

FREQUENCY SPECTRUM REQUIREMENTS FOR PASSIVE SENSORS IN BANDS ABOVE 275 GHz

In response to the preliminary agenda item for the World Radiocommunication Conference WRC-2010 to consider frequency allocations between 275 GHz and 3000 GHz this contribution informs CGMS about this unique opportunity for the inclusion of appropriate provisions in the Radio Regulations for services such as the Earth Exploration Satellite Service (passive) in frequency bands above 275 GHz at WRC-2010.

1 INTRODUCTION

Currently, frequency bands above 275 GHz are not allocated in the frequency allocation table of the ITU Radio Regulations (RR). Only footnote **5.565** in the RR governs the use of a list of frequency bands in the range 275-1000 GHz by passive and active services and recognises the need to conduct further experimentation and research.

A preliminary agenda item for WRC-2010 as agreed at WRC-03 (Resolution 803) asks for consideration of the frequency allocations between 275 GHz and 3000 GHz taking into account the results of ITU-R studies in accordance with Resolution 950 (WRC-03).

However, to retain this issue at the forthcoming WRC-07 on the agenda for WRC-2010, the interest of the science community for this subject has to be demonstrated and corresponding proposals/requests will have to be fed into the relevant WRC-07 preparation processes.

In view of this potential agenda item for WRC-2010, the Space Frequency Coordination Group (SFCG) has started working on the consolidation of the passive frequency band requirements and the corresponding instrument performance and protection levels.

2 EUMETSAT ACTIVITIES ON IDENTIFICATION OF APPROPRIATE FREQUENCY BANDS ABOVE 275 GHz

Under EUMETSAT contract, a study on required frequency band allocations for passive sensors above 275 GHz has already been completed in 2001/2002. In this study passive sensor bands for future meteorological and climatological applications (EESS passive) in the frequency range 275-1000 GHz are identified and characteristics, sharing conditions and protection requirements of passive sensor bands are analysed. One outcome of this study is a list of candidate frequency bands for microwave passive sensing from 275 GHz to 1000 GHz. This list is based on RR Footnote 5.565 and Recommendation ITU-R SA.515-4 to which further bands were added on the basis of inputs and comments from the scientific community and information on existing and planned projects at that time.

The table below, that is based on the outcome of the above mentioned EUMETSAT study with further updated information on existing and planned projects, shows that the list of frequency bands as contained in RR footnote 5.565 and Recommendation ITU-R SA.515-4 is not exhaustive. This table constitutes a first rough overview of the growing number of instruments and applications under development, or already in operation, in bands above 275 GHz. It has been prepared to trigger further considerations within SFCG with the objective of consolidating a list of frequency bands and to determine the corresponding instrument performance and protection levels in view of a potential agenda item for WRC-2010.

Proposed allocation (GHz)	Total BW required (GHz)	ΔT_e required (K)	Data availability (%)	Geophysical parameter	Scanning conf. (Nadir, Limb)	Comments, Existing and planned sensors
<u>275-277</u> (1)	<u>2</u>	<u>0.005</u> <i>0.05</i> (2)	<u>99</u> <i>95</i> (02)	Minor	L	Ground based measurements
277-282 (2)	5	0.05	95	Minor	L	Ground based measurements
294-306 (1) 298-305 (4)	<u>12</u> 7 (4)	<u>0.2/0.005</u> (3) <i>0.2/0.11</i> (4)	<u>99.99/99</u> (3) <u>99.99/95</u> (4)	Minor	N, L	MASTER
316-334 (1) 318-325 (4)	<u>18</u> 7 (4)	<u>0.3/0.005</u> (3) <i>0.3/0.12</i> (4)	<u>99.99/99</u> (3) <u>99.99/95</u> (4)	H ₂ O pro, Min.	N, L	MASTER
335-345 (2)	10	0.05	99.99/99 (3)	Min. window	N, L	Future, GEO MW
<u>342-349</u> (1) 342.25 – 347.75(4)	<u>7</u> 5.5 (4)	<u>0.3/0.005</u> (3) <i>0.3/0.04</i> (4)	<u>99.99/99</u> (3) <u>99.99/95</u> (4)	Minor	N,L	MASTER
363-365 (1)	<u>2</u>	<u>0.005</u>	<u>99</u>		L	
<u>371-389</u> (1)	<u>18</u>	<u>0.3</u>	<u>99.99</u>	H ₂ O prof.	N	GOMAS
364-396 (2)	32	0.05	99.99	AMV	N	GEO MW
<u>416-434</u> (1) 420.75- 428.75(2)	<u>18</u> 8 (2)	<u>0.4</u> <i>0.02</i> (2)	<u>99.99</u> <u>99.99</u> (2)	O ₂ prof. Ice Clouds	N	GOMAS GEO MW
<u>442-444</u> (1)	<u>2</u>	<u>0.005</u>	<u>99</u>	Minor	L	
<u>458.62-</u> <u>460.62</u> (2)	2	<i>0.12</i>	99	Ice clouds	N	CIWSIR
459-466 (2)	7		99.99	Ice clouds	N	CLOUDS
<u>464.62-</u> <u>466.62</u> (2)	2	<i>0.12</i>	99	Ice clouds	N	CIWSIR
486-496 (2)	10		99	H ₂ O	L	SMR (Odin), SWAS
<u>496-506</u> (1) <u>497-503</u> (4)	<u>10</u> 8 (4)	<u>0.5/0.005</u> (3) <i>0.5/0.05</i> (4)	<u>99.99/99</u> (3) <u>99.99/95</u> (4)	Min. window	N,L	ODIN, SOPRANO, MASTER
<u>541-546</u> (2)	5			Minor	L	SMR (Odin)
<u>546-568</u> (1)	<u>12</u>	<u>0.5/0.005</u> (3)	<u>99.99/99</u> (3)	H ₂ O	N, L	SMR (Odin), SWAS
<u>568-584</u> (2)	16		99	Meso.H ₂ O	L	SMR (Odin)
606-608 (2)	2			Minor		Airborne measurements
612-614 (2)	2			Minor		Airborne measurements
619-622 (2)	2			Minor		Airborne measurements

Proposed allocation (GHz)	Total BW required (GHz)	ΔT_e required (K)	Data availability (%)	Geophysical parameter	Scanning conf. (Nadir, Limb)	Comments, Existing and planned sensors
<u>624-629</u> (1) 624.62-626.62(4)	<u>5</u> 2 (4)	<u>0.005</u> 0.15 (4)	99 95 (4)	Minor	L	MLS, SMILES, SOPRANO, MASTER
<u>634-654</u> (1)	<u>20</u>	<u>0.5/0.005</u> (3)	<u>99.99/99</u> (3)	Min. window	N,L	MLS, SMILES, SOPRANO
<u>659-661</u> (1)	<u>2</u>	<u>0.005</u>	<u>99</u>	Minor	L	MLS (Aura)
<u>676.45-679.45</u> (2)	<u>3</u>	<u>0.15</u>	<u>99</u>	Ice clouds	N	CIWSIR
<u>676-684</u> (2)	<u>8</u>		<u>99.99</u>	Ice clouds	N	CLOUDS
<u>685.45-688.45</u> (2)	<u>3</u>	<u>0.15</u>	<u>99</u>	Ice clouds	N	CIWSIR
<u>684-692</u> (1)	<u>8</u>	<u>0.005</u>	<u>99</u>	Ice clouds	N,L	CLOUDS
<u>730-732</u> (1)	<u>2</u>	<u>0.005</u>	<u>99</u>	Minor	L	SOPRANO
<u>743-761</u> (2)	<u>18</u>		<u>99.99</u>	H ₂ O prof.	N	
<u>825-843</u> (2)	<u>18</u>		<u>99.99</u>	O ₂ prof.	N	
<u>851-853</u> (1)	<u>2</u>	<u>0.005</u>	<u>99</u>	Min. window	L	SOPRANO
<u>866.88-869.88</u> (2)	<u>3</u>	<u>0.18</u>	<u>99</u>	Ice clouds	N	CIWSIR
<u>868-881</u> (2)	<u>13</u>		<u>99.99</u>	Ice clouds	N	CLOUDS
<u>878.88-881.88</u> (2)	<u>3</u>	<u>0.18</u>	<u>99</u>	Ice clouds	N	CIWSIR
<u>951-956</u> (1)	<u>5</u>	<u>0.005</u>	<u>99</u>	Minor	L	SOPRANO

(1) RR Footnote 565 and ITU-R SA.515-4

(2) Required by existing and planned instruments but not listed in the original recommendation, or inputs from the scientific community.

(3) Second number for microwave limb sounding applications

(4) Latest MASTER requirements

MASTER: Millimeter Wave Acquisitions for Stratosphere/Troposphere Exchange Research

MLS: Microwave Limb Sounder

SOPRANO: Sub-Millimeter Observation of Processes in the Atmosphere noteworthy for Ozone

SMILES: Superconducting Sub-Millimeter Wave Limb Emission Sounder

CIWSIR: Cloud Ice Water Submillimeter Imaging Radiometer

SMR: Sub-mm Radiometer on Odin satellite

GOMAS: Geostationary Observatory for MW Atmospheric Sounding

GEO MW: MW/Sub-mm radiometry for precipitation estimation and cloud property definition

CLOUDS: Clouds, Aerosol, Radiation and Precipitation Explorer

SWAS: Sub-Millimeter Wave Astronomy Satellite

3 CONSIDERATION

The purpose of bringing this issue to the attention of CGMS is to inform about the opportunity for an agenda item for WRC-2010, subject to confirmation by WRC-2007, with the aim of including required frequency band allocations above 275 GHz with the appropriate protection measures.

Condition for the successful retention of such an agenda item for WRC-2010 is the proven requirement for frequency band allocations and companion regulations above 275 GHz and the active support from the science community for such an agenda item in the preparation process for WRC-2007.

SFCG has started working on the consolidation of the passive frequency band requirements and the corresponding instrument performance and protection levels for passive sensors operating above 275 GHz.

CGMS members are invited to note the information provided and to contribute to their SFCG representatives as appropriate.