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The Implications of Classifying the Electromagnetic Spectrum as a Space Resource Rather than a Global Commons in connection with Space Ventures

George Anthony Long
Managing Member, Legal Parallax
P. O. Box 18282, Fountain Hills, AZ 85269
gal@legalparallax.com
www.legalparallax.com

Abstract

The electromagnetic spectrum ("EMS") is a natural continuum of all frequencies of electric and magnetic radiation that propagate energy and travel through space in the form of waves. The known EM frequencies consist of radio waves, microwaves, infrared (IR), visible light, ultraviolet (UV), X-rays and gamma rays. Radio waves, microwaves, infrared and visible light currently constitute the EM frequencies utilized for communications and transmission of data and information.

A global commons is an area or domain viewed as being subject to shared or collective governance and/or use among States. While the term "space resource," does not have an agreed upon international definition, it has been defined as a natural resource in situ in outer space and as an abiotic resource in situ in outer space. The EMS comes within either definition of space resource.

Terrestrially, the portions of the EMS used for communication and the transmission of data and information are treated as a global commons. At the international level, it is regulated and allocated by the International Telecommunications Union ("ITU") with individual States having the responsibility of administering the ITU's policies and allocations. However, if the EMS is viewed as a space resource for purposes of ventures and activities in outer space, then its use and exploitation can be governed by a State's domestic law rather than being governed as a shared or collective domain.

This paper will explore the implications of the EMS being classified solely as a space resource when used in connection with space activities. This will entail examining the impact such a classification will have on the existing protocols governing communications and the transmission of data and information for deep space and Earth orbit activities in the New Space era.

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Key Words: electromagnetic spectrum, space resources, global commons, property rights, ITU, Executive Order 13519

I. Acronyms/Abbreviations

EMS = Electromagnetic Spectrum

EO = Executive Order

ITU = International Telecommunications Union

II. INTRODUCTION

The electromagnetic spectrum (“EMS”) is an abiotic resource which is a continuum of all frequencies of electric and magnetic radiation that naturally propagate energy and travel through space in the form of waves [1]. Radio waves are a portion of the EMS used terrestrially for telecommunication purposes and are generally viewed and treated as a global commons. [3]. While there is not a consensus definition of the term “global commons,” it is said to refer to terrestrial areas beyond national jurisdiction, like the high seas and international air space, which serve as arteries “of the international system.”[4]. As an artery of the international system, all people have access to and share the EMS’ radio wave frequencies with their terrestrial use for telecommunications purposes historically being regulated by the International Telecommunications Union (“ITU”).

The terrestrial duality of the EMS’ radio wave frequencies being a natural resource as well as a global commons may not readily translate into the outer space domain located beyond Earth orbit. For instance, if space is not viewed as a global commons, then it is reasonable to view the resources situated in the space domain are not deemed to be a global commons or part of a global commons. This perspective tends to negate the concept of international regulation of the exploitation and use of space resources, which includes the sharing of such resources and their benefits. It also gives rise to the belief that ownership or property rights may attach to abiotic resources “in situ” in outer space. Moreover, and most important for purposes of this paper, this vision of ownership and property rights of space resources does not distinguish between physical abiotic natural space resources such as ice and helium 3, and non-physical abiotic natural space resources such as solar light, solar energy and the EMS. The foreseeability of exerting ownership or property rights over abiotic non-physical space resources “in situ” in outer space, such as the EMS’ radio wave frequencies, is feasible not only because of national State legislation authorizing the exploitation and use of abiotic space resources, but also because a major space power has proclaimed that space is not a global commons [3].

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This paper will briefly explore the implications of the EMS not being viewed as a duality of a natural resource and global commons for purposes of State laws allowing the exploitation of space resources. It will focus on the radio wave portion of the EMS *in situ* in outer space being viewed solely as a space resource.

III. Overview of the ITU Regulation

The ITU is an international entity under the auspices of the United Nations which is governed by a Constitution, Convention, and Radio Regulations. Essentially, “the ITU allocates global radio spectrum and satellite orbits and develops technical standards to ensure that networks and technologies seamlessly interconnect” [5]. Although the EMS is an abundant and renewable resource, it is considered a “limited” or “scarce” resource when used for telecommunications purposes. This classification exists because technology is necessary to access and use the EMS for telecommunications purposes and historically, technology has only allowed the beneficial use of any particular frequency in a certain geographical area to one user “at any one time” [2]. When more than one person seeks to use the same frequency at the same time in the same geographical region, then that gives rise to what is called “interference” [2]. The sharing of telecommunications frequencies and the avoidance or minimizing of interference or more specifically, “harmful interference,” in telecommunications constitutes the genesis of and *raison d’être* for the ITU [2].

The ITU does not prohibit all interference. Instead, its goal is to promote equitable sharing of frequencies and to eliminate “harmful interference” terrestrially as well as in space. Regarding space, ITU Constitution Article 44(2) instructs member States to “bear in mind that radio frequencies and any associated orbits, including the geostationary-satellite orbit, are limited natural resources and that they must be used rationally, efficiently and economically, in conformity with the provisions of the Radio Regulations...” Article 44(2) also informs that the purpose of this instruction is to allow other countries or group of countries to “have equitable access to those orbits and frequencies, taking into account the special needs of the developing countries and the geographical situation of particular countries.” ITU Constitution Article 45(1) then expressly obligates its members to establish and operate all telecommunication and other stations:

... in such a manner as not to cause harmful interference to the radio services or communications of other Member States or of recognized operating agencies, or of other duly authorized operating agencies which carry on a radio service, and which operate in accordance with the provisions of the Radio Regulations.

Article 45(3) further instructs its members to “recognize the necessity of taking all practicable steps to prevent the operation of electrical apparatus and installations of all kinds from causing harmful interference to the radio services or communications” of others. At this juncture, it may

be of assistance to be aware of the definition associated with certain terms utilized in ITU Constitution Article 45 as defined by the Article 1 of the ITU's Radio Regulations.

Pursuant Article 1, the word "telecommunication" means "[a]ny transmission, emission or reception of signs, signals, writings, images and sounds or intelligence of any nature by wire, radio, optical or other electromagnetic systems" while "station" means "[o]ne or more transmitters or receivers or a combination of transmitters and receivers, including the accessory equipment, necessary at one location for carrying on a radiocommunication service, or the radio astronomy service." A space station is "[a] station located on an object which is beyond, is intended to go beyond, or has been beyond, the major portion of the Earth's atmosphere." Article 1 defines "interference" as the effect of unwanted energy caused by one or a combination of "emissions, radiations, or inductions upon reception in a radiocommunication system, manifested by any performance degradation, misinterpretation, or loss of information which could be extracted in the absence of such unwanted energy" "Harmful interference" is defined as **"interference which endangers the functioning of a radio navigation service or of other safety services or seriously degrades, obstructs, or repeatedly interrupts a radiocommunication service operating in accordance with Radio Regulations."** Radionavigation refers to determining "the position, velocity and/or other characteristics of an object, or the obtaining of information relating to these parameters, by means of the propagation properties of radio waves" which are used for navigational purposes, "including obstruction warning." A "space radiocommunication" is "[a]ny radiocommunication involving the use of one or more space stations or the use of one or more reflecting satellites or other objects in space. These definitions in conjunction with ITU Constitution Articles 44 and 45 indicate that a State's space activities should refrain from endangering the functioning of a radio navigation service or seriously degrading, obstructing, or repeatedly interrupting a radiocommunication service operating in accordance with the ITU's radio regulations.

Despite the extensive regulation designed to avoid harmful interference, the ITU lacks enforcement powers. Pursuant to ITU Constitution Article 6 and Radio Regulations Art. 15.21 § 13, the ITU relies on member States to abide by and enforce its Constitution, Convention and Radio Regulations. The lack of specific enforcement powers does not necessarily deprive the ITU of regulatory tools to persuade an errand State member to comply with its authority in the outer space domain. For instance, since a State does not own the orbital slots assigned to it by the ITU, the ITU could withdraw recognition of the assigned orbital slots or deny assigning any new orbital slots to the State for its failure to comply with or enforce ITU regulations [6]. However, without express authority to take such action, the ITU, in all likelihood, will not venture down that path.

The above synopsis sets the scenario within which the EMS is internationally shared and regulated in space as a global commons for telecommunications purposes. With this background, focus now turns to the perspective that outer space and space resources are not a global commons and therefore are subject to becoming a property right of a space actor.

IV. The Perspective that Outer Space and Space Resources Are Not a Global Commons

Given the extensive and historic ITU regulation of telecommunications between Earth and space, space and Earth and satellites in Earth orbit, the ITU's governance of the frequencies associated with such telecommunications is deeply entrenched. Accordingly, it is simply unrealistic to believe that this terrestrial related regulatory structure, constructed on the notion that the EMS telecommunication frequencies are a global commons, will be discarded or abandoned. However, the perspective of outer space and space resources not being a global commons is beginning to emerge which triggers the notion that the EMS "in situ" in outer space may not be a global commons when it concerns telecommunications between locations or objects beyond Earth orbit.

The notion that outer space is not a global commons gained traction with United States Executive Order ("EO") 13914, 84 Federal Register 20, 381(10 April 2020), in which announced the United States' new policy position that it does not consider outer space to be a global commons. Specifically, the United States proclaimed that:

Americans should have the right to engage in commercial exploration, recovery, and use of resources in outer space, consistent with applicable law. **Outer space is a legally and physically unique domain of human activity, and the United States does not view it as a global commons.** Accordingly, it shall be the policy of the United States to encourage international support for the public and private recovery and use of resources in outer space, consistent with applicable law.

It should be noted that the EO omits asserting that outer space is not a global commons. Instead, the EO takes the tact that the United States does not "view" outer space as a global commons. This policy position diverges from the traditional view that outer space is a global commons and caused some scholars to aver that:

[t]here has, however, been a long-standing consensus among states that the recovery and use of space resources should be governed by an international agreement, as has been done in other "areas beyond national jurisdiction" where resources are recognized as constituting "global **commons**," for example, the deep seabed, international airspace, and the **radio frequency** spectrum ... The current US Administration takes the unprecedented position that outer space is not a global **commons**. It favours a unilateral approach to governing the recovery and use of space resources.[3]

The EO indicates that, in the context of the use and exploitation of space resources, the United States will proceed on the basis that space resources are not a global commons. The United States defines what it considers to be a space resource in the Commercial Space Competitiveness Act, codified at 51 U.S.C. §§ 51301 - 51303.

Section 51301 defines a “space resource” to mean an “abiotic resource in situ in outer space” and clarifies that the term includes natural resources such as water and minerals. Abiotic means the absence of life or living organisms [7]. Thus, the definition’s use of the term “abiotic” establishes that a space resource cannot be biotic or derived from living organisms. The definition does not, however, distinguish between physical or non-physical abiotic resources. Likewise, the definition does not limit a “space resource” to natural resources and can encompass resources in space which are of artificial origin [8]. In any event, the EMS is abiotic as it is not and has not been alive and is “in situ” in outer space. The EMS, therefore, comes within the definition of a space resource under United States domestic law. This results in the EMS being subject to § 51303 which allows the licensing of United States citizens to possess, own, use, and sell a space resource obtained in accordance with applicable law and international obligations.

Shortly after issuance of EO 13914, the United States’ space agency announced the Artemis Accords [9], which establishes an international partnership which principally governs the civil use of space resources located on the Moon [3]. Among other things, the Artemis Accords acknowledges that signatories will engage in utilization of natural resources and provides for the creation of Safety Zones which appear to allow a State to occupy, use, and control a particular area of the Moon for purposes of avoiding harmful interference with its space activities. It should be noted that the Artemis Accords reference to “harmful interference” does not refer to the ITU or the ITU’s definition of the term. Moreover, the Artemis Accords, like EO 13914 and the Commercial Space Competitiveness Act, qualifies that the utilization of space resources will be subject to applicable international obligations. This raises the issue of whether a State can authorize the acquisition of property rights in the telecommunication frequencies in outer space or otherwise regulate space telecommunications independent of the ITU.

V. The ITU Issue

The ITU’s Constitution and Radio Regulations negate the acquisition of property rights in telecommunication frequencies. However, this prohibition is premised upon the need to share telecommunication frequencies and avoid harmful interference. Accordingly, if technology is developed which allows for the use of a telecommunication frequency which does not interfere with another’s use of the same frequency in the same geographical location at the same time, then a State authorizing a property right in a telecommunication frequency in space may be consistent with its ITU obligations. While such a technological development may emerge, that has not yet occurred.

Another approach can seek to assert that the ITU’s regulatory authority over the EMS resource should not be extended to space telecommunications lacking a terrestrial nexus or a nexus to Earth orbit activity. Without such a limitation, the ITU literally has universal regulatory authority over human telecommunications regardless of its nexus to Earth. Such a reach of the ITU is not consistent with maintaining that outer space is *res nullis* rather than a global commons.

Res nullis denotes an area that belongs to no one. If an area does not belong to anyone, then it is logical that someone can possibly assert a property interest in the natural resources located in res nullis without appropriating any portion of the res nullis. This is not an unusual tenet as applied in the space context, as the United States, without an objection from any country, asserts property rights to the lunar natural resources harvested during the Apollo program without claiming any rights to the Moon [10]. Thus, if outer space is considered to be res nullis, then a property right interest in the use of a space resource which lacks any nexus to Earth can be appropriate. This suggests that communications between and among installations and objects beyond Earth orbit should be beyond ITU regulatory control. Under this scenario, private space actors may be able to obtain a property right in a telecommunication frequency used for such non-terrestrial related telecommunications. This conceivably creates the opportunity for the emergence of private space telecommunications services for telecommunications lacking a terrestrial nexus.

In addition to the above, an ITU member State may simply rely on the ITU Constitution to circumvent ITU regulatory control over space communications which are purely extraterrestrial, although such a measure may not involve the assignment of property rights.

ITU Constitution Article 34 allows a State, in accordance with its national law to “cut off,” any private communication “which may appear dangerous to the security of the State or contrary to its laws, to public order or to decency.” Similarly, ITU Constitution Article 35 reserves to each State “the right to suspend the international telecommunication service, either generally or only for certain relations and/or for certain kinds of correspondence, outgoing, incoming or in transit.” Article 35 does not appear to require a State to proffer any reason for a suspension. It is said that the rights bestowed by Articles 34 and 35 can conceivably be employed to disrupt certain satellite communications without violating the ITU’s regulatory regime [11]. Thus, Articles 34 and 35 may serve as a basis under the Artemis Accords to regulate, restrict, or “cut-off” external communications surrounding a State’s safety zone. The Articles may also allow a State to regulate, restrict, or “cut-off” telecommunications surrounding asteroids or other areas in space in which it has licensed the use and exploitation of space resources without violating the ITU.

Lastly, the issue surfaces as to whether the Outer Space Treaty [12]. can negate extending the ITU’s regulatory authority to telecommunications with a terrestrial nexus. For instance, Outer Space Treaty Article IX contains a mechanism for addressing “potentially harmful interference” with the space activities of others. While the Outer Space Treaty does not define the term “harmful interference” its unrestricted and unqualified definition is sufficiently broad to encompass the ITU’s definition. Given that the ITU does not possess any enforcement authority, then reliance on Outer Space Treaty Article IX’s procedure for resolving harmful interference with telecommunications should be just as effective as the ITU’s reliance on State’s to ensure compliance. Moreover, given that human activities beyond Earth orbit is in its infancy, it may not be prudent to automatically extend a terrestrial based telecommunications regulatory regime to telecommunications without a nexus to Earth. Prudence may suggest taking the time to ascertain whether such a regime is necessary for all space telecommunications regardless of their terrestrial nexus.

CONCLUSION

The EMS' radio wave frequencies are an abiotic space resource. Historically and currently, the frequencies have been considered a global commons terrestrially, subject to sharing and regulation at the international level. However, if outer space is not a global commons, then the EMS, like any other abiotic space resource, is arguably not subject to the sharing and regulation by an international body without consent. This raises the fundamental issue of whether the EMS frequencies used in connection with space telecommunications lacking a terrestrial nexus should be treated solely as a space resource under a State's domestic law. While this is a reasonable proposition, the focus shifts to whether this approach is consistent with a State's international responsibility and obligation under the ITU regulatory regime. This is essentially an emerging question which potentially opens the path for privatization of non-terrestrial space communications through the acquisition of ownership of or property rights in EMS frequencies or alternatively State, rather than international, regulation of the frequencies for the space telecommunications of its nationals which lack a nexus to Earth or Earth orbit.

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