Recommendation SFCG 14-3R10

USE OF THE 8025-8400 MHz BAND BY EARTH EXPLORATION SATELLITES

The SFCG,

CONSIDERING

a) that Earth exploration-satellites are an increasingly important tool for acquiring information about the Earth and its environment;

b) that the 8025-8400 MHz band is allocated to the EESS on a primary basis;

c) that the band 8025-8400 MHz is shared with the fixed, mobile and fixed-satellite (Earth-to-space) services and the band 8175-8215 MHz is also shared with the meteorological satellite (Earth-to-space) service;

d) that use of the band by EESS systems operated by commercial interests, military organisations and space agencies is increasing and could result in harmful interference among EESS systems;

e) that proper selection of orbit parameters for sun-synchronous satellites can be a very effective interference mitigation technique which in general requires coordination at a very early stage;

f) that homogeneity among a set of technical parameters will lead to a more efficient use of the orbit/spectrum resource by the EESS systems;

g) that high gain antennas radiate power only towards a limited portion of the Earth surface but the higher obtained e.i.r.p may be a disadvantage for co-located stations;

h) that isoflux antennas have a more homogeneous power flux density distribution across the surface of the Earth as compared to omnidirectional antennas;

i) that broadcast modes generally cause higher levels of interference due to continuous transmissions and relatively high power spectral densities but have typically lower bandwidth requirements;

j) that proper selection of bandwidth and power efficient modulation and coding techniques could result in smaller occupied bandwidths and lower adjacent channel interference;

k) that higher order advanced modulation (HOM) schemes such as 16 phases PSK and above need less bandwidth than currently used QPSK and 8PSK but generally require higher power flux densities;

l) that the interference risk is more significant in high latitude areas since most of Earth exploration-satellites use polar orbits;

m) that tropospheric propagation effects in high latitude areas are generally limited;

n) that a number of other interference mitigation techniques such as polarisation discrimination, earth station separation and earth station antenna discrimination can also contribute to lower interference levels when they can be used;

o) that Earth-based, deep space research receivers operated in the adjacent 8400-8450 MHz band are extremely sensitive and highly susceptible to interference with relevant protection criteria given in Recommendation ITU-R SA.1157;

p) that time-critical events occur in both deep space research and EESS operations;

q) that most of the techniques proposed to reduce interferences between Earth Exploration Telemetry links also reduces adjacent emissions received by Deep Space stations in the 8400-8450 MHz band;

r) that a primary allocation to the Earth Exploration Satellite Service is also available in the band 25.5 – 27 GHz;

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

t) that VCM techniques can be used to compensate for range variations and that with simple coarse range compensations using VCM, significant bandwidth or power reduction can be obtained;

u) that reliable and efficient power-controllable RF solid state power amplifier technologies are available which may allow for a close control of the link budget, and thus can contribute to mitigating the interference risk.

RECOGNIZING

i) that increasing congestion of the 8025 – 8400 MHz band and requirements for higher data rates will lead to increasing levels of interference,

ii) that guidelines for use of the band are desirable to maximize the capacity of the band and to minimize harmful interference,

NOTING

that all RECOMMENDS below are considered of equal importance

RECOMMENDS

1. that Earth exploration-satellites operating in a non broadcasting mode radiate only when transmitting data to one or more earth stations;

2. that phasing of the orbital parameters for sun-synchronous satellites should be considered for which early coordination is required in accordance with the most recent version of Resolution SFCG A12-1;

3. that low sidelobe, high gain satellite antennas be used and if high gain satellite antennas are not practicable, isoflux antennas should be considered instead of omnidirectional antennas;

4. that broadcast modes be avoided whenever practicable or, if unavoidable, consider the use of a portion of the lower half of the band 8025-8400 MHz;

5. that future EESS networks consider characteristics of existing networks[1] in order to maintain a relatively homogeneous operational environment;

6. that Earth exploration-satellites using directional antennas be designed to limit the power flux density on the Earth's surface in all areas with latitudes above 55° or below -55° to less than -145 dB(W/m^2) for a reference bandwidth equal to 4 kHz;

7. that Earth exploration-satellites using isoflux antennas be designed to limit the power flux density on the Earth's surface to less than -150 dB(W/m^2) for a reference bandwidth equal to 4 kHz;

8. that Earth exploration-satellites not using directional or isoflux antennas be designed to limit the power flux density on the Earth's surface to less than -147 dB(W/m^2) for a reference bandwidth equal to 4 kHz;

9. that Earth exploration-satellites developed after 1 January 2017 comply with recommends 6, 7 and 8;

10. that bandwidth and power efficient modulation and coding techniques[2] be used, taking also into account Recommendation SFCG 21-2 regarding adjacent channel interference and the desire to preserve a homogeneous power flux density environment;

11. that SFCG member agencies consider implementing VCM, where practicable, when operating high data rate EESS links in the 8025-8400 MHz frequency band;

12. that due consideration also be given to other interference mitigation techniques such as polarisation discrimination and geographical separation of earth stations;

13. that in order to mitigate interference to the earth stations, earth station antennas with the performance as specified in Recommendations ITU-R S.465 or ITU-R S.580 be used, and preferably with a diameter of at least 4.5 m;

14. that, in order to minimize the need for operational coordination, Earth exploration satellites utilize, to the maximum extent possible, appropriate techniques to prevent unwanted emissions

exceeding the ITU-R deep space interference criterion (Rec. ITU-R SA.1157) in the band 8400 – 8450 MHz, including on-board filtering, large geographical separation between EESS and deep-space Earth stations, low-sideband modulations, and one or more of the applicable techniques given in RECOMMENDS 1 through 13;

15. that Earth exploration-satellites use the 25.5-27.0 GHz band whenever practicable;

16. that operational coordination be used only as the last resort to mitigate interferences among EESS missions and from EESS missions to deep-space Earth stations,

17. that agencies consider, whenever practicable, the use of on-board power-controllable RF power amplifiers.

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[1] See SFCG X-Band database

[2] Guidelines for implementation of bandwidth efficient modulation & coding schemes have been developed by CCSDS