Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Band	)	IB Docket No. 01-185
	)	
Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum at 2 GHz for Use by the Mobile Satellite Service	)	ET Docket No. 95-18

COMMENTS OF CONSTELLATION COMMUNICATIONS HOLDINGS, INC.

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EXECUTIVE SUMMARY

Constellation is a current mobile-satellite service ("MSS") licensee, holding licenses in the 1.6/2.4 GHz and the 2 GHz MSS bands. Constellation supports the Commission's proposals to authorize MSS operators to conduct ancillary terrestrial operations in the L-Band and 2 GHz MSS bands, and requests the Commission to amend its rules to allow licensees in the 1.6/2.4 GHz MSS bands to conduct the same type of ancillary terrestrial operations.

The authorization of ancillary terrestrial facilities will provide MSS licensees with additional flexibility to provide higher quality and more reliable advanced services to the American public, and will allow MSS systems to serve users when they are located in urban areas which can not now be reached by satellite. More efficient spectrum use (both technical and economic) will result since more customers can be served in the same amount of spectrum.

Although the Commission identifies the alternative of licensing non-MSS operators to operate terrestrial facilities in portions of the MSS bands, Constellation believes that pursuing such an alternative will adversely affect the public interest, result in ineffcient spectrum use, and frustrate the Commission's policies regarding MSS and service to rural and underserved areas. Constellation believe that use of MSS bands by alternative licensees, either by segmenting the MSS bands into satellite and terrestrial segments, or by allowing operations in the band by MSS operators and independent terrestrial operations on a shared basis, is unworkable and will result in inefficient use of the spectrum.

The Commission should minimize the regulatory burdens and restrictions on the technical design and operations of these facilities in order to encourage the rapid introduction of this exciting new technology that can substantially improve the scope and reliability of MSS

services. The service rules for ancillary terrestrial operations by MSS licensees should provide as much flexibility as possible to MSS operators to design and operate their satellite and ancillary terrestrial facilities to minimize costs and maximize the diversity of services provided to the public. The Commission should adopt only the minimum rules necessary to preserve the ancillary nature of the terrestrial facilities to be operated in conjunction with MSS systems and to protect existing services from harmful interference. Although the Commission identified and discussed the issues to be addressed in the service rules governing ancillary terrestrial operations in the MSS bands, it did not include specific text for these rules and Constellation submits proposed text for these service rules in the Appendix to these Comments.

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COMMENTS OF CONSTELLATION COMMUNICATIONS HOLDINGS, INC.

Constellation Communications Holdings, Inc. ("Constellation") submits these comments in response to the Commission's Notice of Proposed Rulemaking, FCC 01-225 released August 17, 2001, ("Notice") in the proceedings referenced above.

Constellation is a current mobile satellite service ("MSS") licensee, holding licenses in the 1.6/2.4 GHz and the 2 GHz MSS bands.[1] As an MSS licensee, the decisions adopted by the Commission in this proceeding will significantly enhance the capabilities of Constellations as well as other licensees 1.6/2.4 GHz and 2 GHz MSS Systems.

Constellation supports the Commission's proposals to provide MSS licensees with additional flexibility to provide higher quality and more reliable advanced services to the largest possible segment of the American public, and urges the Commission to promptly approve the operation of ancillary terrestrial facilities operations by all current L-Band, 1.6/2.4 GHz and 2

[1] *See Notice* at paras. 9 and 21. In these Comments, Constellation uses the notation "L-Band" to denote the 1525-1559 MH and 1626.5-1660.5 MHz bands, "1.6/2.4 GHz" or "Big LEO" to denote the 1610-1626.5 MHz and 2483.5-2500 MHz bands, and "2 GHz" to denote the 1990-2025 MHz and 2165-2200 MHz bands.

GHz MSS licensees. The Commission hould minimize regulatory burdens and restrictions on the technical design and operations of these facilities in order to encourage the rapid introduction of this exciting new technology that can substantially improve the scope and reliability of MSS services.

I. Ancillary Terrestrial Operations Will Enhance The Quality And Reliability Of MSS Services

The high altitude of MSS satellites inherently provides wide area coverage that can not be matched by terrestrial systems, especially in rural and underserved areas. However, the market penetration of MSS systems has been slow. Ancillary terrestrial operations will allow the establishment of a fully integrated system that retains the inherent nationwide coverage of MSS systems, including the most remote areas, while allowing access to urban areas. By providing more competitive services in urban areas, MSS systems will have a sounder financial footing during their initial market ramp-up, increasing confidence in their continuing ability to meet the need for service in rural and underserved areas.

Using spectrum for terrestrial service in urban areas does not diminish the spectrum capacity available for satellite service in rural and underserved areas.[2] All of the frequencies assigned to a satellite beam can be reused within the geographical area covered by the beam in both urban areas and rural areas if the urban areas served by terrestrial facilities and the rural areas served by satellite are separated by a sufficient distance. Thus, the full amount of spectrum

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[2] Demand in areas served by MSS systems can easily require more capacity in a beam than can be provided within the allocated spectrum This spectrum limitation is especially critical in meeting emergency communications requirements in areas experiencing catastrophic events where MSS is one of the few means of proving immediate communications. Given the worldwide coverage of non-GSO MSS systems, it is likely that there will be areas in the world where demand for service will exceed capacity as traffic demands shift in response to events.

assigned to an MSS system remains available to serve users by satellite links in remote areas most in need of MSS service.[3]

A. Ancillary Terrestrial Facilities Complement The Low Link Margins Inherent In MSS Design And Operations

The ICO and Motient proposals point to the significant technical challenges to the design and operation of MSS systems intended to serve users with handheld terminals.[4] The key technical factor underlying these proposals is the fact that satellite link margins[5] are necessarily much smaller than those available over terrestrial facilities. This is due to the much longer signal path lengths required for satellite communications, and the much greater difficulty of generating transmit powers on board satellites compared to the virtually unlimited amount of power available to terrestrial transmitters.

The longer signal paths of satellite links compared to terrestrial links encounter much higher path losses resulting in lower received signal levels. The free space loss for a satellite link is about 158 dB for a typical 1,000 km satellite link compared to 118 dB for a typical 10 km terrestrial link at 2 GHz. Additional losses occur in areas where the line of sight to an MSS satellite is attenuated by buildings or heavy foliage. For typical MSS coverage areas defined by elevation angles above 15 degrees, foliage attenuation can typically be overcome with link

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3 *See Notice* at para. 28. While specific assignment algorithms need to be developed for each MSS system to optimize the assignment of MSS system resources between satellite and ancillary terrestrial facilities, management of the spectrum and capacity resources of such hybrid satellite/terrestrial systems should present no insurmountable problems to the operator of an integrated system.

4 *See Id.* at para. 26.

5 Link margin is the difference between the received signal level and the minimum signal level required for the desired quality of service. Satellite links are usually designed to provide a small positive link margin to overcome fast fading effects that can not be overcome by the slower dynamics of the automatic power control scheme and to account for measurement uncertainties in this power control loop. Dynamic power control algorithms can compensate for a limited range of slow fading effects over satellite links, such as varying propagation losses due to foliage in the satellite signal path as the user moves.

margins of 3 to 15 dB above free space transmit power levels. To provide service when a user is located within a building, signal levels typically need to be 10 to 20 dB above free space levels for wooden buildings and 20 to 40 dB above free space levels for steel and concrete buildings.

In addition, generating power on board satellites is more difficult and costly compared to terrestrial transmitters.[6] The amount of transmitter power that can be generated on board a satellite is limited by the size of the solar array and the amount of heat due to power dissipation from the transmitter that can be radiated into space by the satellite.[7] Both of these factors are limited by the launch vehicle, which is also limited by the satellite mass and size that can be delivered into orbit.[8]

The combination of these two limitations make it impractical for satellite systems to provide the same magnitude of link margins as terrestrial systems without greatly reducing satellite capacity.[9] The baseline capacity of MSS systems used for financial modeling purposes is normally calculated in terms of the number of circuits that can be provided to nominal users with line-of-sight signal paths to the satellite and a small, fixed link margin. A "pool" of the

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6 Regulatory limits may also have a significant impact on satellite links, such as the power flux density limits on satellite transmissions in the 2.4 GHz MSS downlink.

7 Because they are not perfectly efficient, all transmitters waste some of the power applied to them in the form of heat which must be dissipated in order to keep the transmitter temperature within design limits. Unlike terrestrial transmitters that can use air or water flow to conduct away this waste heat, the only way a satellite can eliminate the waste heat generated by its electronics is by radiating it into space. The amount of heat that can be radiated is proportional to the surface area of the satellite which is limited by the launch vehicle fairing.

8 The received signal level is determined by the effective radiated power, which is the combination of transmit power and transmit antenna gain. The antenna gain is limited by the antenna aperture size, which is limited by the size of the launch vehicle fairing.

9 A similar set of limitations apply to the reverse link where handset power is limited by battery power and safety-related and frequency sharing power limits. The satellite G/T is limited by the satellite antenna gain which is limited by the aperture size that can be launched within the launch vehicle fairing size. The uplink margin from user transceivers may also be constrined by regulatory standards, such as the limit on out-of-band emissions to protect GPS which has significant limiting effects on the power transmitted by 1.6 GHz handsets.

limited satellite power is reserved for dynamic allocation to a subset of users whose line-of-sight signal path is attenuated. This satellite power control pool for disadvantaged users has a very high rate of trade-off between capacity and link margin (e.g. providing an additional 10 dB of link margin to one user is equivalent to serving 10 nominal users, 20 dB link margin to 100 users, etc.) On the other hand, terrestrial systems are easily capable of providing sufficient link margins to penetrate most buildings with little if any impact on system capacity.

Consequently, satellite capacity is used most efficiently to serve customers that have direct line of sight to the satellites, i.e. users in remote or rural areas or users encountering light to moderate foliage attenuation. However, a large portion of the potential MSS market (i.e. customers who also require service in urban areas) are reluctant to subscribe to MSS service. Ancillary terrestrial facilities will allow MSS systems to serve customers in both rural and urban areas.

B. Ancillary Terrestrial Operations Will Result In More Efficient Spectrum Utilization

Ancillary terrestrial operations in urban areas will allow a greater number of customers to be served within the spectrum currently assigned to an MSS system, while more satellite capacity resources (including more robust links) is freed up to serve customers outside of urban areas. This extension of the capabilities of MSS systems does not require the assignment of any more spectrum than is already allocated for MSS, and therefore results in more efficient spectrum utilization.

C. Ancillary Terrestrial Operations Will Preserve The Inherent Satellite Nature Of The Networks Operating In The MSS Bands

Although ancillary terrestrial operations allow MSS systems to extend their service into urban areas where the satellite signal is less reliable, it will not change the inherent nature of the service offering. As long as the Commission requires MSS licensees to operate and maintain their satellite system, there is no reason to believe that the addition of ancillary terrestrial facilities will result in the MSS service becoming primarily a terrestrial service.[10] Current MSS licensees are committed to building and operating their satellite systems, and satellite technology will remain a vital part of any integrated satellite/terrestrial network. Moreover, suitable rule provisions can be adopted to ensure that the assigned MSS frequencies are not used for an "exclusively" terrestrial service.

The high capital investment in satellite facilities requires that they carry as much traffic as possible in order to generate the revenue needed to recover their costs. Thus, as long as the MSS operator maintains its space segment, revenue generating requirements will dictate that the system fully utilize its assigned spectrum for satellite communications, particularly to satisfy demand in remote areas where competitive, advanced mobile services are not provided by the terrestrial infrastructure of existing networks. As long as the assigned spectrum is fully utilized for satellite communications, the Commission should not be concerned about the level of usage of the ancillary terrestrial component, since such usage reflects only more intensive utilization of an existing spectrum assignment in serving the public.

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[10] *See Id.* at para. 26.

D. Ancillary Terrestrial Operations By MSS Licensees Are In The Public Interest

Constellation believes that the public interest will be served by the authorization of ancillary terrestrial operations by MSS licensees on their assigned frequencies since integrated satellite/terrestrial networks can rapidly provide advanced wireless services throughout the United States. Moreover, the improved capabilities of MSS services from the expanded customer base in urban areas will provide greater assurance that affordable basic and advanced telecommunications services will be available over MSS systems serving even the most remote areas of the country.

(i) Ancillary Terrestrial Operations Will Provide MSS Users With A Greater Variety And More Robust Services

The initial benefit of ancillary terrestrial operations to users will be the ability to receive service in suburban and urban areas where attenuation of the satellite signal caused by building walls makes it difficult to receive a reliable service directly by satellite. In those areas where only a marginal satellite signal is available due to heavy foliage attenuation, the availability of ancillary terrestrial facilities will provide users with a more robust signal without the dropouts that can not be overcome within the limits of the satellite dynamic link power control scheme. The result will be a higher link availability over a wider geographical area, more efficient spectrum use and a greater range of advanced wireless services provided by MSS systems.

The increased reliability of MSS services over large geographic areas and higher data rates can lead to new applications and services over MSS systems. Authorization of ancillary terrestrial operations will also further the Commission's general policy goal of granting licensees

technical, operational, and service flexibility[11] and is consistent with the provisions of Section 303(y) of the Communications Act[12] that gives the Commission authority to provide flexible use of spectrum under certain specified conditions.

New satellite systems, including the systems licensed to Constellation, will provide advanced wireless services throughout the country from the outset. Ancillary terrestrial operations will allow these services to be provided even in urban areas where satellite signals can not be received on a reliable basis. Allowing MSS systems to extend their services into urban areas will have a positive impact on the telecommunications market.[13] Since demand for service is growing in urban areas, ancillary terrestrial operations by MSS operators will increase the competitive supply of service without requiring the allocation of any additional spectrum. Moreover, the new service capabilities unique to integrated satellite/terrestrial system architecture will spur competitive responses by existing terrestrial operators. For example, integrated satellite/terrestrial systems allow a more rapid rollout of new advanced or specialized services on a nationwide basis.[14]

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11 *See, e.g.,* Principles for Reallocation of Spectrum to Encourage the Development of Telecommunications Technologies for the New Millennium, *Policy Statement*, 14 FCC Rcd 19,868 (1999); Principles for Promoting the Efficient Use of Spectrum by Encouraging the Development of Secondary Markets, *Policy Statement*, 15 FCC Rcd 24,178 (2000).

12 Section 303(y) grants "authority to allocate electromagnetic spectrum so as to provide flexibility of use, if (1) such use is consistent with international agreements to which the United States is a party; and (2) the Commission finds, after notice and an opportunity for public comment, that— (A) such an allocation would be in the public interest; (B) such use would not deter investment in communications services and systems, or technology development; and (C) such use would not result in harmful interference among users." 47 U.S.C. § 303(y).

13 *See Notice* at para. 27.

14 *See Id.* at para. 28. With respect to the availability of technology for integrated systems, Constellation believes that there are no technological barriers, but that some development work is needed. However, the required investment will not be made unless enough spectrum is assured for system implementation.

(ii) Ancillary Terrestrial Operations Will Improve The Viability of MSS Systems

Constellation agrees with the premise offered by ICO and Motient that allowing terrestrial operations in conjunction with MSS networks is important to assure the commercial viability of MSS systems and to promote the Commission's goal of bringing access to advanced communications services to rural and underserved areas of the country.[15] The level of acceptance of MSS service, and the current financial state of the industry, is due, in significant part, to user expectations that handheld satellite terminals can be used in locations that do not have a direct line of sight path to the satellite. Ancillary terrestrial operations will help correct this situation by allowing MSS systems to satisfy these expectations and attract customers who require service in urban areas as well as rural areas where only MSS can reach. This expanded customer and revenue base is an important element of improving the commercial viability of MSS systems.

Satellite systems require high capital investment and a long period of time for system construction and launch. These capital costs, as well as operating expenses for a significant period of time during market ramp-up, have to be financed before a financial break even point is reached. The initial MSS systems designed to serve handheld terminals have been very ambitious in their scope and very sensitive to market assumptions regarding initial system ramp-up. Past experience of current operators indicates that ramp-up rates are lower than anticipated and initially insufficient to cover interest and operating costs of their systems.

Additional revenue derived from ancillary terrestrial services will allow MSS systems to remain viable during the satellite market ramp-up stage. Premium voice/data services provided

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15 *See Id.* at paras. 24 – 25.

by integrated systems will provide another revenue base to ensure availability of affordable service in remote areas, and the availability of improved signal levels in urban areas will increase demand for MSS services. Moreover, customers with wide area requirements that include urban locations can now be better served with ancillary terrestrial operations.

Ancillary terrestrial operations can also reduce the price of MSS services by reducing handset complexity and thus cost. Integrated MSS systems can eliminate separate antennas and RF components previously required for the terrestrial component of dual mode transceivers, thus, reducing handset size and weight.[16] With a bigger customer base, economies of scale can reduce handset costs through larger production runs. In addition, use of terrestrial repeaters for users with attenuated links to the satellite allows a greater number of revenue producing customers to be served by satellite if terrestrial facilities can handle such disadvantaged users, thereby reducing space segment costs as well.

(iii) A More Viable MSS Industry Will Enhance The Availability Of Advanced Wireless Services In Rural And Underserved Areas

MSS systems offer the most practical means of extending affordable, modern telecommunications to remote areas of the country. These capabilities will be enhanced by the increased financial viability of competitive MSS providers along with the increased revenue base created through ancillary terrestrial operations.

MSS systems are designed to link remote users and gateway (feeder link) earth stations separated by distances of up to hundreds to thousands of miles with no intervening terrestrial facilities. MSS systems cover all areas of the country without requiring local towers or landline

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16 *See Id.* at para. 27.

extensions. Thus, MSS systems are inherently more capable than terrestrial CMRS carriers to serve rural and underserved areas.[17]

On the other hand, terrestrial links between users and base stations span distances of only a few miles. These ground based networks are based on an infrastructure of repeaters located on radio towers, buildings or other structures and must be connected together and with the CMRS switching center and the public switched telephone network by wireline or radio facilities. Such a network architecture routinely begins in high density urban areas and gradually expands to less dense areas over time. However, a point must come where the user density is too low to economically support the necessary ground based infrastructure of towers, repeaters and base station interconnection facilities. CMRS carriers are unlikely to invest in towers and associated infrastructure in rural areas. In these areas, service is either not provided or must be subsidized. In the absence of viable MSS systems, service to rural and underserved areas is likely to be spotty, provided by a mixture of different technologies with inconsistent capabilities, and likely to require large subsidies to make them affordable.

By authorizing ancillary terrestrial operations by MSS operators, they will be able to attract customers who also require service in urban and suburban areas and thus provide a larger and more viable revenue base for MSS systems. In the absence of such a wide customer and revenue base, the financial case for MSS systems will be much weaker. Their failure may eliminate the availability of MSS systems for service in rural areas, especially those remote areas that are unlikely to ever be served by any terrestrial CMRS carrier.

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[17] *See Id.* at para. 26.

II. The Commission Should Authorize Big LEO MSS Licensees To Conduct Ancillary Terrestrial Operations In The 1.6/2.4 GHz Bands

Constellation supports the Commission's proposals to authorize MSS operators to conduct ancillary terrestrial operations in the L-Band and 2 GHz MSS bands, and requests the Commission to amend its rules to allow licensees in the 1.6/2.4 GHz MSS bands to conduct the same type of ancillary terrestrial operations. Constellation asks the Commission to consider these comments as a "proposal to permit Big LEO MSS operators to provide terrestrial services in the Big LEO MSS bands."[18]

A. The Public Interest Will Be Served By Ancillary Terrestrial Operations Conducted By Big LEO MSS Licensees

For the same reasons advanced in the ICO and Motient proposals with respect to the L-Band and 2 GHz MSS bands, ancillary terrestrial operation in the 1.6/2.4 GHz MSS bands will provide the same public benefits.[19] Although the Big LEO MSS systems in the 1.6/2.4 GHz bands were initially intended to provide extensions of cellular voice services into areas that could not be affordably served by ground-based facilities or serve users requiring service over a wide geographical area, more advanced wireless services are currently being planned. In particular, Constellation is planning to upgrade its planned service offerings over its Big LEO system to include higher data rate transmission that would support advanced wireless services in addition to its initial plans to offer basic telephony and voice bandwidth data services.

The same economic forces facing satellite systems in the L-Band and at 2 GHz are also being encountered by Big LEO systems in the 1.6/2.4 GHz bands. To the extent that MSS

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18 *See Id.* at para. 80.

19 *See Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum in the 1.6/2.4 GHz Band for Use by the Mobile Satellite Service*, 9 FCC Rcd 536 (1994) ("Big Leo Allocation Order").

systems are designed to support handheld user terminals, the same economic, technical, and service availability factors that support ancillary terrestrial operations in L-Band and at 2 GHz are applicable to MSS systems in the 1.6/2.4 GHz band. As a policy matter, Big LEO MSS system operators would be adversely affected and placed in an uncompetitive market position if they were denied the same opportunities as other MSS operators to conduct ancillary terrestrial operations.

B. Ancillary Terrestrial Operations In The Big LEO MSS Bands Can Be Licensed Under The Same Basic Approaches Applied To The Other MSS Bands

Constellation believes that ancillary terrestrial operations should be authorized on the same basis as ancillary terrestrial operations in L-Band and 2 GHz MSS systems. Apart from a few band specific technical provisions relating to the specific inter-service sharing conditions and band usage arrangements that exist in the 1.6/2.4 GHz MSS bands, ancillary terrestrial operations in these bands should be subject to the same service rules as the L-Band and 2 GHz MSS.[20] In Section IV below, Constellation provides its proposals for specific service rules to govern the authorization and operation of ancillary terrestrial facilities by MSS licensees in all three pairs of MSS bands.

With respect to sharing criteria, Constellation believes that the current technical standards that apply to user terminals should apply to handsets whether used to communicate with a satellite or a terrestrial repeater.[21] Constellation believes that results of Negotiated Rule

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20 *See Id.* at paras. 79 – 83.

21 Handsets will transmit to terrestrial repeaters at lower powers than when transmitting to satellites, and thus will cause no higher levels of interference than that permitted by handsets transmitting to MSS satellites. Since the current satellite mode standards adequately protect other services, there is no need to apply more stringent limits on handsets when operating with terrestrial repeaters.

Making[22] are suitable basis for developing any new standards applicable to terrestrial transmitters involved in ancillary terrestrial operations. For example, the concept of exclusion zones to protect 1.6 GHz radio astronomy sites can be applied to terrestrial fixed base stations, but probably requires the establishment of a distance scaling formula based on the ratio of maximum terrestrial repeater power to the assumed maximum handset power.

(i) Ancillary Terrestrial Operations By TDMA Big LEO MSS Systems Should Be Confined To The TDMA Band Segment

The Commission's Big LEO Order assigns 5.35 MHz at 1621.15 – 1626.5 MHz to a time division multiple access ("TDMA") MSS system – Iridium – for both transmission and reception in the same band, i..e. on a time division duplex ("TDD") basis. The Iridium system has demonstrated the feasibility of a TDD systems in actual practice and Constellation believes that ancillary terrestrial operations can similarly be conducted on a TDD basis.[23] In fact, this type of operation is described as duplex sharing modes in the ICO Motion.[24] Since the TDMA user transceivers are already designed to operate in a single band, Constellation believes that ancillary terrestrial operations should be confined to the same band, implying a TDD architecture for ancillary terrestrial facilities. Any other architecture for the ancillary terrestrial facilities of the TDMA satellite operator would require the restructuring of the 1.6/2.4 GHz MSS band sharing arrangement, which is outside of the scope of this proceeding.

Because terrestrial base stations generally operate at a higher power level than handsets, Constellation believes that the terrestrial repeaters should be operated in the higher frequency portions of the TDMA band segment in order to minimize the amount of adjacent channel

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22 *See* Report of the MSS Above 1 GHz Negotiated Rulemaking Committee (April 6, 1993).

23 *See Notice* at para. 81.

24 *See* ICO Motion, Appendix B.

interference introduced into Constellation's spacecraft receivers.[25] In coordinating such TDD or TDMA operations in the TDMA band segment with the code division multiple access ("CDMA") system operators, no more stringent conditions should be placed on the transmissions of CDMA user transceivers, whether for satellite or terrestrial links, than are required for the current satellite-only operations.

(ii) Ancillary Terrestrial Operations By CDMA Big LEO MSS Systems Should Be Coordinated Under The Current Coordination Arrangements

Constellation plans to use CDMA for the satellite links in its 1.6/2.4 GHz MSS system. With respect to the CDMA segments of the Big LEO MSS bands, Constellation is confident that ancillary terrestrial operations can be coordinated by the two remaining CDMA licensees.[26] The two CDMA systems[27] can share the entire CDMA segment for satellite transmissions using cross-polarization discrimination.

This cross-polarization isolation technique is unlikely to provide sufficient isolation to permit use of the same frequencies for ancillary terrestrial operations in the same geographic area. This is due to the larger variations in handset and base station transmit levels when operating with terrestrial repeaters compared to the variation in power levels when satellite

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25 Constellation's satellites are designed with nominal 11 MHz filtering to reduce the effects of Iridium transceiver transmissions on the performance and loading of its inbound transponders. Operating more transmitters in the TDMA segment, whether user transceivers or high power base station transmitters, will increase the noise level in the Constellation satellite receiver and reduce system capacity. The effects of this interference will be reduced for transmissions farther away from the CDMA segment due to the transponder filtering. However, the total amount of power produced by all of the transmitters in the TDMA band segment needs to be coordinated with CDMA operators in the same manner as CDMA operators coordinate with the TDMA system operator.

26 *See Id.* at para. 82.

27 Constellation and Globalstar have chosen opposite senses of polarization for their systems, which provides enough isolation that both systems can use the entire CDMA segment in their systems subject to coordination of power levels.

transmissions are involved. Consequently, some form of band segmentation between the terrestrial facilities operated by each of the two CDMA systems in any geographic area is likely to be required. However, it would be premature for the Commission to specify a specific band sharing arrangement.[28] To minimize operational impact and maximize spectrum efficiency, such an arrangement will involve coordinating specific channel arrangements and is best left to the licensees involved. In particular, optimum satellite/terrestrial frequency use plans may be different in the 1.6 GHz and 2.4 GHz bands due to the differences in sharing conditions between the uplink and downlink bands.

III. Terrestrial Operations In The MSS Bands Should Be Limited To MSS Licensees

Ancillary terrestrial operations should be limited only to MSS operators in the L-Band, 1.6/2.4 GHz and 2 GHz MSS bands.[29] Although the Commission identifies the alternative of licensing non-MSS operators to provide terrestrial facilities in portions of the MSS bands,[30] Constellation believes that pursuing such an alternative will adversely affect the public interest, result in inefficient spectrum use and frustrate the Commission's policies regarding MSS and service to rural and underserved areas. Effective spectrum utilization in the MSS bands requires that any ancillary terrestrial operations in the MSS bands be operated by the MSS operators to avoid harmful interference and achieve optimum utilization of spectrum and satellite resources.[31]

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28 Both the forward band sharing arrangement and a TDD arrangement in the downlink band appear to be viable approaches to implementing ancillary terrestrial operations in the 1.6/2.4 GHz bands. Transmission from higher power terrestrial base stations in the lower portion of the CDMA band segment of the 1.6 GHz band appears problematic because of the increased size of radio astronomy protection zones and the difficulty of designing high power terrestrial base station transmitters to meet the stringent out-of band emission limits needed to protect GPS.

29 *See Notice* at para. 29.

30 *See Id.* at para. 27.

31 As a threshold matter, Constellation believes that no basis has been provided for modifying Constellation's MSS licenses or the licenses of the other MSS satellite system operators pursuant to Section 316 of the Communications Act for purposes of reassigning MSS spectrum to independent terrestrial operators.

Constellation does not believe it appropriate to allow terrestrial use of MSS bands, either by segmenting the MSS bands into satellite and terrestrial segments, or by allowing operations in the band by MSS operators and independent terrestrial operations on a shared basis:[32] Constellation believes that the future of MSS requires that all of the current MSS allocations between 1 and 3 GHz must be retained for use by MSS systems if the public is to receive the benefits of this technology.[33]

A. The Viability of MSS Systems Requires Retention Of The Current MSS Allocated Spectrum

The amount of spectrum allocated to the MSS is relatively small compared to the amount of spectrum allocated for terrestrial mobile services. Specifically, only 34 MHz is allocated for L-Band systems, 16.5 MHz for Big LEO systems, and 35 MHz for 2 GHz systems in each direction of transmission (i.e. the same amount of spectrum is allocated for forward and for return links). However, this limited amount of spectrum must be shared by multiple systems, e.g. at least 5 systems at L-band, 3 systems at 1.6/2.4 GHz, and up to eight systems at 2 GHz. This amounts to about 5 MHz per system,[34] compared to much larger blocks of spectrum available to terrestrial systems. This limited MSS spectrum is implemented by all types of users, including government, safety, commercial and even by broadcasters for remote program feeds. Thus, any reduction of MSS spectrum would unfairly limit MSS capabilities and capacity. This would be particularly disadvantageous to users in rural and underserved areas where MSS may

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Formal proceedings would be required before any frequencies currently assigned to MSS licensees could be assigned or auctioned to terrestrial operators.

32 *See Id.* at para. 28.

33 With respect to the 2 GHz MSS bands, see also Constellation's Comments of October 22, 2001 in ET Docket No. 00-258 regarding the alternative of reducing these allocations to permit terrestrial operations by independent terrestrial licensees.

34 More precisely computed values are 6.8 MHz at L-Band, 5.5 MHz at 1.6/2.4 GHz, and 4.375 MHz at 2 GHz, if the allocated spectrum is divided equally among the identified number of MSS operators.

be the only viable technology for providing advance mobile services. Consequently, reallocation will only reduce available capacity of MSS systems and adversely affect their viability.

In no way should the proposals for terrestrial operations be viewed as an implication of excessive allocations of spectrum to MSS. Instead, they simply represent an opportunity for MSS operators to serve more customers using spectrum already allocated and assigned to them. Previous studies have concluded that the amount of spectrum allocated to MSS is not sufficient to satisfy the potential market for MSS services. The slow ramp-up of MSS systems is only a reflection of the normally slow ramp-up of satellite services, not proof that there is no demand for MSS services.

B. Operation Of Satellite And Terrestrial Systems In The Same Bands By Different Entities Is Inefficient And Unworkable

The basic technical premise underlying the spectrum efficiency of ancillary terrestrial operations in MSS bands is to provide service in localized urban areas by terrestrial repeaters, while using the same set of frequencies to serve rural locations by satellite. This requires a careful balancing and control of technical operations and traffic loading that will be impractical if satellite and terrestrial operations were controlled by different entities.[35]

Alternative terrestrial licensees would use spectrum only in urban areas, and would not add any additional service beyond that provided by the MSS licensees in those areas. On the other hand, reallocated MSS spectrum would not be available to MSS operators who are the only ones capable of serving remote areas where terrestrial infrastructure is not economical. If MSS were allowed to provide service only outside of urban areas, coordination and definition of unusable boundary areas is impractical and is likely to result in either inefficient spectrum use if

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[35] *See Notice* at para. 37.

the criteria were too conservative or harmful interference if the criteria were too liberal. Finding the proper balance would be very difficult for two competitors to achieve. Inefficient spectrum utilization would occur in any of these cases.

Constellation believes that the key characteristic of ancillary terrestrial operations is the integration of satellite and ground-based facilities designed and operated by an MSS licensee as a hybrid system. While different modulations and waveforms might be used when communicating with satellites and with terrestrial repeaters,[36] the major advantage in handset design is a common antenna and RF module for communications via both transmission modes. Ancillary terrestrial operations provide an additional spectrum and capacity resource to manage. However, a single resource management scheme is necessary to maximize spectrum utilization and service capacity and quality.[37]

Consequently, Constellation does not believe that the terrestrial component of a hybrid satellite/terrestrial system can be independently designed and operated by a separate terrestrial CMRS carrier.[38] An independent terrestrial CMRS operator would have no incentive to design an independent system that works efficiently with the satellite component, either as a technical matter or as a business and economic matter. In particular, if only a single independent CMRS carrier were authorized by the Commission, it would have monopoly pricing power over

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36 Satellite and terrestrial radio channels generally have different fading statistical characteristics, e.g. Rician versus Rayleigh fading, and optimum performance may require different signal formats and error correction coding algorithms to optimize performance.

37 For example, the spectrum capacity resources available to a CDMA satellite systems is measured by the number of beams, bandwidth, CDMA codes, and available power (defined by both available spacecraft power and power flux density limits).

38 *See Notice* at para. 27. However, Constellation does not believe the Commission should preclude voluntary commercial arrangements between satellite and terrestrial CMRS operators since there may be opportunities for joint marketing or provisioning arrangements or maintenance support even though the hybrid satellite/terrestrial network is designed and operated by the MSS licensee.

providing the terrestrial component of an integrated MSS service offering. If multiple CMRS operators were authorized, the MSS operator would be forced to deal with multiple technical and business arrangements in order to achieve an integrated service offering that would add significant costs and cumbersome administrative burdens to achieve an integrated service offering. In particular, economic and spectrum efficiency requires dynamic allocations of system resources (frequencies, satellite power, CDMA codes) between satellite beams and terrestrial repeaters on a nationwide basis.[39]

As a practical matter, requiring independent terrestrial operators to provide the terrestrial component of integrated satellite/terrestrial networks will only increase the cost of service to the public and hamper the development of MSS.[40] Any mandatory requirement to negotiate with CMRS operators would increase prices since it would preclude the normal (economically efficient) mechanisms of in the negotiating process for roaming rights. Since current terrestrial networks would have to be modified to accommodate an integrated satellite/terrestrial network, a Commission mandated reliance on terrestrial CMRS carriers would provide an incentive for them to undercut development of satellite-based competition. In particular, terrestrial CMRS operators with large market shares in a market could have the incentive to route traffic over their existing terrestrial network, using facilities in the MSS bands only in the last resort, to deny satellite operators the traffic and revenue they might otherwise acquire by direct marketing.

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39 *See Notice* at para. 28. Constellation does not believe there are any near term technological advances that would allow independent satellite and terrestrial networks to efficiently share the same frequencies. Efficient spectrum usage by satellite and terrestrial facilities require complex resource assignment algorithms involving frequency, power, code assignments to individual users on a dynamic basis, as well as geographical allocation of resources between satellite and terrestrial use. Additional complexities include dynamic satellite power and payload configuration management, as well as other operational changes to control inter-system interference; e.g., feeder link beam coupling interference between non-GSO systems. It is unlikely the level of interaction and intervention between the internal operations of the satellite and terrestrial facilities using the same frequencies would be acceptable to either operator.

40 *See Id.* at para. 27.

C. Competitive Bidding Procedures Are Prohibited For Licensing Ancillary Terrestrial Facilities To The Current MSS Licensees

The Commission raises the possibility of employing competitive bidding procedures[41] or imposing additional fees similar to those for ancillary services provided in broadcast spectrum.[42] However, the mutual exclusivity required for imposing competitive bidding procedures does not apply to ancillary terrestrial facilities licenses issued to existing MSS licensees to supplement their authorized systems.

The Commission has already issued MSS system licenses in a manner that avoids mutual exclusivity in these services. No new mutual exclusivity is created by authorizing these licensees to operate ancillary facilities in the same bands allocated to MSS and subject to the same basic frequency selection, assignment and coordination procedures established for their MSS systems. Consequently, if the provision of terrestrial services in bands is limited to the current MSS licensees, the Commission cannot use competitive bidding under Section 309(j) because the terrestrial license rights are directly linked to the outstanding MSS authorizations. Under such circumstances there are no mutually exclusive applications that trigger the competitive bidding provisions of Section 309(j).

Moreover, the Open-Market Reorganization for the Betterment of International Telecommunications Act (the "ORBIT Act") precludes competitive bidding for global satellite systems. Constellation agrees with the Commission's observation that Section 647 of the ORBIT Act prohibits the Commission from assigning by competitive bidding, spectrum or orbital locations used for the provision of international or global satellite communications

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41 *See Id.* at para. 38.

42 *See Id.* at para. 40.

services.[43] Non-GSO MSS systems, such as the Constellation system, are inherently designed to provide service on a global basis. Such global service capabilities are in fact a requirement of the Commission's rules.[44] Thus, Section 647 of the ORBIT Act prohibits the Commission from authorizing spectrum for ancillary terrestrial operations in MSS bands by MSS licensees through competitive bidding procedures. The ORBIT Act auction exemption on competitive bidding is not affected by a grant flexibility to MSS authorized providers to use the spectrum for ancillary terrestrial services that may not otherwise be subject to the exemption.

In addition, Constellation agrees with the Commission's observation that the case where Congress allowed flexible use of the broadcast spectrum and permitted licensees to offer ancillary or supplemental services[45] is not applicable to the present circumstances. Since the Commission does not have specific legislative authority to this effect for ancillary terrestrial services in MSS bands, it does not have authority to assess similar fees in this context.

IV. The Commission Should Carefully Craft Its Rules And Regulations To Govern Ancillary Terrestrial Operations

Constellation believes that the service rules for ancillary terrestrial operations by MSS licensees should be carefully crafted to avoid any unintended restrictions that would prevent the full benefits of ancillary terrestrial operations to be provided to the public. Such rules should provide as much flexibility as possible to MSS operators to design and operate their satellite and ancillary terrestrial facilities to minimize costs and maximize the diversity of services provided

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43 Pub. L. No.106-180, 114 Stat. 48 (enacted March 12, 2000) ("the ORBIT Act"). *See Id.* at para. 39.

44 *See* § 25.143(b)(2) which specifies minimum coverage requirements for non-GSO MSS systems.

45 47 U.S.C. § 336. Congress also required that if the Commission were to permit a licensee to offer ancillary or supplementary services for a fee or in return for compensation, it should establish a system of fees to be paid by the licensee equal to the amount that would have been recovered had such service been licensed by auction to avoid unjust enrichment through the method employed to permit such uses of that resource. *See Notice* at para. 40.