



Briefing on Spread Spectrum Technology

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Government and commercial users of satellite communications increasingly rely on advanced broadband services to support their mobile operations – maritime, aeronautical and land-based. The communications technology often behind today's mobile satellite networks, and which is especially well suited for small lightweight antennas, is called **spread spectrum**.

Spread spectrum networks have grown steadily since the 1980s across a wide base of demanding customers. Despite this impressive success, many in the satellite industry would benefit from a better understanding of spread spectrum's advantages and the applications for which it is best suited.

Telesat, as one of the largest satellite operators in the world, has extensive experience designing, implementing and supporting spread spectrum networks. We have received requests from customers and business partners for a high level view of spread spectrum technology and its potential uses for their networks. This discussion has been developed in response. We hope you find it a useful introduction and would welcome any feedback or questions you may have.

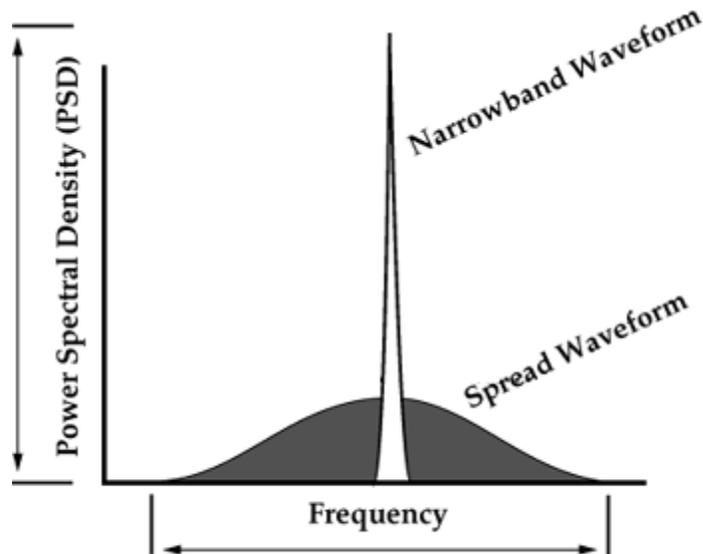
What is Spread Spectrum?

A spread spectrum service is one in which the transmitted signal is spread over a wide frequency band, much wider in fact than the minimum bandwidth required to transmit the information being sent. This is done by taking a carrier of a certain occupied bandwidth and power and 'spreading' the same power over a wider occupied bandwidth. The effect is a reduction in the carrier's spectral density (dBW/Hz).*



US Coast Guard uses spread spectrum services delivered via Telesat's Telstar 11N satellite. Photo courtesy of KVH Industries.

* The 'spreading factor' is the ratio of the spread bandwidth to the un-spread bandwidth, typically stated as an integral number – e.g. a 5:1 ratio is typically stated as a 5 times spreading factor (a 2 MHz carrier spread 5 times would occupy 10 MHz).



Telesat has extensive experience designing, and operating spread spectrum systems at both Ku-band and C-band and can assist customers with spread spectrum link design by providing analysis and end-to-end field testing.

Why use Spread Spectrum?

A benefit of spread spectrum technology is its ability to work at low spectral density levels when compared to narrow bandwidth services, enabling smaller antennas while overcoming adjacent satellite interference and increasing communications link security.



Unmanned Aerial Vehicles (UAVs) like this one utilize Spread Spectrum Technology for operational control and to transmit reconnaissance data.

Spread Spectrum services can coexist with narrow bandwidth services within the same satellite channel. Several conditions, impacts and tradeoffs must be taken into account when designing both services.

In spread spectrum deployments, an increase in bandwidth is exchanged for other benefits – benefits including the ability to use very small antennas. Care must be taken when designing spread spectrum service in terms of antenna size vs. allocated bandwidth.

The advantages of spread spectrum are significantly enhanced when combined with 'Time Division Multiple Access' (TDMA) technologies. This enables multiple remote terminals to access the same satellite capacity which is well suited for comms-on-the-move services used for both commercial markets, maritime and aero, and government applications such as unmanned aerial vehicles (UAVs).

Spread Spectrum Service Design

When designing a spread spectrum service, the following are important considerations:

- There can be additional costs for remote terminals and earth station equipment capable of supporting spread spectrum. There also are typically increased bandwidth costs to support spread spectrum operations. Telesat has the experience to assist customers in cost-benefit scenarios to determine whether the advantages of spread spectrum for a given application would offset these costs.
- Spectral density in spread spectrum networks is defined by regulatory bodies such as the ITU and FCC and by satellite operator coordination agreements. This can affect a customer's ability to fully exploit the advantages of spread spectrum technology. Again, Telesat is in a position to provide guidance in this area.

Commissioning Spread Spectrum services

Telesat recommends testing of the service in non-spread spectrum mode (i.e. narrow bandwidth) before activating spread spectrum to confirm correct operation.

To verify spread spectrum link performance, Telesat typically simulates worst-case operating conditions during system commissioning. Once correct operation and performance are confirmed, the spread spectrum service is enabled. Telesat assists customers during the commissioning process, including making satellite test capacity available, as necessary.

Conclusion

Spread Spectrum is one of various techniques that the satellite industry is using today to provide more choices for customers and improve network performance. It may be a solution that is highly suitable for your network, or there may be other innovations that Telesat can implement that would result in cost savings or other advantages.

Telesat has extensive experience supporting customers around the world who operate spread spectrum services.

Please contact your Telesat sales representative if you would like to learn more about the potential benefits of spread spectrum for your operations, or to discuss other ways Telesat can improve the efficiency and performance of your satellite network.