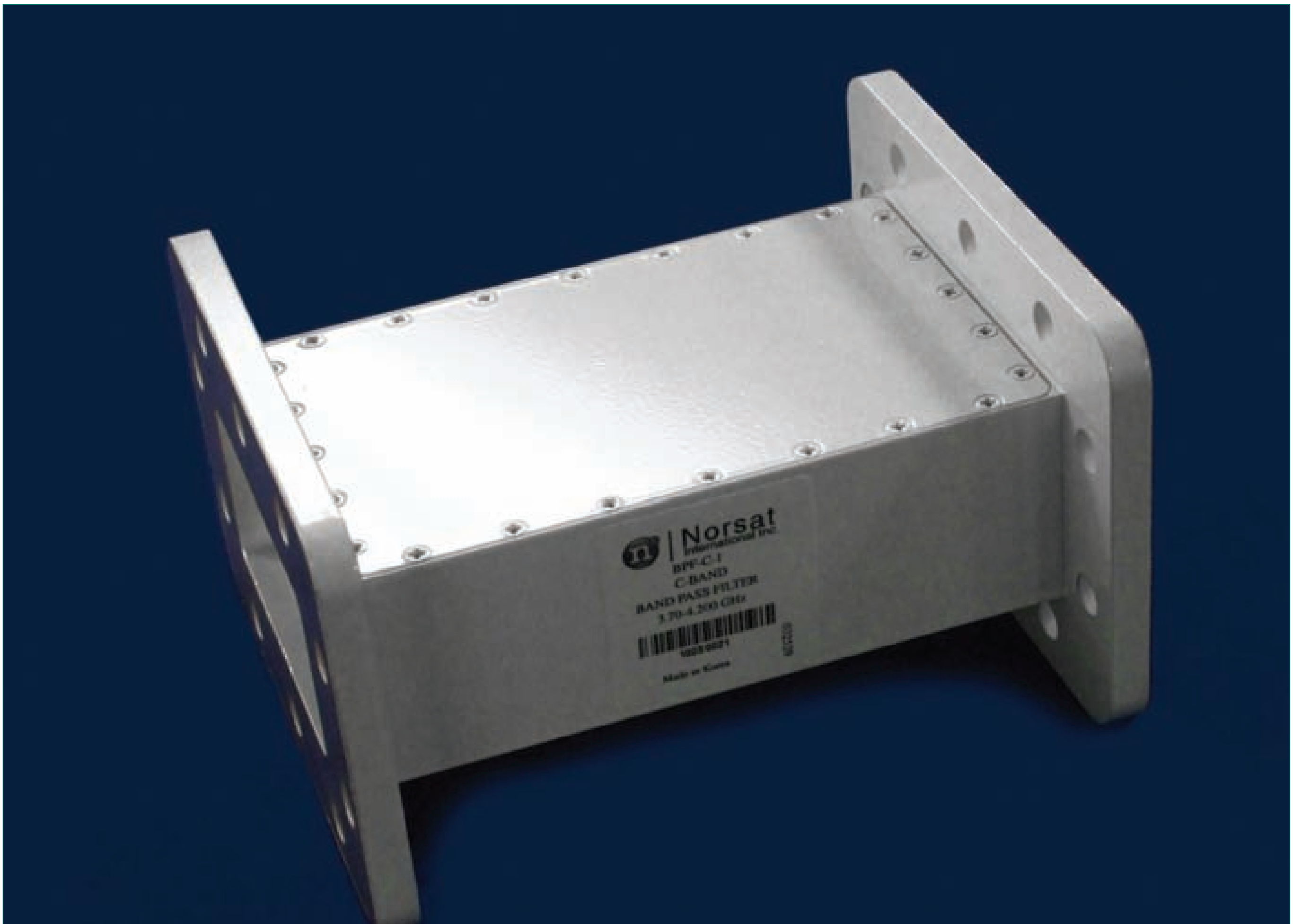


C-band Pass Filter

Improving your signal and mitigating downlink adjacent satellite interference effects in ground satellite terminals

Satellite interference is hard to avoid, especially when it is prolific throughout the industry. According to a survey conducted by the Satellite Interference Reduction Group (IRG), 93 percent of the satellite industry suffers from some type of satellite interference. Brian Donnelly, Vice President of Sales and Marketing at Norsat, outlines the challenges of downlink adjacent satellite interference in ground satellite terminals, and details how the effects can be mitigated.

Interference is caused by unwanted signals that interrupt the reception of radio waves. It can be produced within the same satellite systems, from other satellite systems using the same frequencies, or from ground-based sources such as overhead power lines, conflicting microwave transmitters, or from WiFi/WiMax sources. Since interference is caused by so many different sources, it can be difficult to get to the root of the problem. Satellite interference can be categorized into specific groups including adjacent channel interference, cross-polarization interference, deliberate interference, and adjacent satellite interference.

- Adjacent channel interference is caused by unsolicited signals in an adjacent channel, often the result of an error from the operator.
- Cross-polarization interference is caused when the antenna is not peaked properly, and/or the polarization is incorrectly set-up.
- Deliberate interference involves hostile attempts to disrupt service and is the unauthorized use of bandwidth.
- Adjacent satellite interference is often caused from user error and affects ground satellite terminals nearby. Adjacent satellite interference is categorized into downlink and uplink interference.

According to the IRG, interference can be caused by human error, bad installation, lack of training, poor equipment or system design, and a lack of adherence to industry standards and guidelines. Due to the multitude and range of interference types, this article will focus specifically on downlink adjacent satellite interference and the mitigation tools available for ground satellite terminals.

Adjacent satellite interference is on the rise as more satellites are deployed. According to Euroconsult's '*Satellites to be Built and Launched by 2020, World Market Survey,*' 51 percent more satellites will be built for launch from 2011-2020 than in the

previous decade. The satellite industry is geared for exceptional growth which means more capacity, more users, more services, and ultimately, more challenges involving satellite interference. In some cases, satellites are deployed so closely together that only two degrees separate them from the neighbouring satellite. As such, adjacent satellite interference is most likely accidental and is caused by user-error or incorrect equipment choice/setup such as having a non-compliant antenna or transmitting at higher powers than allowed.

What is Downlink Adjacent Satellite Interference?

Downlink adjacent satellite interference occurs when the receiving ground satellite terminal receives unwanted signals from neighbouring satellites. When it comes to military users, satellite operators say adjacent satellite interference is one of the biggest problem areas. This interference causes issues with satellite service providers and may prevent the satellite terminal from working correctly.

Though interference is attributed to numerous factors, there are specific technologies and techniques that can help mitigate interference, providing safer and error-free communications.

How to avoid Downlink Adjacent Satellite Interference in ground satellite terminals

There are many ways to mitigate downlink adjacent satellite interference such as pointing the antenna accurately, using appropriately-sized ground satellite terminals, and properly setting up the low noise block downconverter (LNB). User-error interference such as incorrect antenna pointing, and misconfiguration can be mitigated with the following techniques and technologies.

Proper antenna pointing: Manual

Proper antenna pointing starts with the setup location of the satellite terminal. To ensure the antenna is pointed properly, the user should set the satellite terminal on a stable and level terrain, confirming a clear line of sight. Some satellite terminals, such as Norsat's GLOBETrekker, offer auto-levelling capabilities so that it can be used on rugged terrain and uneven ground. As well, the satellite terminal should avoid electromagnetic interferences such as overhead power lines, cellular towers, or microwave transmitters. Wind and other environmental factors should be considered as they may cause vibration or other antenna movement.

Also, accessories are available to help ease the process of satellite acquisition and includes devices such as spectrum analyzers, GPS devices, compasses, and narrow band receivers. Norsat's Satellite Acquisition Assistant (SAA) is also an option, as it offers these devices and an inclinometer, DVB receiver, and the intuitive LinkControl software, packaged in a handy toolkit for quick and accurate satellite acquisition.

Photo courtesy of Norsat

Proper antenna pointing: Automatic

The auto-acquisition process ensures terminal alignment is accurate, consistent, and simple, minimizing the technical expertise required in the field. Auto-acquisition algorithms activate the motors in an auto-acquire terminal to point the antenna at the appropriate satellite. Most auto-acquire terminals include peaking of azimuth and elevation and some include polarization peaking. Auto-acquire software is typically easy-to-learn, and can decrease the chance of incorrect antenna pointing. An example of this is Norsat's LinkControl software that offers a step-by-step guide to aid the user through the satellite acquisition process while offering troubleshooting tools to reduce the likelihood of interference. LinkControl also has LinkProfiles which are preconfigured settings that allow operators easy satellite acquisition and transmission. Auto-acquire software reduces training time and allows users to more accurately point antennas without interfering with adjacent satellites.

Correctly-sized and configured satellite communications equipment

Choosing appropriately-sized terminals, antennas, and components will help with the signal quality that is being sent and received. Using an antenna that is too small will increase the chances of sidelobes and adjacent channel interference. As well, configuring components incorrectly will also affect signal quality and produce interference. A wrongly configured low noise block downconverter (LNB) or a block upconverter (BUC) with too much power can cause adjacent satellite interference and disrupt users nearby. A high noise figure in these devices can also lead to poor signal quality.

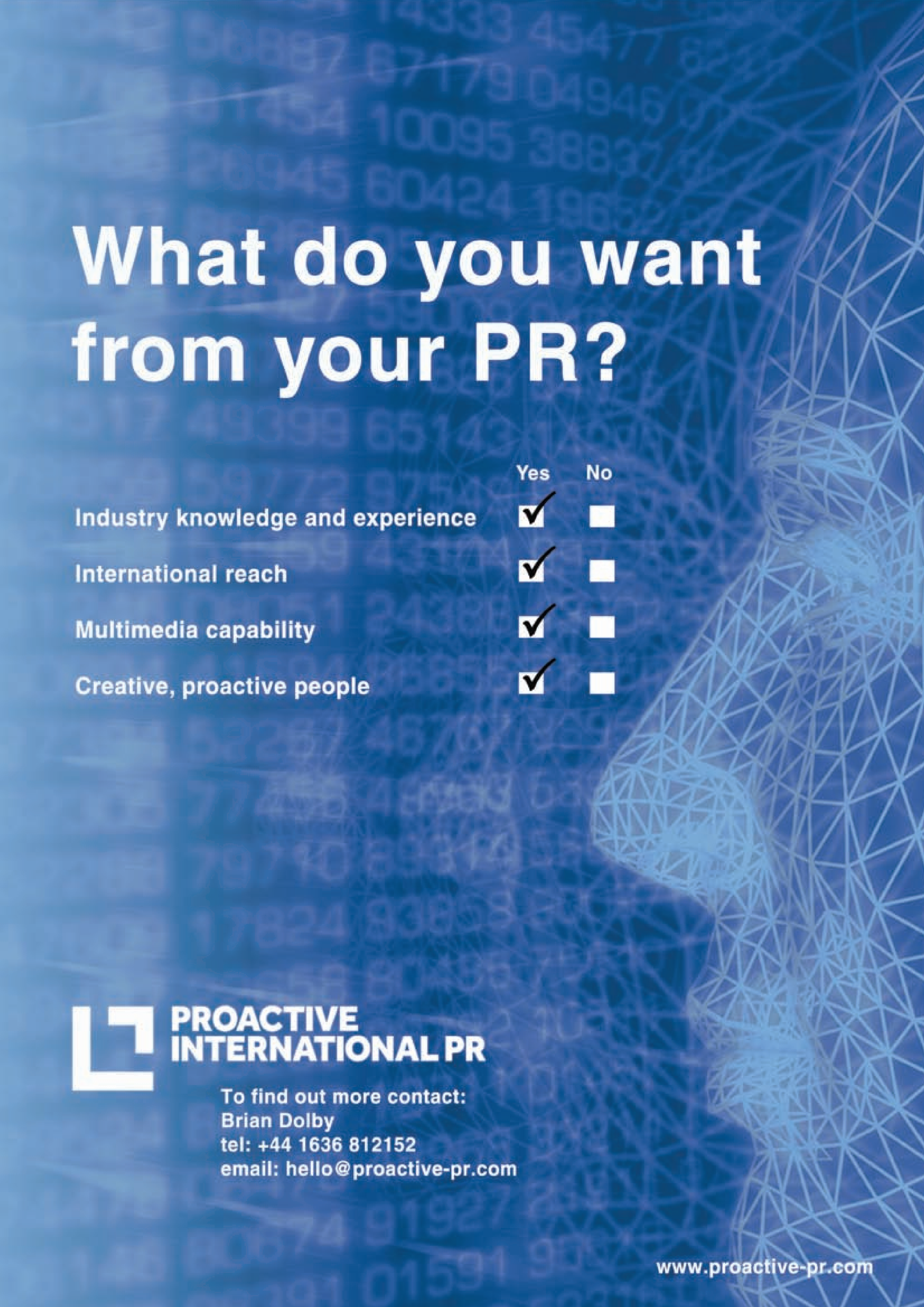
Using integrated bandpass filters to Improve your signal

Integrated or discrete bandpass filters are commonly used in or with LNBs to remove sources of interference, especially in C-band. If the spurious signals are not removed, they can cause problems within the LNB, such as intermodulation, or in some cases, saturation. In the worst case, an LNB can be permanently damaged by strong spurious signals.

Simple filters often have inadequate performance, while more complex filters become too difficult to specify, fabricate, and/or tune. A good filter is built with numerous stringent filter requirements to separate channels or to block adjacent bands. These filters require a broad passband with low insertion loss, steep skirts that roll off quickly, and high stopband rejection. Ideally, the filter would have close to zero dB loss over a broad passband and more than 80 dB of stopband rejection. Advanced filter design techniques have been developed to meet these requirements. For instance, elliptical filters allow for the adjustment of both the passband ripple and stopband attenuation as a means of decreasing the transition bandwidth. Chebyshev filters have steeper skirts at the cost of some ripple in the passband loss. There are many bandpass filters available on the market and in different frequency bands. Consider bandpass filters as an additional method to minimize signal interference (noise).

Conclusion

Satellite interference continues to be an issue in the industry despite the many technologies available on the market to help mitigate this problem. The sources of the interference are often difficult to identify and require time, money, and resources to resolve. With the exponential growth of the satellite industry, interferences are expected to increase, and end users will need more training and options on how to reduce interference to ensure a quality signal. Educating users on how to select and properly use ground satellite communication equipment will provide clearer signals for all satellite users. **GMC**


What do you want from your PR?
Yes No
Industry knowledge and experience ✓
International reach ✓
Multimedia capability ✓
Creative, proactive people ✓
PROACTIVE INTERNATIONAL PR
To find out more contact:
Brian Dolby
tel: +44 1636 812152
email: hello@proactive-pr.com
www.proactive-pr.com