

**National Aeronautics and Space Administration,
Department of Commerce, and
Department of the Air Force
Comments
to the Federal Communications Commission Public Notice (WT Docket No. 20-133)
Regarding
Wireless Telecommunications Bureau Seeks to Supplement the Record on
70/80/90 GHz Bands Notice of Proposed Rulemaking**

Introduction

The National Aeronautics and Space Administration (NASA), Department of Commerce (DOC), and Department of the Air Force (DAF) (hereafter “Joint Agencies”) submit the following comments on the Federal Communications Commission (FCC) Public Notice (PN) seeking to supplement the record in the rulemaking on Modernizing and Expanding Access to the 70/80/90 GHz Bands (WT Docket No. 20-133). In particular, we comment on the possible use of these bands by High Altitude Platform Stations (HAPS), their impact to existing and planned operations, and the adequacy of existing regulations for protection of the following services:

- Earth Exploration Satellite Service (EESS) (passive) and Space Research Service (SRS) (passive) in 86.0-92.0 GHz,
- EESS (active) and SRS (active) in 94.0-94.1 GHz, and
- Fixed Satellite Service (FSS) and Mobile Satellite Service (MSS) in 71.0-76.0 GHz (space-to-Earth) and 81.0-86.0 GHz (Earth-to-space).

EESS (active and passive) and SRS (active and passive) Operations

The Joint Agencies recognize the FCC’s continued efforts to ensure science research activities are not significantly impacted when considering spectrum access for developing and emerging technologies. However, the Joint Agencies note that the PN does not address, in detail, provisions or requirements to protect Science Services operating in adjacent-bands allocated for EESS (active and passive) and SRS (passive). Moreover, the PN does not extend the existing regulations to the protection of the adjacent-band services.

It is worth noting that existing provisions in the International Telecommunication Union (ITU) Radio Regulations (RR) to protect EESS (passive) in the 86.0-92.0 GHz band from adjacent-band fixed service operations are 18 to 32 dB more stringent than the current Part 101 Rules, and high elevation angle links associated with HAPS usage (e.g., ground-to-HAPS links) present significantly worse interference geometries to EESS (passive) than those used to derive the existing provisions. Therefore, studies are required to determine the necessary limitations on unwanted emission levels to protect EESS (passive) operations prior to allowing HAPS systems to operate adjacent to 86.0-92.0 GHz.

The Joint Agencies conduct specific agency missions within the bands and rely on data from partner agency operations in the following bands. [It is important to note that data gathered from partner agencies, including those missions operated by international partners, are critical to developing a robust and comprehensive product.]

- o 86.0–92.0 GHz

The 86.0-92.0 GHz band is used operationally for EESS (passive) sensing as the reference measurement window for atmospheric temperature soundings taken in another band near 118.0 GHz. Additionally, passive microwave measurements near the 89.0 GHz atmospheric window play an important role in the retrieval of precipitation data, particularly over land. Microwave imager data from this band is used to characterize ocean surface vector winds, tropical cyclone intensity, snow depth, soil moisture, and sea ice. The measurements, in combination, are used to assess water abundance in clouds and the atmosphere. The science products are used in weather and climate models.

The Joint Agencies note the following provisions for this band:

- Active service use of the bands adjacent to the 86.0-92.0 GHz band must ensure protection of EESS (passive) operations at an interference level no worse than is afforded by ITU-R RS.2017 “Performance and interference criteria for satellite passive remote sensing.” When comparing against these protection levels, interference aggregation from all HAPS stations and inter-service operations (fixed service, the mobile service, etc.) must be accounted for.
- United States (U.S.) Table of Frequency Allocations footnote US246, which states, “No station shall be authorized to transmit in the 86-92 GHz band.”
- ITU RR footnote 5.340, which states, “All emissions are prohibited in the 86.0-92.0 GHz band.”

As shown in Table 1, this band is used extensively by partner agencies (NASA, DOC – National Oceanic and Atmospheric Administration (NOAA), European Space Agency (ESA) and European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), China Meteorological Administration (CMA), Japan Aerospace Exploration Agency (JAXA), Indian Space Research Organisation (ISRO), and Russian Federal Space Agency (Roscosmos)) to produce data products from the missions listed below, primarily for meteorological and climate science purposes.

<u>Table 1</u> – 86.0-92.0 GHz Current and Future EESS (passive) Missions (includes partner and collaborative missions)		
Instrument	Mission	Primary Organization
MWHS-2	FY-3C through -3F, -3H, -3I	CMA

MWRI-RM	FY-3G and -3J	CMA
MWRI	FY-3B through -3F, -3H	CMA
[TBD]	Arctic Weather Satellite (AWS)	ESA
MWS	EPS-SG, METOP-SG-A1 to A3	EUMETSAT
AMSU	MetOp-A through -C	EUMETSAT
MHS	MetOp-A through -C	EUMETSAT
MWI	EPS-SG, METOP-SG-B1 to B3	EUMETSAT
MADRAS	Megha-Tropiques	ISRO
AMSR-2	GCOM-W	JAXA
AMSR-3	GOSAT-GW	JAXA
AMSU	AQUA	NASA
TMS	TROPICS	NASA
GMI	GPM	NASA
AMSU	NOAA-15, 18, 19	NOAA
ATMS	JPSS-1 through -4	NOAA
ATMS	SNPP	NOAA
MHS	NOAA-18, 19	NOAA
MTVZA-GY	Meteor-M N2, N2-2 through N2-6	RFSA
MTVZA-GY-MP	Meteor-MP N1 and N2	RFSA
MWI	WSF-M	DAF
SSMIS	DMSP-F17 and -F18	DAF
SSM/I and SSM-T2	DMSP-F15	DAF

o 94.0–94.1 GHz

The 94.0-94.1 GHz band includes an allocation to EESS (active) and SRS (active) for active sensing of cloud structures using radar. This is an important band for assessing cloud profiles and cloud physical properties and their seasonal and geographical variations. The data gathered is used to evaluate the way clouds are parameterized in global weather and climate models, contributing to improved predictions of weather, climate and the cloud-climate feedback problem. The data is also used in conjunction with sensing products in other bands to derive additional information useful to weather and climate models. The band is shared with other radiolocation systems and with Radio Astronomy, which has a secondary allocation.

The Joint Agencies note the following provisions for this band:

- Operations in the 94.0-94.1 GHz band must ensure protection with Federal EESS (active) operators as afforded by ITU-R RS.1166, “Performance and interference criteria for active spaceborne sensors.” Further, ITU-R RS.1166-4 prescribes the aggregate interference power threshold that cannot be exceeded to ensure proper operation of EESS (active) service.
- ITU RR footnote 5.562, which states, “The use of the band 94.0-94.1 GHz by the Earth Exploration-Satellite (active) and Space Research (active) services is limited to spaceborne cloud radars.”

Table 2 depicts the current and future EESS (active) and SRS (active) missions.

<u>Table 2</u> – 94.0-94.1 GHz Current and Future EESS (active) Missions (includes partner and collaborative missions)		
Instrument	Mission	Primary Organization
CPR	EarthCARE	ESA

FSS, MSS, and Radiolocation Operations

The DAF notes the PN does not address, in detail, provisions for protecting:

- Federal allocations of the FSS and MSS allocation in 71.0-76.0 GHz (space-to-Earth) and 81.0-86.0 GHz (Earth-to-space), and
- Federal allocated Radiolocation Services within and adjacent to the proposed 92.0-94.0 GHz and 94.1-95 GHz bands (Federal radiolocation allocations for 92.0-94.0 GHz, 94.0-94.1 GHz, 94.1-95.0 GHz bands).

In the 71.0-76.0 GHz and 81.0-86.0 GHz bands, the DAF is executing research and development efforts to develop new technologies that are paving the way for the future use of these wide bandwidth allocations. Specifically, the W/V-Band Satellite Communications Experiments (WSCE) Programs are gathering necessary data for future mission planning and helping to mature components. The proposals in this PN, including addition of HAPS, could significantly complicate spectrum sharing between future space and terrestrial uses of the band.

Furthermore, the DAF operates imaging radars as part of the U.S. Space Surveillance Network to characterize satellites on orbit and provide space situational awareness. The Haystack Ultrawideband Satellite imaging Radar (HUSIR) Program includes a W-Band radar that has the imaging resolution required to characterize the increasing number of small satellites. HUSIR-W operates in 92.3-100.0 GHz and is the only radar available to provide the image resolution required to support the U.S. Space

Surveillance Network. Emissions from HAPS can be a particularly serious source of interference to sensitive radiolocation services used to track space objects.

HAPS Spectrum Requirements and Allocations

The record is unclear as to the specific requirement for additional spectrum access into the 70/80/90 GHz bands to support HAPS, and whether existing allocations are either congested or unsuitable. Previous international and domestic regulations were pursued, which allocated eight bands to support such operations. The PN does note that “several advocates for HAPS are no longer pursuing their planned operations” in certain bands and are seeking access into 70/80 GHz. (See footnote 16.) The Joint Agencies inquire as to the FCC’s plans with respect to underused or un-used spectrum that is no longer being pursued by HAPS advocates.

Conclusion

The Joint Agencies reiterate the importance of the EESS (active and passive) and SRS (passive) bands to meteorology and climate science. Any additional usages for active services should be based on sound engineering studies to determine the limitations on unwanted emission levels to protect EESS (passive), EESS (active) and SRS (passive) operations prior to allowing HAPS systems to operate adjacent to 86.0-92.0 GHz and 94.0-94.1 GHz.

Moreover, the DAF restates the importance of the FSS, MSS, and radiolocation bands to meet current DAF objectives and enable future missions. Studies are required to assess compatibility and impact to DAF operations.

RJ Balanga, NASA

David Franc, DOC

Thu Luu, DAF