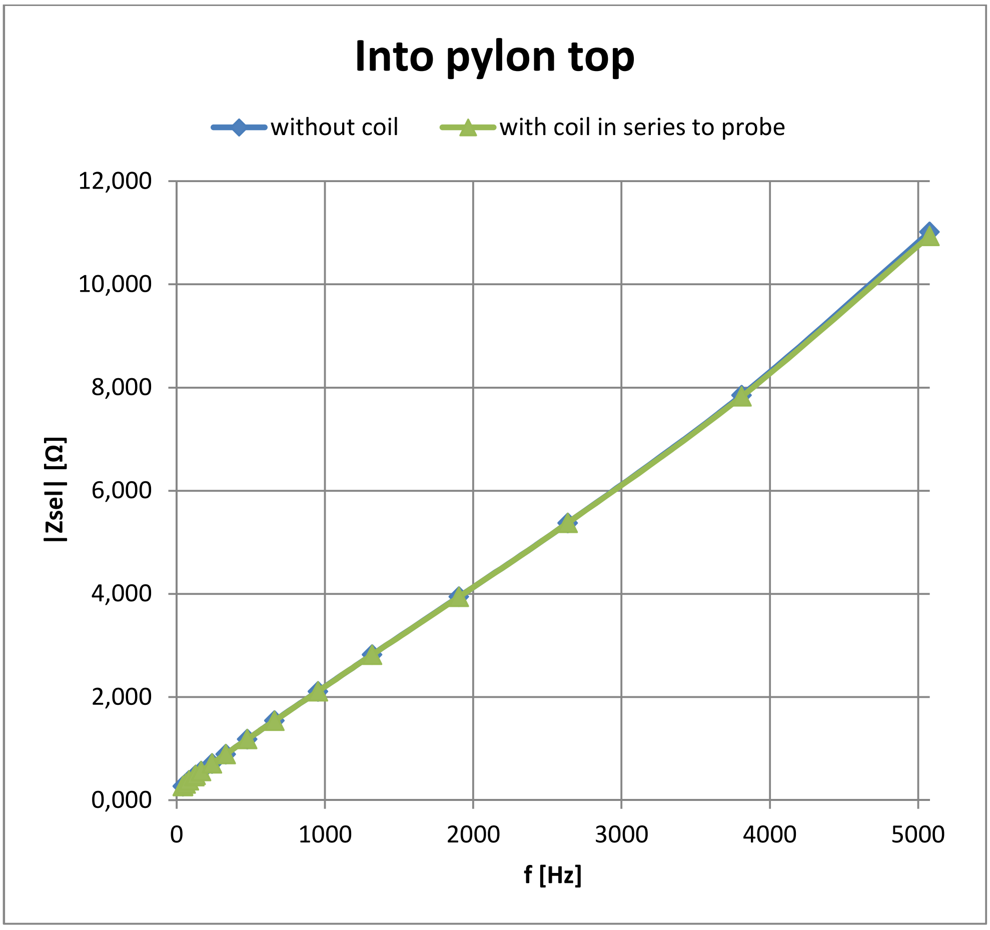


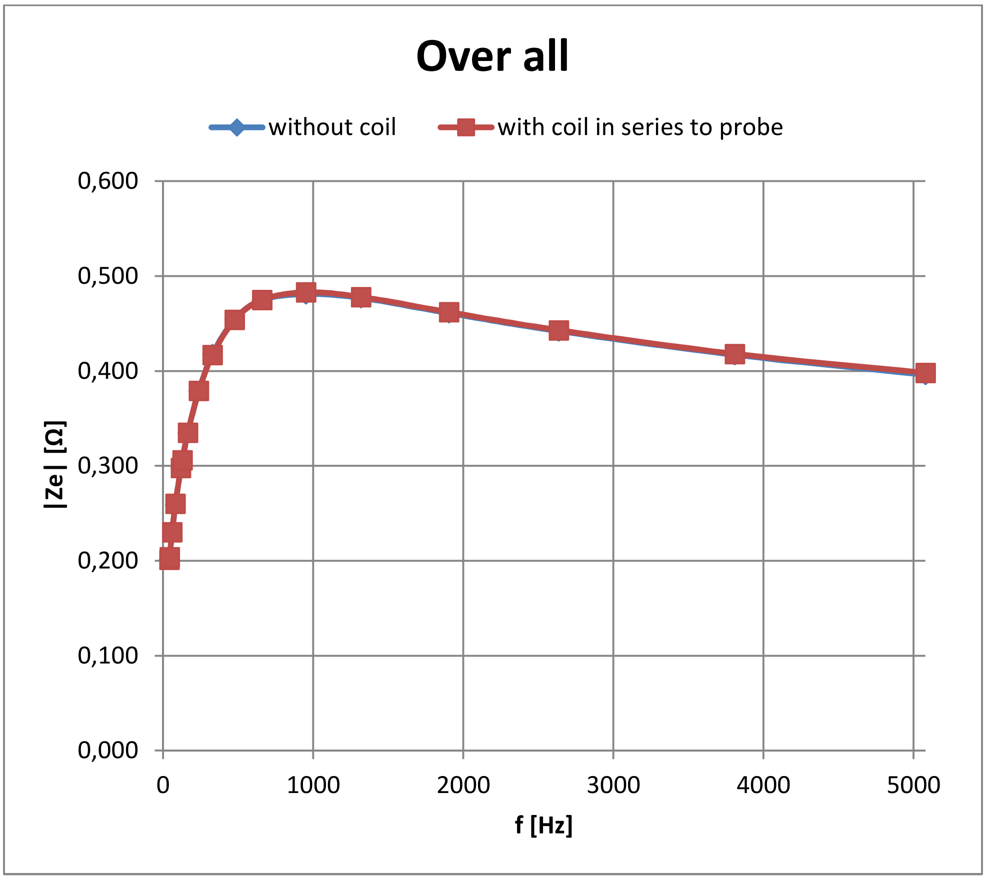
The simulated curves **fit the measured values very well** and **seem thus to be quite reliable**.

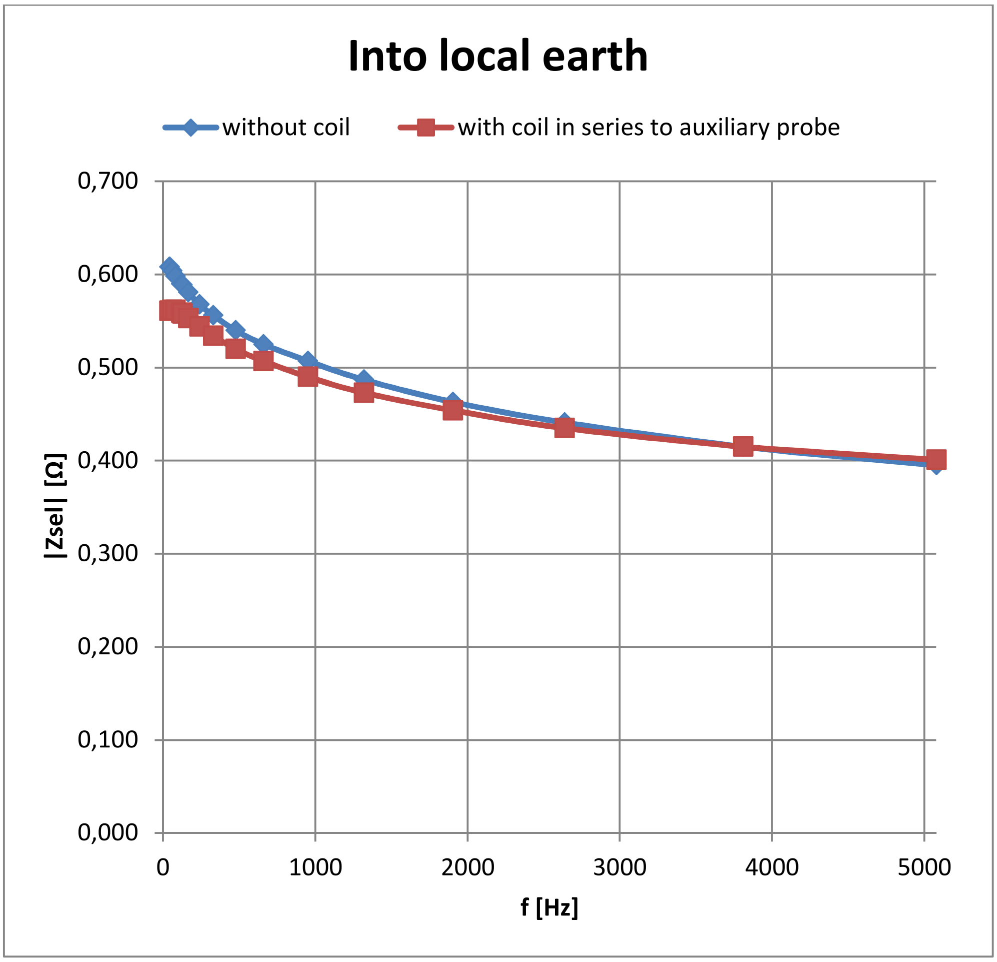
5) Influence of coiled cable

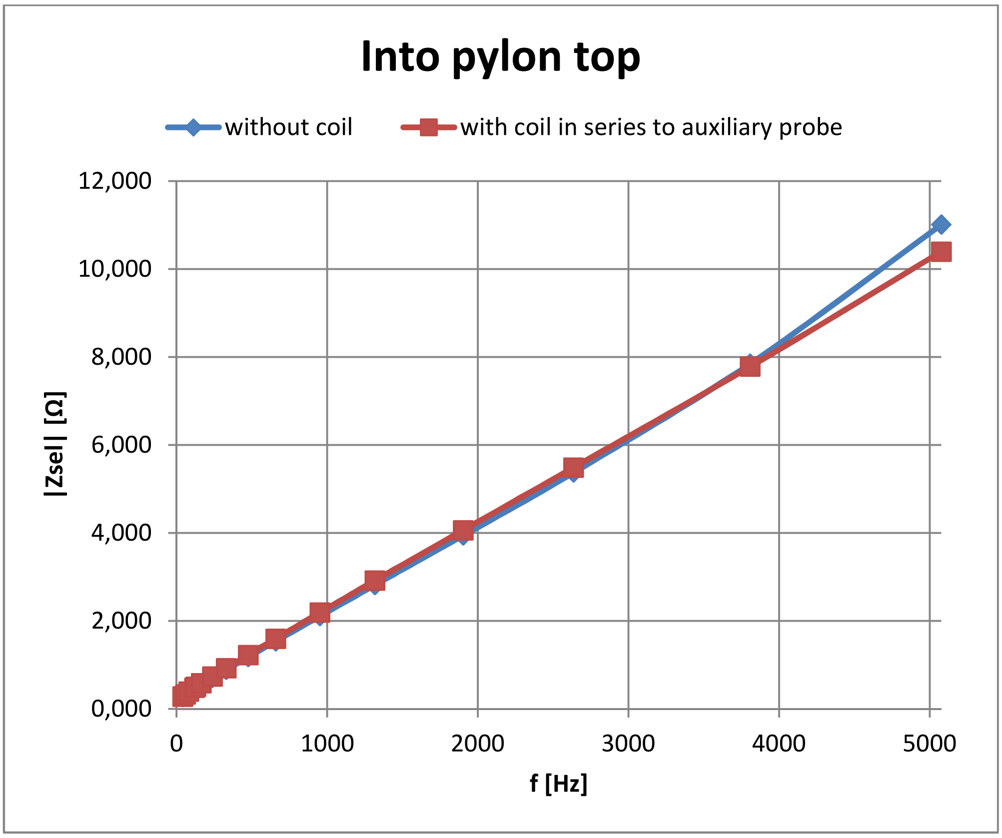
Connecting a **100m wire coil uncoiled in series to probe/auxiliary probe** resulted in **no differences with Amplex/4 Pole Measurement at the probe**, but produced **slightly too small results at the auxiliary probe** (Ampflex results too small, thus 4 Pole over all too high; results for included coil in red, without coil in blue). Explanation: Current between S and ES is very small, so the additional inductivity in the probe connection doesn't influence the result. The cable coil inserted into the auxiliary probe connection on the other hand alters the results. The reason for this lies in the fact that driving a rectangular voltage into the coil causes spikes leading to sampling problems in the measurement process.

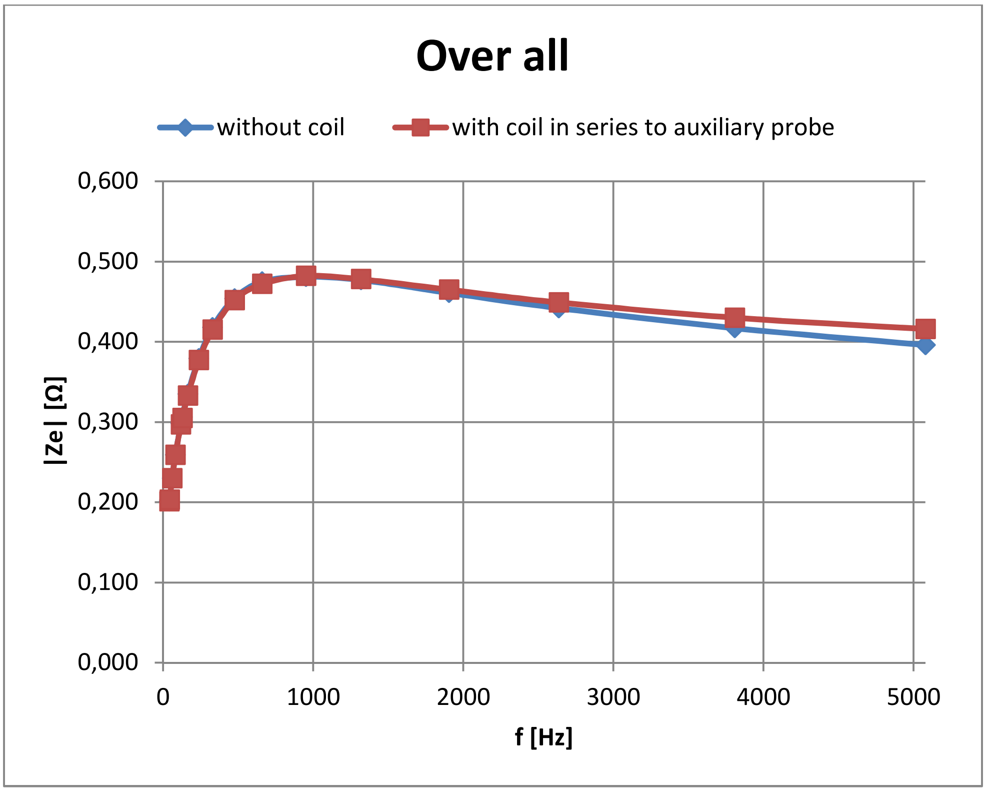

Into local earth
without coil
with coil in series to probe
0,700
0,600
0,500
0,400
0,300
0,200
0,100
0,000
|Zsel| [Ω]
0
1000
2000
3000
4000
5000
f [Hz]


Into pylon top
without coil
with coil in series to probe
12,000
10,000
8,000
6,000
4,000
2,000
0,000
|Zsel| [Ω]
0
1000
2000
3000
4000
5000
f [Hz]


Over all
without coil
with coil in series to probe
0,600
0,500
0,400
0,300
0,200
0,100
0,000
|Ze| [Ω]
0
1000
2000
3000
4000
5000
f [Hz]


Into local earth
without coil
with coil in series to auxiliary probe
0,700
0,600
0,500
0,400
0,300
0,200
0,100
0,000
|Zsel| [Ω]
0
1000
2000
3000
4000
5000
f [Hz]



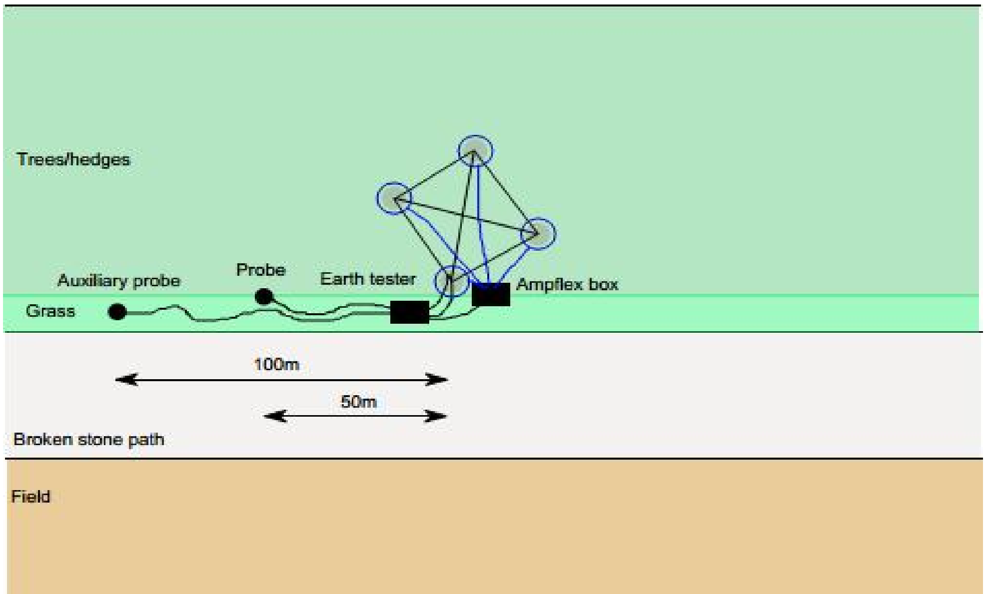


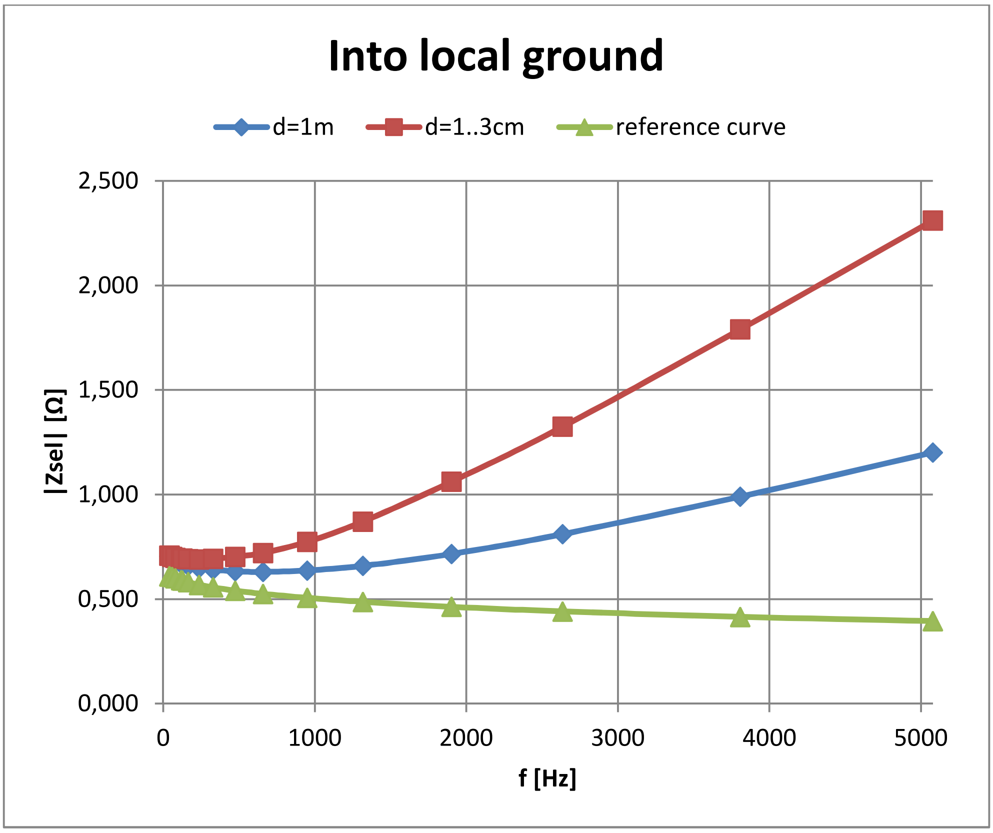
⇨ **Therefore one must take care to always fully uncoil the cable coil for the auxiliary probe connection!**

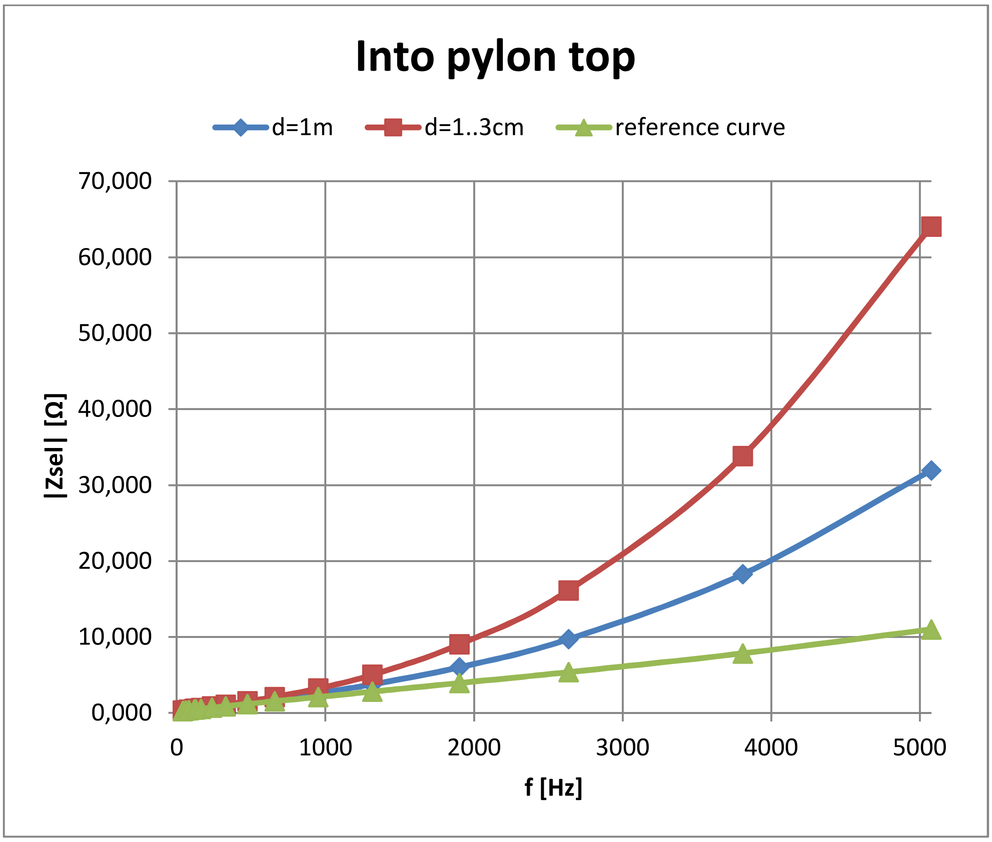
6) Influence of cable guided parallel

Guiding the probe cables in parallel (despite of making a measurement mistake due to the probe residing not exactly on the 62% point between auxiliary probe and local earth) shows clearly **capacitive effects leading to significantly higher earth resistances**, especially for higher frequencies. The effects are (as expected) stronger if the distance of the cables is smaller.

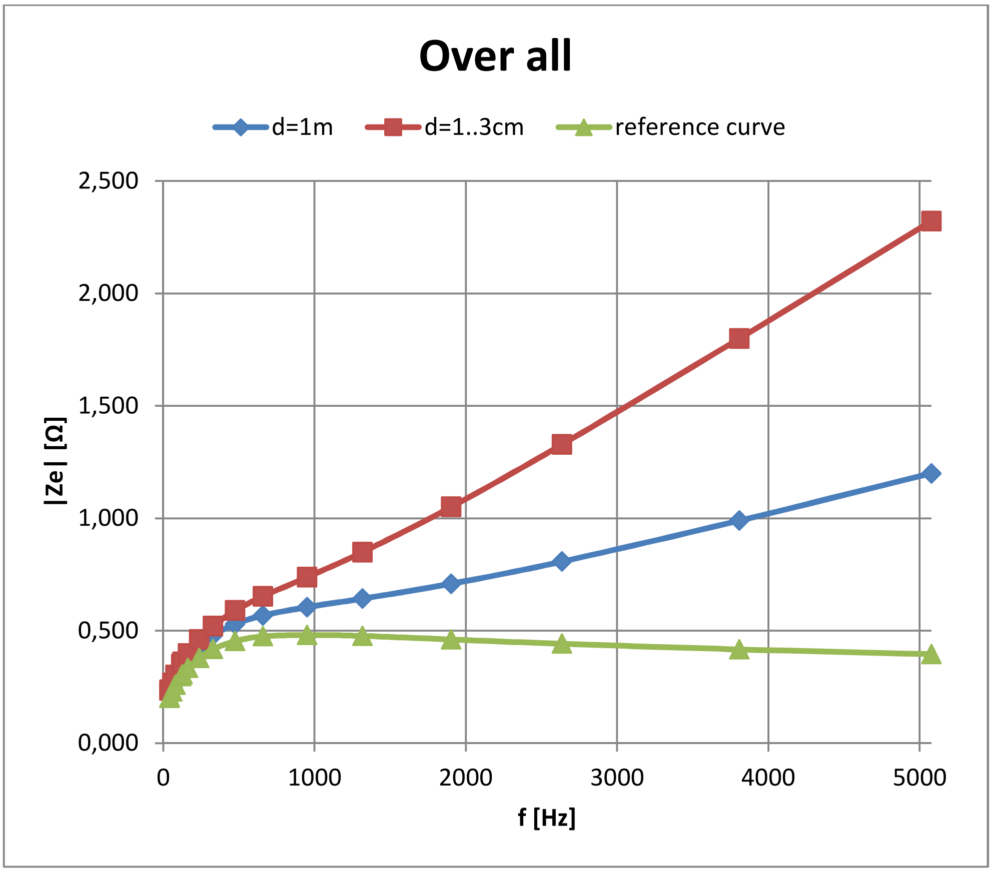
The diagrams show the reference curves (probe and auxiliary probe laid out in opposite directions) in green, the results for 1m distance between the parallel probe/auxiliary probe cables in blue and the ones for a distance of 1-3cm in red.







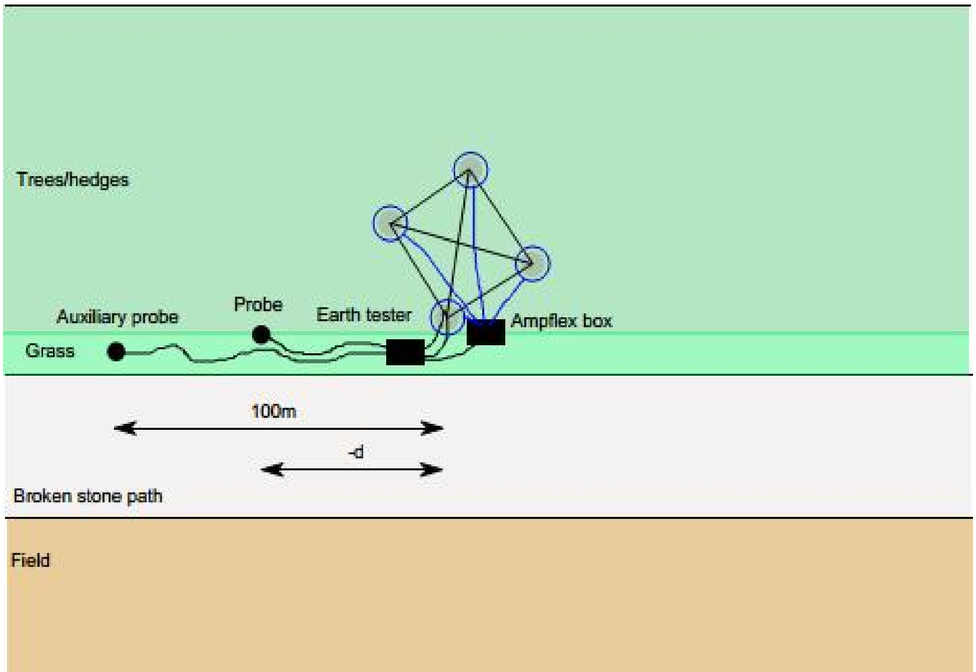
Into pylon top
d=1m
d=1..3cm
reference curve
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0,000
|Zsel| [Ω]
0
1000
2000
3000
4000
5000
f [Hz]



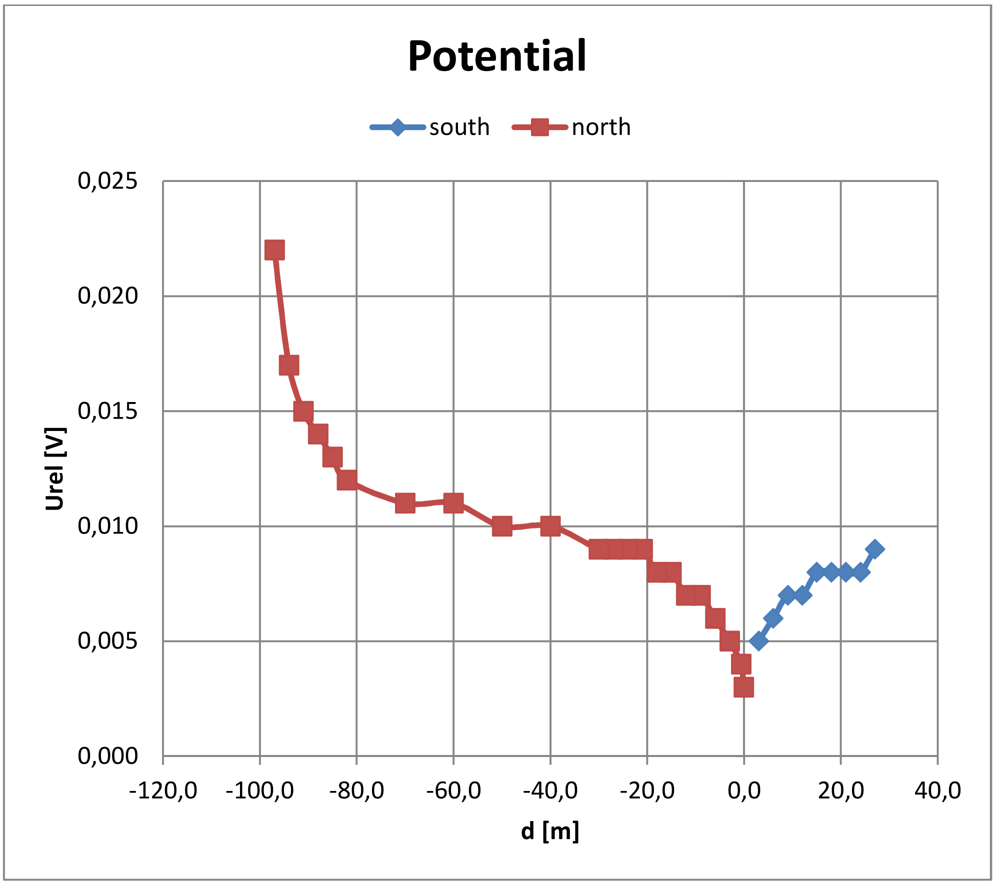
Over all
d=1m
d=1..3cm
reference curve
2,500
2,000
1,500
1,000
0,500
0,000
|Ze| [Ω]
0
1000
2000
3000
4000
5000
f [Hz]

7) Potential curve

Configuration:



The **potential curves** (Obj. 3+4) show the **expected shape**. The smoothness of the curve is limited by the resolution of the measurement and the high ground conductivity leading to small potential differences.



8) Influence of number of rods

Reducing the number of rods for the auxiliary probe connection (Obj. 6) leads to significant higher values for Rh (as expected, since the rod resistances are connected in parallel), the resistance for a single rod being approximately 130 Ohms.

# of rods	Rh in Ohms
3	37
2	52
1	127
0 (connector lying loosely on the ground)	9991

9) Specific earth resistance measurement

The specific earth resistance (Obj. 7+8) was quite low (< 30 Ohm.m), which was certainly the case due to the rain in the night before the measurement and also due to a well-conducting soil. Placing the rods closer to each other resulted in a significant increase of the specific earth resistance with the Schlumberger method (Obj08/Tst. 3+4). We concluded from that result, that **the layer near the ground surface had a higher specific resistance due to broken stone** (as the path was also made with broken stone).