Before the
Federal Communications Commission
Washington DC 20554

In the Matter of	
Procedures to Govern the Use of Satellite Earth Stations on Board Vessels in the 5925-6425 MHz/3700-4200 MHz Bands and 14.0-14.5 GHz/11.7-12.2 GHz Bands	IB Docket No. 02-10

PETITION FOR RECONSIDERATION OF THE FIXED WIRELESS COMMUNICATIONS COALITION

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Pursuant to Section 1.429 of the Commission's Rules, the Fixed Wireless Communications Coalition (FWCC) files this Petition for Reconsideration of certain aspects of the Report and Order (R&O) in the above-captioned proceeding on the operation of earth station vessels (ESVs).[1]

A. SUMMARY

The FWCC commends the Commission for taking into account the importance of protecting the Fixed Service (FS) by requiring ESVs to coordinate their frequencies, limit the shared spectrum they use, and arrange to turn off ESV transmissions automatically if the vessel leaves coordinated waters or slows below the coordinated speed.

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[1] *Satellite Earth Stations on Board Vessels*, IB Docket No. 02-10, Report and Order, FCC 04-286 (released Jan. 6, 2005) (R&O). The FWCC is a coalition of companies, associations, and individuals interested in the Fixed Service -- *i.e.*, in terrestrial fixed microwave communications. Our membership includes manufacturers of microwave equipment, licensees of terrestrial fixed microwave systems and their associations, and communications service providers and their associations. The membership also includes railroads, public utilities, petroleum and pipeline entities, public safety agencies, cable TV providers, backhaul providers, and/or their respective associations, common carrier and private communications carriers, and telecommunications attorneys and engineers. Our members build, install, and use both licensed and unlicensed point-to-point, point-to-multipoint, and other fixed wireless systems, in frequency bands from 900 MHz to 95 GHz. For more information, see www.fwcc.us.

As we show below, however, the R&O's limitations on C-band ESV spectrum fail to protect the FS. A single ESV provider is limited to 36 MHz -- not necessarily contiguous -- on each of two satellites. Each satellite transponder occupies 36 MHz of contiguous spectrum that overlaps either two or three FS 30 MHz channels. ESV use of non-contiguous spectrum could adversely impact many more FS channels. Additionally, the Commission's Rules require certain pairings of FS channels for two-way communications. Taking that into account, even an ESV provider that coordinates its permitted spectrum in two contiguous 36 MHz blocks is likely to encumber at least 240 MHz, which is fully half the FS spectrum. An ESV provider that coordinates only a single 3 MHz on each of two satellites could encumber 120 MHz (counting the FS paired channels rendered unusable). Distributing the permitted 72 MHz in small segments could affect many more FS channels. Similarly, because of the channel pairings, the rules allowing ESV operators collectively to coordinate 180 MHz, and limiting the aggregate spectrum "actually encumbered" over an FS link path to 180 MHz, could still result in ESVs blocking out 360 MHz, or fully 3/4 of the lower 6 GHz C-band FS spectrum.

By far the best way to avoid these problems is to require ESVs to use Ku-band while in U.S. waters. ESV providers allege such a restriction would increase their costs and impair operations. But the alternative is to increase costs and impair operations in the FS. Of course the ESV providers want to maximize service and minimize costs. But the FS should not have to subsidize their profits.

The Commission's assertion that to keep ESVs out of C-band would be inefficient use of the spectrum is simply wrong. Every ESV coordination eliminates the FS from spectrum the ESVs cannot use either, so it goes to waste. Even the spectrum nominally in use by ESVs is idle

at any location for most of the time. Overall, ESV coordination may be the *least* efficient use of spectrum anywhere in the Commission's regime.

In addition to Ku-band, coastal and inland vessels have access to a variety of terrestrial wireless broadband services. These make it possible for the Commission to rule out C-band ESVs, and thus protect key infrastructure and public safety services, without denying broadband service to vessels in U.S. waters. The limited benefits of authorizing C-band use on inland waterways in particular cannot outweigh the harm to critical services.

If the Commission nonetheless insists on authorizing C-band ESVs in U.S. waters, at the very least it should impose a 5,000 gross ton minimum limit. This would still permit service to deep draft vessels that operate in coastal waters and major waterways, and should include all ocean-going cruise ships, but will help to limit proliferation inland.

Finally, for the reasons noted above, the ESV spectrum limitations need a few fixes to work as intended. First, the Commission should reverse its decision allowing ESV operators to coordinate more spectrum than they actually need. Second, the Commission should amend the rules limiting the amounts of spectrum that ESVs can coordinate so as to take into account both the mismatch between satellite transponder and FS channel allocations and the required pairings of FS channels in the following respects: (1) The rule permitting an ESV provider to coordinate, at each location, a maximum of 36 MHz on each of two satellites should provide further that the coordination may not encumber more than two 30 MHz FS channel pairs. (2) The rule limiting collective coordination to 180 MHz should provide further that spectrum coordinated on only one side of an FS frequency pair counts twice against the maximum (because the coordination keeps the FS from using both sides of the pair), and that the collective coordination may not encumber

more than three 30 MHz FS channel pairs. (3) The rule limiting spectrum actually encumbered on an FS link to 180 MHz likewise should count both sides of the frequency pair and not encumber more than three 30 MHz channel pairs. For example, a coordination that impairs both sides of a 30 MHz pair would count as 60 MHz toward the limit, while a coordination blocking one side of each of two different 30 MHz pairs would count as 120 MHz. This simply reflects the true extent to which the coordination excludes the FS. ESV providers will still have access to 270 MHz of satellite spectrum within the three FS pairs they are permitted to encumber, taking into account both transponder polarizations. (See the Appendix, Table 1, for an example of the ESV spectrum available within one FS channel pair.)

These changes are necessary to allow the FS to continue meeting critical infrastructure and public safety needs, and still permit ESVs to deliver service to their customers.

B. INTRODUCTION

The FWCC's concerns throughout this proceeding have centered on the 5925-6425 MHz band, also called the "Lower 6 GHz" or L6 band, where ESV satellite uplinks threaten interference to FS receivers. The FS uses this band to carry important safety and infrastructure services. Applications include public safety communications (such as dispatching police and fire vehicles), coordinating the movement of railroad trains, controlling natural gas and oil pipelines, regulating the electric grid, and backhauling wireless telephone traffic, among many others. Unlike ESV operations, which are highly intermittent at a given location, FS links use their spectrum full time. The L6 band is congested and getting worse, due not only to needed FS expansion and terrestrial earth stations, but also because FS links are being relocated there from other bands -- in some cases to accommodate new satellite services.

Many FS applications in the L6 band require 99.999% (or better) availability, a standard that limits outages from all sources to a total of just five minutes or less per year. Some are designed for 99.9999% -- total outages of less than 30 seconds per year. Critical facilities operate disproportionately in coastal areas, and so are directly at risk of interference from ESVs. Just one ESV interference incident per year would violate either of these availability criteria and cause more service disruption than all other causes combined.

ESV proponents have generally resisted measures to protect the FS on the ground that those would increase costs or impair service. This stance seeks to shift some of the risk and expense of ESV operation to the FS, and is patently unfair. The Commission has always required an incoming technology to protect licensed incumbents. FS operators built their systems in prudent reliance on long-standing Commission Rules. They should not now be asked to accept deleterious changes solely to favor another industry. ESV providers, as the financial beneficiaries of their own operations, cannot object to paying the costs of safely squeezing their operations into already congested spectrum. Any ESV service limitations that result are simply a consequence of the ESV industry's own effort to save money or improve service in other respects by operating in C-band. The FS operators should not have to subsidize ESV providers through either higher costs or impaired service.

C. THE COMMISSION SHOULD BETTER PROTECT FIXED SERVICE OPERATIONS INLAND .

ESV operation on inland waterways raises special problems for the FS. Because it operates while in motion, an ESV must coordinate every point along all of its paths. The resulting coordination blocks out new FS operation over large geographic areas. In the case of coastal ESV operation, at least part of the coordinated area is usually over open water. But when ESVs

operate inland, substantially all the coordinated area is over land mass. Because the largest population centers cluster near waterways, inland ESVs are likely to block FS installations just where they are needed most.

1. ESVs should be restricted to Ku-band in U.S. waters.

The ESV industry resists a limitation to Ku-band operation in U.S. waters because, it claims, (a) Ku-band coverage is not available everywhere on the high seas;[2] (b) dual operation in Ku-band and C-band (needed on the high seas) is "technically complex and expensive";[3] (c) rain attenuation limits Ku-band reliability in some areas;[4] and (d) requiring Ku-band use would be "overly burdensome " for ESV providers that now use C-band for their existing operations.[5]

The first two points -- service on the high seas and dual-band operation -- have no bearing on vessels that stay on inland and coastal routes, where Ku-band coverage is available. The third point, on rain attenuation, unjustifiably asks the FS to give up reliability on critical links so that ESVs can gain reliability. There is no rational basis for such a request. And the last point, on maintaining current operations, amounts to the Commission's protecting ESV investment in C-band equipment, even though all prior ESV authorizations expressly warned the operators that they were proceeding at their own risk.[6]

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[2] R&O at para, 16 & n.57.

[3] R&O at para. 17.

[4] R&O at para. 16.

[5] R&O at para. 16. *See also id.* at para. 63 (similar).

[6] For example, Maritime Telecommunications Network (MTN) relied on a string of Special Temporary Authorities (STAs), each of which stated:

Any actions taken as a result of this Special Temporary Authority are solely

The Commission interposes two other grounds for declining to bar inland C-band operations. One is a concern that it might inadvertently block access to ports that are accessible only through an inland waterway.[7] But such ports can be readily served via Ku-band, or by the alternatives mentioned below. And the Commission asserts it would be "inefficient from a spectrum management perspective" to keep ESV operators from coordinating unused C-band spectrum.[8] To the contrary, ESV coordination is inefficient in the extreme. It blocks off large amounts of spectrum over wide geographic areas, only a tiny fraction of which is ever actually in use at any time. Or it may not be used at all: an ESV operator is permitted to coordinate spectrum it does not need and has no plans to use.[9] And, as explained below, an ESV coordination on one FS channel blocks operation on the other member of the channel pair, making that bandwidth useless to FS operations and leaving it empty. (For this reason, a single 3 MHz ESV channel encumbers 60 MHz of FS spectrum. See the Appendix for details.) If anything, spectrum efficiency is an argument *against* inland C-band use, not in its favor.

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at Maritime Telecommunications Network, Inc.'s own risk.

E.g., *Maritime Telecommunications Network, Inc.*, 15 FCC Rcd 23210 at para. 29 (Internat'l Bur. 2000). Previous to the STAs, MTN's predecessor operated under Part 5 experimental licenses, whose governing rules provide:

> [T]he authority to use the frequency or frequencies assigned is granted upon an experimental basis only and does not confer any right to conduct an activity of a continuing nature[.]

47 C.F.R. Sec. 5.83(a).

7 R&O at para. 63.

8 R&O at para. 63.

9 R&O at para. 44.

Unlike ocean-going ships, inland vessels have other options for broadband service, including wireless broadband and emerging 3G services. The Commission responds that terrestrial services would not suffice for a vessel that operates in both inland waterways and the open sea.[10] Again, however, we have no objection to C-band use on the open sea. The Commission also notes that barring inland C-band use would impair competition among broadband delivery modes.[11] We think this is backwards. The Commission should bar inland C-band use to avoid impairing critical infrastructure and public safety communications. The existence of other options makes such a bar more feasible, not less.

In short, the limited benefits of authorizing C-band use on inland waterways simply fail to outweigh the harm to the public interest caused by hindering FS communications.

2. In the alternative, the Commission should raise the minimum size for C-band vessels to at least 5,000 gross tons.

The FWCC consistently urged the Commission to restrict C-band ESV service to vessels of 5,000 gross tons or larger, if it permits such operation at all. Where the Notice of Proposed Rulemaking had suggested a minimum size of 300 gross tons, we pointed out that this is only the size of a small ferryboat.[12] The ubiquity of small vessels in coastal and inland waterways would pose an unacceptable threat to the FS. A 5,000 gross ton limit, in contrast, would limit ESV

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[10] R&O at para. 65.

[11] R&O at para. 65.

[12] For example, the three classes of vessel used for New York City's Staten Island Ferry are 3,335, 2,109, and 499 gross tons, respectively. The smallest of these -- well over the Commission's proposed minimum for ESVs -- carries only foot passengers and no cars. http://www.nyc.gov/html/dot/html/masstran/ferries/statfery.html#facts

operation to deep draft vessels that operate in coastal waters or major waterways. This should include all ocean-going cruise ships.

The Commission concedes that a 300 gross ton minimum allows more ESV operators to access the C-band than a 5,000 gross ton minimum.[13] It also concedes that 300-ton vessels could access inland waterways and harbors.[14] But the R&O then goes on to state that a 5,000 gross ton requirement "is not needed to protect FS operations."[15] The only explanation offered is an ESV proponent's claim that a limitation to large vessels is "patently unnecessary" because of the routine manner in which in-motion ESVs can be identified[16] -- a *non sequitur*.[17]

We think the reasons offered for allowing any C-band ESVs in U.S. waters are inadequate. But if the Commission is determined to so, it should at least mitigate the damage by restricting such operation to vessels of 5,000 gross tons or larger.

D. THE COMMISSION SHOULD FRAME THE ESV SPECTRUM LIMITATIONS SO AS TO MINIMIZE THE HARMFUL IMPACT ON THE FS.

The recently adopted rules allow each ESV operator to coordinate 72 MHz of L6 spectrum at each location -- *i.e.*, 36 MHz uplink per satellite, using at most two satellites.[18] The

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[13] R&O at para. 61.

[14] R&O at para. 63.

[15] R&O at para. 61.

[16] *Id*. at n.165.

[17] The Commission mentions that ITU-R JWP-4-9S Recommendations would permit ESV operation on vessels over 300 gross tons, R&O at para. 59, but the Commission has jurisdiction to make its own rules. The Commission also cites the FWCC as viewing vessel size as less critical if ESV spectrum is appropriately limited. R&O at para. 61. We take up the issue of ESV spectrum limitations in Part D.2, below.

[18] 47 C.F.R. Sec. 25.221(a)(10); *see* R&O at para. 39.

rules also limit ESV operators as a group to 180 MHz in a given area.[19] The R&O points out that this limitation has two components. The total amount of L6 spectrum coordinated by all ESVs at any point on a waterway is limited to 180 MHz;[20] and the aggregate amount of L6 spectrum "actually encumbered" by ESV operations over an FS link path cannot exceed 180 MHz.[21]

1. ESVs should be restricted to coordinating spectrum they actually use.

When an ESV coordinates, it "sterilizes" the coordinated frequencies against FS use over a wide geographic area -- far more terrain than a fixed terrestrial earth station does. Allowing an ESV to eliminate more spectrum from active use than it needs for its own operations results in spectrum that no one can use. This makes no sense. Yet the Commission squarely rejected a request that it limit ESVs to needed frequencies.[22]

The Commission's sole justification was to say it had rejected an earlier FWCC request to limit terrestrial earth stations to twice the spectrum they actually need.[23] Because ESVs will have spectrum limits, the Commission reasons, the FS will receive more protection from ESVs than it

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[19] 47 C.F.R. Sec. 25.202(a)(8); *see* R&O at para. 40.

[20] R&O at para. 40.

[21] R&O at para. 40.

[22] R&O at para. 44.

[23] *FWCC Request for Declaratory Ruling on Partial-Band Licensing of Earth Stations*, 15 FCC Rcd 23127 at para. 5 (2000). The requested rule would have required a C-band earth station to identify spectrum usage when it coordinated, with exceptions for categories of earth stations whose usage is unpredictable. But the Commission never proposed this rule. Instead it offered an alternative based on "demonstrated use" that would have triggered a mini-adjudication when an earth station blocked coordination efforts by an FS applicant. *Id*. at paras. 53-54. Both the FS and satellite industries opposed that idea, and the Commission ultimately abandoned it. *FWCC Request for Declaratory Ruling on Partial-Band Licensing of Earth Stations*, 17 FCC Rcd 2002 (2002).

does from terrestrial earth stations. If the request to limit coordination to actual use was unnecessary for terrestrial earth station, then *a fortiori* it is unnecessary for ESVs.[24]

This line of reasoning has two serious flaws. First, the spectrum limitations on ESVs are badly inadequate, as we explain below. Second, an ESV coordination necessarily blocks FS use over a much greater area than does a terrestrial earth station coordination. *Each point* on a proposed ESV route is coordinated much as a terrestrial earth station is. The sum of those points over the entire ESV route results in excluding FS installations over a far wider area than for a terrestrial earth station. Even if the Commission had been correct in denying the FWCC's request to limit spectrum for terrestrial earth stations -- a point we do not concede -- that prior action cannot be good precedent for a decision on ESVs. The question deserves a second look.

2. ESV spectrum limitations should reflect encumbrance of FS frequency pairs.

Nearly all FS links are two-way, using different frequencies to communicate in opposite directions.[25] The frequency pairings are set out in the Commission's Rules,[26] and are also wired into the hardware. They cannot be arbitrarily changed. As a consequence, when an ESV coordination keeps the FS from using a particular channel, in practice it eliminates not only that channel, but also the other member of the pair. For this reason, coordinating just a single 3 MHz channel for ESV use within an FS 30 MHz channel encumbers a total of 60 MHz. The other 30

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[24] R&O at para. 44.

[25] An alternative technology, called time division duplex (TDD), uses the same frequency to take turns communicating in the two directions. These installations are uncommon, in part because they can accommodate only half the total traffic of a frequency pair.

[26] 47 C.F.R. Sec. 101.147(i).

MHz, the opposite side of the FS pair, is both unused by ESVs and unusable by the FS over a very large area. It is wasted spectrum.

Compounding the problem, every ESV transponder channel straddles at least two FS 30 MHz channels. (A diagram in the Appendix shows the mismatch between transponder and FS channels.) Six transponders (of 24) overlap three FS channels. At first glance, the rule that limits each ESV operator to 36 MHz uplink per satellite at a given location, using at most two satellites, looks like reasonable protection for the FS. But if we take into account just the two-channel overlaps encumbered by 36 MHz of contiguous spectrum and the corresponding FS pairings , the rule renders unusable a minimum of 240 MHz -- exactly half the FS spectrum in the band -- *to serve just one ESV provider*![27] The effects are far worse if the ESV provider coordinates non-contiguous spectrum.

To restore some semblance of balance, the FWCC asks that the rule be rephrased to provide that an ESV operator can coordinate a maximum of 36 MHz on each of two satellites (as before), but may not encumber more than two 30 MHz FS pairs at a given coordination location. This still leaves an ESV operator over 180 MHz on at least seven different transponders.[28]

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[27] That is, each 36 MHz of contiguous ESV spectrum ties up at least two FS channels directly, and also renders their paired channels unusable, for a total of 120 MHz. Allowing the use of different frequencies on a second satellite doubles that to 240 MHz. If each of the two ESV transponders happened to cover three FS channels, the worst-case total would be 360 MHz. Although the FS doubles its available spectrum by using vertical and horizontal polarizations, these do not correspond to satellite earth station polarizations. Either earth station polarization eliminates the use of both FS polarizations.

[28] We are taking into account that overlapping satellite transponders are cross-polarized, making the same frequencies available on two transponders using different polarizations.

A similar problem -- except the numbers are worse -- arises from the provision allowing ESV operators collectively to coordinate 180 MHz. If the ESV operators use small spectrum blocks dispersed over transponders with the same polarization across either the lower half or the upper half of the L6 band, all eight of the FS 30 MHz channel pairs would be encumbered. The only protection against this outcome is the language in the R&O that limits the aggregate amount of spectrum "actually encumbered" by ESV operations over an FS link path to 180 MHz.[29] But that language is missing from Appendix B of the R&O, and so will not appear in the Code of Federal Regulations -- an omission likely to invite legal challenges over whether the provision is binding on ESV operators. (We request that the language be promulgated in the C.F.R.) Substantively, the wording leaves open the possibility that ESV operators could ignore paired channels in counting toward the 180 MHz limit. The next sentence might support that interpretation by characterizing the 180 MHz as the amount of spectrum that ESVs can collectively "coordinate" (rather than "encumber").[30] A reading that allows ESV operators to tie up 180 MHz without counting the paired channels could make up to 360 MHz unavailable -- fully 3/4 of the L6 band FS spectrum.

Far from "sufficiently protect[ing] FS operations,"[31] as the Commission intended, the recently adopted rules gravely threaten availability of FS services over wide areas of the country. To avoid wholesale blockage, we request that the rules permitting ESV operators collectively to coordinate 180 MHz, and limiting encumbered FS channels to 180 MHz on a single link, be

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[29] R&O at para. 40.

[30] R&O at para. 40.

[31] R&O at para. 42.

modified to reflect both sides of an affected frequency pair. In the rule limiting collective coordination, each ESV spectrum block coordinated on only one side of an FS frequency pair and within the FS channel bandwidth would count as 60 MHz. (Multiple ESV spectrum blocks within the bandwidth of a single FS 30 MHz channel would still count as 60 MHz of encumbered spectrum.) Under the rule limiting spectrum actually encumbered, an ESV coordination that impairs both sides of a 30 MHz pair would count as 60 MHz toward the limit, while a coordination that blocks one side of each of two different 30 MHz pairs that would count as 120 MHz. These changes accurately reflect the effect of ESV coordination on future FS coordinations. Overall, the approach provides an incentive for ESV operators to choose transponders in ways that minimize the overall impact on the FS.

CONCLUSION

While fully acknowledging the Commission's efforts to find a balance between the needs of the FS and of the ESV industry, we submit that it missed the mark in some respects. As originally adopted, the rules would unintentionally result in ESV operators leaving very little spectrum available for the FS. The changes we request will resolve those problems while still letting the ESV industry deliver broadband services to ships in U.S. waters and around the world.

Respectfully submitted,

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APPENDIX: Encumbered Spectrum in the Lower 6 GHz Band

Dennis Gross[1]

Fixed Service (FS) stations share the lower 6 GHz band (5925 – 6425 MHz) with C-band satellite earth stations but not the same channel (transponder) allocation plan. As a result, a single 3 MHz ESV signal that does not meet the interference criteria within the passband of an FS receiver will encumber not only the 30 MHz of that FS receiver but also the 30 MHz of the associated channel that is paired with the receiver for a total of 60 MHz. (See diagram of Lower 6 GHz Band Frequency Allocation.) The effect of the ESV signal is actually doubled, i.e., 120 MHz of FS spectrum is encumbered, when both horizontal and vertical polarization of the FS channel is taken into account.[2] In the interest of spectral efficiency and maximum spectral utilization, the FWCC respectfully requests that the Commission reconsider the spectrum limits on ESV operators.

Without a modification of the spectrum limits for ESV operations, the FWCC is concerned that an inordinate amount of spectrum will lie fallow if ESV operators are allowed to indiscriminately coordinate spectrum across the lower 6 GHz band. Several FS channel pairs (out of the 8 available pairs) would be rendered unusable for FS operation if ESV operators coordinate slivers of spectrum across the lower 6 GHz band. For this reason, the FWCC respectfully requests that the Commission reconsider the spectrum limits imposed on an ESV operator and change the restriction so that no more than two FS 30 MHz channel pairs (i.e., two frequency pair allocations for 30 MHz FS operation) be encumbered in a geographical area by a single ESV operator and, collectively, no more than three FS 30 MHz channel pairs be encumbered in an area by all ESV operators.

The example below shows that sufficient spectrum would be available for ESV operations if the spectrum limit were changed as proposed. Table 1 shows that several transponders could be selected for alternate or backup ESV service, depending on the requirements of the ESV operator.

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[1] Dennis Gross is a Microwave Systems Engineer with eight years' experience as frequency coordinator for C-band earth stations.

[2] Note: There is no cross-polarization discrimination that can be taken into account for FS operation vis-à-vis the ESV signal because the horizontal and vertical polarization reference plane for satellites and satellite earth stations is skewed with respect to the FS station's horizontal and vertical reference to the earth's surface. As a result, the use of both polarizations of a channel pair is encumbered by a single ESV signal.

Example of Available Spectrum
for
ESV Operator with One Encumbered FS Channel

As an example, the fixed service (FS) channel pair, 12T/22T, (center frequency of 5974.85 MHz and 6226.89 MHz, respectively) was chosen as the encumbered FS channel pair. The table below shows the respective spectrum available for an ESV operator within the spectrum limits of the encumbered FS channel pair. This table indicates that sufficient spectrum is available in five different transponders for an ESV uplink even under the restriction of not encumbering more than *one* FS channel.

Two (2) MHz guard bands at the edge of the FS channels are excluded from the spectrum available for ESV operation. Furthermore, the 2 MHz guard bands at the edge of the transponders are not included in the calculation of available transponder (XPDR) spectrum. The 40 MHz satellite transponder allocation is used for this example and is representative of domestic satellites. International satellites may have wider transponder allocations and, as a result, would not lose as much spectrum for guard bands (given that there would be fewer guard bands).

Table 1. Available Spectrum for ESV Operation

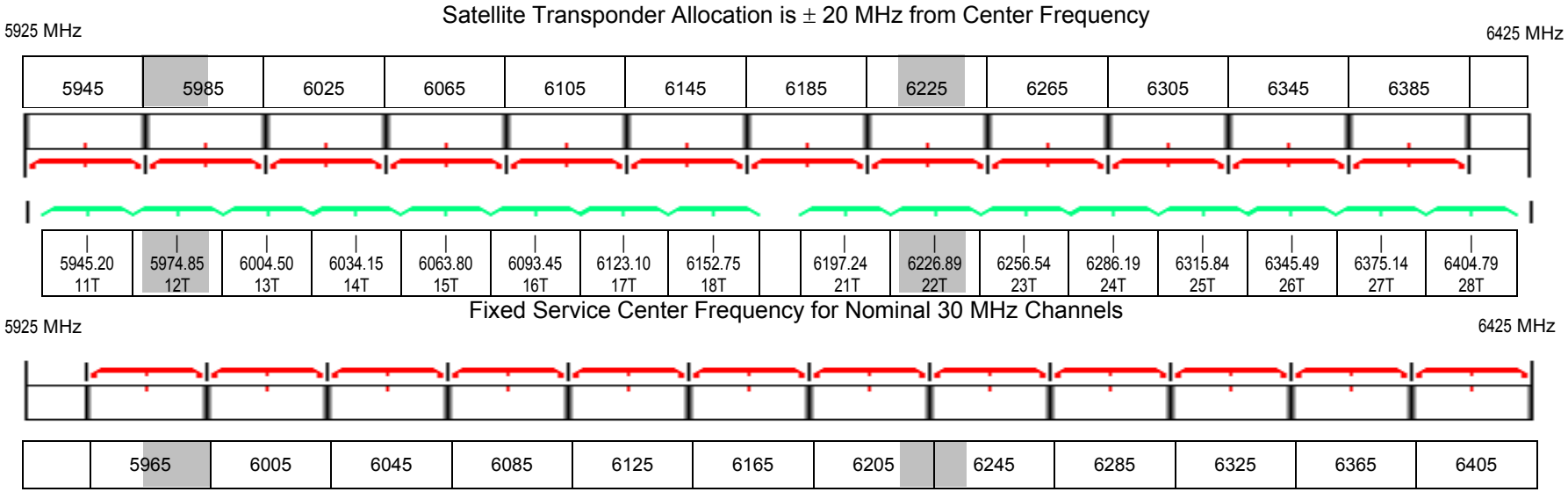
(Encumbered FS Channel Pair 12T/22T)

Fixed Service Channel		ESV Satellite Transponder		
Center Frequency	Spectrum Limits for ESV	Center Frequency	Spectrum Available for ESV Operation	XPDR Spectrum
5975	5962-5988	5965	5962-5983	21
5975	5962-5988	5985	5967-5988	21
6227	6214-6240	6205	6214-6223	9
6227	6214-6240	6225	6214-6240	26
6227	6214-6240	6245	6227-6240	13
			TOTAL =	90

Note: Frequencies in the table are rounded to the nearest MHz for this example.

In additional to the available spectrum shown in the table above, the mid-band spectrum between 6170-6180 MHz would generally avoid interference conflicts with FS stations. This would give an ESV operator a total of 100 MHz of available spectrum on any satellite under the proposed limit of not encumbering more than one FS channel pair. (Refer also to diagram of Lower 6 GHz Band Frequency Allocation.) Similar outcomes would be achieved when other individual FS channel pairs are used as the encumbered pair.

Lower 6 GHz Band Frequency Allocation
for
Fixed Service (FS) and Fixed Satellite Service (FSS)



Key:

= 40 MHz Satellite Transponder with 2 MHz guard band at each edge (center frequency shown in top and bottom rows).

= 30 MHz (nominal) FS Channel (center frequency for lower 6 GHz band FS allocation shown in middle row).

= Shaded area indicates an encumbered FS channel pair (middle row) from a single 3 MHz ESV signal within the bandwidth of an FS receiver and also shows total satellite spectrum (transponders) available for ESV operation within the spectrum limits of the respective encumbered FS channel. (See Table 1. for spectrum available for ESV operation in the area.)
Note: Shaded area is 26 MHz wide to provide a 2 MHz guard band for the adjacent FS channels.

dlg 02/24/05

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