Application Note AN 1

Cell Phone Base Station Protection

The Protection Challenge

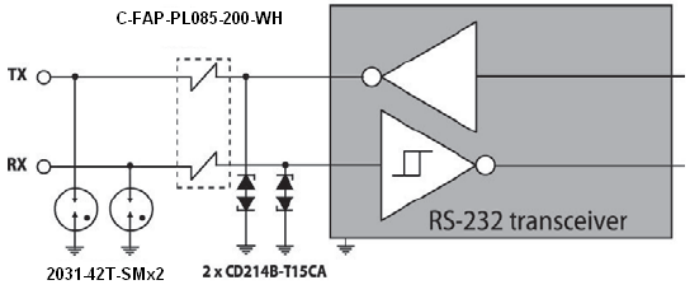
Mobile phone base stations are often placed in exposed elevated locations for the maximum possible broadcast coverage. Often this unintentionally results in the erection of an ideally positioned lightning conductor. Protection against inevitable direct or nearby lightning strikes makes the protection of all mobile base stations essential. Failure to design robust protection leads to expensive repairs in these exposed and often difficult to reach areas. It is common for antenna masts to see voltages of 250 kV from top to bottom during a direct lightning strike! With appropriate protection these events can be survivable.

Protection Circuit Suggestions

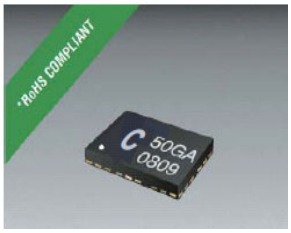
Protection is required on all services into and out of the base station equipment; failure to protect just one port can lead to extensive equipment damage. The kind of ports commonly found are coaxial or waveguide for RF transmission, and also multiple control lines, to monitor and control antenna status, etc. To add further complication, the distance between the tower and the transmitters can be up to 30 meters also adding ground potential rise (GPR) as a threat to deal with. The following are three common interface ports which are exposed to significant threat from lightning and resultant GPR. Using the unique C-FAP Electronic Current Limiter technology can limit the overcurrents caused by very fast lightning events resulting in greater system reliability and ultimately lifetime cost savings.

RS-232 Protection

RS-232 is a relatively old signalling standard which dates back to the late 1960s. Logic states “0” and “1” are ±5 V to ±12 V on the transmit (TX) lines, and are ±3 V to ±15 V for the receive (RX) lines. Therefore a symmetrical protection topology is suggested allowing the datastream to pass with some common mode offset on either the TX or RX lines without damage or signal degradation. The C-FAP device limits currents into or out of the interface to ±200 mA.

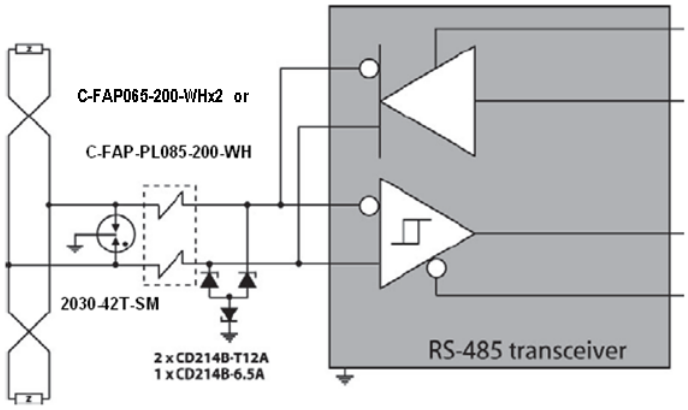


NIDEC COMPONENTS



RS-485 Protection

RS-485 is a more modern signalling standard, employing differential signalling allowing a higher data rate on a more defined transmission line. Multiple RS-485 terminals can coexist on the same bus. The likelihood of common mode ground offsets in this application defines the TVS diode configuration followed by the C-FAP overcurrent protector, limiting fault currents to just ±200 mA.



Opto-Input Protection

The most basic signalling likely to be deployed are opto-isolated alarm and status lines to report system status. The C-FAP device protects the interface circuitry from excessive energy due to lightning and GPR events.