Group on Earth Observations

Contribution to the Radio Spectrum Policy Group (RSPG) public consultation on “A coordinated EU spectrum approach for scientific use of radio spectrum"

13th July 2006

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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.

1 Introduction

The Group on Earth Observation (GEO) would like to thank the EU Radio Spectrum Policy Group (RSPG) for the opportunity to comment on the current report on **"A coordinated EU spectrum approach for scientific use of radio spectrum"** issued on 15 May 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 at least some of these radio frequencies be protected and used solely by earth observation applications. This includes, in particular, radio frequency ranges where passive measurements are the focus of discussion within the EU RSPG.

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 downloading. 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. The part of this Report dedicated to frequency issues is provided in Annex 1 of one this document.

On this basis, a specific action point (AR-06-11, see detailed Task Sheet in Annex 2) is now underway within GEO to prepare a series of advocating activities through national and international bodies in charge of frequency management, such as the current response to the present RSPG public consultation.

5 GEO Comments to the RSPG public consultation

GEO welcomes the current Report toward a RSPG opinion on a "coordinated EU spectrum approach for scientific use of radio spectrum" in that it certainly adequately reflects overall importance of scientific services and in particular their considerable societal value upon which GEO is built.

GEO supports Section 9 "Draft elements for an opinion of the RSPG" that does raise the most important points, societal as well as economic value of scientific services, international governmental commitments, recognition of the essential passive bands covered by RR footnote **5.340**.

With regards to this latter specific frequency bands covered by RR footnote **5.340**, GEO would like to stress, if needed, the essential importance of these bands for Earth Observations as unique natural resources that cannot be put at risk and to fully support the "Appeals" 1) of the WMO Resolution 3 (Cg-XIV) :

> *"To ensure the availability and absolute protection of the radio-frequency bands which, due to their special physical characteristics, are a unique natural resource for spaceborne passive sensing of the atmosphere and the Earth surface; In this regard, the exclusive 23.6-24 GHz passive band that is associated with a water vapour absorption line is of crucial importance for weather, water and climate research and operations."*

In the introduction of the RSPG public consultation, GEO noted in particular that "*In the process of developing this opinion, the RSPG is seeking the views of stakeholders … in particular concerning… the approach to assess costs and benefits in cases where spectrum can be used on a shared basis."*

GEO notes that such impact assessment is already covered in item 7 of section 9 of the current RSPG progress report for bands that are already shared between scientific services and other radio services.

GEO is however of the view that such impact analysis should not be generalised to "exclusive" passive bands protected by RR footnote **5.340** bands that have to remain purely passive.

In particular, GEO would like to stress that the SRR 24 GHz precedent in the passive band 23.6-24 GHz (Commission Decision 2005/50/EC of 17 January 2005), even though on a temporary basis shall remain exceptional.

Finally, GEO believes that, concerning costs and benefits, the WMO elements provided in the RSPG Report (Section 4.2) as well as the elements from the UK report on "The role of science in physical natural hazard assessment" (in section 4.4) should provide sufficient

materials in impact assessments analysis to justify maintaining current protection of scientific services in their related frequency bands. GEO recommends that the Executive Summary of the UK report be included as an annex to the RSPG document and given further attention.

Annex 1

Group on Earth Observations (GEO)

Report of the Subgroup on Data Utilization (SGDU)

March 19, 2004

(Abstract)

…/…

3.2 Protection of existing radio frequencies for earth observation systems

A specific but important point is the question of protection of radio frequencies necessary for earth observations in particular for passive measurements. Passive remote sensing is based on the detection/measurement of emissions at some precise electromagnetic frequencies. Some of these frequencies are in high demand for active applications not related to GEOSS, i.e. some groups would like to emit at these currently protected frequencies. Such emissions would contaminate the signals coming from natural sources and make quality earth observation measurements difficult or impossible. A specific goal of the GEOSS initiative will be to ensure that these radio frequencies be protected and used solely by earth observation applications. A more detailed presentation of this issue can be found Annex 3 (Protection of radio frequencies used for Earth Exploration by Satellite).

Frequencies used for active remote sensing are also important and must be protected should they become threatened.

…/…

SGDU Annex 3

Protection of Radio Frequencies Used for Earth Exploration by Satellite

Passive frequency bands

Space-borne passive sensing of the Earth's surface and atmosphere has an essential and increasing importance in Earth Observation. The impressive progress made in the recent years as well as expected future development in weather analysis, warning and forecasts in particular for dangerous weather phenomena (rain and floods, storms, cyclones, droughts) and in the study and prediction of climate change, is mainly attributable to the space borne observations. On this basis, economic studies show that meteorological services have a high positive impact on a wide range of economic activities, notwithstanding safety of life and property aspects.

Space-borne passive sensing feeds crucial observational data to numerical weather prediction models run on the most advanced super-computers that are operated by a few global forecasting centres. All meteorological and environmental satellite organisations operate these crucial remote-sensing missions as part of the GOS of the World Weather Watch.

Space-borne passive sensing for meteorological applications is performed in frequency bands allocated to the Earth Exploration-Satellite Service (EESS) (passive) in the ITU-R Radio Regulations. The appropriate bands are uniquely determined by the physical properties (e.g. molecular resonance) of constituents of the atmosphere, and are therefore one of the unique natural resources (similarly to Radio Astronomy bands). Measurements at several frequencies in the microwave spectrum must be made simultaneously in order to extract the individual contribution of the geophysical parameter of interest. Bands below 100 GHz are of particular importance to provide an "all-weather" capability since clouds are almost transparent at these frequencies.

Along this line, Figure 1. describes respectively the zenithal opacity of the atmosphere due to water vapour and dry components in the frequency range 1 to 275 GHz on which have been based the definition of most of the current allocations to EESS (passive) that are listed, as currently specified in ITU-R Recommendation SA.515-4, in Table 1. Interference criteria and performance criteria of passive sensors are indicated in ITU-R Recommendation SA.1028-2 and 1029-2, respectively.

In addition, Figure 2. also gives the sensitivity of frequency bands between 1 and 40 GHz to some geophysical parameters over ocean surface that are able to be determined by passive sensing (similar curves also describes the situation above land surfaces).

Passive sensors measure natural radiations, most of the time at very low level, which represent noise for radio-communications in other frequency bands. They integrate all natural (wanted) and man-made (unwanted) emissions within a given band and cannot differentiate between these two kinds of signals, since the atmosphere is a highly smoothing medium with fast changing characteristics, spatially and temporally. Passive services are hence extremely vulnerable to interference and need absolute protection. Any artificial increase of the noise due to man-made in-band or out-of-band emissions immediately results in a detrimental impact to operational and research meteorology and definitely jeopardizes future development and progress.

The passive frequency bands can be split in 4 categories:

- frequency bands currently quoted in footnote 5.340 of the Radio Regulations that stipulates that all emissions are prohibited and that hence, are assumed to be fully protected,
- frequency bands where the EESS (passive) has a co-primary allocation with active services. In some of these bands, sharing conditions are defined in the Radio Regulations as, for example, power limitations, but, in most of them, sharing studies are either not completed or missing. Agenda item 1.2 (WRC-07) deals with such sharing issues with active services,
- frequency bands which is either allocated to the EESS (passive) on secondary basis or indicated in footnote,

- frequency bands above 275 GHz which still need consolidation scientific and technical studies to define the optimum characteristics of the concerned channel. The bands in the 275GHz-3000GHz range are hence not yet allocated in the Radio Regulations but this issue is currently on agenda item 2.2 of the WRC-2010 preliminary agenda.

Due to the worldwide development of telecommunications and radiocommunications in particular, the pressure of active services on using the same or adjacent frequency bands used for passive sensing is important and likely to increase in the forthcoming years.

Even the frequency bands assumed to be protected by footnote 5.340 (see above) are still under pressure with regards to unwanted emissions from actives services operating in adjacent frequency bands and/or from new technology Ultra-Wide-Band (UWB) applications that recently arise.

The issue of protection of passive bands from unwanted emissions are on going within the ITU-R and the related agenda item 1.20 for the next WRC-07 will be studied within a specific ITU-R Task Group (TG) 1/9.

Similarly, the other specific ITU-R TG 1/8 studies the impact and possible future regulations for UWB applications. These new technologies, also considered in ITU-R Resolution 952 (WRC-03), use bandwidth of several GHz and may hence covers multiple frequency ranges and potentially impact large number of radio services in all frequency bands, currently between 3 and 79 GHz, among of them, EESS (passive).

Among others and as typical examples, such a situation is currently occurring in the two following frequency bands covered by footnote 5.340 in the radio Regulations:

- passive frequency band 1400-1427 MHz endangered by unwanted emissions resulting from a new allocation to Fixed-Satellite Service (FSS) for Mobile Satellite Service (MSS) systems feeder links in a nearby band decided at the last WRC-03. This allocation is to be confirmed at the next WRC-07 (agenda item 1.17) after completion of the compatibility studies.
- passive frequency band 23.6-24 GHz which may be jeopardized by 24 GHz UWB Short-Range Radars (SRR) used for automotive purposes. These SRR are expected to transmit in a 5 GHz bandwidth, covering in particular the 23.6-24 GHz and their possible deployment is currently under discussion. This use, which has already been accepted in the US, is under study within Europe on the basis of a temporary introduction. The whole scientific community, including Radio astronomy experts that are also using this 23.6-24 GHz band, facing the powerful automotive lobby, has been heavily deploying effort to convince Administrations that, even though this temporary approach may be theoretically feasible, the unresolved regulatory issues makes practical control of SRR density difficult to achieve and the transfer of SRR from 24 to 79 GHz bands unguaranteed. In addition, it is foreseen the risk that the 24 GHz temporary solution is transformed into a permanent solution under economical and political pressure.

Active frequency bands

In addition, the case of EESS active frequency bands has also to be considered. These bands are used for multiple different purposes (Synthetic Aperture Radars (SAR), precipitation radars, cloud profile radars, Altimeters, Scatterometers…) that all take part of meteorology and environmental measurements and survey. Even though, by principle, these bands (see Table 2) are relatively less sensitive to interference than passive bands, sharing issues with other active services occur that may also jeopardised measurements carried-on with the existing and future sensors.

As an example, last WRC-03 has allocated the band 5 150-5 350 MHz on a primary basis to the mobile service for the implementation of wireless access systems (WAS), including RLAN. Even though this allocation is associated with several measures drawn to ensure the protection of EESS active in the band 5250-5350 MHz (mainly a set of EIRP limits that apply to RLANs), the limitation to indoor use, essential to the protection of EESS active and currently regulated within Europe, has not been retained on a world-wide basis. Administrations are however requested to take appropriate measures that will result in the predominant deployment of RLANs in indoor environment but the non-mandatory status of this indoor deployment create a risk of highly detrimental interference that may endanger future EESS operations.

For more information

More detailed information about Earth Exploration Satellite Service (EESS) is currently developed in section 5 of the handbook on "the use of radio spectrum for meteorology". This handbook, issued in 2002, has been edited by both the International Telecommunications Union (ITU) and World Meteorological Organisation (WMO) and is available on the website of both these international bodies.

Apart from these two International Organisations, it is worth noting that these issues are also discussed within specific groups such as the "Space Frequency Coordination Group" (SFCG) where common positions are defined among all the relevant space agencies, the "International TOVS Working Group" (ITWG) where operational and research users of passive measurements coordinate their efforts and the "Committee on Earth Observation Satellites" (CEOS) where space-related Earth observation activities are coordinated and promoted (see respectively:
cimss.ssec.wisc.edu/itwg/,.www.sfcgonline.org, and www.ceos.org).

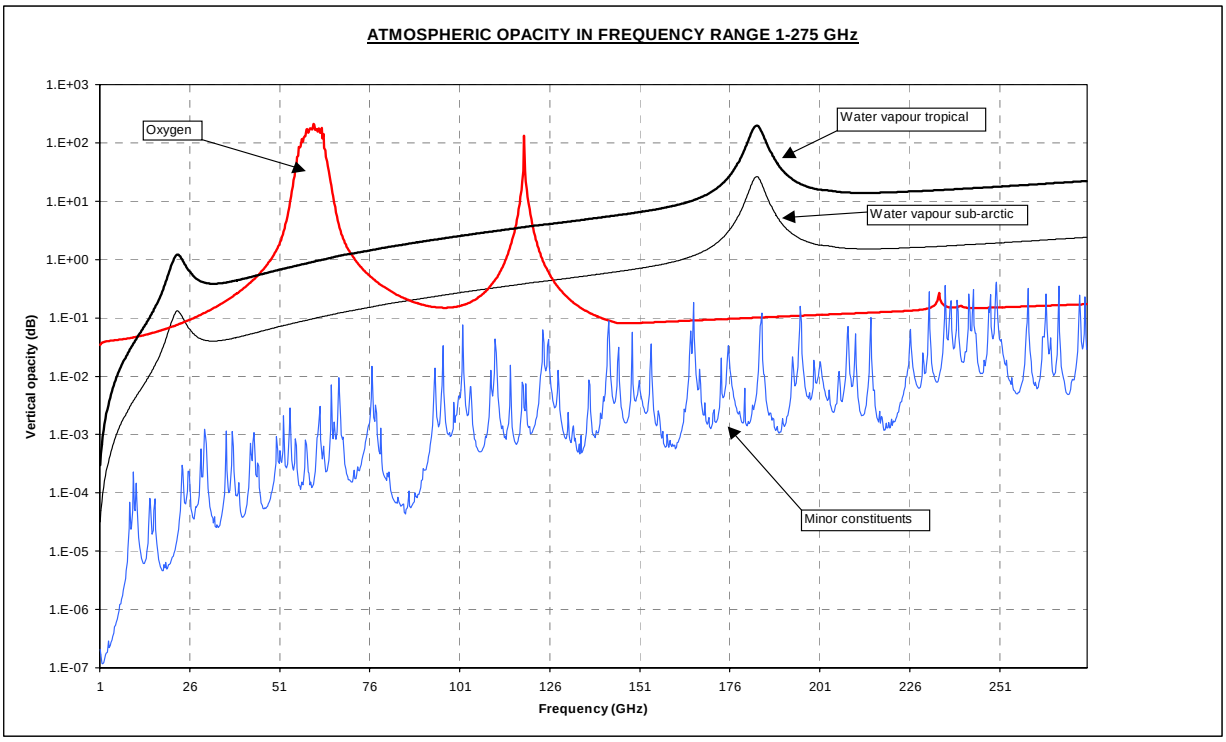

Figure 1. Zenithal opacity of the atmosphere due to water vapour and dry components in the range 1-275 GHz

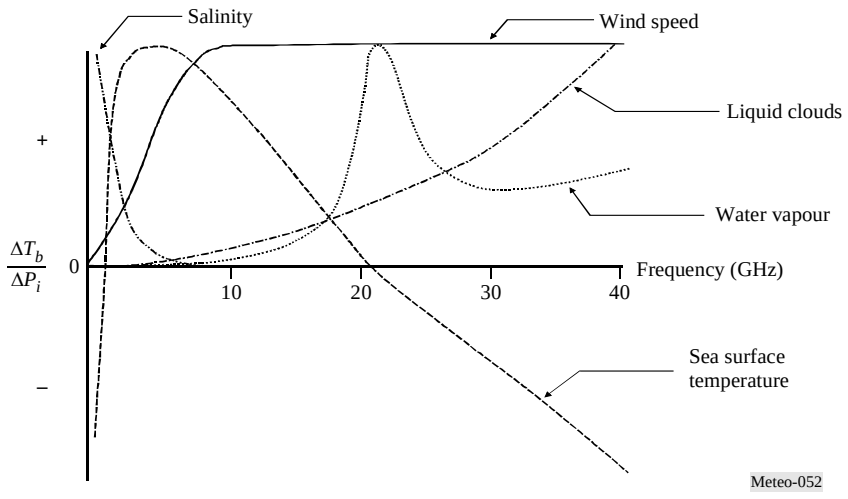

Figure 2. Sensitivity of brightness temperature to geophysical parameters over ocean surface

Table 1 - EESS Passive Frequency Bands (page 1/3)

Frequency band(s)(1) (GHz)	Total bandwidth required (MHz)	Spectral line(s) or centre frequency (GHz)	Measurement	Scan mode N, L(2)
1.37-1.4s, 1.4-1.427P	100	1.4	Soil moisture, ocean salinity, sea surface temperature, vegetation index	N
2.64-2.655s, 2.655-2.69s, 2.69-2.7P	45	2.7	Ocean salinity, soil moisture, vegetation index	N
4.2-4.4s, 4.95-4.99s	200	4.3	Sea surface temperature	N
6.425-7.25	200	6.85	Sea surface temperature	N
10.6-10.68p, 10.68-10.7P	100	10.65	Rain rate, snow water content, ice morphology, sea state, ocean wind speed	N
15.2-15.35s, 15.35-15.4P	200	15.3	Water vapour, rain rate	N
18.6-18.8p	200	18.7	Rain rates, sea state, sea ice, water vapour, ocean wind speed, soil emissivity and humidity	N
21.2-21.4p	200	21.3	Water vapour, liquid water	N
22.21-22.5p	300	22.235	Water vapour, liquid water	N
23.6-24P	400	23.8	Water vapour, liquid water, associated channel for atmospheric sounding	N
31.3-31.5P, 31.5-31.8p	500	31.4	Sea ice, water vapour, oil spills, clouds, liquid water, surface temperature, reference window for 50-60 GHz range	N
36-37p	1 000	36.5	Rain rates, snow, sea ice, clouds	N
50.2-50.4P	200	50.3	Reference window for atmospheric temperature profiling (surface temperature)	N
52.6-54.25P, 54.25-59.3p	6 700(3)	Several between 52.6-59.3	Atmospheric temperature profiling (O_2 absorption lines)	N
86-92P	6 000	89	Clouds, oil spills, ice, snow, rain, reference window for temperature soundings near 118 GHz	N

Table 1 - EESS Passive Frequency Bands (page 2/3)

Frequency band(s)[1] (GHz)	Total bandwidth required (MHz)	Spectral line(s) or centre frequency (GHz)	Measurement	Scan mode N, L[2]
100-102P	2 000	100.49	N_2O, NO	L
109.5-111.8P	2 000	110.8	O_3	L
114.25-116P	1 750	115.27	CO	L
115.25-116P, 116-122.25p	7 000[3]	118.75	Atmospheric temperature profiling (O_2 absorption line)	N, L
148.5-151.5P	3 000	150.74	N_2O, Earth surface temperature, cloud parameters, reference window for temperature soundings	N, L
155.5-158.5[4]p	3 000	157	Earth and cloud parameters	N
164-167P	3 000[3]	164.38, 167.2	N_2O, cloud water and ice, rain, CO, ClO	N, L
174.8-182p, 182-185P, 185-190p, 190-191.8P	17 000[3]	175.86, 177.26, 183.31, 184.75	N_2O, Water vapour profiling, O_3	N, L
200-209P	9 000[3]	200.98, 203.4, 204.35, 206.13, 208.64	N_2O, ClO, water vapour, O_3	L
226-231.5P	5 500	226.09, 230.54, 231.28	Clouds, humidity, N_2O (226.09 GHz), CO (230.54 GHz), O_3 (231.28 GHz), reference window	N, L
235-238p	3 000	235.71, 237.15	O_3	L
250-252P	2 000	251.21	N_2O	L
275-277	2 000[3]	276.33	NO, N_2O (276.33 GHz)	L
294-306	12 000[3]	301.44	NO, N_2O (301.44 GHz), O_3, O_2, HNO_3, HOCl	N, L
316-334	18 000[3]	325.15	Water vapour profiling (325.1 GHz), O_3, HOCl	N, L
342-349	7 000[3]	345.8, 346	CO (345.8 GHz), HNO_3, CH_3Cl, O_3, oxygen, HOCl	N, L
363-365	2 000	364.32	O_3	L
371-389	18 000[3]	380.2	Water vapour profiling	N
416-434	18 000[3]	425	Temperature profiling	N
442-444	2 000[3]	443	H_2O, O_3, HNO_3, N_2O, CO	N, L

Table 1 - EESS Passive Frequency Bands (page 3/3)

Frequency band(s)(1) (GHz)	Total bandwidth required (MHz)	Spectral line(s) or centre frequency (GHz)	Measurement	Scan mode N, L(2)
496-506	10 000(3)	498.1, 498.2, 498.3, 498.4, 498.5, 498.6	O_3, CH_3Cl, N_2O, BrO, ClO, water vapour profiling	N, L
546-568	22 000(3)	557	Water vapour profiling	N, L
624-629	5 000(3)	624.27, 624.34, 624.77, 625.37, 625.92, 627.18, 627.77, 628.46	HCl, BrO, O_3, HCl, SO_2, H_2O_2	L
634-654	20 000(3)	635.87, 642.85, 647.2, 649.45, 649.7, 650.28, 650.73, 651.77, 652.83	CH_3Cl, HOCl, ClO, water vapour, N_2O, BrO, O_3	N, L
659-661	2 000	660.49	BrO	L
684-692	8 000(3)	688	ClO, CO, CH_3Cl	L
730-732	2 000(3)	731	Oxygen, HNO_3	L
851-853	2 000	852	NO	L
951-956	5 000(3)	952, 955	Oxygen, NO	L

(1) P: Primary Allocation, shared only with passive services (RR No. **5.340**); p: primary allocation, shared with active services; s: secondary allocation.

(2) N: Nadir, Nadir scan modes concentrate on sounding or viewing the Earth's surface at angles of nearly perpendicular incidence. The scan terminates at the surface or at various levels in the atmosphere according to the weighting functions. L: Limb, Limb scan modes view the atmosphere "on edge" and terminate in space rather than at the surface, and accordingly are weighted zero at the surface and maximum at the tangent point height.

(3) This bandwidth is occupied by multiple channels.

(4) This band is needed until 2018 to accommodate existing and planned sensors.

HNO_3: Nitric acid
H_2O_2: Hydrogen peroxide
SO_2: Sulphur dioxide
CH_3Cl: Methyl chloride
HOCl: Hypochlorous acid
NO: Nitric oxide
BrO: Bromine monoxide
N_2O: Nitrous acid
CO: Carbon monoxide
HCl: Hydrochloric acid
ClO: Chlorine monoxide
O_3: Ozone

Table 2 - EESS Active Frequency Bands (page 1 of 2)

Frequency band (GHz)	Allocation status	User objectives	Users
0.420-0.470	Secondary in the 432-438 MHz None in the remaining parts of the band RR No 5.279A	Forest monitoring (biomass)	P-band SAR Airborne SAR
1.215-1.300	PRIMARY RR Nos. 5.332 and 5.335A	Wave structure, vegetation, biomass, geology, soil moisture, interferometry (DEM)	L-band SAR (SAR/JERS-1, SIR-C, PALSAR/ALOS, TerraSAR(L), AirborneSAR)
3.1-3.3	Secondary	Geology	S-band SAR, Scatterometers, Altimeter (Envisat RA-2 second frequency)
5.15-5.25	None	Geology, oceanography, sea ice, land use, inter-ferometry (DEM)	High resolution radar altimeters (Jason)
5.25-5.57	PRIMARY RR Nos. 5.447D, 5.448A, B	Geology, vegetation, oceanography, altimetry, sea ice, land use, inter-ferometry (DEM), SAR	C-band SAR (RADARSAT, Envisat, Airborne SAR), Scatterometers, Altimeters (AMI, ASCAT, ASAR, ALT/dual, IKAR-N)
8.55-8.65	PRIMARY RR No. 5.469A	High resolution SAR applications (tactical) plus snow and ice	Not identified
9.5-9.8	PRIMARY RR No. 5.476A	High resolution SAR applications (tactical) plus snow and ice	X-band SAR (TerraSAR(X)), AirborneSAR, Okean-O SLR
9.975-10.025	Secondary RR No. 5.479	High resolution SAR applications (tactical) plus snow and ice	Not identified
13.25-13.75	PRIMARY RR Nos. 5.498A, 5.501B	Wind, ice, geoid	Ku-band scatterometers, altimeters (NSCAT, ALT/dual, PR, R225, IKAR-D&N, RA, RA-2, DPR)
17.2-17.3	PRIMARY RR No. 5.513A	Vegetation, snow, rain, wind	Rain radars precipitation radar, scatterometers
24.05-24.25	Secondary	Rain	Rain radars precipitation radar (IKAR-D & N)

Table 2 - EESS Active Frequency Bands (page 2 of 2)

Frequency band (GHz)	Allocation status	User objectives	Users
35.5-36	PRIMARY RR No. 5.549A	Ice, rain, wind, geoid, snow, oceanography	Altimeters, scatterometers, precipitation radar (IKAR-N, DPR/GPM, AltiKa)
78-79	PRIMARY RR No. 5.560	Altimetry (land and ice) at high spatial resolution	Radio altimeters
94.0-94.1	PRIMARY RR No. 5.562	Cloud profiling	Cloud profile radars (ESA CPR, CPR/NASA, IKAR-D & N)
133.5-134	PRIMARY RR No. 5.562E	Cloud profiling	Cloud profile radars
237.9-238	RR No. 5.563B	Cloud profiling	Cloud profile radars

Annex 2

GEO AR-06-11 Task Sheet

Area	**Title**
Architecture	Prepare a series of appropriate advocacy activities, including representations to the International Telecommunication Union. For example, evaluation of challenges presented by the industrial development of automobile radar and the implications for the use of radio frequencies essential for tropospheric sounding.
Relevant Committee	
Architecture & Data	

Description of the Work to be Performed

A specific but essential point for GEO has been recognised to be the question of protection of radio frequencies necessary for earth observations, in particular for passive measurements. Passive remote sensing is based on the detection/measurement of emissions at some specific electromagnetic frequencies. Some of these frequencies are in high demand for active applications not related to GEOSS, i.e. some groups would like to emit at these frequencies, even though protected by the Radio Regulations (RR) provision **5.340** that states that all emissions are prohibited. Such emissions would contaminate the signals coming from natural sources and make quality earth observation measurements difficult or impossible.

To reflect on a more general basis the aim of this Task and the related work to performed, it is assumed that the Title of the Task will need to be changed as follows. Such modification will have to be agreed within GEO at the first occasion :

> *"Assess the potential impact of interference on Satellite measurements necessary for the GEOSS and prepare a series of appropriate advocacy activities, including representations to the International Telecommunication Union (ITU) and other bodies in charge of frequency management. In particular, the case of passive bands, essential for Earth observations, will be monitor with the highest care (For example, evaluation of challenges presented by the automotive short-range radars (SRR 24 GHz) applications and their implications)."*

Further recognising that frequencies used for active remote sensing are also important and must be protected should they become threatened, the following issues will have to be performed within the GEO AR-06-11 :

(1) Coordinate actions with WMO, SFCG and other relevant national and regional agencies to discuss and determine the needed requirements.
(2) Establish a reference GEOSS frequency band list (passive and active), based on the initial work performed within the SGDU and the current CEOS questionnaire, providing all details on expected data products retrieved (see reference document 1 and 6),
(3) Assess the potential impact (data products, economical and societal impacts), of the degradation or loss of measurements in microwave atmospheric sounding and SAR bands due to interference produced by all potential radio sources, and in particular unwanted emissions or unregulated emissions of commercial users.

(4) Develop "GEOSS recommendation" and provide it to ITU and, possibly, other regional spectrum regulatory groups
(5) Contribute, as necessary, to all issues where GEOSS frequency bands are considered or could be endangered (technical contributions, response to public consultations[1] issued by radiocommunications bodies,…) (see for example reference document 3)

It has to be noted that while some of these issues relate to the regular work of frequency managers, as represented within this GEO task, and hence could be performed within this task, the issue (3) will need scientific and operational assessments that is not of AR-06-11 competence. A coordination within GEO and among a number of other GEO tasks will have to be handled.

Reference Documents

N°	Title and/or description	Date
1	Report of the Subgroup on Data Utilization (SGDU) (March 19, 2004)	March 2004
2	WMO Resolution 3 (Cg-XIV) : "Radio Frequencies for meteorological and related environmental activities" NOTE : Included at the end of Document N°4	June 2003
3	WMO response to the Australian ACMA consultation on Short-Range Radars 24 GHz	April 2006
4	Preliminary WMO position on World Radiocommunication Conference 2007 agenda	March 2006
5	UK report on "The role of science in Physical Natural Hazard Assessment"	June 2005
6	CEOS "Survey of the use of radio spectrum for Earth observation"	January 2006
7	EC Decision 2005/50/EC on the "harmonisation of the 24 GHz range radio spectrum band for the time-limited use by automotive short-range radar equipment in the Community"	17 January 2005
8	European Commission Radio Spectrum Policy Group (RSPG) progress report on "A coordinated EU spectrum approach for scientific use of radio spectrum". NOTE : currently in public consultation that will end on 14 July	15 May 2006

Output & Deliverables

(1) GEOSS reference frequency bands list (delivery 3rd quarter 2006)
(2) GEOSS "Recommendation" on the use and protection requirements of related frequency bands (delivery 4th quarter 2006) to be presented at the Conference Preparatory Meeting (CPM, February 2007)

[1] A GEO response to the current European Commission RSPG public consultation on "scientific use of the spectrum" (See document 8) has to be considered

(3) Study on economical and societal impact of the scientific services and corresponding loss of Earth Observation microwave measurement data due to RF interference (delivery 4th quarter 2006)
(4) As required, contributions to different radiocommunications bodies (delivery as needed, such as, for example, the current EU RSPG consultation))

Calendar (incl. milestones)

Start: 2nd Quarter 2006 | End: Continuous

Responsible Entity, Participants

Lead Organizations:

World Meteorological Organisation (WMO) (World Weather Watch (WWW))

AR-06-11 Point Of Contact (POC) :
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Financial Contributions (from GEO Operations Budget)

None. Funding for the assessment study (issue 3) will come from voluntary contribution by CEOS members

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GEO Member Potential Contributions Reported to date:

CEOS

Assess the potential impact of the degradation or loss of measurements in microwave atmospheric sounding and SAR bands due to interference with unregulated emissions of other commercial users. This impact will be evaluated in terms of economical and social impact on the final user, the average citizen. The study will try to associate real economical figures to the loss of end data products (short and medium term weather forecast, climate research, various SAR end data products ...). It will be presented to the ITU and, possibly, other regional spectrum regulatory groups. It will be used, for example, as a tool to argue about the need for regulatory limits on unwanted emissions in purely passive bands (Agenda Item 1.20 of WRC 2007). More generally it will be used to counter the economical arguments used by commercial services to justify the lack of regulatory limits.

ECMWF

Through impact studies and/or simulations (already initiated in the context of the 24GHz issue).

EUMETNET

One of EUMETNET programmes is dedicated to "protection of radio-frequencies" (EUMETFREQ) to coordinate and contribute to different forum where such issues are discussed, and in particular to the European Communication Committee with which EUMETNET has a Letter of Understanding (LoU) allowing us to attend and contribute to its different meetings. EUMETNET contribution will take the form of an expertise in the frequency field and a relay of the GEO positions within the relevant forum within ECC as well as within the European Commission that is currently discussing its future policy on "scientific use of the spectrum" and to which EUMETNET is invited to represent the meteorological community.

WMO

WMO participates in ITU-Radiocommunication Sector activities in its capacity as ITU-R Member. It is the focal point for ITU-R as regards frequency bands allocated for meteorological purpose (in broad sense): Met Aids, Met Radar, Met Sat, EESS (spaceborne passive remote sensing).
The WMO Commission for Basic Systems (CBS) has established the Steering Group on Radio-Frequency Coordination (SG-RFC) to coordinate radio-frequency issues for operation and research (see TOR attached);
Its work plan and deliverables are as follows:

a. Organize, with the assistance of the Secretariat, a Workshop on Radio Frequencies for meteorology, including sharing aspects between Met Aids and Met Sat in common bands (WMO Headquarters, 20-21 March 2006).
b. Contributions to issues on radio frequencies for meteorology, in particular related to the protection of space-borne passive sensing bands. Promote/facilitate (by providing information and guidance) Members' participation in national, regional and global (i.e. ITU-R) activities regarding radio frequencies.
c. Finalize updates of the joint ITU-WMO publication "*Handbook on use of radio spectrum for meteorology"* in coordination with the ITU-R.
d. Develop Guidance and information for Members on relevant issues for the next World Radiocommunication Conference 2007.