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MEASURED SATELLITE AND SYSTEM PERFORMANCE VERSUS DESIGN TARGETS FOR A SDARS HYBRID CONSTELLATION

Abstract

A paper was presented at IAC 2007 predicting the performance of a satellite then under construction called Sirius FM-5. The satellite was for use in a Satellite Digital Audio Radio Service (SDARS), herein called Satellite Radio, covering North America. Sirius FM-5 is a very high powered geostationary satellite whose operation was to be incorporated into an existing three satellite non-geostationary (NGO) constellation to create a hybrid constellation. This hybrid constellation was predicted to improve system operation in a variety of ways. One was to improve service availability to the currently more than 20 million vehicular, home and other subscribers in North America; a second was to extend the life of the NGO satellites and, lastly, to provide on-orbit sparing capability. The satellite also included some advanced technology, particularly attitude and orbit control star sensors, lithium-ion batteries and Electric Ion propulsion.

Sirius FM-5 finished construction and factory test in April 2009 and was launched on June 30th of that year by a Proton M/Breeze M launch vehicle from Baikonur, Kazakhstan. After launch, orbit raising and deployments of its solar arrays and 9 meter diameter antenna, Sirius FM-5 went through a comprehensive in-orbit test (IOT) program. Concurrent to the IOT of Sirius FM-5, field measurements were taken on the service availability of the existing NGO satellite constellation. After these test programs were complete, Sirius FM-5 was put into full operation in August 2009, establishing the hybrid constellation. Field measurements on the service availability of the new constellation were then retaken.

This paper compares the performance parameter values of the Sirius FM-5 satellite and of the hybrid constellation with the values measured during IOT and system availability field measurements. The results of the comparison show that the prediction analyses/methods used for satellite and system performance yield a conservatively accurate estimate of actual performance. Performances of the advanced technology devices are also compared.