

Major Performance Analysis for Trade-off Design of Ka-band Transponder Subsystem

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Abstract

In order to configure the Ka-band transponder subsystem, it is necessary to allocate performance to the transponder equipments and to specify corresponding elements. What the process to allocate performance and to evaluate them required iterations and provides overall system configuration for preliminary design. It begins with analyzing the requirements and allocating performance parameters by establishing budgets for electrical and mechanical characteristics. For transponder subsystem of Satellite Communication (SATCOM) system, the trade-off design has been performed with emphasis on the improving performances of the payload system. In this paper, introduction of SATCOM system and major RF performances analysis will be mainly presented.

Keywords— Ka-band transponder, SATCOM system, communication payload, performance analysis.

1. Introduction

The SATCOM system, which to be designed to acquire the communication mission of the Communication, Oceanographic, and Meteorological Satellite (COMS) consists of Communication Payload, Satellite Ground Control System, and Experimental Test Earth Station.

The SATCOM that operates in the geostationary orbit of 116°E longitude will provide Ka-band Fixed Satellite Services (FSS). The FSS system provides four 100 MHz wide operational RF channels. The spacecraft will have a service life of at least seven years, however, the design lifetime of the SATCOM system will be at least twelve years to achieve the following main missions:

- In-orbit verification of the performance of the advanced communication technologies, and
- Experiment of wide-band multi-media communication services.

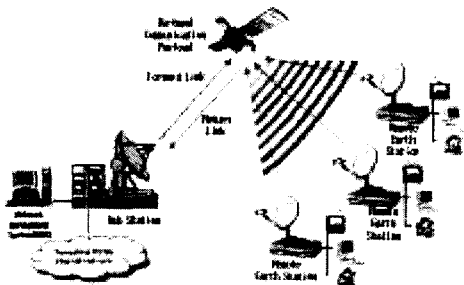


Figure 1. Network Configuration of SATCOM System

The main features of SATCOM system are shown in Table 1.

Table 1. Main feature of SATCOM system

Service area	Korean peninsula and Northeast area of China
Relevant frequency band	Ka-band
Orbit and position	Geostationary at 116°E
Design lifetime	More than 12 years
Reliability	More than 0.856 (TBC)

This paper focuses on the technology development being carried out for the space segment of SATCOM system at the ETRI, principally related to the COMS program.

2. Ka-band Payload and Transponder

2.1 Overview of Payload Architecture

The Ka-band communication payload under development consists of multi-beam antenna and on-board switching transponder subsystems. The payload system includes all kinds of the necessary microwave hardwares in order to receive, switch, amplify, and transmit microwave signals within the defined coverage area.

The Ka-band communication payload system is designed to be capable of the communication service function among the individual beams.

The transponder subsystem provide four 100 MHz active and one 100 MHz redundant channels as the Ka-Band. The three channels of them have the beam switching function for high speed multimedia services including the internet via satellite in the public communication network, and the rest one channel provides a bent-pipe type function for communication services for natural disaster in government communication network.