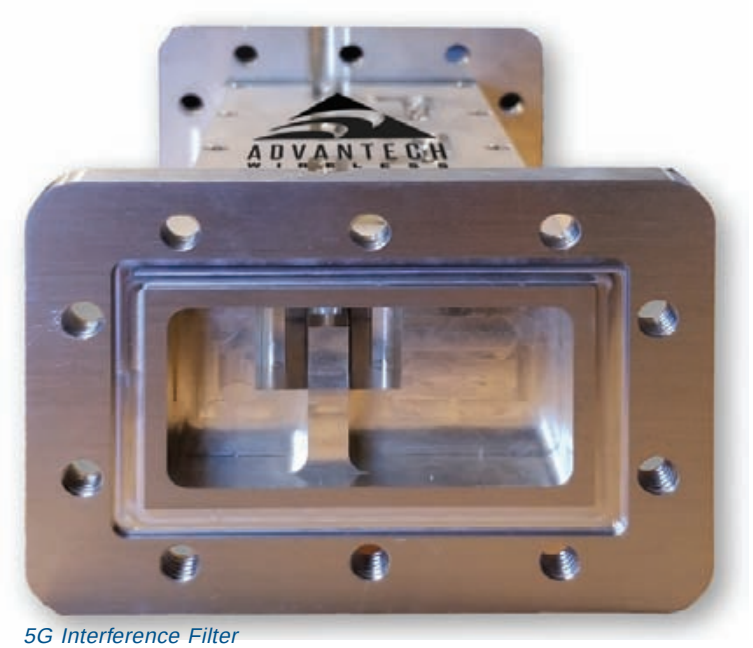
5G and Satcom – The perfect ecosystem

With the upcoming bandwidth sharing of C-band spectrum all but inevitable, satellite sector players will have to find innovative new solutions to maintain service levels. High power amplifier products are expected to play a key role in creating the next new normal.

Cristi Damian, Vice President Business Development, Advantech Wireless Technologies



5G Interference Filter

Based on recent announcements, it appears that the FCC will move forward with plans to auction off 280MHz of satellite C-band spectrum, from 3.7 to 3.98GHz, to 5G cellular networks.

The lack of a firm decision one way or the other has created great uncertainty for the satellite industry in the past few months. The number of deployed ground and space-based C-band assets are significant, and the reallocation will restrict the ability of some satellite operators to deliver services. The impact has also been felt by satcom component manufacturers as requirements for C-band equipment that would normally be used for sustainment, upgrades and modernization had been put on hold pending a decision. The unimagined impact of COVID-19 and the commensurate cancellation of major sporting events has impacted the video broadcast and mobile uplink markets tremendously as well.

Promises made that 5G will deliver both higher bandwidth and faster access to the mobile masses have created a level of demand that can only be met by making spectrum available to mobile network operators that have already made major investments in this new technology.

The coexistence of 5G cellular networks and satellite operations is paramount to both group's long-term success. A symbiotic relationship results in a 'win-win' for both parties. The proliferation of 5G is dependent upon the ubiquity of satellite communications to facilitate international roaming and the needs of mobile customers. Additionally, the enormity of needed backhaul services will benefit teleports worldwide.

Terrestrial and satellite service providers need to ensure that they are taking full advantage of the potential benefits of 5G while mitigating technical risks.

Baylin Technologies Inc., parent to: 1) Galtronics (USA) Inc., a global R&D manufacturer of 5G antenna products, 2) Advantech Wireless Technologies Inc., a market leader in the manufacture of satellite communications products, and 3) Alga Microwave, a designer and manufacturer of high quality, cost effective active and passive RF/Microwave components, bridges the gap between the two technologies. The three sister companies are invested in research and development to provide solutions on both sides of the spectrum.

Life after 5G

As 5G services come online, the necessity of spectrum-sharing for 5G and C-band satellite operators will be required to deliver high quality service. High-power transmitters and beam-forming antennas on the 5G side are bound to cause bleed-over and, as a result, overwhelm sensitive components used in satcom terminal architecture, such as LNAs and LNBs. It will be imperative that specialized filtering be used to maintain RF separation.

Working in conjunction with the C-Band Alliance, a consortium comprised of Intelsat, SES, Eutelsat and Telesat, Alga Microwave has developed a 5G interference rejection filter to ensure that C-band frequencies above the designated 5G band will still be usable for satellite links.

The filter provides an impressive 60dB of rejection at 3.98GHz, while passing signals in the 4.0 - 4.2GHz band. This represents the most cost-effective means for mitigating

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5G interference with C-band satellite services.

Sharing the bandwidth

Once the C-band spectrum has been divided, there won't be enough bandwidth remaining to facilitate the current C-band satellite services without drastic changes to the way RF spectrum is utilized. One solution is to increase the number of 'bits per Hz' and increase utilization efficiency by operating with higher modulation and error correction codes. Advantech has proven that modulation schemes as high as 256 APSK can work well in satellite links.

Previous tests performed using a 4.5m C-band antenna and a 500w C-band GaN Advantech SSPB demonstrated a spectrum efficiency of 8 bits/Hz that represents ~ 240Mbps in a 36MHz transponder. The principal benefits are two-fold; more information is transmitted with less bandwidth (critical for 5G back- hauls) and higher efficiency means reduced OPEX for Satcom service providers.

Pushing higher bits per Hz requires additional transmitter power to maintain acceptable C/N ratios.

Advantech manufactures the highest power satcom amplifiers available in the industry today with the latest solid-state technology.

High power is the key

Advancements in solid state amplifier technology have eliminated the difficulty in achieving extremely high levels of RF output power from satcom transmitters. The Advantech product portfolio includes high-power, standalone amplifiers as well as phase-combined and soft-fail redundant amplifier systems specifically architected for outdoor installations – amplifiers that can be mounted on work platforms of some antennas, greatly reducing insertion losses.

Advantech's solid-state amplifiers, manufactured using Gallium Nitride (GaN) transistor technology, run cooler and reach much higher output power levels and require less mains-power. GaN devices typically operate over wider bandwidths, so more of the C-band (up to 7.025GHz) can be utilized for satellite transmissions. GaN, considered military-grade technology, was specifically developed to operate in harsh conditions.

Satcom and 5G - The big picture

In the near future, low latency and high throughput needs will prompt military customers to incorporate 5G technology into their next generation networks. Advantech's amplifier portfolio includes the military-centric bands including X and Ka.

With more and more services becoming cloud-based, the advent of LEO constellations will take cloud services access to a whole new level. High-power Ka-band amplifiers and beam-forming antennas will continue to be a major staple in ground station architecture.

The unrivalled ubiquity of satellite-based services will provide high-capacity links that utilize high-order mod/cods and high-power transmitters to connect terrestrial 5G networks wherever they are needed. In areas where the saturation of C-band capacity is an issue, frequency separation between 5G and satellite will be possible with the utilization of special filters.

Satellite services will be a fundamental enabler in the proliferation of 5G services worldwide– two technologies that, if properly implemented, will form the perfect ecosystem. ■

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