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# Satellite communications law: The nexus of space and telecom law

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## 1. THE WORLD OF SATELLITE COMMUNICATIONS

Satellite communications is not only effectively the oldest, but without a doubt also the most important application of space technology for terrestrial societies. This, however, was not always as self-evident as it may seem in hindsight.

Since Arthur Clarke's seminal paper of 1945<sup>1</sup>, explaining how a mere three man-made satellites in the right orbital positions could function as the core of a telecommunication infrastructure for almost-comprehensive coverage of the globe, it took roughly two decades for the technology to mature sufficiently for that option to become feasible. While the first Telstar launched in 1962 provided for the first transmission of television pictures and phone calls from, respectively through space on an experimental basis<sup>2</sup>, it was 1965's Early Bird which truly marked the birth of the commercial satellite communication industry<sup>3</sup>.

Early Bird was operated by COMSAT, the US corporation created by federal statute<sup>4</sup> which also served as the foundation for the ensuing US efforts to open up the system to international cooperation. This was achieved in first instance by the establishment of Interim INTELSAT in 1964<sup>5</sup>, where COMSAT was uniquely responsible for operating the satellite system, until in 1971 the truly intergovernmental organization INTELSAT was established, where the United States was merely one (albeit the most important) member state<sup>6</sup> and COMSAT merely one (albeit the most important) national telecom operator involved<sup>7</sup>.

The successful example of INTELSAT was followed by other organizations established for basically similar purposes. INMARSAT (originally for maritime satellite communications but later engaged in mobile satellite communications *lato sensu*)<sup>8</sup> and EUTELSAT (essentially a European version of INTELSAT much more focused on broadcasting)<sup>9</sup> followed the two-level structure of INTELSAT quite faithfully, while the Soviet-Union-led INTERSPUTNIK<sup>10</sup> and the Saudi-Arabia-hosted ARABSAT<sup>11</sup> were established as more classical intergovernmental organizations operating their own respective satellite systems.

Originally, international satellite communications, more precisely the comprehensive chain of launching, operating and maintaining satellite systems as well as mar-

keting the services making use of those, thus was very much the exclusive domain of a handful of intergovernmental entities. But then, from the 1980s onwards, the ongoing technological and economic developments and the resulting interest of the private sector in this special branch of telecommunications meant that the pressure on privatization of these organizations and the liberalization of the corresponding markets increased. This resulted in the privatization of INTELSAT, INMARSAT and EUTELSAT, where henceforth private commercial operators Intelsat, Inmarsat and Eutelsat would operate the satellite systems and market the relevant services<sup>12</sup>. Currently, the global market for satellite communication services is calculated to be worth in the range of 70 billion US\$ annually – and to be growing by something close to 10% per year<sup>13</sup>.

## 2. SATELLITE COMMUNICATIONS: THE TECHNOLOGY AND THE LAW

When addressing the legal aspects of satellite communications, one should realize that at the most fundamental level the activities concerned are conducted by a system comprised of three main generic sets of component elements.

The first one concerns the terrestrial components. This comprises both ground stations controlling the satellites in terms of for instance their orbital positions and monitoring their operational status, the so-called Telemetry, Tracking & Control (TT&C) functions, and ground stations actually allowing for the satellites to deliver their services to users so interested – in this case, either two-way communications such as phone, fax or email exchanges or one-way broadcasts such as radio, television and Internet<sup>14</sup>. Ground stations, in particular if of a ‘fixed’ nature due to size, can very well combine the two sets of functions; conversely, in particular as for the actual service provision in recent decades technological advances have allowed for terminals to become ‘mobile’, in many cases even handheld.

It is important to realize – also with a view to legal analysis – that such terrestrial components do not (need to) exclusively connect via satellites. As a matter of fact, most connections still make use of terrestrial infrastructure such as cables for wired communications and cell towers for wireless communications; and usually the satellites only come into play when long distances need to be covered and/or natural obstacles such as oceans, deserts or mountain ranges need to be overcome. This also means that many of the particular individual phone calls or radio broadcasts using the infrastructure would not even make use of a satellite’s relay possibilities.

Legally speaking, terrestrial infrastructure usually finds itself on the territory of one State or another, which essentially means that all the legal aspects of its manufacturing, building and operation are handled by domestic law and regulation, unless and until such operations start to have international ramifications which may bring in international law<sup>15</sup>. Even terrestrial infrastructure operated from such quasi-territorial bases as ships, platforms or aircraft is at a first level addressed by domestic law, applied on a quasi-territorial basis to such ships, platforms or aircraft and only subject to such international law as is necessary to properly regulate their operations in international areas and as far as the relevant States have somehow assented to such treaty or customary international law<sup>16</sup>.

The second major element of any satellite communications system concerns the use of radio technology for the wireless connections, effectively resulting in the (invisible) “vibration of the air constituting a wave”<sup>17</sup>, the frequency of which is expressed in Hertz as the metric referencing the number of vibrations per second. The total spectrum of usable frequencies currently is perceived to run from 8.3 kHz to 3,000 GHz – at least, that is what the international regime on the use of radio frequencies has so far dealt with<sup>18</sup>. It is for practical purposes subdivided into frequency bands, usually indicated by the two bookending frequencies thereby also indicating the particular bandwidth, while often, certainly among telecommunication experts, short letter codes are used for the sake of brief reference<sup>19</sup>.

These radio waves traverse (1) the airspace between various terrestrial transmitters, receivers and combinations thereof, (2) airspace and parts of outer space as between terrestrial devices on the one hand and satellites (or other space objects) on the other hand, and/or (3) outer space only as between satellites. Following from the national sovereignty of individual States over their own national airspace<sup>20</sup>, the regulation of the use of radio frequencies as long as limited to national territory and national airspace again remains a matter of sovereign discretion without much interference by international law.

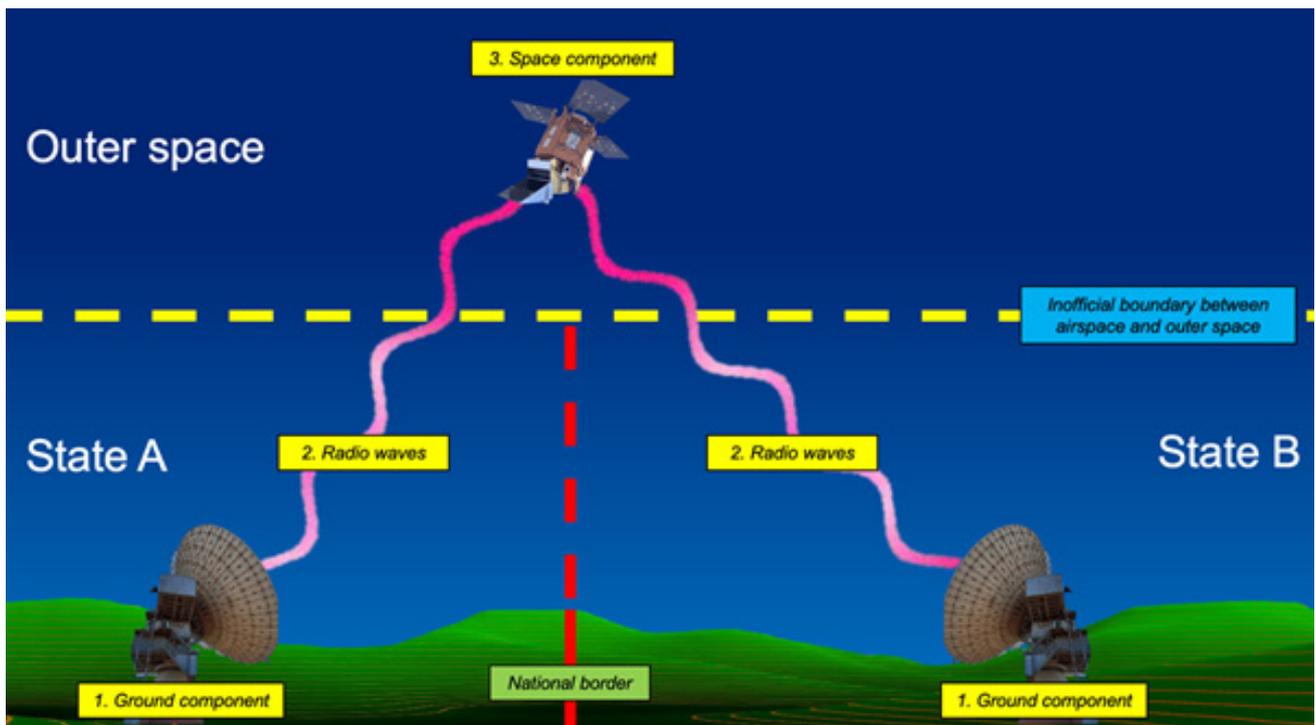
Whether exclusively addressed by national law or also (to be) impacted by international law, however, the overarching aspect of the use of radio waves for such applications as communications always concerns the laws of physics which simply dictate that the use of the same radio frequency by two transmitters in the same area results in white noise for both, thus calling for an efficient and enforceable system to avoid such (mutually) harmful interference – which is where law and regulation will (have to) come in.

The third element of a satellite communications system obviously concerns the satellites: man-made devices allowing for the relay, transmission, reception and broadcasting as applicable of the relevant radio waves at the relevant frequencies, orbiting in what is commonly accepted to be outer space<sup>21</sup>. Generally, but without specific legal connotations or even definitions, distinctions are made here between Low-Earth Orbits (LEO) of up to some 2,000 km above the Earth, Geostationary Orbit (GEO) at about 35,786 km altitude, Medium-Earth Orbits (MEO) basically in between LEO and GEO, and Highly Elliptical Orbits (HEO) which may have perigees sometimes as low as 600 km and apogees in the range of 40,000 km<sup>22</sup>.

Clarke’s paper of 1945 addressed the possibilities of the GEO orbit in view of the relatively easy and straightforward physical requirements for interconnection: viewed from Earth, the satellites essentially seemed ‘stationary’ (hence of course the epithet ‘geostationary’), meaning both that ground antennae needed to focus on only one particular spot in space (and maintaining occupation of that spot usually was fairly easy) and that the satellites’ transponders essentially needed to be directed only once. Only much later did technological advances make it possible for MEO and LEO systems to become a realistic possibility. Due to the larger velocities needed for satellites in those orbits to remain in orbit (in view of their closer proximity to Earth) they required more complicated hand-over techniques between various satellites following each other up over the horizon. At the same time, their closer proximity to Earth then allowed considerable cuts in power requirements and launch costs.

Outer space being, as will be seen, a fundamentally international area<sup>23</sup>, from the very beginning the use of satellites was addressed by international law, driving as necessary the establishment of national legislation to elaborate and apply the relevant international rules, rights and obligations – noting the fundamental fact that the overwhelming majority of space activities in outer space are still essentially remote-controlled from some place or other down on Earth.

**Figure 1:** Schematic overview of satellite communications system components from a legal perspective. ©2021 F.G. von der Dunk.

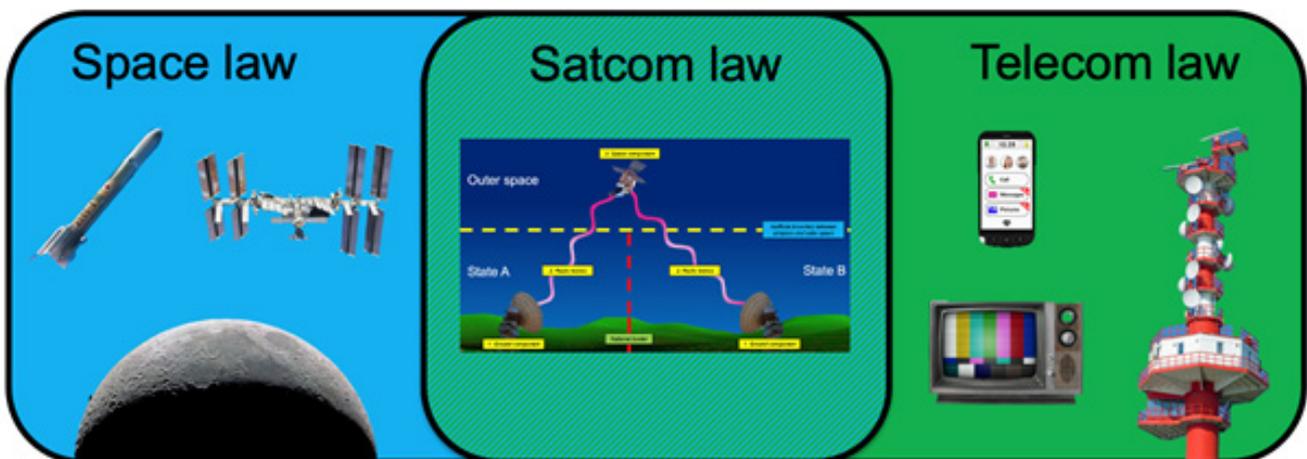


### 3. 'SATELLITE COMMUNICATIONS LAW'?

Following partly from the above brief analysis of satellite communications from a largely operational and technical perspective, it is difficult to discern a single body of satellite communications law as comprising a more or less monolithic set of coherent rules, even if only at the international level.

The present contribution will ignore for the sake of conciseness other potentially relevant other legal regimes which could be viewed as more or less coherent, such as international intellectual property rights law to the extent it impacts satellite communications technology<sup>24</sup> or private international law to the extent it impacts international contractual relationships in the sector<sup>25</sup>. Instead, it will focus on two major legal bodies of law both relevant to satellite communications – if there is indeed something we might sensibly refer to as 'satellite communications law', it finds itself at the nexus of those two regimes, of what may be confidently labelled 'space law' respectively 'telecommunications law'<sup>26</sup>.

**Figure 2:** The concept of 'satellite communications law' as the nexus of 'space law' and 'telecommunications law'. ©2021 F.G. von der Dunk.



Both regimes address much more than only satellite communications: space law addresses such issues as launch vehicle operations<sup>27</sup> or space station operations<sup>28</sup> and the legal status of celestial bodies and their exploration and use<sup>29</sup>, while telecommunications law addresses among others mobile phone services, TV broadcasts and radio cell tower operations<sup>30</sup>.

Both regimes were even originally developed very much without satellite communications in mind. Yet, they both provide for key legal rules, rights and obligations for satellite communications operators and regulators. In the following sections they will each be discussed separately, as to the main legal impacts they have on the operation of communication satellite systems and the provision of services using those.

## 4. INTERNATIONAL SPACE LAW – AND SATELLITE COMMUNICATIONS

Certainly as compared to telecommunications law, international space law still has a relatively distinguishable core, which is essentially comprised of the 1967 Outer Space Treaty<sup>31</sup>, the 1968 Rescue Agreement<sup>32</sup>, the 1972 Liability Convention<sup>33</sup> and the 1975 Registration Convention<sup>34</sup>, all rather widely ratified by the major spacefaring nations<sup>35</sup>.

Generally developed with a clear focus on military and security issues on the one hand and scientific aspects of space activities on the other<sup>36</sup>, this core of the *corpus juris spatialis internationalis* nevertheless provides for a number of principles and rules also of importance for satellite communications. Seven of those may be seen as actually crucial in that respect.

First, Article II of the Outer Space Treaty provides that “[o]uter space, including the Moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means”. This is generally perceived to provide outer space with a legal status as a kind of ‘global commons’, as an international *are(n)a* by definition falling outside of the territorial sovereignty of any individual State<sup>37</sup> thereby precluding any individual State from imposing its will by law in that area – including with respect to satellite communications.

Second, closely related to the above, Article I provides that the exploration and use of outer space is free for all States, constituting the “province of all mankind”<sup>38</sup>. This effectively echoes the famous Lotus principle, which provided: “International law governs relations between independent States. The rules of law binding upon States therefore emanate from their own free will as expressed in conventions or by usages generally accepted as expressing principles of law and established in order to regulate the relations between these co-existing independent communities or with a view to the achievement of common aims. Restrictions upon the independence of States therefore cannot be presumed”<sup>39</sup>.

Consequently, limitations to the baseline freedom of outer space can only be imposed at the international level, and this then only by specific sources such as treaties and customary international law<sup>40</sup> which States are – barring such exceptions as *per jus cogens* or foundational principles of international law such as *pacta sunt servanda* – at liberty, following their sovereign discretion, to adhere to or not. The Outer Space Treaty itself in turn presents the first instance where some limitations are then indeed imposed on States with respect to their activities in outer space. All of this also applies in principle to the use of space for communication purposes.

Third, following Article VI of the Outer Space Treaty, States are responsible for all national space activities, including if carried out by “non-governmental entities”, and required to authorize and supervise such private activities<sup>41</sup>. Following these clauses, States are obliged to ensure that any satellite operators operating under their jurisdiction, whether public or private, comply with international (space) law<sup>42</sup>, and if indeed private, are somehow to be subjected to governmental authorization and continuing supervision, preferably by way of national space legislation including some sort of licensing system<sup>43</sup>.

Fourth, as a twin clause closely related to Article VI, Article VII of the Outer Space Treaty provides that States are also liable for damage caused by space objects in

the launch of which they are fundamentally involved<sup>44</sup>. This, again, includes space objects built, launched, operated and/or maintained by private operators, including private communication satellite operators<sup>45</sup>. The Liability Convention further elaborates the resulting liability, *inter alia* providing for absolute liability when damage is caused on Earth and, in principle, unlimited compensation<sup>46</sup>. With a view in particular to satellite communications as a commercial sector, it is important to note that damage compensable under the Liability Convention is defined as being limited to “loss of life, personal injury or other impairment of health; or loss of or damage to property of States or of persons, natural or juridical, or property of international intergovernmental organizations”<sup>47</sup>. While Article XII of the Liability Convention does provide that compensation shall “restore the person, natural or juridical, State or international organization on whose behalf the claim is presented to the condition which would have existed if the damage had not occurred”, which could be interpreted as *including* indirect damages such as loss of revenues, this interpretation is far from generally accepted<sup>48</sup>.

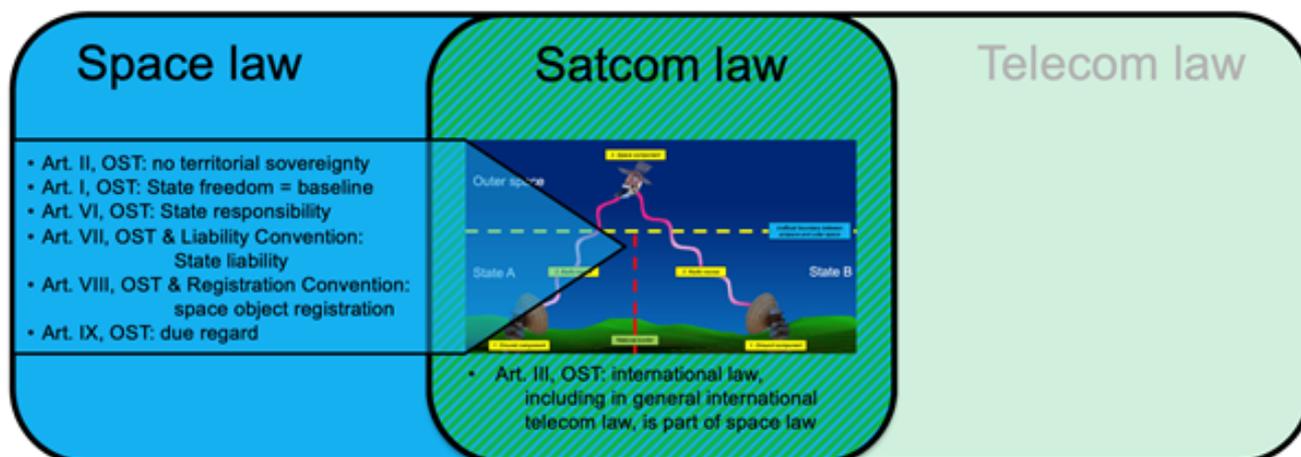
Fifth, Article VIII of the Outer Space Treaty jointly with the Registration Convention elaborating it provides for an obligation to register any space objects launched into outer space and by that token also provides the State of registration with quasi-territorial jurisdiction over the space object in question<sup>49</sup>. States should by that token ensure the registration, both domestically and internationally, also of communication satellites launched under their aegis, and can commensurately exercise legal control over its operations.

Sixth, Article IX of the Outer Space Treaty provides for a general duty of States to act with due regard for the interests of other States’ activities in outer space and the outer space environment in general, as well as for certain obligations of consultation in case potential harmful interference with other States’ activities would be at issue<sup>50</sup>. Being generally seen as too vague to properly cope with the increasing problem of space debris, at this stage it has been augmented by various sets of authoritative international guidelines which are hoped to evolve into customary international law in the not-too-distant future<sup>51</sup>.

Finally, the Outer Space Treaty contains a comprehensive fall-back clause, stating: “States Parties to the Treaty shall carry on activities in the exploration and use of outer space, including the Moon and other celestial bodies, in accordance with international law, including the Charter of the United Nations, in the interest of maintaining international peace and security and promoting international cooperation and understanding”<sup>52</sup>.

Article III by that token ‘imports’ general principles and rules of public international law into space law, at least to the extent that the latter, as *lex specialis* compared to the *lex generalis* of the former<sup>53</sup>, does not provide a clear and unambiguous legal answer – in that case, the specifics of ‘space law’ take precedence over any conflicting or contradictory rules or principles of general public international law. This clause actually presents a bridge to the international regime developed for satellite communications as a subdomain of telecommunications, which is part of the “international law” referred to above, and thereby recognizes on its part the applicability thereof in principle to that subdomain.

**Figure 3:** What 'space law' contributes to the nexus of 'satellite communications' law. ©2021 F.G. von der Dunk.



## 5. INTERNATIONAL TELECOMMUNICATIONS LAW – AND SATELLITE COMMUNICATIONS

International telecommunications law effectively goes back more than a century-and-a-half, when the International Telecommunication Union (ITU) in its then-guise as 'International Telegraph Union' was established<sup>54</sup>. The creation of this organization in 1865 to address the international aspects of especially wireless communications, such as radio interference across national borders, a full century before Early Bird proved the practical potentialities of satellite communication technology, obviously lacked any consideration of the possibilities that outer space would ever become involved in satellite communications<sup>55</sup>.

Sputnik-I's launch in 1957 caused that lack of consideration to change, and within two years, at the ITU's World Administrative Radio Conference (WARC) of 1959, it was agreed by the ITU Member States to include space communications and the coordination of the international use of frequencies to avoid radio interference within the regime developed under ITU auspices to deal with such international coordination<sup>56</sup>.

While the ITU had meanwhile evolved in many respects and is currently in a legal sense based on the 1992 ITU Constitution<sup>57</sup>, the 1992 ITU Convention<sup>58</sup> and the ITU Radio Regulations<sup>59</sup> revised roughly every four years at World Radio Conferences (WRCs; the 'successors' to the WARC), the essence of the process of international radio frequency usage coordination, now fundamentally applied to space usage as well, has remained the same.

First, the ITU Constitution outlines a handful of key principles which regulate that (international) usage of satellite frequencies, and thereby underpin the actual process of international coordination thereof. The two most important ones are provided by Articles 45 and 44 of the ITU Constitution respectively. Thereby, on the one hand, "[a]ll stations, whatever their purpose, must be established and operated 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 oper-

ate in accordance with the provisions of the Radio Regulations<sup>60</sup>. This reflects the main legitimization of ITU's role and competences in the coordination of the international usage of radio frequencies by which are, after all, sovereign States.

On the other hand, “[i]n using frequency bands for radio services, Member States shall 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, so that countries or groups of countries may 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.”<sup>61</sup>

A number of further, subordinate principles are provided by the ITU Constitution, such as the need to use as much as possible state-of-the-art technology<sup>62</sup>, a priority for distress calls and messages<sup>63</sup>, an obligation for ITU Member States to safeguard channels and operations within their national jurisdiction<sup>64</sup>, the right of States to cut off activities in case of national security threats<sup>65</sup> and the fact that “Member States retain their entire freedom with regard to military radio installations”<sup>66</sup>, which all largely follow from the above.

Second, the ITU Constitution, ITU Convention and ITU Radio Regulations together provide for an intricate and inherently often cumbersome process for international coordination of any satellite frequencies in conjunction with the orbital slots (as far as GEO is concerned) respectively orbits (as far as the other orbits are concerned) – since the possibility of interference *also* depends on whether certain frequencies are (to be) used within the same geographical realm. This process can be summarized as comprising two alternatively three steps<sup>67</sup>.

The first step concerns the allocation of frequency *bands* to specific *types* of services with international ramifications<sup>68</sup>. The ITU Radio Regulations currently distinguish no less than 41 separate services, of which about half are defined as ‘space services’<sup>69</sup>. Essentially, the ITU Member States jointly determine at the World Radio Conferences every four years which frequency bands are, further to the main principles discussed above and depending upon the actual and/or foreseen needs and interests in using radio frequencies for specific types of services, to be allocated to which types of services. Resulting in amendments to the Radio Regulations in particular as to Article 5, which includes the Table of Frequency Allocations by way of Section IV, for the next four years it is this allocation within which specific requests for the usage of frequencies would have to fit in order to be contemplated to start with.

This brings analysis to the second step, of allotment of specific *frequencies* to States for specific services with international ramifications<sup>70</sup>. At any particular moment, States can notify the ITU of their intentions to initiate a new service using certain proposed frequencies, which to start with of course has to comply with the Table of Frequency Allocations. Then, an extended process of coordination enters into operation, allowing other Member States to indicate whether their existing or planned operations could suffer from interference by the proposed system, and if such interference would indeed likely result, thereby basically force the notifying State to find a solution *not* giving rise to such concerns. At the end of the day, the frequencies thus ‘coordinated’ end up in the Master International Frequency Register, and by that token are – at least in law – protected from any radio interference by other users of the frequency spectrum.

If the frequencies so allotted are indeed to be used by a State itself or one of its public agencies, the process stops there; if however the intended usage is by a private company or an international organization, neither of which have autonomous standing to request the allotment of frequencies, the third step is taken, of 'assignment' by the State concerned to its private operator or the intergovernmental organization on whose behalf it acts<sup>71</sup>. It is this assignment which will then end up in the Master International Frequency Register.

While the ITU regime has played and continues to play a pivotal role in allowing international satellite communication activities to be undertaken for the overwhelming part without radio interference, its focus on the technical and generally apolitical aspects of satellite communications also started to raise some issues from the 1980s onwards<sup>72</sup>.

In particular in the United States, where in 1985 a Report of the Federal Communications Commission (FCC) initiated a process of breaking down the existing domestic monopoly of COMSAT on satellite communications<sup>73</sup>, a process finalized in 2000 with the adoption of the ORBIT Act<sup>74</sup>, and in the European Union, where in 1994 the Satellite Directive similarly initiated the establishment of an Internal Market for satellite communication services across the EU Member States<sup>75</sup>, the call for privatization and liberalization of telecommunications at large (and then within its wake also satellite communications specifically) started to replace the idea that the provision of such services and attendant infrastructure was for governments to take care of. Inevitably, this also led to pressures on the global level to reorient the sector to commercial applications and international market access which the ITU was ill-equipped to handle.

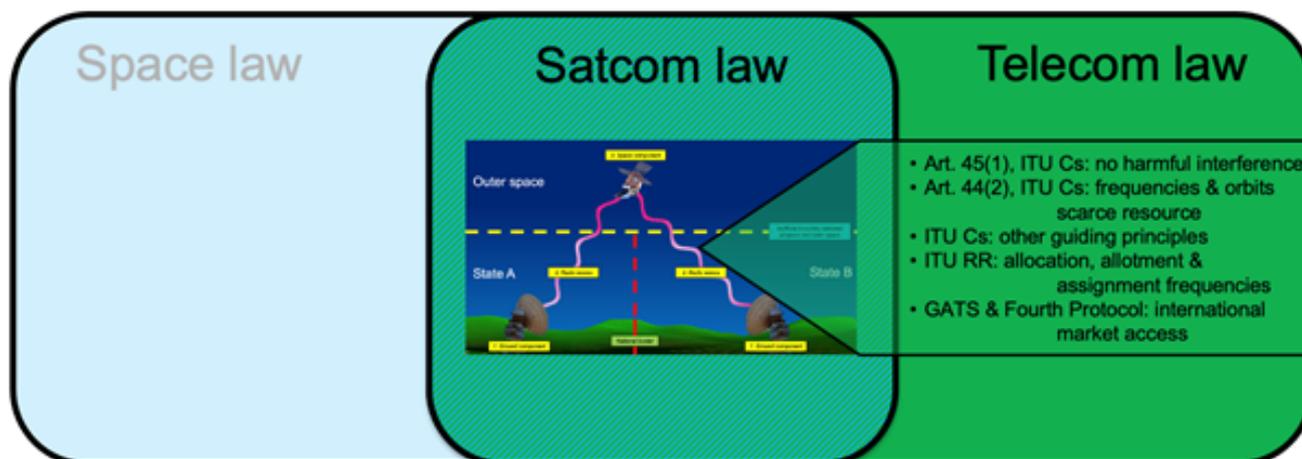
This is where ultimately the World Trade Organization (WTO), established in 1994<sup>76</sup>, and the concurrent adoption of the General Agreement on Trade in Services (GATS)<sup>77</sup> came into play, having basically been created precisely to pursue the goal of market liberalization across the globe, read across the WTO Member States which signed up to those. Again, the remit of both WTO Agreement and GATS was much broader than telecommunications let alone satellite communications<sup>78</sup>; and while upon closer view this concerns a body of law separate and distinct from the technically oriented ITU regime<sup>79</sup>, just like the latter it takes satellite communications on board as part of *telecommunications*, not as part of *space activities*, wherefore, for the present purpose, it is discussed in the same paragraph here.

Thus, as the third major part of international telecommunications law relevant also for the satellite communications sector, in 1997 the Fourth Protocol to the GATS<sup>80</sup> set the stage for inclusion of telecommunications in the GATS regime. This opened the door to application of the two most fundamental principles of WTO-style market liberalization, the Most-Favoured-Nation (MFN) principle (requiring States to accept foreign service providers from all other parties on an equal basis in their domestic service markets)<sup>81</sup> and the National-Treatment (NT) principle (requiring States to accept foreign service providers into their domestic service markets at the same conditions as domestic service providers)<sup>82</sup> to the sector.

The details thereof, of fundamental importance given that the application of MFN and NT was premised on the basis of reciprocity between States, were to be found in the individual Schedules of Specific Commitments which the States parties to the Fourth Protocol drafted<sup>83</sup>. In most cases satellite communication services were included, sometimes explicitly, sometimes implicitly. In sum, even if in a very com-

plicated and oftentimes rather fragmented manner, the international satellite communication services market is now liberalized to a very large extent, providing private satellite communication operators with the legal framework for their commercial operations which allows them to turn satellite communications into the multi-billion-dollar business it is today.

**Figure 4:** What 'telecommunications law' contributes to the nexus of 'satellite communications' law. ©2021 F.G. von der Dunk.



## 6. CONCLUDING REMARKS

Given the complexity of satellite communications as a global business sector involving many private as well as public operators, many national and international regulators and a constantly evolving suite of services offered to an ever-increasing number of users and consumers, it should not come as a surprise that the legal environment, the sets of rules, rights and obligations applicable to anyone operating in the field, is highly complex as well. This is already true even if merely focusing at the international level, where the myriad domestic regimes play varying roles – largely neglected in this particular article – in implementing, interpreting, refining, enforcing or even changing whatever is offered internationally.

Nevertheless, it may be fair to note that without a thorough knowledge of at least space law, the ITU regime and the WTO regime (the two latter for the sake of simplicity here being addressed under one overarching heading of telecommunications law), no communication satellite operator would stand much of a chance of doing business without soon running into major conflicts and roadblocks, likely even full-blown showstoppers. Space law takes care of the major requirements flowing from the unique and dangerous environment of outer space, ITU law of the technical coordination necessary to avoid white noise, and WTO law of the possibility for operators to generate sufficient business to make it all worthwhile. It is the interaction of these regimes at the nexus of space activities and telecommunications which paves the way for a satellite communications sector which is both sensibly profitable for the private operators and sufficiently mindful of the larger public interests of all States, and indeed humanity, in a fair and safe use of outer space – and this article represents a basic effort to sketch the contours of this nexus as legally taken care of currently.

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- <sup>1</sup> A. Clarke, *Extra-Terrestrial Relays*, [in:] “Wireless World” (Oct. 1945), pp. 305–8.
- <sup>2</sup> See <https://en.wikipedia.org/wiki/Telstar> [access: 8/4/2021].
- <sup>3</sup> See <https://www.euronews.com/2017/03/16/remembering-early-bird-the-satellite-that-changed-how-we-communicate> [access: 8/4/2021].
- <sup>4</sup> I.e., the Communications Satellite Act, 31 August 1962, Public Law 87-624, 87th Congress, H.R. 11040; 76 Stat. 419; as amended 1978; *Space Law – Basic Legal Documents*, E.III.2. See further F. Lyall, *Law and Space Telecommunications* (1989), pp. 30–73.
- <sup>5</sup> By way of the Agreement Establishing Interim Arrangements for a Global Commercial Communications Satellite System, and Relative Special Agreement, Washington, done 20 August 1964, entered into force done 20 August 1964; 514 UNTS 25; TIAS 5646; 15 UST 1705; 1966 UKTS 12; 3 ILM 805 (1964).
- <sup>6</sup> As party to the Agreement Relating to the International Telecommunications Satellite Organization (INTELSAT), Washington, done 20 August 1971, entered into force 12 February 1973; 1220 UNTS 21; TIAS 7532; 23 UST 3813; UKTS 1973 No. 80; Cmnd. 4799; ATS 1973 No. 6; 10 ILM 909 (1971). This was the governmental treaty spelling out the main aspects, roles and related rights and obligations of the organization and its member states. See further on INTELSAT e.g. Lyall, *Law and Space Telecommunications*, pp. 74–208; P.A. Salin, *Satellite Communications Regulations in the Early 21<sup>st</sup> Century* (2000), pp. 106–20.
- <sup>7</sup> As signatory to the Operating Agreement Relating to the International Telecommunications Satellite Organization (INTELSAT), Washington, done 20 August 1971, entered into force 12 February 1973; 1220 UNTS 149; TIAS 7532; 23 UST 4091; UKTS 1973 No. 80; Cmnd. 4799; ATS 1973 No. 6; 10 ILM 946 (1971). This was an operational agreement between the various national telecom providers, detailing the respective roles – including financial – of these operators and how, consequently, the satellite system was to be exploited to the maximum benefit of the respective operators – and the Member States ‘behind’ them.
- <sup>8</sup> As per the Convention on the International Maritime Satellite Organization (INMARSAT), London, done 3 September 1976, entered into force 16 July 1979; 1143 UNTS 105; TIAS 9605; 31 UST 1; UKTS 1979 No. 94; Cmnd. 6822; ATS 1979 No. 10; 15 ILM 1052 (1976); and the Operating Agreement on the International Maritime Satellite Organization (INMARSAT), London, done 3 September 1976, entered into force 16 July 1979; 1143 UNTS 213; TIAS 9605; 31 UST 1; UKTS 1979 No. 94; Cmnd. 6822; ATS 1979 No. 10; 15 ILM 233, 1075 (1976). See further e.g. Lyall, *Law and Space Telecommunications*, pp. 209–43; Salin, pp. 120–6.
- <sup>9</sup> As per the Convention Establishing the European Telecommunications Satellite Organization (EUTELSAT), Paris, done 15 July 1982, entered into force 1 September 1985; UKTS 1990 No. 15; Cm. 956; Cmnd. 9069; *Space Law – Basic Legal Documents*, C.II.1; and the Operating Agreement Relating to the European Telecommunications Satellite Organization (EUTELSAT), Paris, done 15 July 1982, entered into force 1 September 1985; UKTS 1990 No. 15; Cm. 956; Cmnd. 9154; *Space Law – Basic Legal Documents*, C.II.2. See further e.g. Lyall, *Law and Space Telecommunications*, pp. 264–95; Salin, pp. 365–72.
- <sup>10</sup> As per the Agreement on the Establishment of the “INTERSPUTNIK” International System and Organization of Space Communications, Moscow, done 15 November 1971, entered into force 12 July 1972; 862 UNTS 3; TIAS 859 (1973) No. 12343; *Space Law – Basic Legal Documents*, C.VIII.1. See further e.g. Lyall, *Law and Space Telecommunications*, pp. 364–8; B. Cheng, *Studies in International Space Law* (1997), pp. 548–50.
- <sup>11</sup> As per the Agreement of the Arab Corporation for Space Communications (ARABSAT), Cairo, done 14 April 1976, entered into force 15 July 1976; *Space Law – Basic Legal Documents*, C.VII.1; 44 *Telecommunications Journal* (IX/1977), at 422. See further Lyall, *Law and Space Telecommunications*, pp. 303–8; A. Ziadat, *Arabsat: Regional Development in Satellite Communications: Lessons from the Arabsat Venture*, [in:] 37 “*Zeitschrift für Luft- und Weltraumrecht*” (1988), pp. 35–45.
- <sup>12</sup> See more in detail e.g. P.K. McCormick & M.J. Mechanick (Eds.), *The Transformation of Intergovernmental Satellite Organisations* (2013); F.G. von der Dunk, *Legal aspects of satellite communications* [in:] F.G. von der Dunk & F. Tronchetti (Eds.), *Handbook of Space Law* (2015), pp. 287–90, 293–5, 297–301.

- <sup>13</sup> Cf. e.g. <https://www.grandviewresearch.com/industry-analysis/satellite-communication-market> [access: 8/4/ 2021].
- <sup>14</sup> Note that over time, due to the so-called ICT (Information and Communication Technology) convergence, the erstwhile clear boundaries between the two have basically eroded, and many services provide an interactive version of broadcasting in the widest sense of the word. See e.g. <https://www.sociologydiscussion.com/science/ict-convergence-of-information-and-communication-technology/723> [access: 9/4/2021].
- <sup>15</sup> This follows from the fundamental sovereignty of States over their own national territory and the resulting jurisdiction regarding all activities taking place there. Cf. in general e.g. A. Cassese, *International Law* (2001), pp. 88 ff.; G. Boas, *Public International Law* (2012), pp. 158 ff., 180 ff., 251–4.
- <sup>16</sup> As recognized for ships e.g. by Art. 91, United Nations Convention on the Law of the Sea, Montego Bay, done 10 December 1982, entered into force 16 November 1994; 1833 UNTS 3 & 1835 UNTS 261; UKTS 1999 No. 81; Cmnd. 8941; ATS 1994 No. 31; 21 ILM 1261 (1982); S. Treaty Doc. No. 103-39; for aircraft e.g. by Arts. 17–19, Convention on International Civil Aviation (hereafter Chicago Convention), Chicago, done 7 December 1944, entered into force 4 April 1947; 15 UNTS 295; TIAS 1591; 61 Stat. 1180; Cmd. 6614; UKTS 1953 No. 8; ATS 1957 No. 5; ICAO Doc. 7300.
- <sup>17</sup> Cf. the definition of “frequency” as “the rate per second of a vibration of the air constituting a wave”; e.g. <https://quizlet.com/264866398/y9-science-waves-flash-cards/> [access: 9/4/2021].
- <sup>18</sup> See further *infra*, § 5.
- <sup>19</sup> See for more detail Von der Dunk, *Legal aspects of satellite communications*, pp. 471–2; M. Williamson, Technical Issues and Empowerment of the ITU [in:] M. Hofmann (Ed.), *International Regulations of Space Communications* (2013), pp. 34–6.
- <sup>20</sup> As enshrined in Art. 1, Chicago Convention.
- <sup>21</sup> While there is no unequivocal international agreement on the altitude at which outer space is supposed to ‘begin’, with at best some convergence on a 100 km-altitude being discernible, orbiting satellites are by that token generally accepted to be ‘in outer space’; see further F.G. von der Dunk, *International space law* [in:] F.G. von der Dunk & F. Tronchetti (Eds.), *Handbook of Space Law* (2015), pp. 60–72; in great detail T. Gangale, *How High The Sky?* (2019).
- <sup>22</sup> See [https://en.wikipedia.org/wiki/Low\\_Earth\\_orbit](https://en.wikipedia.org/wiki/Low_Earth_orbit) [access: 9/4/2021]; [https://en.wikipedia.org/wiki/Geostationary\\_orbit](https://en.wikipedia.org/wiki/Geostationary_orbit) [access: 9/4/2021]; [https://en.wikipedia.org/wiki/Medium\\_Earth\\_orbit](https://en.wikipedia.org/wiki/Medium_Earth_orbit) [access: 9/4/2021]; and [https://en.wikipedia.org/wiki/Highly\\_elliptical\\_orbit](https://en.wikipedia.org/wiki/Highly_elliptical_orbit) [access: 9/4/2021].
- <sup>23</sup> See further *infra*, § 4.
- <sup>24</sup> For those further interested, see in general e.g. C. Doldirina, *Intellectual property rights in the context of space activities* [in:] F.G. von der Dunk & F. Tronchetti (Eds.), *Handbook of Space Law* (2015), pp. 949–94.
- <sup>25</sup> For those further interested, see in general e.g. L.J. Smith & I. Baumann, *Contracting for Space* (2011); cf. also D. Zannoni, *Conflict and Conciliation of National Space Laws* [in:] 38 “Annals of Air & Space Law” (2013), pp. 343–84.
- <sup>26</sup> Cf. already F. Lyall, *Interrelation between Space Law and ITU Law* [in:] M. Hofmann & A. Loukakis (Eds.), *Ownership of Satellites* (2017), pp. 165–73, although as the title indicates his analysis as far as telecommunications law is concerned remains confined to ITU law.
- <sup>27</sup> While communication satellites all require being launched into outer space prior to starting their operations, apart from being part of international space law of a comprehensive scope (see further *infra*, § 4) there exists an extended body of international law addressing such launches regardless of the nature of the payloads. See further e.g. H.P. van Fenema, *Legal aspects of launch services and space transportation* [in:] F.G. von der Dunk & F. Tronchetti (Eds.), *Handbook of Space Law* (2015), pp. 382–453.
- <sup>28</sup> Note that the term ‘space station’ in this context refers to habitats for humans orbiting in outer space, not to ‘(radio) stations’ orbiting in outer space. The use by such space stations of (satellite) communications does not come with any tailor-made law as relevant for the current analysis.
- <sup>29</sup> Note that the use of communication devices on celestial bodies has so far simply been part of the broader usage of such devices in outer space, without any specific regard to the legal status of such celestial bodies.

- <sup>30</sup> Note that, however, such law is very much of a domestic nature anyway, largely limited to respective national territories.
- <sup>31</sup> Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (hereafter Outer Space Treaty), London/Moscow/Washington, done 27 January 1967, entered into force 10 October 1967; 610 UNTS 205; TIAS 6347; 18 UST 2410; UKTS 1968 No. 10; Cmnd. 3198; ATS 1967 No. 24; 6 ILM 386 (1967).
- <sup>32</sup> Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, London/Moscow/Washington, done 22 April 1968, entered into force 3 December 1968; 672 UNTS 119; TIAS 6599; 19 UST 7570; UKTS 1969 No. 56; Cmnd. 3786; ATS 1986 No. 8; 7 ILM 151 (1968). Though its provisions include requirements to return space objects to the launching State, which would also apply to communication satellites if found somewhere on Earth, it will not be discussed in any greater detail here.
- <sup>33</sup> Convention on International Liability for Damage Caused by Space Objects (hereafter Liability Convention), London/Moscow/Washington, done 29 March 1972, entered into force 1 September 1972; 961 UNTS 187; TIAS 7762; 24 UST 2389; UKTS 1974 No. 16; Cmnd. 5068; ATS 1975 No. 5; 10 ILM 965 (1971).
- <sup>34</sup> Convention on Registration of Objects Launched into Outer Space (hereafter Registration Convention), New York, done 14 January 1975, entered into force 15 September 1976; 1023 UNTS 15; TIAS 8480; 28 UST 695; UKTS 1978 No. 70; Cmnd. 6256; ATS 1986 No. 5; 14 ILM 43 (1975).
- <sup>35</sup> See, for an extended analysis of how space law *lato sensu* comprises much more than only those four treaties agreed upon in the context of the United Nations, F.G. von der Dunk, *Advanced Introduction to Space Law* (2020), esp. pp. 1–13. For the current status of ratification of those treaties, see <http://www.unoosa.org/documents/pdf/spacelaw/treatystatus/TreatiesStatus-2020E.pdf> [access: 19/4/2021].
- <sup>36</sup> Cf. e.g. P. Jankowitsch, *The background and history of space law* [in:] F.G. von der Dunk & F. Tronchetti (Eds.), *Handbook of Space Law* (2015), pp. 1–9, 14–20; Von der Dunk, *Advanced Introduction*, pp. 18–22; S. Hobe, *Historical Background* [in:] S. Hobe, B. Schmidt-Tedd & K.U. Schrogl (Eds.), *Cologne Commentary on Space Law*, Vol. I (2009), pp. 1–24.
- <sup>37</sup> See further Von der Dunk, *International space law*, pp. 55–60; S.R. Freeland & R. Jakhu, Article II [in:] S. Hobe, B. Schmidt-Tedd & K.U. Schrogl (Eds.), *Cologne Commentary on Space Law*, Vol. I (2009), pp. 44–63; Cheng, pp. 434–44.
- <sup>38</sup> See further Von der Dunk, *International space law*, pp. 57–9; P.G. Dembling & D.M. Arons, *The Evolution of the Outer Space Treaty* [in:] 33 “Journal of Air Law and Commerce” (1967), pp. 429–32; S. Hobe, *Article I* [in:] S. Hobe, B. Schmidt-Tedd & K.U. Schrogl (Eds.), *Cologne Commentary on Space Law*, Vol. I (2009), pp. 25–43. Note that the freedom is, as far as the Outer Space Treaty is concerned, limited to States; it is then up to those to allow private sector entities under their respective aegis to enjoy (parts of) that freedom as well, subject to appropriate authorization and continuing supervision as per Art. VI, Outer Space Treaty.
- <sup>39</sup> *SS Lotus* (Fr./Turk.) 1927 PCIJ Rep. (ser. A) No. 10, at 44.
- <sup>40</sup> Pursuant to Art. 38(1)(a) & (b), Statute of the International Court of Justice (San Francisco, done 26 June 1945, entered into force 24 October 1945; 156 UNTS 77; USTS 993; 59 Stat. 1031; UKTS 1946 No. 67; ATS 1945 No. 1), treaty law and customary international law are generally recognized as the two major sources of public international law; see further e.g. Cassese, pp. 119 ff.; Boas, pp. 52 ff.
- <sup>41</sup> See further Von der Dunk, *International space law*, pp. 50–5; M. Gerhard, Article VI [in:] S. Hobe, B. Schmidt-Tedd & K.U. Schrogl (Eds.), *Cologne Commentary on Space Law*, Vol. I (2009), pp. 103–25; F.G. von der Dunk, *Private Enterprise and Public Interest in the European ‘Spacescape’* (1998), pp. 17–22; Dembling & Arons, pp. 436–8; Cheng, pp. 237–9, 608–9.
- <sup>42</sup> Strictly speaking, Art. VI, Outer Space Treaty, only refers to compliance “with the provisions set forth in the present Treaty”, but since the Outer Space Treaty is generally acknowledged to provide the fundamental legal framework for all activities in outer space, and by virtue of Art. III specifically also includes general public international law within that body of space law, by proxy this clause refers to all applicable international law.

- <sup>43</sup> See in great detail I. Marboe, *National space law* [in:] F.G. von der Dunk & F. Tronchetti (Eds.), *Handbook of Space Law* (2015), pp. 127–204; also Von der Dunk, *Advanced Introduction*, pp. 115–25; R.S. Jakhu (Ed.), *National Regulation of Space Activities* (2010); C. Brünner & E. Walter (Eds.), *Nationales Weltraumrecht/National Space Law* (2008).
- <sup>44</sup> Further to Art. VII, Outer Space Treaty, Art. I(c), Liability Convention, provides for a fourfold criterion in this regard: “(i) A State which launches or procures the launching of a space object; (ii) A State from whose territory or facility a space object is launched”. See further Von der Dunk, *International space law*, pp. 50–2; A. Kerrest de Rozavel & L.J. Smith, Article VII [in:] S. Hobe, B. Schmidt-Tedd & K.U. Schrogl (Eds.), *Cologne Commentary on Space Law*, Vol. I (2009), pp. 126–45.
- <sup>45</sup> Note that as a consequence all national space laws issued pursuant to Art. VI, Outer Space Treaty, also include clauses on derogation of such international liability to the operators authorized under it; see again in detail Marboe, pp. 127–204.
- <sup>46</sup> As per Art. II resp. Art. XII, Liability Convention. See further on the Liability Convention in general Von der Dunk, *International space law*, pp. 82–94; L.J. Smith, A. Kerrest de Rozavel & F. Tronchetti, *The 1972 Convention on International Liability for Damage Caused by Space Objects* [in:] S. Hobe, B. Schmidt-Tedd & K.U. Schrogl (Eds.), *Cologne Commentary on Space Law*, Vol. II (2013), pp. 83–226.
- <sup>47</sup> Art. I(a), Liability Convention.
- <sup>48</sup> Cf. however further on this Smith, Kerrest de Rozavel & Tronchetti, pp. 105–6, 174–5.
- <sup>49</sup> See further Von der Dunk, *International space law*, pp. 94–9; B. Schmidt-Tedd & S. Mick, Article VIII [in:] S. Hobe, B. Schmidt-Tedd & K.U. Schrogl (Eds.), *Cologne Commentary on Space Law*, Vol. I (2009), pp. 146–68; B. Schmidt-Tedd et al., *The 1975 Convention on Registration of Objects Launched into Outer Space* [in:] S. Hobe, B. Schmidt-Tedd & K.U. Schrogl (Eds.), *Cologne Commentary on Space Law*, Vol. II (2013), pp. 227–324. Note, that this registration regime is different from that of registration of frequencies and attendant satellite orbits under the ITU regime; see further on that *infra*, § 5.
- <sup>50</sup> See further L. Viikari, *Environmental aspects of space activities* [in:] F.G. von der Dunk & F. Tronchetti (Eds.), *Handbook of Space Law* (2015), pp. 729–31; S. Marchisio, *Article IX* [in:] S. Hobe, B. Schmidt-Tedd & K.U. Schrogl (Eds.), *Cologne Commentary on Space Law*, Vol. I (2009), pp. 169–82.
- <sup>51</sup> See further e.g. Viikari, pp. 741–52.
- <sup>52</sup> Art. III, Outer Space Treaty. See further Von der Dunk, *Advanced Introduction*, pp. 4–5, 17–19; O. Ribbelink, *Article III* [in:] S. Hobe, B. Schmidt-Tedd & K.U. Schrogl (Eds.), *Cologne Commentary on Space Law*, Vol. I (2009), pp. 64–9.
- <sup>53</sup> See on the *lex specialis derogat lege generali* concept e.g. Boas, pp. 46, 65, 104, 107, 116, 291.
- <sup>54</sup> As per the International Telegraph Convention, Paris, done 17 May 1865, entered into force 1 January 1866; 130 CTS 198; 56 BFSP 295.
- <sup>55</sup> See in greater detail Von der Dunk, *Legal aspects of satellite communications*, pp. 460 ff.; F. Lyall, *International Communications – The International Telecommunication Union and Universal Postal Union* (2011), pp. 17–212; D. Westphal, *International Telecommunication Union (ITU)* [in:] R. Wolfrum (Ed.), *The Max Planck Encyclopedia of Public International Law*, Vol. VI (2012), pp. 166–76.
- <sup>56</sup> See e.g. Von der Dunk, *Legal aspects of satellite communications*, pp. 475–6; Lyall, *Law and Space Telecommunications*, p. 324; M. Mejía-Kaiser, *The Geostationary Ring* (2020), pp. 110–4.
- <sup>57</sup> Constitution of the International Telecommunication Union (hereafter ITU Constitution), Geneva, done 22 December 1992, entered into force 1 July 1994; 1825 UNTS 1; UKTS 1996 No. 24; Cm. 2539; ATS 1994 No. 28; Final Acts of the Additional Plenipotentiary Conference, Geneva, 1992 (1993), at 1; amended a number of times since 1992.
- <sup>58</sup> Convention of the International Telecommunication Union (hereafter ITU Convention), Geneva, done 22 December 1992, entered into force 1 July 1994; 1825 UNTS 1; UKTS 1996 No. 24; Cm. 2539; ATS 1994 No. 28; Final Acts of the Additional Plenipotentiary Conference, Geneva, 1992 (1993), at 71; amended a number of times since.
- <sup>59</sup> The latest version concerns the Radio Regulations Articles, Edition of 2020 (hereafter ITU Radio Regulations), <https://www.itu.int/en/myitu/Publications/2020/09/02/14/23/Radio-Regulations-2020> [access: 10/4/2021].

- <sup>60</sup> Art. 45(1), ITU Constitution. See further F. Lyall, 'Harmful Interference' and the ITU [in:] M. Hofmann (Ed.), *Harmful Interference in Regulatory Perspective* (2015), pp. 19–29.
- <sup>61</sup> Art. 44(2), ITU Constitution. Cf. also e.g. Mejía-Kaiser, esp. pp. 3, 125–6.
- <sup>62</sup> See Art. 44(1), ITU Constitution; also Art. 4(1), ITU Radio Regulations. Cf. further e.g. S. Spassova, *New and Alternative Means for Safeguarding the Efficient Use of Spectrum Resources for Satellite Communications* [in:] M. Hofmann (Ed.), *Harmful Interference in Regulatory Perspective* (2015), pp. 208–11, on one example of ITU engagement in this area, for which Arts. 7(e), 17–20, ITU Constitution, and Arts. 13–15, ITU Convention, provide the institutional/legal foundations.
- <sup>63</sup> See Art. 46, ITU Constitution.
- <sup>64</sup> See Art. 38(3), (4), ITU Constitution.
- <sup>65</sup> See Art. 34(2), ITU Constitution.
- <sup>66</sup> Art. 48(1), ITU Constitution.
- <sup>67</sup> See in more detail Von der Dunk, *Legal aspects of satellite communications*, pp. 464–75.
- <sup>68</sup> Cf. the definition of 'allocation' as: "Entry in the Table of Frequency Allocations of a given frequency band for the purpose of its use by one or more terrestrial or space radiocommunication services or the radio astronomy service under specified conditions. This term shall also be applied to the frequency band concerned." Art. 1.16, ITU Radio Regulations. Also e.g. S. Spassova, *Harmful Interference and Ownership of Satellites (or Frequencies) in Outer Space* [in:] M. Hofmann (Ed.), *Ownership of Satellites* (2017), pp. 216–7.
- <sup>69</sup> See Art. 1.20–1.60, ITU Radio Regulations. Originally, at the 1959 WARC only two space services were recognized: the 'up-link' and the 'down-link'; the extension to the present number is a clear indication not only of the refinement of the ITU approach but also of the growing importance as well as special character of space communications within the larger realm of telecommunications.
- <sup>70</sup> Cf. the definition of 'allotment' as: "Entry of a designated frequency channel in an agreed plan, adopted by a competent conference, for use by one or more administrations for a terrestrial or space radiocommunication service in one or more identified countries or geographical areas and under specified conditions." Art. 1.17, ITU Radio Regulations. Also e.g. Spassova, *Harmful Interference*, p. 217.
- <sup>71</sup> Cf. the definition of 'assignment' as: "Authorization given by an administration for a radio station to use a radio frequency or radio frequency channel under specified conditions." Art. 1.18, ITU Radio Regulations. Also e.g. Spassova, *Harmful Interference*, p. 217.
- <sup>72</sup> Cf. e.g. U.M. Bohlmann, K.U. Schrogl & I. Zilioli, *Report of the 'Project 2001' Working Group on Telecommunication* [in:] K.H. Böckstiegel (Ed.), *'Project 2001' – Legal Framework for the Commercial Use of Outer Space* (2002), pp. 216–28; in great detail P.K. McCormick, *Neo-Liberalism: A Contextual Framework for Assessing the Privatisation of Intergovernmental Satellite Organisations* [in:] P.K. McCormick & M.J. Mechanick (Eds.), *The Transformation of Intergovernmental Satellite Organisations* (2013), pp. 1–34.
- <sup>73</sup> See e.g. C.E. Butler, *The Antitrust Liability of Comsat in Its Role as Representative to Intelsat* [in:] 17 "North Carolina Journal of International Law and Commercial Regulation" (1992), pp. 558–60.
- <sup>74</sup> Open-market Reorganization for the Betterment of International Telecommunications Act, 17 March 2000, Public Law 106-180, 106th Congress. See further S. Ospina, *International Satellite Telecommunications: An Assessment of their Past and Future* [in:] K.H. Böckstiegel (Ed.), *'Project 2001' – Legal Framework for the Commercial Use of Outer Space* (2002), pp. 292–300; Bohlmann, Schrogl & Zilioli, pp. 218–9.
- <sup>75</sup> Cf. Commission Directive amending Directive 88/301/EEC and Directive 90/388/EEC in particular with regard to satellite communications, 94/46/EC, of 13 October 1994; OJ L 268/15 (1994). See further S. LeGoueff, *Satellite Services: The European Regulatory Framework* [in:] 2–5 "Computer & Telecommunications Law Review" (Oct. 1996), pp. 186–8; C.D. Long, *Telecommunications Law and Practice* (2nd Ed., 1995), pp. 223 ff., esp. 253–4.

- <sup>76</sup> As per the Agreement Establishing the World Trade Organization (hereafter WTO Agreement), Marrakesh, done 15 April 1994, entered into force 1 January 1995; 1867 UNTS 154; UKTS 1996 No. 57; ATS 1995 No. 8; 33 ILM 1125, 1144 (1994). See further P. Malanczuk, *The Relevance of International Economic Law and the World Trade Organization (WTO) for Commercial Outer Space Activities* [in:] R.A. Harris (Ed.), *International Organisations and Space Law* (1999), pp. 305 ff.; S. Lessard, *International Trade in Telecommunications Services: Towards Open Markets* [in:] 22-1 "Annals of Air & Space Law" (1997), pp. 405–7.
- <sup>77</sup> General Agreement on Trade in Services (hereafter GATS), Marrakesh, done 15 April 1994, entered into force 1 January 1995; 1869 UNTS 183; UKTS 1996 No. 58; Cm. 3276; ATS 1995 No. 8.
- <sup>78</sup> For a high-level analysis of WTO and GATS, see e.g. F.G. von der Dunk, *International trade aspects of space services* [in:] F.G. von der Dunk & F. Tronchetti (Eds.), *Handbook of Space Law* (2015), pp. 818–36; J.H. Jackson, *The World Trading System* (2nd Ed., 1997), pp. 44 ff., 306–10; P.T. Stoll, *World Trade Organization (WTO)* [in:] R. Wolfrum (Ed.), *The Max Planck Encyclopedia of Public International Law*, Vol. X (2012), pp. 968 ff.; M. Krajewski, *General Agreement on Trade in Services (1994)* [in:] R. Wolfrum (Ed.), *The Max Planck Encyclopedia of Public International Law*, Vol. IV (2012), pp. 323–34.
- <sup>79</sup> Cf. on this in more detail e.g. Von der Dunk, *Advanced Introduction*, pp. 66–72, 92–3, 108–12.
- <sup>80</sup> Fourth Protocol to the General Agreement on Trade and Services of 15 April 1994, Geneva, done 15 April 1997, entered into force 5 February 1998; 2061 UNTS 209; WTO Doc. S/L/20 of 30 April 1996 (96-1750); ATS 1998 No. 9; 33 ILM 1167 (1994); 36 ILM 354 (1997).
- <sup>81</sup> See on MFN in general Jackson, pp. 157–73; R. Bhala, *International Trade Law: Interdisciplinary Theory and Practice* (3<sup>rd</sup> Ed., 2008), pp. 321–48.
- <sup>82</sup> See on NT in general Jackson, pp. 213–28; Bhala, pp. 373–414.
- <sup>83</sup> See for a brief discussion of the individual Schedules of Specific Commitments of the most important countries as well as the European Union already Von der Dunk, *International trade aspects of space services*, pp. 847–52.

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