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Group on Earth Observations

Contribution to the FCC Public Notice for Additional Comment regarding WRC-07 Agenda Item 1.20

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NOTE: This document has been prepared by technical experts representing GEO Members and Participating Organizations designated to implement GEO 2006 Work Plan Task AR-06-11 concerning protection of radio frequencies for Earth observation.

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1 Introduction

The Group on Earth Observation (GEO) would like to thank the Federal Communications Committee for the opportunity to comment on its Public Notice DA 06-2262 regarding WRC-07 Agenda Item 1.20 issued on November 1, 2006.

From the initialization of GEO, Radio frequency protection has been recognized as a critically important issue for Earth observations, and it has been a specific goal of the GEO initiative to ensure that radio frequencies used for Earth observation be protected. This includes, in particular, radio frequency ranges where passive measurements are being made by Earth orbiting radiometers. These instruments use frequencies which, due to their special physical characteristics, are a unique natural resource for spaceborne passive sensing of the atmosphere and the Earth surface and the availability and absolute protection of these frequencies must be ensured on the long-term.

2 About GEO

The *Group on Earth Observations* (GEO) is an intergovernmental body currently comprising 64 member countries, the European Commission and 43 participating international organisations GEO meeting in plenary at least annually at the senior-official level, and periodically at the Ministerial level, taking decisions by consensus of its Members.

GEO is leading a worldwide effort to build a Global Earth Observation System of Systems (GEOSS) over the next 10 years that will work with and build upon existing national, regional, and international systems to provide comprehensive, coordinated Earth observations from thousands of instruments worldwide, transforming the data they collect into vital information for society.

The GEO was formally established at the Third Earth Observation Summit in February 2005 to carry out the GEOSS 10-Year Implementation Plan. Prior to its formal establishment, the Ad Hoc GEO (established at the First Earth Observation Summit in July 2003) met as a planning body to develop the GEOSS 10-Year Implementation Plan.

The following summits led to the creation of GEO and GEOSS:

- The World Summit on Sustainable Development, Johannesburg, 2002, highlighted the urgent need for coordinated observations relating to the state of the Earth.
- A meeting of the Heads of State of the Group of 8 Industrialized Countries Summit in June 2003 in Evian, France, affirmed the importance of Earth Observation as a priority activity.
- The First Earth Observation Summit was convened in Washington, D.C., in July 2003, and adopted a Declaration establishing the ad hoc intergovernmental Group on Earth Observations (ad hoc GEO) to draft a 10-Year Implementation Plan.
- The Second Earth Observation Summit in Tokyo, Japan, in April 2004 adopted a Framework Document defining the scope and intent of a Global Earth Observation System of Systems (GEOSS).

- The Third Earth Observation Summit, held in Brussels in February 2005, endorsed the GEOSS 10-Year Implementation Plan and established the intergovernmental Group on Earth Observations (GEO) to carry it out.

Finally, it can also be noted that Heads of State further supported GEOSS in the G-8 Gleneagles Plan of Action released in July 2005.

GEOSS will yield a broad range of societal benefits, including:

- Reducing loss of life and property from natural and human-induced disasters.
- Understanding environmental factors affecting human health and well-being.
- Improving management of energy resources.
- Understanding, assessing, predicting, mitigating, and adapting to climate variability and change.
- Improving water resource management through better understanding of the water cycle.
- Improving weather information, forecasting and warning.
- Improving the management and protection of terrestrial, coastal and marine ecosystems.
- Supporting sustainable agriculture and combating desertification.
- Understanding, monitoring and conserving biodiversity.

3 What is and why Earth Observation needed ?

Earth observation refers to the collection, processing, modelling, and dissemination of data about the Earth system.

These data are collected through in situ, airborne and space-based observations, using satellites, buoys, seismometers, and other devices.

They then can be processed into forecasts, maps, and other decision support tools, providing valuable and often life-saving information to end users.

More and more, citizens require their governments to make evidence-based policy decisions about the environment, including better predictions of natural disasters, epidemics, the impact of energy choices, or variations in the climate.

Only through comprehensive, systematic Earth observation can we improve prediction of the Earth system. Observing what is happening today and analyzing what has happened in the past, is our key to understanding and predicting what will happen in the future.

"Prediction is a difficult art when addressing the complexity of Earth processes ... how do we account for phenomena as diverse and poorly understood as seismic fault dynamics, climate variation, or the ecological intricacy of a wetland? Observations are the only means for deciphering nature's complexities." (Jose Achache, GEO Secretariat Director)

4 GEO and radio-frequencies

Earth Observations encompasses ground-based and satellite applications and instruments that rely to a large extent on radio-frequencies. Recognising the importance of ground-based observation applications, in particular in meteorology, it is now also widely recognised that satellites provide an essential contribution to Earth observation, making use of radio-frequency either for observations or data downlink. Since its inception GEO has accordingly recognised the critical importance of protecting radio-frequencies.

Early in the development of the GEOSS 10-Year Implementation Plan, the *ad hoc* GEO subgroup on data utilisation (SGDU) issued a report stressing this point. It articulated the specific goal of the GEOSS initiative to ensure protection of frequency bands and related instruments used for Earth Observations and in particular that radio frequencies used for passive sensing be protected and used solely by earth observation applications.

On this basis, a specific action point (AR-06-11) is now underway within GEO to prepare a series of advocating activities through national and international bodies in charge of frequency management.

5 GEO Comments to the FCC Public Notice DA 06-2262

General comments

In the view of GEO, the outcome of WRC-07 Agenda Item 1.20 will be decisive for future planning and use of the passive bands listed in Resolution 738 for which the current use is mainly in the field of operational meteorology. Therefore, any proposed regulatory limits pertaining to this agenda item (or any absence of limits, as is the case now) do not only have an impact on the active services surrounding the EESS (passive) allocations as per table contained in Resolution 738, but will also impact the use of the EESS (passive) allocations for future satellite missions.

A regulatory limit on the amount of unwanted emission power to be emitted inside the exclusive passive allocations (No. 5.340) will help in two ways.

First, a maximum interference envelope for these bands will ensure that operations of EES (passive) will be possible in the future and that planning for future missions is not additionally constrained by high-likelihood interference risks.

Secondly, mainly from the frequency managerial perspective, regulatory actions to be made at WRC-07 will significantly aid in preventing huge operational incompatibilities between active and EES (passive) services operating in nearby and adjacent bands, for which any regulatory limitations can be taken into account in the design for both the active and passive service equipment.

Therefore, GEO is of the opinion that even in the case where current active service equipments, due to the current designs, do not cause interference to the EESS (passive), this (i.e., without making any regulatory actions at WRC-07) does not imply compatibility is guaranteed for the future.

This is in strong contrast with the proposals contained in Annex 1 and 3 of the Public Notice. Performing regulatory action also in case where currently no interference potential is present,

will enable protection of EESS (passive) operations for the foreseeable future. A NOC for these bands is not a viable solution on the long-term for that given EESS (passive) frequency band.

The work of ITU-R Task Group 1/9 has brought to solid results that the studied unwanted emission power levels would not limit the active services beyond what are their current technical and operational characteristics. Also, the concept of burden sharing has been applied throughout the TG 1/9 work and the imposed limits on the active service unwanted emission power level are not to be seen only on the active services.

Specific comments

Most of the proposals contained in Annex 1 and 3 of the Public Notice are in line with the GEO view on the issue. In these comments, GEO will only mention where the GEO view deviates from the proposal contained in Annex 3 of the Public Notice.

For the radiolocation service (RL) within the band 1350-1400 MHz, it is absolutely essential to have a limit since the radars have potential to cause harmful interference. The reasons for NOC noted in Annex 1 and 3 of the Public Notice are not fully in line with the conclusions made in ITU-R Task Group 1/9. The proposed power level of -29 dBW/27MHz has been supported by showing the effect on the processing of images at 1.4 GHz disturbed by varying levels of RFI. The compatibility study showed that if the outcome of the dynamic analyses as presented can be taken as representative for many existing systems, it can be concluded that a vast number of the existing radar systems already meet the proposed average unwanted emission power limit of -29 dBW/27MHz. With an average power level of -29 dBW/27MHz satellite interference exceeding the availability criteria will occur but some useful data could still be retrieved. Far from representing the ideal situation, a scenario with unwanted emission limits beyond -29 dBW/27 MHz represents a significant impact to the EESS (passive) operations.

GEO notes that the difficulty of imposing a stringent limit on radar unwanted emissions near 1.4 GHz may not be solely a problem within the USA, but is likely to create difficulties in a number of other administrations. Noting that without any limits on unwanted emissions from radars the issue is left unresolved, GEO believes that a global regulatory action could still be taken in the form of a power level that is strongly recommended (e.g. through a footnote in Article 5 or Conference Resolution).

For the bands above 10 GHz, the situation is as follows:

In Annex 3, a NOC is proposed for the Inter Satellite band 22.55-23.55 GHz. Studies have shown that current systems operating in the ISS can meet without additional constraints unwanted emissions of a single satellite into the passive band of -46dBW/200 MHz within the EESS (passive) allocation. The simulations of the ISS links in the non-GSO MSS systems indicate that the permissible interference criteria of Recommendation ITU-R RS.1029-2 will be satisfied for current sensors such as the conical scan and the nadir scan passive sensors. For future passive sensors such as a push-broom sensor, the study shows that an unwanted emission level of of -46 dBW/200 MHz of ISS links having antenna gains less than 55 dBi and transmitting data (with modulation) in the 23.6 24 GHz band would satisfy the permissible interference criteria of Recommendation ITU-R RS.1029-2. This level of

attenuation can be easily met by ISS systems, including the ISS links in the non-GSO MSS systems.

It is essential to highlight the fact the proposed limit will not constrain existing and future systems since the analysis is based on current known attenuation (modulation and filtering).

For the FSS band 30-31 GHz simulations for future passive sensors and their corresponding attenuation assessment showed that an FSS uplink producing an unwanted emission power level of -20 dBW/200MHz in the 31.3 - 31.5 GHz band would achieve compatibility. It is unlikely that his reduced power level will constrain the FSS as the existing systems already respect these limits.

For the FSS bands around the passive band 50.2-50.4 GHz, it is preferable to have limits in unwanted emission power instead of unwanted levels expressed in eirp (cf. Annex 1 and 3). For the bands 47.2 - 50.2 GHz in regions 2 and 3, and 49.44 - 50.2 GHz in region 1, the proposed unwanted emission power limit (resulting from ITU-R TG 1/9) of the FSS into the passive band is -20dBW/200MHz both for a GSO and non-GSO system. For the band 50.4 - 51.4 GHz, FSS (E to s), the proposed unwanted emission power limit (resulting from ITU-R TG 1/9) of the FSS into the passive band is -15dBW/200MHz for a single GSO system. The proposed unwanted emission levels can be met by the FSS systems considered in the study. In addition to that, the FSS systems which were considered are supposed to be representative of existing and future systems.

Concluding comments

The overall conclusion is that the proposed limits will not constrain the existing and future active services, especially for the systems in the FSS and ISS where the studied unwanted emission power limit could be met in all cases. This conclusion is based on the fact that interference assessments were made using filtering and modulation patterns proposed by ITU-R Working Party 4A (the ITU-R group responsible for satellite issues) itself. Therefore, one can only conclude that there are no significant modifications to satellite design, since the material used within the interference assessment is derived from information provided by the satellite industry (and has to be understood as typical or representative of "standard" equipment).

Therefore, it can also be mentioned that the impact of the proposed limits on the active services should be none or close to none. One could argue that due to limitation, there is a lack of flexibility on the design of future active systems. On the other hand, one should also admit that this is just a small price to pay when services (active and passive) in adjacent and nearby bands can co-exist without the risk of excessive interference.