Orion 3Application Note
Protection against electro-magnetic discharges and emissions

Orion 3 devices had been especially designed for continuous and stable operation even if the environment is harsh.

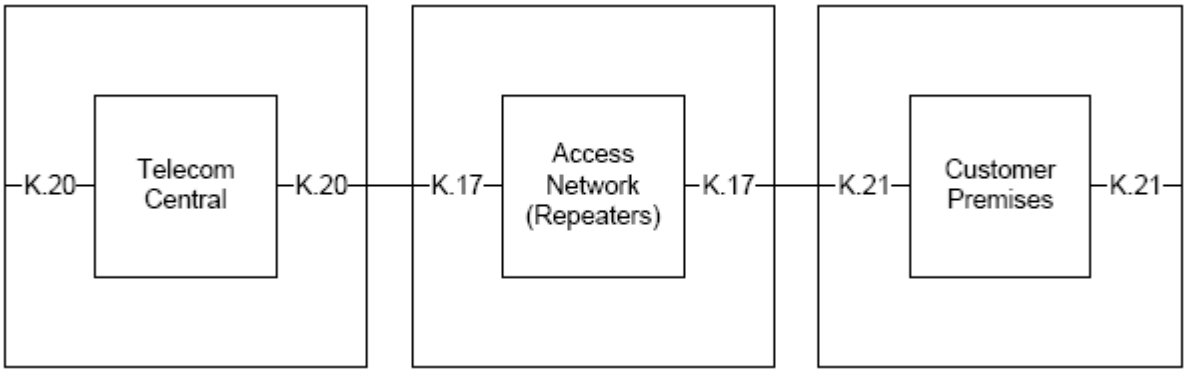
To achieve this goal we carefully select components that could be used in a wide temperature range of -40°C to +85°C. Therefore we can guarantee that industrial tested products will work if in outside temperatures in the range of -25°C to +70°C. Even more extended ranges could be granted after additional tests.
Additional protection is provided for the xDSL lines on Orion products, this protection is used to increase the units resistance against electro-magnetic discharges and emissions caused by lighting and power surges

Technology background

The ITU define interfaces of a telecommunication network and interconnections between them. The ITU also define that each element of a network should work under special over voltage and over current conditions including:

- Surges due to direct and indirect lighting strokes on or near a line plant;
- Short term induction from adjacent power lines or railways, usually when these systems develop faults;
- Direct contacts between telecommunication lines and power lines;
- Electrostatic discharges generated by users touching the equipment;
- Transient surges on mains-voltage power supplies.

The ITU define following standards for equipment protection as it is shown on a picture below:



Each recommendation has a list of test schemas, time of emission, voltage and current limits. These tests allow a simulation of events that could happen on a real network. Recommendations only define borders, but they could be too low for real life. That's why good xDSL equipment must have better protection then defined in the ITU standard.
The protection against electro-magnetic discharges and emissions will work properly if equipment is connected to a ground. For LTU it is usually not a problem because racks are grounded, but CPE / NTU with cases that are made from plastic, have no point of connection except ground connection in the AC outlet. Orion3 NTUs are a special case as they have a point of connection to take full advantage of the build-in advanced protection.

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Tested scenarios

Lighting surge simulation

To simulate lighting surge a short high voltage impulse applied to an interface of a modem. The impulse simulates a power induction caused by a lighting strike. Referenced voltages and other test parameters are represented in Table 1.

Nominal for CO (LTU) (K.20)	Nominal for CPE (NTU) (K.21)	Nominal for Repeater (K.17)	Test Parameters of FlexDSL Orion2 / 3
Without primary protection: **1kV** impulse, 700 µs With primary protection: **4kV** impulse, 700 µs	Without primary protection: **1kV** impulse, 700 µs With primary protection: **4kV** impulse, 700 µs	With primary protection: **1.5 kV** impulse, 700 µs Vendor could carry about additional tests to fit existing environment	LTU/NTU/Repeater: **5 kV** impulse 700 µs Modems have primary protection included

Test results: FlexDSL Orion 3 modems can accept a higher voltage then defined in the standard.

Power Induction Test

The test simulates a constant operation of an xDSL line if affected by a failure on high voltage power line (150V, 200V or 650V) worked in parallel. Referenced voltages and other test parameters are represented in Table 2.

Nominal for CO (LTU) (K.20)	Nominal for CPE (NTU) (K.21)	Nominal for Repeater (K.17)	Test Parameters of FlexDSL Orion2 / 3
Without primary protection: AC **600V**, 200 ms With primary protection: AC **600V**, 1 s	Without primary protection: **600V**, 200 ms With primary protection: AC **600V**, 1 s	With primary protection: AC 150V; 1.5 s AC 200V; 1.5 s AC 650V; 1.5 s	LTU/NTU/Repeater AC 150V; 1.5 s AC 650V; 1.5 s Modems have primary protection included

Test results: FlexDSL Orion 3 modems can accept high voltage with a longer period of influence then required in the standards K.20 and K.21.

Nevertheless that FlexDSL Orion 3 shows excellent performance, provided that installations use correct grounding and cabling in accordance with rules applied in your country.

Reference to test protocols:

Date: 31.03.2009, Swisscom, Zürich, Switzerland
Protocol: INO-EEC_12772-1
Test Basis/Standard: EN 55022:2006 and EN 300 386 V1.4.1:2008; EN 300 386 V1.4.1:2008 and EN 50121-4:2006
Date: 27.02.2009, ZNIIS, Moscow, Russia
Protocol: NAT_OR_090227
Test Basis/Standard: (1OCT P 51317.4.5-99), ITU-T K.20, K.21, K.17