DC voltage distribution requirements in VDL-1 system with AAA-1C amplifiers

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We found out that VDL-1 might have a problem when model AAA-1C active antenna amplifiers are used with it. These models are using optocouplers in the relay control lines in order improve the isolation from strong RF signals induced from high power amplifires (above 1 KW).

If the non-stabilized power supply (PS) voltage, which is coming from VDL-1 at the AAA-1 amplifier input is higher than 14.5 V it's relays A and B might be energized irrespective of the state of *La* and *Lb* lines. This leads to wrong antenna connection and the phased array diagram will be unpredictable. Sometimes if the supply voltage is marginal to the above value, the relays might begin to vibrate which is audible. The reason for that is ULN2003 IC (see the schematics in VDL-1 manual), which has an internal reverse biased diode at each output in order to protect the IC from relay spikes. When the input supply voltage of the AAA-1C is higher than 14.4 V and the driver is in off position, a current begins to flow through the optocoupler and the protective diode since the IC common terminal (pin9) is connected to lower voltage of +12 V from VDL-1 internal stabilizer.

The remedy for that is not to use supply voltage higher than 14.4 V at AAA-1 input. This voltage must be measured after the FTP cable (which is between VDL-1 and each amplifier) at the RJ45 plug. The easiest points to measure are between pins 1 (-V) and 2 (+V) of the terminal block CN4 shown on *Fig 1*. Measure this voltage both in dipole mode and in loop mode. All antenna amplifiers must be connected to VDL-1 in order to load the PS properly. The recommended safe margin for input supply voltage of AAA-1C must be between 12.4 and 14.4 volts.

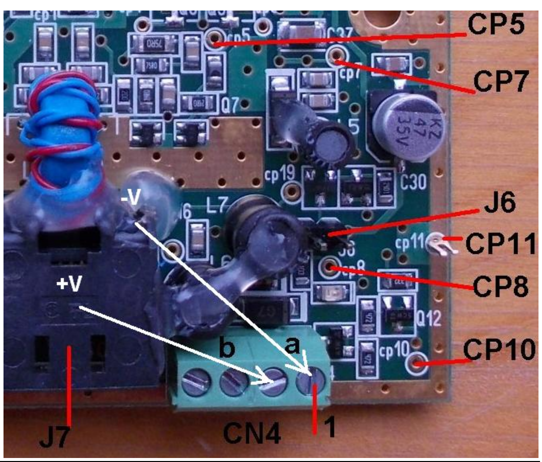

Fig.1

If the voltage is higher, it might be reduced with several serially connected diodes (e.g. type 1N4000) between points *1* and *2* as shown on *Fig.2* . The number of diodes depends on the excessive voltage to be killed. Each diode has approximately 0.7 V drop. The current consumption of each AAA-1 amplifier is approximately 120 mA in Dipole mode and 145 to 160 mA in Loop mode and the total maximal current with phased array with 3 amplifiers is approximately 0.5 A, so 1A diodes will do the job.

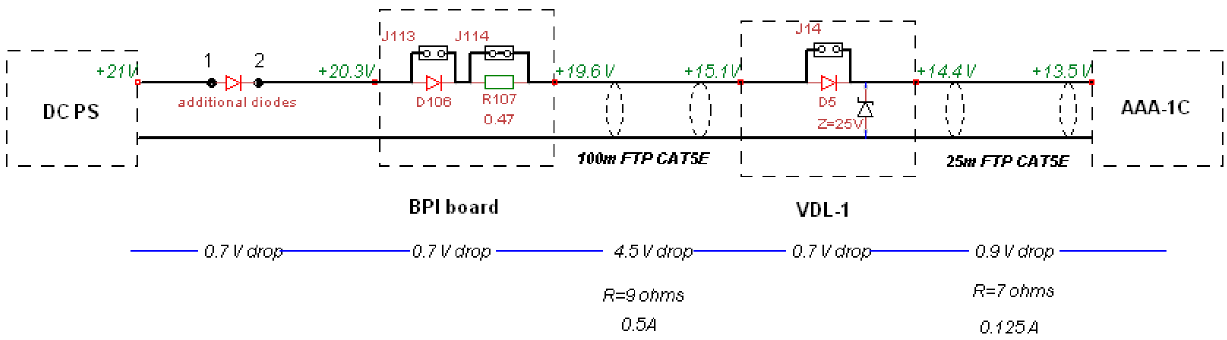

Fig.2 *DC voltage distribution in VDL-1 system with AAA-1C amplifiers. An example is given with 100 m long FTP cable between VDL-1 and BPI board and 25 m FTP between VDL-1 and each AAA-1C. The DC resistances of the cables are calculated taking into account that 4 wires from FTP pairs are used for supply of VDL-1 and 3 wires for AAA-1C. (See the corresponding schematics in VDL-1 and AAA-1 manuals). BPI board and VDL-1 main board have polarity protection diodes which can be switched on/off with jumpers and used to increase or decrease the AAA-1 supply voltage. The additional voltage reduction diodes can be inserted between points 1 and 2 in the positive PS line if needed. The voltage drop and currents shown are for three AAA-1C connected to VDL-1.*

There is a protection diode in BPI board serially connected to PS line of VDL-1 which can be inserted or removed with jumper *J113* in order to have or not additional 0.7 V drop. There is a similar diode in VDL-1 main board with jumper *J14*. Earlier models AAA-1 and AAA-1B do not have this problem and can be used with input voltage up to 16 V. AAA-1C amplifiers mounted alone (not with VDL-1) also do not have the above limitations.

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