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MANAGING REGULATORY SPECTRUM THREATS TO GLOBAL NAVIGATION SATELLITE SYSTEMS

Abstract

Global Navigation Satellite Systems (GNSS) are vital parts of multiple critical infrastructures such as aviation, shipping, oil and gas, power distribution, financial networks. Along with satellite communication, weather monitoring, and remote sensing, continuing access to reliable space-based satellite navigation is an important motivation for ensuring a sustainable environment for space activities.

GNSS satellites such as GPS generally operate in medium Earth orbit. The risk from orbital debris for such systems is growing but is less severe than for satellites in lower orbits. As a result, risk assessments for GNSS services have tended to focus on intentional and unintentional interference to radio signals such as military jamming and solar storm events. However, natural, accidental, and malicious threats do not include harm resulting from improper radio regulations and spectrum management failures. Over the past twenty years, a large and disproportionate share of GNSS industry and government agency resources have been devoted to combatting the risk of "legalized interference" from domestic and international spectrum regulators.

The Radio-Navigation Satellite Service (RNSS) radio frequency bands used by GNSS services are located in the range of 1-3 GHz. This is a highly popular region that is under increasing pressure for use by non-space commercial services such as terrestrial mobile broadband. Regulatory risk can arise in several ways, such as the reallocation of an existing service allocation, required sharing of RNSS allocations with incompatible services, and changes to adjacent bands that create harmful interference within the RNSS bands. GNSS services are particularly vulnerable to increases in the spectrum "noise floor" as GNSS signals rely on very precise measurements of known signal codes. An increase in noise makes those measurements less precise, which in turn translates into less accurate positioning, navigation and timing solutions.

The paper provides a brief overview of major domestic and regulatory conflicts affecting GNSS, and specifically GPS, over the past twenty years. These conflicts are characterized and organized into a general threat framework that shows different types of regulatory risk and their relative significance. Recommendations are provided for domestic and international regulatory practices to mitigate risks to GNSS signals. Such recommendations should be considered not only by national spectrum authorities by also by industries and government agencies that rely on GNSS services. Doing so will enable them to more effectively participate in global regulatory processes and help ensure the sustainability of the radio frequency environment for space-based navigation activities.