

Creating a Robust Electrical Environment for Critical Broadcasting and Telecom Sites

Broadcasting transmitters and telecom base stations are often exposed to adverse Electromagnetic Interference (EMI) and Electromagnetic Pulse (EMP). These occurrences can have severe ramifications if essential protective measures are not employed.

Taking protective measures

For broadcasting or telecom installations located in urban areas interference from other, powerful transmitters can cause significant reductions in performance. Installations in remote locations, on the other hand, are more frequently subjected to recurrent lightning activity capable of inflicting permanent damage on transmitting equipment. Moreover, electromagnetic pulses represent far greater threats, having the potential to cripple entire RF networks.

When activities such as these occur, destructive currents accumulate within the station's antenna line and are propagated further into the system. Therefore, when planning an effective defence against the damage caused by EMI and EMP, it is necessary to begin with the antenna itself.

A chain of protection

Antennas should be DC grounded and properly connected to ground. This involves short-circuiting the outer and inner conductors for DC voltage so that any lightning that strikes the antenna will be arrested immediately upon impact. By doing so, destructive currents are effectively prevented from reaching the transmitter by way of the inner conductor.

In addition to these measures, the antenna cable's outer conductor should be grounded at one or more places. This is done to ensure that any over voltage encountered

in the cable will be grounded. The earlier the excess current in the outer conductor is diverted to ground, the lesser the amount of current that can be induced into the inner conductor.

The final link in the chain of protective measures for antenna lines consists of an EMP-protector installed just prior to the transmitting station. An EMP-protector effectively removes all unwanted frequencies while at the same time short-circuits DC voltage in the inner conductor to ground.

When uncertainty is not an option

While these measures do not represent the only way to provide protection for antenna lines, other methods may prove less reliable than believed. For military and public safety applications, where uncertainty is not an option, it is crucial that the most effective practices be employed in order to fully protect critical transmitting equipment.

Advanced EMC construction techniques

Like all electrical equipment, broadcasting and telecom installations are required to fulfil certain standards concerning Electromagnetic Compatibility (EMC) in order to be granted type approval. But meeting these standards does not always necessarily mean achieving the most favourable electrical environment for the equipment.

Perhaps the most deciding factors for attaining the



best electrical environment for these installations are the choice of design principle and construction techniques for each system.

A winning topology

At Exir Broadcasting & Telecom we strongly advocate a design theory called "Controlled Electromagnetic Topology"(CET). This entails the use of an enclosure, referred to as the 'zone border,' constructed for the purpose of separating the internal volume of the system from the external electromagnetic environment.

Lightning, electromagnetic pulses, radiated electromagnetic fields from other transmitters and conducted interference on cables are all factors in the electrical environment, each capable of damaging the performance and reducing the life span of the equipment.

By applying CET construction techniques all negative exterior influences are identified and removed. Additionally all paths through the zone border, such as antenna cable, power supply, command and control using fibre optic, coaxial or wire are protected.

QuickSite a perfect example

An excellent example of CET is the new QuickSite Gapfiller Solution from Exir Broadcasting & Telecom. The EMC design of QuickSite completely adheres to this principle, isolating all transmitting equipment from the exterior electromagnetic environment thereby minimising the influence of external disturbances on QuickSite's performance. At the same time these principles also eliminate cabinet radiation of the internal equipment.

Antenna System Measurement Facility

To protect large antenna systems from electromagnetic pulses typically encountered through lightning activity, lightning diverters are often put into place. Such measures, however, can have a significantly negative impact on antenna capability.

Balancing protection with performance

One of the methods commonly employed is to install a system of lightning conductor wires in the radome that protects the antenna from the elements. Naturally, these wires have an adverse effect on the antenna's radiation pattern. The challenge therefore is to achieve an optimal design that provides adequate protection from lightning while at the same time minimizes the negative effect on the radiation characteristics of the antenna.

Full-scale testing

Our company headquarters in Hörby, Sweden is not only the home of Exir Broadcasting & Telecom's highly experienced R&D department, but is also the site of our Antenna System Measurement Facility. This facility consists of a 20 m high, rotating antenna mast surrounded by an array of instruments for conducting full-scale measurements of antenna systems. ■

Exir Broadcasting & Telecom's Consulting Services

Exir Broadcasting & Telecom has a long history of developing highly reliable, long-lasting solutions for the broadcasting and telecom industries. Through decades of service in the pursuit of these challenges we have achieved a level of expertise that is highly regarded within the field.

Our broad experience is available to customers through a number of channels, including RF design projects, consulting services and seminars, to name just a few.

Expertise for building reliable systems

As the dependence on reliable RF systems continues to grow so does the importance of creating robust electrical environments for critical broadcasting and telecom sites. For this reason, we at Exir Broadcasting & Telecom are pleased to offer our customers highly specialised design services based on the principle of "Controlled Electromagnetic Topology" and regarding, among other things:

- Over voltage protection
- Filter requirements
- Equipment configuration
- Cable layout
- External cable connections
- Grounding

If you have any questions about us or about how we may be able to assist you, please do not hesitate to contact us at the following address and telephone number: