VDL-1 Ground Connections and Baluns

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On *Fig.1* is shown a schematic diagram of ground connections of different parts of the phased array system with VDL-1 device. This is an important stage in array mounting in order to achieve proper performance.

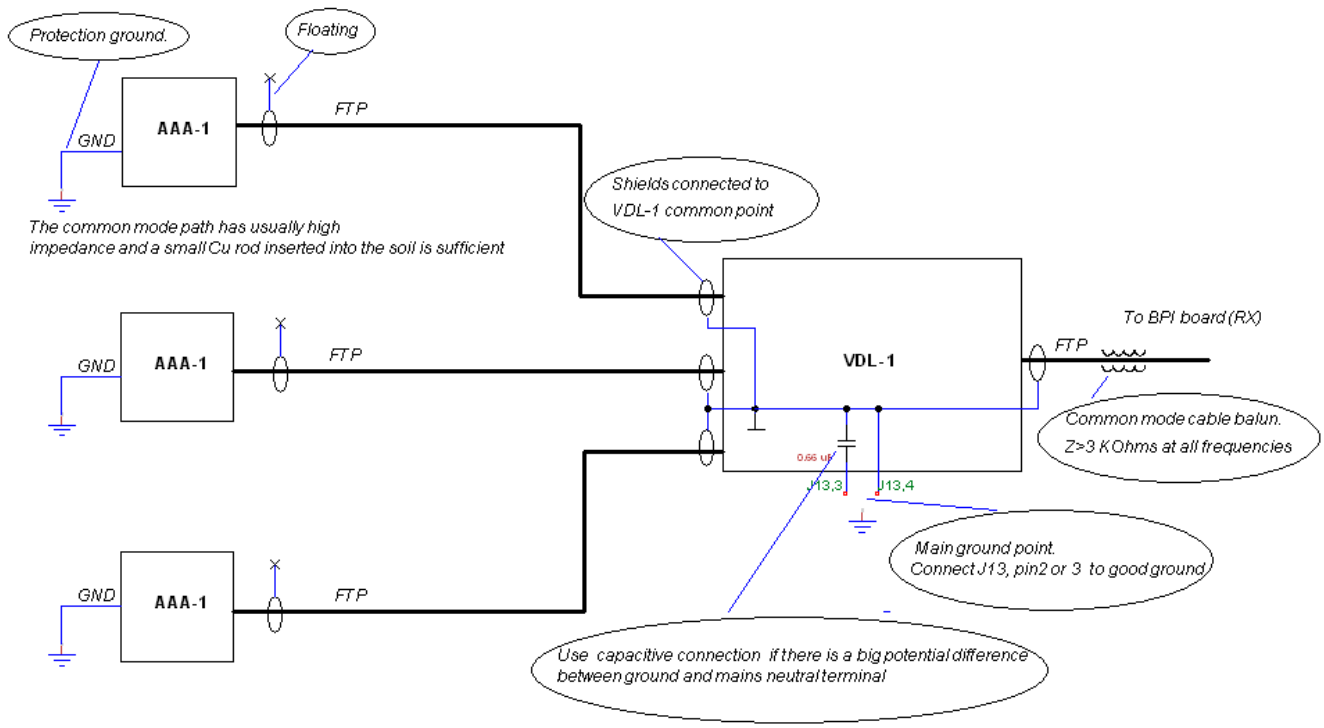

Fig.1 Ground connections and baluns of different parts of the phased array system with VDL-1 device.

FTP shield

The FTP shield must be left floating at the AAA-1 amplifier side. This will reduce the conducting noise problems. The only point which must be grounded is at VDL-1 .

Baluns

I will strongly suggest to use a common mode 1:1 balun at the VDL-1 main FTP cable coming from the RX. It is obligatory if the user has a high power TX amplifier. For noisy environment conditions its impedance must be higher than 3 Kohm. A schematics of suitable balun for FTP cable is shown on *Fig.2* .

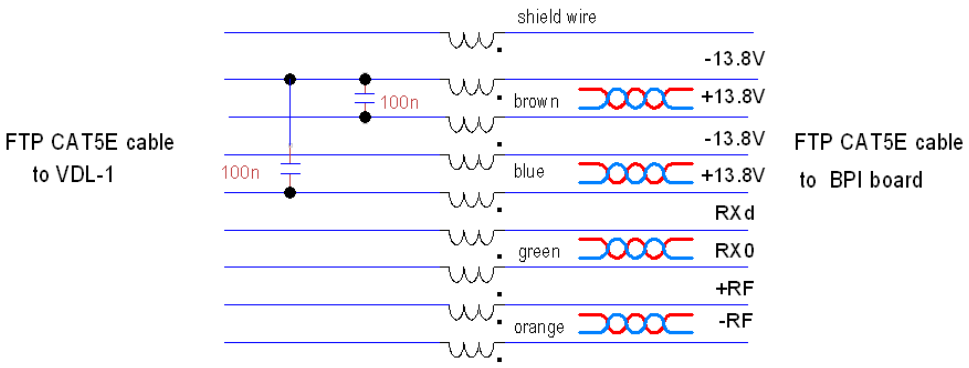

Fig.2 FTP balun schematics

It is not practical to wind the FTP cable on toroidal core as is the case for the coaxial cables. Here the balun is made from 4 bare pairs taken from a piece of CAT5E cable along with one additional conductor for the cable shield. These 4 paires can be wound on a common

Fig. 3

ferrite core. The easier solution is to wind all pairs on separate cores as shown on *Fig.3*. Much higher inductances can be reached. The core used here is Feroxcube 16 x 9.6 x 6.3 mm, u=2000 , 3F3 material, Al = 1160 nH/w$^{2.}$. The orange pair is the RF and has 14 turns on 2 cores. On this particular picture the other pairs are wound on single toroidal cores but it is better to use the same cores for all pairs. There is an additional wire for the shield on one of the cores. The measured inductance in the RF pair is 700 uH and the measured impedance curve is shown on *Fig.4*. This balun must be placed near the VDL-1 and its shield wire is connected to the common point of VDL-1. There the VDL-1 is grounded. If the balun is far away from VDL-1 its shield wire must be grounded immediately after the balun (between VDL-1 and balun).

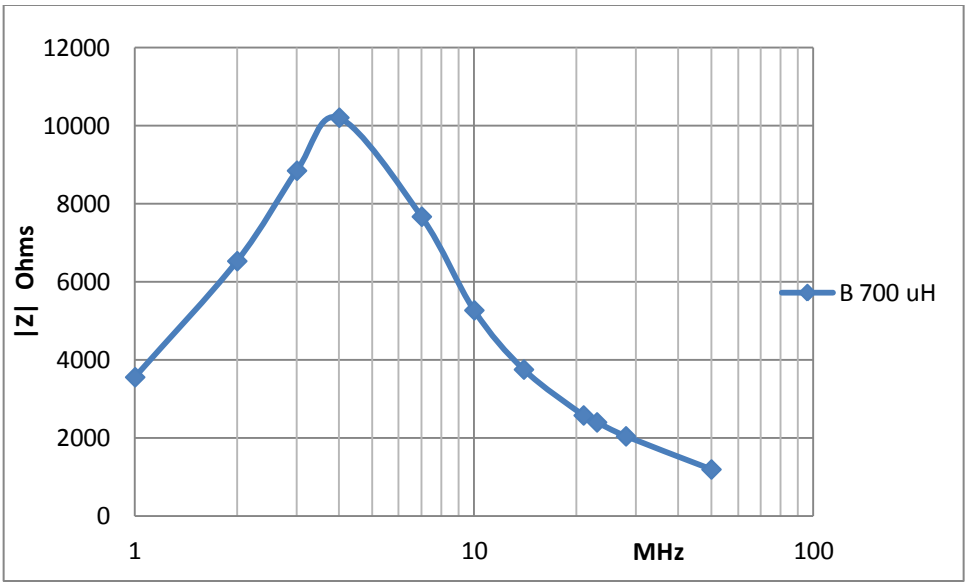

Fig.4 Impedance as a function of frequency for RF balun shown on Fig.4. This balun is very good for low bands and has acceptable impedance at 30 MHz.

Grounding

The protection ground terminal GND of each AAA-1 amplifier is connected to ground . The common mode path has usually high impedance and a small copper rod inserted into the soil is usually sufficient.

The VDL-1 ground is the only signal grounding point. There we must use better grounding. In the case where there is not good ground , a radial system of 4 to 8 bare wires with 2 to 4 m length laying on the ground must be used. The cable shield after the balun must be connected to the same ground point as shown in the VDL manual.

VDL-1 has two ground terminals. When there is a potential difference between ground and mains neutral terminal use the capacitive connection to avoid 50 Hz ground loops. Use a capacitor of 0.1 to 0.5 uF for the balun ground when VDL-1 is with capacitive connection since the balun shield wire is connected to the same VDl-1 common point.

Cables

The best way to improve the system performance is to lay down the FTP cables on the ground. In this way we will reduce the common mode currents and reduce the influence of strong RF filds from the TX. Cables passing highly above the ground are not recommended.

Remark: If the user is living in electromagnetically quiet place and has no powerful TX and the cables are laying on the ground the baluns might be omitted. Check that before taking any further measures.

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