EMRESEARCH®
FULL SPECTRUM INNOVATION

THE SPACE RACE TO LEO

and Impact to Future Communication

SATELLITE INDUSTRY BRIEF

WRITTEN BY MARC CRAM

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Overview

The satellite industry is currently in the midst of a formative era comparable to the 1950's Space Race. Driven by the ever-increasing need for high speed communication, top tech companies are locked in high-stakes competition to establish a worldwide network of low earth orbit (LEO) satellites, the prize being the lucrative prospect of delivering next generation internet access on a global scale. Considerable wealth and resources have been invested in the development of cost-effective launch vehicles and systems capable of reaching LEO, laying the groundwork to vastly expand the commercial utilization of space.

This commitment to the potential of satellite communications can be seen in the contributions of industry visionaries such as Elon Musk and Jeff Bezos. Musk's SpaceX is lowering cost per flight by rapidly building and turning around launch vehicles for reuse. This has allowed him to put more than 600 LEO satellites in orbit, with plans to establish a constellation of between 12,000 and 30,000 to deliver global low-latency high-bandwidth internet access. In like fashion, Bezos started Blue Origin to enable his e-commerce and cloud computing company Amazon to put over 3,200 satellites in orbit. Making the establishment of such large-scale LEO infrastructure both efficient and profitable requires constant innovation, particularly in the design of the essential components these systems rely upon.

Communicating with launch vehicles on the pad, payloads in flight, and satellites in orbit requires microwave spectrum in a variety of bands to provide the data throughput and latency needed to make LEO networks efficient and reliable. EM Research's extensive portfolio of signal conversion and synthesis solutions are the perfect fit to fulfill this need. EM Research is a leading solutions provider of off the shelf and highly customized rugged components that are necessary to successfully construct and operate every step of a satellite's life cycle, providing high reliability performance no matter the mission profile.

Why LEO?

Satellites operating in low earth orbit between 300 and 1200 miles above ground enable a round trip for radio signals of less than 20 milliseconds, whereas signals going to and from a satellite in geostationary orbit require closer to 250 milliseconds, a more than 12-fold improvement. While geostationary satellites are well-suited for the “one to many” delivery of broadcast applications, they are not well suited to the high speed, two-way interactive data flows of modern internet-based applications. By placing a large number of satellites in low earth orbits, Bezos and Musk hope to have true competitors rivalling the performance of forthcoming cellular technology known as 5G.

Verizon, AT&T and other wireless carriers are targeting 5G network latencies of one to ten (1-10) milliseconds once their ground-based infrastructure is fully deployed. The difficulty for these carriers is that they are going to have to rely on microwave frequencies well above 6 GHz, potentially going as high as 60 GHz, in order to meet the stated latency and bandwidth goals of 5G. Due to the propagation characteristics at the extreme high frequency (EHF) and millimeter wavelengths licensed to them, the carriers are going to have to deploy a greater amount of infrastructure in much greater density than today’s macro cell tower-based networks. This presents a window of opportunity for the building and operation of LEO satellites to deliver “direct to satellite” two-way communications and internet access.

Getting There

Achieving low earth orbit requires rockets that can reach a very high velocity in a short period of time, and depending on the launch vehicle, payloads that can withstand a higher acceleration than those going to geostationary orbits. It is not uncommon for rockets to achieve 6G’s of acceleration or higher during ascent.

On the ground and in flight, on board communications systems providing telemetry from the rocket must be able to withstand the same forces as the satellite payloads. Ruggedized communications components tailored to be able to withstand the rapid change in air pressure and the multi-axis vibrations present when under way are crucial to achieving a successful mission.

Ground-based tracking and listening stations must be able to operate reliably and accurately under a variety of weather conditions to track and maintain operational control of the rocket during ascent, payload deployment, and booster recovery/de-orbit. Frequency stability, adjacent channel noise/interference immunity, and numerous other attributes must all be carefully designed into the communication equipment on the ground.

Once in orbit, satellites and their multitude of systems must be able to withstand the harsh conditions of space. This means coping with wide temperature swings of frequent sunrises and sunsets, exposure to vacuum, solar and cosmic radiation. Satellites must also be able to cope with impacts from a growing number of micrometeorites and other “debris” coming from prior rocket launches and satellite decommissions.

Making it happen

It takes a strong and deep pool of engineering talent to design the rockets, satellites, and ground stations to fulfill their respective mission objectives. The entire ecosystem of aerospace companies, satellite builders/integrators, and subsystems manufacturers is replete with personnel committed to the mindset that “failure is not an option.” And because no two satellite operators have the same orbits, frequency assignments, or business models, the engineering communities of the companies have to design flexibility, adaptability and manufacturability into their products in order to maximize volumes and achieve cost efficiencies that support the operators’ respective business models.

Why EM Research for your most demanding aerospace applications

The role that RF-based communications plays in all aspects of aerospace cannot be understated. Systems operating in the upper reaches of the electromagnetic spectrum provide the means of monitoring, controlling, and delivering service from ground stations, rockets, satellites, missiles, jets, and drones. Having light weight, power efficient, highly integrated, and custom-tailored products best-suited to the application at hand is critical to creating cost-effective solutions capable of fulfilling mission objectives.

Our line of single, dual, triple and quad-band BUCs are but one area of our impressive microwave component portfolio. We also offer reference oscillators, frequency synthesizers, channelized down converters, and block down converters. We also offer custom assemblies that integrate multiple components.

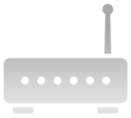
At EM Research, we offer innovative solutions that solve your most demanding requirements. And we are committed to working with you as a true partner throughout the development, integration, and implementation processes to ensure our products work in your application consistently the first time and every time, whether for single units or for high volume needs. Contact your EM Research representative to find out what sets us apart from other manufacturers.

Conclusion

The LEO satellite market is booming with new opportunities. Numerous companies old and new are bringing the costs of space access “down to earth.” Innovative upstarts are deploying massive constellations of satellites requiring new microwave communications equipment that is targeted at delivering high speed internet access to the more than four billion people on Earth who do not live within range of land-based cell tower service.

EM Research is helping the largest players in the LEO satellite industry fulfill their most critical communications requirements today and into the future.

Explore our full range of SatCom products at
WWW.EMRESEARCH.COM



CONVERTERS

AIRCRAFT-BASED EQUIPMENT

SATELLITE BROADBAND

EMRESEARCH®
FULL SPECTRUM INNOVATION

HIGHEST QUALITY

ISO, IPC, J-Std, RoHs, and REACH Compliant.

Rigorous Configuration Management and Quality Assurance program.

Streamlined manufacturing capability with top of the line equipment, and automated testing and alignment procedures.

Robust in-house testing including environmental simulations for vibration, temperature, and humidity.

COMPREHENSIVE SERVICE

Direct access to engineers and technical experts, partnered to build what you need.

More than 150 years combined engineering expertise.

We commit to your organization's success by delivering constant communications

We partner with industry leaders to provide cutting edge products.

Specifications to meet every one of your project's needs

BEST PERFORMANCE

Individualized product support until the end of our customer's needs.

Ruggedized design to ensure performance in the toughest environments

Customizable specifications, manufacturing, and testing to meet your project's needs

We deliver exceptional products that give you a competitive advantage.

Find out why industry leaders rebuy from EMR again and again.

We are committed to delivering an exceptional customer experience, providing products you can trust for a competitive advantage.

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