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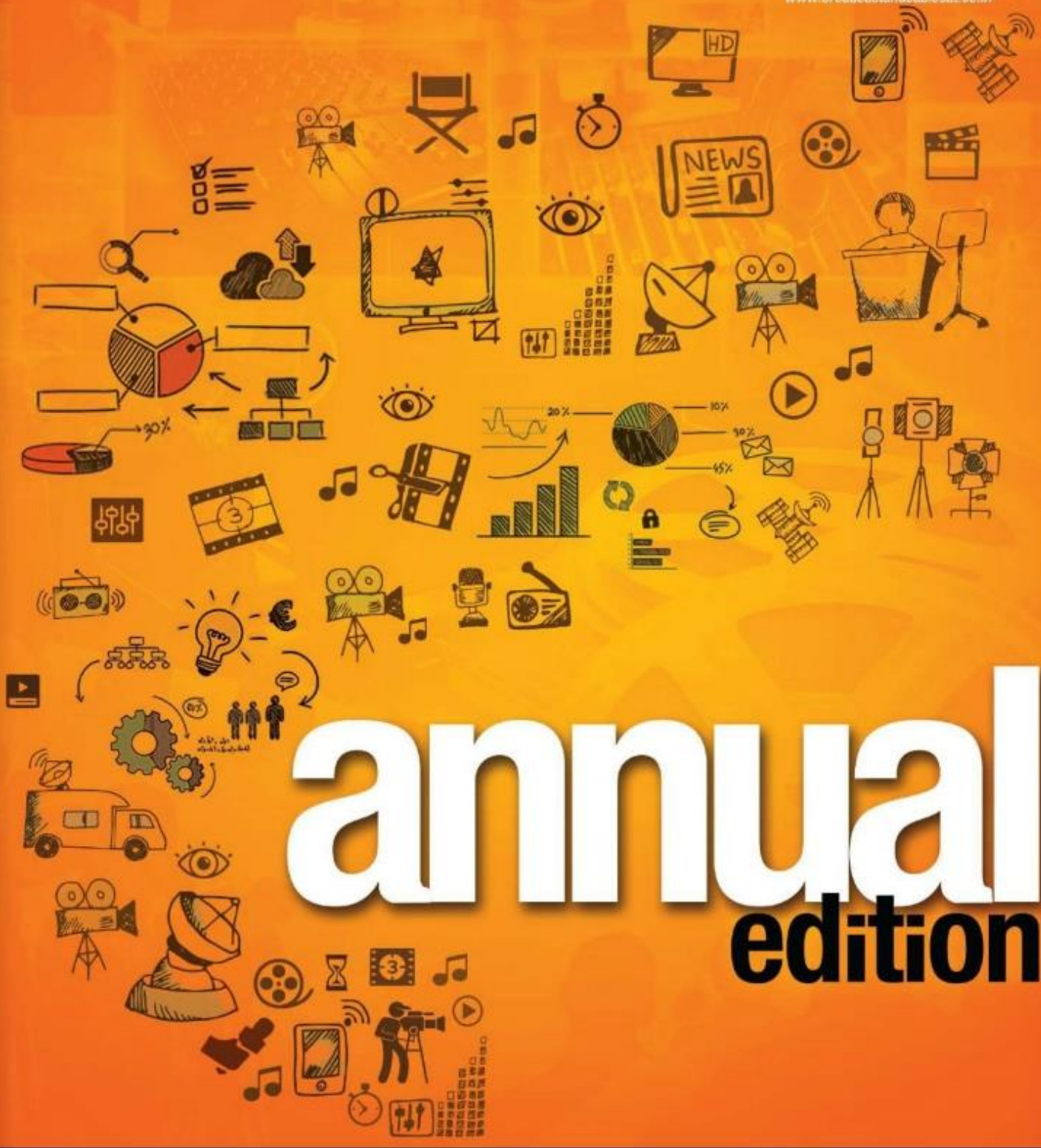

annual edition

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Need to Mitigate RFI Impact

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Satellite radio frequency interference (RFI) strongly impacts satellite operator's quality of service. In recent years, RFI incidents have increased and are expected to continue to grow due to the new satellite services and applications such as LEO constellations, and the increase of RFI sources. Broadcasters are especially sensitive to RFI incidents during live transmission such as major sporting events, like the Olympics, FIFA World-Cup, and Formula-1. Any interruption during this type of event can lead to significant penalties for broadcasters who hold valuable transmission rights.

Mitigating an RFI incident is complicated and resource-consuming. In some cases, RFI cannot be mitigated at all, resulting in dead-capacity where the satellite frequency band is abandoned. Since Satellite operators are usually responsible for global RFI , where the interference impacts the satellite and the entire beam, most statistics are collected on those types. The major sources are unwanted carrier, X-Pol, and adjacent satellite interference (ASI). Unintentional interference can also be caused by incorrect operation of SNG or VSAT terminals or equipment malfunction. There is an ongoing effort to reduce unintentional RFI in the satellite industry through equipment certification and operator training programs.

There are also many local interference types, such as LTE and cellular signals, which can impact the receiving earth station. Depending upon the source and severity, different approaches are used to mitigate RFI impact.

When service is interrupted by severe global interference caused by unwanted carriers such as VSAT, radar, etc., the satellite operator has to first shift the service to an alternate frequency, and then must locate the source to try to stop it. This is difficult and not always possible. Locating the source is done mainly through geolocation methods, which require coordination between adjacent satellite operators and access to expensive tools. Convincing the RFI source to cease their activity can also be a challenge, especially in some parts of the world.

DVB-CID is a new standard that adds a Carrier-ID to new services to simplify and speed up the process of finding the source of interference. However, the CID standard is useful only for new services and specific types of RFI and cannot be used in CW transmission.

RFI impact can also be lessened by reducing transponder gain, hence reducing RFI signal power, as well. This process is problematic and cannot be used in many cases due to link-budget limitations. If the RFI source cannot be controlled, the frequency becomes dead capacity. Local interference is usually handled by moving or protecting the receiver antenna or, if the RFI is not on the exact service frequency, by adding a band-pass filter. The above methods are resource-intensive and can lead to major service breakdown.

Fortunately, new innovative technologies were developed in recent years, to help combat RFI. Robust interference-mitigation receivers include advanced receivers' algorithms to cancel interference. Since there are many types of RFI, each with distinctive characteristics, no single receiver algorithm is applicable. For example, mitigating CW RFI is completely different from cancelling radar RFI. Hence, a set of advanced mitigation algorithms and detection mechanisms is needed to be able to handle all RFI types.

Another powerful set of tools against RFI is robust satellite transmission waveforms. NovelSat NS3 and NS4, for example, further increase resilience to interference. In addition, enhanced RFI analysis tools can be embedded in the satellite terminal, which enable the user to identify RFI incidents in real time. This is mainly useful for local interference sources to which the main teleport does not have visibility. These technologies enable satellite operators to continue high-quality transmission even while various types of RFI are present.

The bad news is that satellite RFI incidents will continue to grow, potentially causing a major impact on satellite broadcasters' revenue and customer satisfaction. The good news is that new RFI handling technologies already exist and continue to be developed to enable continuously reliable satellite links even when RFI appears. ■