Satellite Interference

Satmotion Pocket is an excellent tool for accelerating VSAT installation productivity while enforcing interference prevention.

The fight against interference

Interference is a tricky problem for the satellite industry. While most of it is unintentional, it can be very challenging to mitigate, and even more so to prevent. However, interference costs the industry in terms of both money and reputation, rendering it a vital area of focus. Locating the source of interference is just one challenge as, in the case of intentional interference or jammers, halting the interference can be next to impossible. Recent developments like Carrier ID, Geolocation services and products like SatGuard and SigX Protect can all go some way to mitigating interference, while training provides another route. However, we’ve still got some way to go before interference is no longer a problem that blights the satellite sector.

A survey carried out in 2013 by the Satellite Interference Reduction Group (iRG) and Newtec found that 93 percent of the almost 500 respondents suffered from satellite interference at least once a year, with more than 50 percent suffering at least monthly, and 17 percent putting up with it continuously in their daily operations. That’s a lot of interference.

Sources of interference include, but are not limited to, the following:

- **Intentional interference (jammers):** Intentional interference is usually politically motivated, and includes propaganda broadcast interference and the jamming of satellite communications in times of war. Although often highlighted in the media, intentional interference comprises an extremely minor amount of overall interference, so minor in fact that there are no accurate statistics of incident volumes.
- **Adjacent satellite interference (ASI):** Signals broadcast from satellites, particularly wide beam satellites, interfere with adjacent ground station terminals, while terrestrial antennas transmit signals that are received by more than just the target satellite.
- **Poor planning:** Improper ground equipment installation, poor ground equipment quality, and a lack of adherence to industry standards and guidelines can all cause unintentional interference that could be easily avoided.
- **Sun spots:** At certain times of the year, before the Spring Equinox and after the Autumn equinox, the sun’s radiation overwhelms satellite signals, causing interruptions or distortions of geostationary satellite signals. Sun spots affect specific locations for less than 12 minutes each
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day for several consecutive days. Solar flares have a similar effect, but are less predictable and much more short-lived.

ASI and other unintentional interference is, without a doubt, the biggest cause of problems for satellite operators. Indeed, the recent proliferation of mobile VSATs and HTS have caused quite a stir. Although HTS have a completely new design, with small band-limited footprints that minimise interference, signals are often received by small ground antennas, which have wider beam widths, thus amplifying ASI. When it comes to VSATs, the problems stem from their mobility; while it might be possible to identify an interfering system such as cross-polar (XPOL) and inter-satellite such as ASI. The system, a combination of smartphone/PC app and special hub equipment, enables VSAT field technicians to perform cross-polar alignment, compression tests, site planning, and other critical tasks at any time, without requiring intervention from the satellite access centre or even a working phone connection.

In the course, technicians learn how to correctly install, configure and use the Integrasys Satmotion Pocket system to align a VSAT antenna. Simulators enable the operation of a virtual Satmotion system, observing a real-time spectrum analyser, as the user adjust the controls on a 3D antenna model. GVF 514 builds on the knowledge and skills the technician learned in GVF 510, ‘Core Skills for VSAT Installers.’

“Satmotion Pocket is an excellent tool for accelerating VSAT installation productivity while enforcing interference prevention,” said Ralph Brooker, President of SatProf. “A well-trained field technician can interpret the real-time spectrum of the uplink test carrier at the monitoring station, as well as data from the local modem, to rapidly align antennas for minimum cross-polar and adjacent satellite interference. This also reduces the burden on the satellite operators’ access centres for processing telephone calls for routine carrier line-ups.”

**Carrier ID**

One interference mitigation solution that has been getting a lot of attention lately is Carrier ID. According to the iRG’s Executive Director Martin Coleman, the notion of Carrier ID has been discussed within industry circles for about 20 years now, but only since the iRG refocused its efforts in the last two years is it coming into play.

Carrier ID is an embedded code that contains identification information, which is injected into the carrier by the modulator at the uplink site. It enables the identification of the source of interfering transmissions quickly and easily. The latest version, DVB-CID, adds a lower spread of spectrum on top of the carrier, which means that the correct transmission needn’t be interrupted to identify the interfering carrier. Most of the major operators have completed the work required to add Carrier ID to their transmissions, while 95 percent of modulators and more than 50 percent of DSNG encoders available on the market have DVB-CID available now.

The Space Data Association’s (SDA) Chairman Mark Rawlins told *Satellite Evolution* that governments around the world are starting to make Carrier ID a requirement. The USA has stipulated that, by 2017, all SNG units must have a Carrier ID, which Rawlins expects to see duplicated in Europe shortly. As a result of the soon-to-be widespread implementation of Carrier ID, the SDA is putting into place a database for Carrier IDs and their assigned satellite operators, which will enable its members to identify unknown signals on their networks. It will soon be available to all satellite operators.

**Geolocation services**

When it comes to interference mitigation, it’s not always as simple as identifying the interfering signal through its ID or MAC address. With so many mobile VSATs and SNG vehicles, it may well be that the signal is identified, but the interferer...
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cannot be located or reached. This is where geolocation, which is used to identify the geographical origin of transmissions to a satellite, comes in.

In February 2016, the SDA launched a new geolocation support service, available for free to its members. It offers a support matrix between satellite operators whereby they share resources and expertise to locate sources of interference. The service requires a second satellite, within 7° of the satellite experiencing interference, to function. While some of the larger satellite operators may well have a second satellite in the required proximity, many of the smaller operators do not. With the SDA’s new service, all members who are subject to interference on any of their satellites have access to a system and a process to engage support from other SDA members and request help in performing geolocation.

“The SDA is actively pursuing its policy of information exchange and cooperation in order to ensure quality of service (QoS) for the satellite communications community,” said the SDA’s Mark Rawlins. “In offering this service, we will be able to help our members resolve interference issues quickly and efficiently. Interference is an industry issue. A problem affecting one member today may affect another tomorrow!”

The SDA’s offering is far from the only geolocation service available on the market. 2015 saw Glowlink launch the latest version of its Single Satellite Geolocation System (SSG). Unlike the SDA’s service, SSG does not require a second satellite to locate ground-based satellite interference. Instead, it can locate the interference transmitter, whether intentional and unintentional, using just the affected satellite. SSG performs geolocation operation directly on the interference signal itself to extract the emitter location, thus avoiding dependency on any prior information about the carrier or the interferer, such as the carrier’s identity or prior incidents of offences by the interferer.

The VeriSat SatGuard for VSAT interference mitigation

In December 2014, VeriSat launched SatGuard, which the iRG’s Martin Coleman asserts is still the best interference-mitigation tool on the market today. It was developed in conjunction with SES after a VeriSat engineer attended an iRG workshop.

SatGuard uses patent-pending technology to identify the source of ASI and XPOL caused by VSATs; it measures the interference for each individual terminal, even when that interference is masked by other services. It works with an L-band interface, so it can be used for Ka, Ku or C-band VSAT
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networks. SatGuard uses software radio technology and off-the-shelf hardware to capture and analyse the signals from the operational and interfered links. The system finds the terminal ID or MAC address from the signalling information in the operational satellite links and correlates this information with bursts detected in the interfered signal. This information can then be sent to the VSAT network operator, where the necessary actions to stop the interference can be performed.

VeriSat and SES conducted a series of successful tests on a live network to find the terminal IDs of interfering terminals. The tests showed that interference levels as low as -10dB SNR could be measured, which corresponds to a level where the interference is no longer an operational problem.

“According to our statistics, VSAT systems cause approximately 40 percent of all interference, and are responsible for 50 percent of downtime due to interference,” said Martin Coleman of the iRG. “This development from VeriSat is extremely significant for VSAT interference, an area which is particularly difficult to solve.”

Coleman told Satellite Evolution of one example of SatGuard’s unsurpassed application. For more than two years, an operator in the Americas had struggled and failed to clear its interference. When SatGuard was used at just five of its 100,000 terminals, with just ten minutes of downtime, the issue was resolved.

**SAT Corporation’s SigX Protect cancels out interfering signals**

In March 2015, Kratos Defense & Security Solutions’ SAT Corporation (SAT) subsidiary launched SigX Protect, a patent-pending RF signal protection product that can be configured to automatically cancel interference in real time with no human intervention.

SigX Protect automatically detects and characterises interfering signals by phase, amplitude and frequency. It then creates a cancelling signal to remove the interference and preserve the integrity of the protected link. SigX Protect employs a technique called blind separation, which requires equipment only on the receiving end of the communications path and allows SigX Protect to characterise and cancel an interfering signal with no prior knowledge of the source or location of the interference. SigX Protect is installed directly in the communications chain to reduce any potential delay or latency in the communications signal.

“Sig-X Protect dramatically reduces vulnerability to RF interference. For service providers, satellite operators and broadcasters alike, the ability to quickly cancel interference without the cooperation of the interfering party will help assure quality of service (QoS), interference-free communications and time-sensitive delivery of critical communications. The system provides greater than 25dB of cancellation, and signals can be protected even when the interferer is operating at a power greater than the protected signal,” said Bob Potter, Chief Technology Officer at SAT Corporation.

Previously, satellite operators and communications providers were largely limited to solutions to monitor, detect and locate interference; cancelling the interference usually required contacting the interferer for assistance, if known and if cooperative.

Expensive, controlled technologies such as frequency hopping waveforms and advanced channelisers on the satellite have been available for government and defence applications for some time, but these come with significant cost and operational complexity. In contrast, SigX Protect works with all existing and new satellites, incurs no added bandwidth costs and provides dedicated protection with no impact on operations.

**A part to play for everyone**

The prevailing opinion of satellite industry experts is that, as long as we communicate via RF, interference will never be solved. However, while it may never be wiped out completely, a massive amount of attention in the last few years has seen significant advancements in interference mitigation. This can be expected to continue in the years to come as innovative new products like SatGuard and SigX Protect are added to, geolocation services are advanced and Carrier ID is rolled-out nationwide. Ultimately, every participant in the satellite sector will have their role to play to ensure that 17 percent of satellite operators no longer experience interference on a daily basis.