Recommendation SFCG 30-2

EFFICIENT USE OF THE 25.5 – 27.0 GHz FREQUENCY BAND BY FUTURE EARTH EXPLORATION SATELLITE SYSTEMS AND SPACE RESEARCH SATELLITE SYSTEMS

The SFCG,

CONSIDERING

a. that the 25.5 - 27.0 GHz frequency band is allocated to the Earth exploration-satellite service (EESS) (space-to-Earth), the space research service (SRS) (space-to-Earth) and the 25.25 - 27.50 GHz frequency band is allocated to the inter-satellite service (ISS);

b. that EESS and SRS missions in the 25.5 – 27.0 GHz frequency band are likely to transmit payload telemetry data at very high rates;

c. that the very high data rates will impose the use of high gain pointable transmit antennas onboard satellites;

d. that, contrary to fixed isoflux antennas used in the 8025-8400 MHz frequency band, high gain antennas do not allow to compensate for the range variation of about 10 dB from 5 to 90 degrees elevation, thus leading to an excessive and unnecessary link margin at high elevations;

e. that atmospheric attenuation in the 25.5-27 GHz frequency band may be as high as 35 dB at low elevations for an availability of 99.9% and still 15 dB for an availability of 99%;

f. that administrations may decide to counteract atmospheric attenuation by designing their space-Earth links with considerable margins so as to ensure necessary availability;

g. that the RR Article 21 power flux density limits at the Earth's surface in the 25.5-27 GHz frequency band are of -115dBW/m^2/MHz for elevations of 5 degrees and less and of -105 dBW/m^2/MHz for elevation of 25 degrees or more;

h. that manned missions may have different operational constraints than unmanned missions that may preclude the implementation of certain advanced operational techniques,

FURTHER CONSIDERING

i. that operational adjustment of the transmit power along a pass is costly, inefficient and may affect the reliability of the onboard high power amplifier;

j. that variable coding and modulation (VCM) techniques exist and are used operationally for space-Earth links of telecommunication satellites;

k. that VCM techniques can be used to compensate for range variations, variations of atmospheric attenuation or both;

l. that already with simple coarse range compensation using VCM, a data throughput increase of typically 90% or a bandwidth reduction by a factor of typically 1.6 can be obtained while finer and more performing range compensation will be feasible in most cases;

m. that adaptive coding and modulation (ACM) would allow even more efficient use of the link through real-time compensation of atmospheric attenuation;

n. that higher elevation angle tracking techniques, in which transmissions begin at relatively large elevations angles (e.g. 30 degrees), present an efficient means of increasing data throughput for Lagrangian points and lunar orbit missions,

RECOGNIZING

1. that developing systems operating with unnecessary huge margins may lead to premature interference problems either between EESS missions or into SRS missions;

2. that, due to range variations along a pass and atmospheric attenuation, huge margins are necessary if the onboard transmitter operates with fixed transmit power, modulation, coding and data rate,

RECOMMENDS

1. that SFCG member agencies consider implementing variable coding and modulation (VCM) or adaptive coding and modulation (ACM), where practicable, when operating high data rate EESS and SRS space-Earth links in the 25.5 – 27 GHz frequency band;

2. that SFCG member agencies consider implementing higher elevation tracking methods, where practicable, when operating high data rate SRS space-to-Earth links in Lagrangian and lunar orbits in the 25.5 – 27 GHz frequency band.