

Photo courtesy of Glowlink.

Stop interfering!

It is a big problem in the commercial satellite sector and it can threaten the security of satellite networks – but what is it and how can it be prevented? Helen Jameson looks into the troublesome problem of satellite interference.

We have all experienced the irritation of interference – a loss of connection whilst chatting on your mobile phone, a break in a conversation when you are listening to the radio, loss of Internet connection – they are all very annoying and they are all caused by different types of interference. For satellite operators and their customers, this is no different. In fact, interference is a sizeable problem and can cause loss of revenue, annoyance to customers and could, ultimately, threaten security of satellite links. In the not-too-distant past, Intelsat fell victim to abuse of their own satellite when it was used by the Liberation Tigers of Tamil Eelam, a Sri Lankan-based terrorist group to broadcast their messages. Intelsat was eventually forced to meet with Sri Lanka's Ambassador to address the problem of the unauthorised use of its satellite. This type of deliberate interference may

make up a small percentage of interference incidents, but is extremely dangerous and hugely costly to satellite operators. It is a widespread problem that has increased in incidence as the amount of satellite use has increased and an integral part of a satellite operator's system is interference detection and mitigation.

A costly problem

The problem of interference can be costly on two different levels. In the first instance, the operator is losing precious man-time spent by employees trying to locate the source of the interference and then stop it. On a financial level, the interference is also incredibly detrimental and can cost the affected operator millions of dollars due to the loss of capacity.



What causes it?

Interference can be placed into two camps – intentional and unintentional. Any interference can be considered a potential threat. Causes can be intentional or inadvertent, military or civil or foreign or domestic. However, commercial operators and satellite installers can be their own worst enemies in terms of interference as they do occasionally interfere with their own systems due to user error and operation and procedures. In fact, the majority of satellite interference is created by user error and a small percentage is created with malicious intent, but both types of interference – any interference - can have a very negative impact on commercial revenues and cannot be tolerated.

Any instance of interference must be reported, tracked and the geographical location pinned down and the source identified so that it can be stopped. When experiencing harmful interferences the operator has to be able to discern whether the interference is caused by natural phenomenon or manmade sources. With natural phenomenon the operator can try to work through the interference or assign an alternative frequency but if he or she suspects manmade interference, they can check and act upon it.

So what are the main causes of interference in the commercial sector. The Satellite Users Interference Reduction Group (SUIRG) is a tireless campaign group dedicated to the reduction of interference and they identify the following as main reasons for the rise in this problem:

- Reduction in the orbital spacing of satellites;
- Reduced antenna size, wider beams and higher power;
- Poor equipment manufacturing and unmet performance specifications;
- Decrease in knowledgeable staff and lack of training;
- Poor installations, lack of route station maintenance;
- Lack of industry standards and guidelines; and
- Unauthorised use of satellite space segments.

In the commercial satellite sector there is a lack of policing of interferences, unlike the military where a great deal more discipline is instilled in terms of detection of interference. SUIRG is the only group to have carried out a real study on commercial satellite interference.

Bob Potter of Sat Corporation explained to Satellite Evolution the main causes of interference: “You are right in saying that only one percent or less of interference is malicious. The rest is really down to equipment failure and various forms of human error. The human error really comes down to being in the wrong place at the wrong time, transmitting on the wrong frequency, the wrong polarity to the wrong satellite, or all of the above.”

He continued: “Another form of human error could be running a test where the transmit line should be run into a termination and forgetting that it is actually connected to the antenna. The other forms of interference that you could link through to human error but are actually designated as separate entities within the SUIRG study, are cross-pol leakage which basically means that the antenna is not aligned correctly or the antenna has become misaligned due to external forces – the weather being one.”

So there are various different forms of interference but no matter which type it is, the problems caused are the same and the source must be stopped to prevent the consequences that we have already discussed.

Prevention

Sat Corporation’s SAT-DSA or Digital Spectrum Analyser, part of the MONICS equipment family, is a modern spectrum analyser with advanced features that provide greater instantaneous bandwidth and dynamic range. The DSA’s unique signal characterisation is not possible with a traditional spectrum analyser. Using characterisation parameters, traffic quality can be maintained and any interfering carriers can be identified. When an interfering carrier is present in an unused portion of the transponder or even under the desired carrier, the DSA will produce an alarm and traces and measured data are stored. The operator is then able to view the offending carrier and take action.

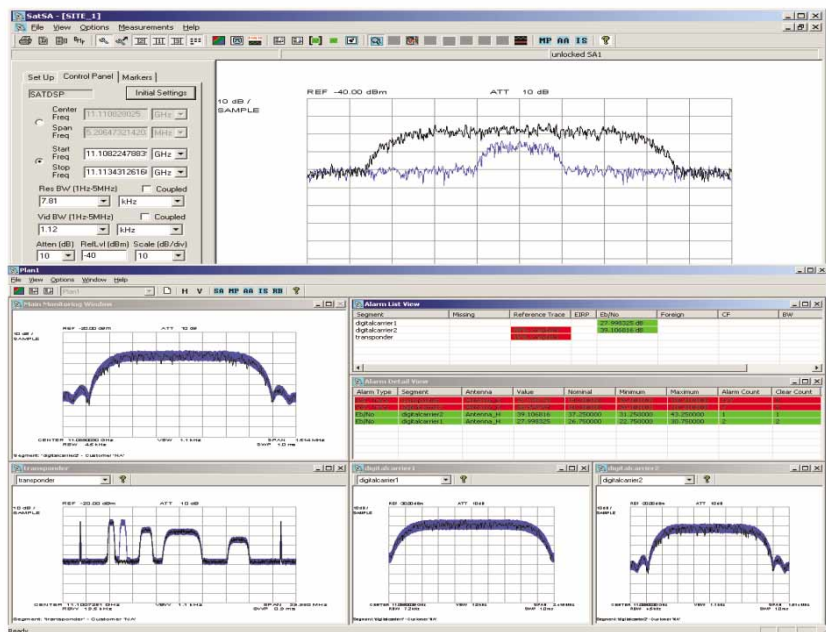
The SAT-DSA is available for 70MHz or L-band applications. It will run on various computers including laptops, servers and consumer grade computers and Windows 2000 and later operating systems. The interface is easy to use and can also be accessed remotely and is able to run concurrently with other non-DSA software.

Once an instance of interference has been detected it must be removed as quickly as possible. In most cases, this is achieved by the use of a database where the ‘fingerprints’ of offenders can be found and the culprits identified and apprehended. This usually solves the problem. SUIRG are trying to encourage all operators to share their information on the Interference Analysis Database but this information is seen as proprietary and sensitive to share with other operators but SUIRG see this database as the only way that interference can be reduced. However, the database cannot provide the answer for every case of interference and in these cases, operators are turning to another technique to help them discover where interference is coming from and that is geolocation.

GeoLocation

It’s not always possible to locate the source of interference and in the instances where it cannot be easily located, geolocation can help. This system will actually find the source of interference and establish the latitude and longitude of the transmitter so that the interferer can be identified.

Jeffrey Chu, President of Glowlink told us: “The key to preventing interference is finding out where the interference is coming from. That’s what geolocation is all about. The concept of geolocation has



Draft CSA screen. Photo courtesy of Integral Systems.



“The WRC further restricted IMT, including Wimax, by imposing stringent requirements for the protection of existing and future satellite services in the band, including transborder protection.”

been around for a long time. Up to about two years ago these systems were cost prohibitive. They were very expensive and they didn't work very well and the reason was that they were designed upon old technology that really couldn't deal with these problems effectively. Some of these legacy products simply have not been able to step up to the plate. However, these days the systems are highly effective, and extremely affordable.”

Glowlink offers its customers the Model 8000 Geolocation System. This system ensures that every satellite provider has the tools it needs to keep their bandwidth pristine – all-in-one interference detection, geolocation and also carrier monitoring. The Model 8000 is not only a highly affordable system, but with its integrated monitoring and interference detection features, it allows for faster and more accurate geolocation.

SatID System

The satID system that has been developed by QinetiQ and VT Systems offers the fastest and most accurate location of interfering signals. There are two levels of service available to operators. The first is an ad hoc service that enables an operator with occasional interference problems to manage them as and when they occur. The other level is relevant to those operators who experience multiple interference occurrences and this entitles operators to a certain number of interference events being resolved, over a specified time period, for a fixed annual fee. The systems can alternatively be rented long-term or purchased – depending on the level of interference the operator is facing.

The System utilises the standard multiple satellite geolocation techniques for location of non-cooperative signals, but applies state-of-the-art algorithms and processing systems to maximise the effectiveness against both intentional and unintentional interference on satellites.

The multiple satellite geolocation technique uses adjacent satellites to determine the location of a signal by measuring the signal characteristics as it is transmitted via pairs of satellites. This requires pairs of satellites that have similar uplink frequency and beam configurations and are in a geometry suitable for the location process. The configurations of satellites from the multiple satellite operators across Asia-Pacific are analysed and the criteria for geolocation are assessed in various scenarios. Generically it is shown the trade-offs between scenario parameters such as interference source terminal size, transmit power, satellite geometry/separation and the performance of the geolocation processing system.

The C-band threat

The threat the satellite industry's C-band has, over the past two to three years, been the most talked-about case of interference seeing the industry unite and campaign in a way that it never has done before.

At the World Radio Conference last year it was decided that the ITU would go against the global identification for IMT, including Wimax, in any part of the satellite C-band. In effect, the ITU table of allocations remains unchanged and the limited number of countries in favour of change are identified in an opt-in footnote. With this ap-

proach, the world's regulators participating in the WRC have clearly signalled that these bands are not globally harmonised for IMT. The WRC further restricted IMT, including Wimax, by imposing stringent requirements for the protection of existing and future satellite services in the band, including transborder protection.

However, there are still several administrations that have not acknowledged that C-band should be left alone exclusively for satellite services and this forms the next part of the fight for C-band. For now, C-band is safe and there are no plans to review this decision in the future as yet. However, rather than resting on their laurels, the satellite community will continue to raise awareness and to attempt to change the minds of those countries where the impact of IMT services has not yet been recognised. So, the fight for C-band goes on, and the satellite industry has been urged to approach the administrations of those countries who have not yet stated that they will fully protect C-band from IMT services to make them understand the impact of what they are considering. Letting these services in to use C-band would be disastrous for the industry, especially in areas where high rain attenuation is a problem.

Protecting business and livelihood

Satellite interference is a recurrent problem that can only really increase as more and more satellites are launched and the skies become overcrowded. So the ways in which this is dealt with need to become ever more sophisticated and intelligent. Interference is damaging in different ways - financially, in manpower terms, can cause outages that damage customer relations and can even threaten the satellite industry as a whole. The use of systems such as the ones provided by companies like Glowlink and Sat Corporation and the backing of SUIRG and its campaign to initiate an Interference Analysis Database will help the industry to move in the right direction and help to mitigate the disruption caused by satellite interference – whether it is intentional or unintentional. ■

Geolocation and carrier monitoring equipment award

Glowlink announced on October 27 2008, that it had won a competitive contract award from Turksat A.S. for geolocation and carrier monitoring equipment. Under the contract, Glowlink will deliver, install, and conduct training for the company's Model 8000 and Model 1000 systems at Turksat's facilities in Ankara, Turkey.

The Model 8000 is a compact, state-of-the-art geolocation system—the industry's first such system to have built-in interference detection and analysis features that are essential for the fast, accurate, and effective geo-location of interference transmitters.

Model 1000, on the market since year 2000, is the world's most innovative DSP based carrier monitoring system, having introduced and popularised highly acclaimed features such as carrier-under-carrier interference identification, equipment control via the web, and on-the-fly transponder monitoring to prevent power overload.

“We are pleased to select Glowlink's geolocation and carrier monitoring equipment,” said Dr. Ibrahim Oz, Vice President, Satellite Operations for Turksat A.S. “Turksat conducted a thorough evaluation of all the monitoring and geolocation products on the global market. In the end, Glowlink product offerings were unequivocally chosen for their superior performance, innovative technologies, and outstanding track record. As one of Europe's most innovative and competitive satellite services providers, Turksat is proud to have the kind of technologies from Glowlink to further differentiate itself in service quality and customer satisfaction in the highly competitive market that it serves.”