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FEDERAL COMMUNICATIONS COMMISSION
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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Redevelopment of Spectrum to Encourage Innovation in the Use of New Telecommunications Technologies	)	ET Docket No. 92-9
	)	RM-7981
	)	RM-8004

COMMENTS

Pursuant to Section 1.415 of the Commission's Rules, Alcatel Network Systems, Inc. ("ANS"), by its attorney, hereby submits its Comments on the above-captioned Further Notice of Proposed Rule Making, 7 FCC Rcd 6100 (1992)("FNPRM").[1]

SPECIFIC RULES GOVERNING OPERATION OF FIXED MICROWAVE SERVICES IN BANDS ABOVE 3 GHZ ARE NECESSARY

In the FNPRM, the Commission proposes specific rules to govern provision of fixed microwave service in the bands above 3 GHz. ANS supports prompt adoption of these rules. Given the importance of fixed microwave operations to critical public health and safety services and to commercial operations by utilities, railroads, financial institutions and other businesses, ANS applauds the Commission's efforts in presenting the FNPRM for public review and supports prompt adoption of the rules proposed therein.

The Commission has reallocated 220 MHz of spectrum between 1.85 and 2.20 GHz for emerging technologies, including personal

[1]The deadline for filing Comments in this proceeding was extended to December 11, 1992. Order Extending Time For Comments and Reply Comments, ET Docket No. 92-9, RM-7981 and RM-8004 (DA 92-1599, released November 24, 1992).

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communications services ("PCS").[2] To accommodate these new technologies, the Commission will require a phased-in exodus of existing common carrier and private op-fixed 2 GHz users to bands above 3 GHz. Unfortunately, when it proposed this migration, the Commission neglected to define specific rules for how the displaced 2 GHz users would operate on the bands above 3 GHz. Instead, the Commission proposed applying a "blanket" waiver of the technical rules and coordination procedures for each of the bands above 3 GHz.[3]

The Commission's "blanket" waiver approach was inappropriate. Operation by 2 GHz common carrier and private op-fixed users in the bands above 3 GHz requires specific channelization and loading standards, path length and propagation characteristics, and reliability standards. A "blanket" waiver could not establish such precise requirements. Concerned that the Commission's "blanket" waiver approach would result in inefficient use of the spectrum and unacceptable uncertainty among fixed microwave users, ANS and the Utilities Telecommunications Council ("UTC") stepped into the breach and supplied necessary solutions to such problems.

In its May 22, 1992, Petition for Rulemaking ("Petition")(RM-8004), ANS did what no other fixed microwave user or equipment

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[2]Redevelopment of Spectrum to Encourage Innovation in the Use of New Telecommunications Technologies, First Report and Order and Third Notice of Proposed Rulemaking (ET Docket No. 92-9, RM-7981, RM-8004) (FCC 92-437, released October 16, 1992) ("First Report and Order").

[3]See FNPRM, 7 FCC Rcd at 6100.

manufacturer cared to or was able to develop--specific proposals for operation by orphaned 2 GHz users in the bands above 3 GHz. In its Petition, ANS proposed rules to ensure that the 2 GHz users' low and medium capacity systems would be compatible with their current operations when relocated to the primarily high capacity bands above 3 GHz. Specifically, ANS proposed requirements for co-primary use of all available bands by private op-fixed users and common carriers, eligibility, band channelization, modulation efficiency and minimal channel loading, minimum path lengths, frequency coordination, and antenna standards.

In its Petition for Rulemaking (RM-7981), UTC took a similar approach. It proposed adoption of specific technical rules to accommodate operation by displaced 2 GHz users in the bands above 3 GHz. However, unlike ANS, UTC did not propose any specific rules for this purpose.

Based upon clear public support in the comments on the Petition, the Commission, in the FNPRM, found ANS' proposals to be in the public interest. Consistent with ANS' proposals:

> The Commission...proposes to reallocate five bands above 3 GHz to private and common carrier fixed microwave use on a co-primary basis and to prescribe additional technical standards to govern use of these bands.
>
> * * * * *
>
> [These proposals are intended] to ensure that alternative frequencies will be available to 2 GHz licensees that are suitable for providing equivalent service with comparable reliability.[4]

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[4] FNPRM, 7 FCC Rcd at 6100.

ADOPTION OF THE FNPRM IS IN THE PUBLIC INTEREST

When ANS tossed down the gauntlet and submitted its Petition for public consideration, it anticipated and welcomed constructive proposed modifications or revisions from the Commission and the public. It anticipated that such public review would promote the development of the most spectrally efficient fixed microwave "user friendly" palette of rules for operation on the bands above 3 GHz. ANS was not disappointed.

The rules proposed by the Commission in the FNPRM differ, in certain respects, from those ANS proposed in its Petition.[5] These modifications, however, reflect an industry consensus. Accordingly, with the limited exceptions discussed below regarding reallocation of the 3.6-3.7 GHz band and regarding measures designed to facilitate the transition to the new requirements for operation on bands above 3 GHz, the rules proposed in the FNPRM are appropriate and must be adopted.[6]

A. 3.6-3.7 GHz Reallocation

Adoption of the FNPRM is an important first step in protecting

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[5]In the FNPRM, the Commission tentatively decides to: (a) forego reallocation of the 4 GHz band so that 80 MHz of this band would be designated for exclusive primary use by fixed microwave users; (b) forego reallocation of the 3.6-3.7 GHz band on a co-primary basis with government users; (c) maintain current coordination procedures for common carriers (Part 21) and private users (Part 94) instead of applying Part 21 procedures across-the-board; and (d) phase-in standards based upon digital equipment. FNPRM, 7 FCC Rcd at 6103-05.

[6]There are certain typographical corrections that must be made to the rules set forth in Appendix A of the FNPRM. These corrections are set forth in the attached Analysis prepared by ANS ("Analysis").

the integrity of fixed microwave operators. However, as detailed in the attached Analysis, it still is uncertain whether adequate spectrum above 3 GHz would be available for migrating 2 GHz users.

Using current frequency coordination data, ANS estimates that, in various metropolitan markets, displacement of 2 GHz users only could be achieved by filling virtually all spectrum below the 10 GHz band. On a long-term basis, this congestion does not bode well for existing or prospective fixed microwave users. The Commission's decision not to pursue reallocation of the 3.6-3.7 and 4 GHz bands limits the spectrum available and thus exacerbates the potential capacity problem.

One of the proposals ANS made in its Petition is that the 3.6-3.7 GHz band should be reallocated and rechannelized for displaced 2 GHz users. Under this proposal, the 3.6-3.7 GHz band would be reallocated to fixed point-to-point use for common carrier and private op-fixed users on a co-primary basis. This band then would be shared by government and by non-government users.

The Commission decided not to propose reallocation of the 3.6-3.7 GHz band at this time. However, it did indicate agreement with the long-term benefits from further consideration of this approach: "we will approach NTIA and open formal discussions to determine whether some form of shared access to the 3.6-3.7 GHz band by fixed microwave users is feasible."[7]

Further consideration must be given to reallocating the 3.6-3.7 GHz band for private sector fixed point-to-point use on a co-

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[7] FNPRM, 7 FCC Rcd at 6103.

primary basis with government use. Under the Commission's First Report and Order, after expiration of a yet-to-be determined transition period, incumbent 2 GHz users will be downgraded to secondary status with respect to PCS licensees and likely will begin migrating to higher bands en masse. Based upon data regarding anticipated current and future capacity needs for 2 GHz microwave users, there may not be adequate capacity available in the higher bands to accommodate the displaced users.

Fortunately, the need for additional fixed microwave capacity is a long-term concern and thus is consistent with the Commission's approach to the 3.6-3.7 GHz reallocation. Under the phased-in migration of 2 GHz users to the higher bands contemplated by the Commission in the First Report and Order, potential capacity problems will not materialize for several years.

In addition, the National Telecommunications and Information Administration ("NTIA") is conducting an inquiry into long-term spectrum requirements for various radio services, including Fixed services.[8] NTIA is taking a deliberate approach to considering reallocation of shared bands, such as the 3.6-3.7 GHz band.

ANS supports NTIA's policy. In measuring long-term spectrum needs, it is appropriate for NTIA, as part of the inquiry established in the Notice, to factor in the needs of displaced 2 GHz users and the benefits available to these users if private sector access to the 3.6-3.7 GHz band is permitted. Furthermore, with the

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[8]Current and Future Requirements for the Use of Radio Frequencies in the United States, NTIA, Docket No. 920532-2132 ("Notice").

potential acute spectrum shortage in the bands above 3 GHz, it is critical that the Commission fulfill its commitment to pursue evaluation with NTIA regarding reallocation of the 3.6-3.7 GHz band.

B. Transition

Upon adoption of the rules proposed in the FNPRM, existing microwave equipment and system routes must be protected for a reasonable period of time. To achieve this level of comfort, ANS proposes that the Commission implement the following measures:[9]

1. Maintain the type accepted equipment spectrum efficiency requirements for two (2) years following adoption of the rules proposed in the FNPRM.

2. System routes in existence when the FNPRM is adopted should be permitted reasonable expansion without excessive retuning. Specifically, expansion of existing frequency plans must be allowed without waiver after a valid showing to the Commission.

CONCLUSION

ANS' goal in developing the proposals set forth in the Petition and submitting them for Commission and public consideration has been achieved. Viable rules specifying how displaced 2 GHz users will operate in the bands above 3 GHz have been proposed by the Commission in the FNPRM. The Commission correctly has concluded "that the reallocation and channelization plan proposed by [ANS] for bands above 3 GHz balances the interests of" the entire fixed microwave industry and that adoption of its plan "will

[9] See attached Analysis.

treat both private users and common carriers equitably."[10]

With the exceptions noted herein regarding reallocation of the 3.6-3.7 GHz band and regarding transition measures to protect microwave equipment manufacturers and system paths, these rules would serve the public interest.[11] Consequently, ANS supports prompt adoption of the rules proposed in the FNPRM.

Respectfully submitted,

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GW03/130441

December 10, 1992

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[10] FNPRM, 7 FCC Rcd at 6103(footnote omitted).

[11] ANS is a member of the Telecommunications Industry Association's Fixed Point-to-Point Communications Section ("TIA"). In Comments to be filed in this proceeding, TIA states its general support for adoption of the FNPRM, but it recommends adoption of what it purports to be certain "modest" changes to the proposed channelization plan and technical rules. While ANS appreciates TIA's efforts, it respectfully opposes TIA's proposed modifications and will demonstrate, in its Reply Comments in this proceeding, why these changes should not be adopted.

ANALYSIS OF
COMMISSION PROPOSALS

FURTHER NOTICE OF
PROPOSED RULE MAKING
ET Docket No. 92-9
RM-7981
RM-8004

Prepared by:
Alcatel Network Systems, Inc.

GW03/130511

Adequate Spectrum for Displaced 2 GHz Users will not be Available

Under ET Docket No. 92-9, the FCC will displace existing fixed point-to-point microwave users to make room for emerging technologies in the 2 GHz band. An unpublished study by Comsearch shows that, in some metropolitan areas, this displacement of private users only can be accommodated by filling virtually all private spectrum below 10 GHz. Conservatively, user needs would be difficult to satisfy by the cost effective microwave radio circuits. Consequently, the FCC's decision not to pursue reallocation of a portion of the 4 GHz or the government (NTIA) bands exacerbates this problem. Thus, notwithstanding the Commission's efforts to obtain new spectrum or to reuse existing spectrum, ANS remains concerned regarding the available spectrum for long term migration.

Determining the available spectrum for the common carriers and private users after 2 GHz has been removed from availability is difficult. An attempt was made by the FCC's Office of Engineering and Technology ("OET") in its study, Section 4.0.[1] Capacity analysis was made on the basis of one degree squares (sixty mile side squares) for lightly populated areas and two degree squares (120 mile side squares) for the fifty most populated metropolitan statistical areas. Arbitrary capacity limits for the analysis squares were used. The validity of this approach is not clear. It was offered without any justification. The approach treats all cities the same. For example, New York and Phoenix are assumed the same.

The OET approach would have been more compelling had a few cities been used as trial systems to test the validity of the approach. Somehow we are to conclude that treating a city as a 120 mile square block of land is appropriate. Frequency planning and path design have never been done on this basis. In actual practice, careful consideration must be given to each individual case.

The OET study arrives at conclusions which experienced path designers would question. Fixed point-to-point microwave paths at 4 GHz are very difficult to obtain in urban areas. The OET study ignores this well known problem.

The OET results at 6 GHz also are questionable. The study concludes that the lower 6 GHz paths in San Francisco are only half used and those in Los Angeles are only three quarters used. Experienced frequency planners know this is far too optimistic for these cities. However, there appears to be a basic flaw in the approach of applying the 120 square mile area to any type of city. Very dense cities, like Los Angeles and San Francisco, have desert or low population areas.

1 *Creating New Technology Bands for Emerging Telecommunications Technology*, FCC OET/ITS 91-1.

within sixty miles of the city center. The cities themselves are quite dense. If paths in the desert or agricultural areas are useful, there is spare path capacity. If urban paths are needed (which is typically the case), the cities are choked.

In summary, the FCC/OET analysis method is unreliable. The 4 GHz satellite interference frequency planning problem was not noticed. When the results are compared with well known problem cities, unrealistic results are obtained. The overall results are questionable.

The results in the OET study thus appear far more optimistic than known cases would dictate. If reality is significantly worse that the OET study (as spot checks indicate), there can be little doubt that we are running out of spectrum below 10 GHz. Moreover, as detailed previously by ANS and others, alternative media will not solve this spectrum shortage.

To gain perspective on the utilization of the fixed point-to-point microwave bands, ANS obtained transmit frequency coordination data from Comsearch, a leading frequency coordination company. The data show these commercial coordinations from January 1991 through August 1992. The results of these data are displayed in Figures 1 through 7 of this report. Figures 1 and 2 show the month-to-month coordinations by frequency band. Figures 3 and 4 show total coordinations by month over the twenty month period. Figure 5, which depicts non-government fixed microwave 2 GHz usage, was obtained from the Comsearch data contained in a current NTIA Report.[2]

Figure 6 uses the last year of Comsearch data to assess the trend of average coordinations. The need for new frequencies continues unabated. Figure 7 displays the distribution of digital versus analog traffic currently being implemented. Three quarters of all new frequencies are used for digital transmission. Analog transmission, however, can not be ignored.

Viewed at large, based upon the Comsearch data, the use of microwave remains quite popular (Figures 1 through 6). One can not help but notice the lack of 4 GHz utilization. This emphasizes the inability of fixed point-to-point microwave systems to be coordinated with satellite down links. Figures 1 through 4 point out that the bands below 10 GHz are by far the most popular. Of these, 2 GHz is the most popular band. As noted in Figure 5, existing utilization is quite large. Finding places for these displaced systems will be a formidable challenge.

2 *Feasibility of Relocating Non-government Fixed Systems into the 1710-1850 MHz Band,* NTIA Report 92-286.

Moreover, as detailed below and as depicted in Figure 6, demand for microwave paths is expected to increase in the future. Thus, it is incumbent upon the Commission, in evaluating the long-term needs for fixed microwave users, to recognize the anticipated shortage of available spectrum resulting from the Commission's actions and to consider the appropriateness of making government spectrum available for the private sector to mitigate this problem.

2 GHz Band

The 2 GHz band is the most heavily utilized fixed point-to-point microwave band today (Figures 1, 2, 3, 4 and 5). When the FCC reallocates this band, this spectrum no longer will be available to the fixed point-to-point microwave community. Somehow, approximately 33% of new microwave frequencies which are currently provided in this band must be accommodated elsewhere. How or where this can be done over a long term basis is of considerable concern to the fixed point-to-point microwave community.

4 GHz Band

The 4 GHz band, currently a fixed common carrier point-to-point and fixed satellite band, is attractive for long distance, high reliability paths. It has radio propagation characteristics similar to the 2 GHz band. However, certain issues involving coordination with incumbent users hinder use of this band. Current fixed point-to-point microwave frequency coordination procedures require investigation of possible interference from stations as far as 250 miles from the microwave station.

To prevent interference from point-to-point microwave into satellite earth stations, ANS proposed technical revisions to allow microwave users back into a portion of the 4 GHz band. That proposal was denied by the FCC. The FCC has declined to reallocate any portion of this band for exclusive co-primary use of the displaced 2 GHz users. Without such a reallocation, this band is largely unavailable to fixed point-to-point microwave users. This has been clearly demonstrated previously.

6 GHz

The only other frequency band available for fixed microwave operation below 10 GHz is the 6 GHz band. It already supports the next greatest utilization for fixed microwave behind the current 2 GHz band. Frequencies are already difficult to find in many metropolitan areas. This shortage will place a much greater load on this band unless other alternatives can be found.

Bands Above 10 GHz

Higher frequency bands can support higher bandwidths and/or more radio channels. However, above approximately 10 GHz, these bands suffer from extreme vulnerability to path outage due to rain. This limitation can be mitigated somewhat by using short paths or by building the network into rings with diameter over a few miles (typical rain cell diameter). Applications which can be implemented this way (e.g., PCS microcell interconnects, industrial parks, backup data transfer circuits) will take advantage of the relative availability of the higher frequencies. However, networks with long path requirements, inability to form closed loops, or extremely high availability requirements simply can not be moved to higher frequencies. Many industrial backbones and cellular telephone cell sites fall into this category.

In paragraph 4 of the FNPRM, the Commission suggests the use of two new frequency allocations: 11.7 to 12.2 GHz and 12.7 to 13.25 GHz. The first is another band currently allocated for satellite down links. The current 4 GHz band is virtually unusable because of unfavorable frequency coordination procedures with satellite down links. ANS strongly objects to repeating this problem in another band. The second band is allocated for satellite up links. These up links would be easier to coordinate but would eliminate East-West paths. Again, cooperation with satellite services is unfavorable to fixed microwave point-to-point service. ANS does not recommend placing fixed microwave point-to-point systems in the same band as satellite services.

ANS sincerely appreciates the Commission's desire to make more spectrum available. However the high frequency spectrum from 10.5 to 11.7 GHz seems appropriate. What is badly needed is more spectrum below 10 GHz. Further coordination with NTIA for possible co-use of government bands is strongly recommended.

Other Alternatives Needed

Notwithstanding the considerable need of the existing and potential 2 GHz private and common carrier fixed microwave operators, both the current 2 and 4 GHz bands are no longer viable. The 6 GHz bands offer no long term relief. Bands above 10 GHz can not support ultrahigh reliability circuits. The need for spectrum to replace the spectrum denied by the FCC will become more and more critical over time. The government bands may offer some long term help in this area.

For example, the 3.6 to 3.7 GHz band is allocated on a shared basis for government and for non-government uses. For government use, this band is

allocated for aeronautical radio navigation and radio location on a primary basis. For non-government use, this band is allocated for fixed satellite down link service on a primary basis and radio location service on a secondary basis. The only private sector satellite utilization of this band is by INTELSAT. Few INTELSAT earth stations are deployed in the United States. Since this band is shared with the government, coordination with NTIA is necessary.

Other possible government frequency bands suitable for shared utilization are the 4.5 to 4.8 and the 7.1 to 8.5 GHz allocations. Unlike other bands, these are allocated primarily for fixed point-to-point microwave both in the United States and Internationally. The most pressing commercial need for frequencies is in metropolitan areas. Typically government microwave applications are not near these areas. Perhaps both groups could share this band and gain the economic advantages of increased competition by vendors.

ANS understands that reallocation of the non-government bands such as 3.6 to 3.7, 4.5 to 4.8 or 7.1 to 8.5 GHz, consistent with future government needs, is a complicated matter. Reallocation issues would take many years to resolve and implement. This time frame is consistent with NTIA's anticipated time frame for determining its spectrum needs and is consistent with the time frame when additional spectrum requirements of the fixed microwave users will become most extreme. ANS strongly recommends government coordination be maintained with the objective to obtain more spectrum for the private sector.

Suggested Corrections

Section 94.73 Power Limitations

The Maximum allowable EIRP for Frequency Bands (MHz) 21,200 to 23,600 and 38,600 to 40,000 is +40. In Part 21.107, the maximum is +50. ANS suggests revising +40 to +50.

In the Part 21.107 chart comparable to this section's chart, the 27.500 to 29.500 GHz band is listed. ANS suggests adding that band to page 62 of the FNPRM.

Frequency Corrections

Further corrections are listed on the following pages.

(1) 400 kHz bandwidth channels: NOTE: CHGE CHANGE

Transmit (receive) (MHz)	Receive (transmit) (MHz)
5925.2175	6175.2175
5925.6325	6175.6325
5926.0475	6176.0475
5926.4625	6176.4625
5926.8775	6176.8775
5927.2925	6177.2925
5927.7075	6177.7075
5928.1225	6178.1225
5928.5375	6178.5375
5928.9525	6178.9525
5929.3675	6179.3675
5929.7825	6179.7825
6170.2175	6420.2175
6170.6325	6420.6325
6171.0475	6421.0475
6171.4625	6421.4625
6171.8775	6421.8775
6172.2925	6422.2925
6172.7075	6422.7075
6173.1225	6423.1225
6173.5375	6423.5375
6173.9525	6423.9525
6174.3675	6424.3675
6174.7825	6424.7825

(2) 800 kHz bandwidth channels:

Transmit (receive) (MHz)	Receive (transmit) (MHz)
5925.425	6175.425
5926.255	6176.255
5927.085	6177.085
5927.915	6177.915
5928.745	6178.745
5929.575	6179.575
6170.425	6420.425
6171.255	6421.255
6172.085	6422.085
6172.915	6422.915
6173.745	6423.745
6174.575	6424.575

(2) 800 kHz bandwidth channels:

Transmit (receive) (MHz)	Receive (transmit) (MHz)
6525.425	6870.425
6526.255	6871.255
6527.085	6872.085
6527.915	6872.915
6528.745	6873.745
6529.575	6874.575

(3) 1.6 MHz bandwidth channels:

Transmit (receive) (MHz)	Receive (transmit) (MHz)
6548.34	6728.34
6450.00	6730.00
6551.66	6731.66
6558.34	6738.34
6560.00	6740.00
6561.66	6741.66
6588.34	6748.34
6590.00	6750.00
6591.66	6751.66
6598.34	6758.34
6600.00	6760.00
6601.66	6761.66
6608.34	6768.34
6610.00	6770.00
6611.66	6771.66
6618.34	6778.34
6620.00	6780.00
6621.66	6781.66
6628.34	6788.34
6630.00	6790.00
6631.66	6791.66
6638.34	6798.34
6640.00	6800.00
6641.66	6801.66
6648.34	6808.34
6650.00	6810.00
6651.66	6811.66
6658.34	6818.34
6660.00	6820.00
6661.66	6821.66
6668.34	6828.34
6670.00	6830.00

Existing Equipment

In the FNPRM, it is unclear what position the Commission has taken regarding currently developed microwave transmission equipment. ANS suggests the exemption of currently type accepted equipment from the proposed spectrum efficiency rules for a period of two years.

Existing Systems

In the FNPRM, it is unclear what position the Commission has taken regarding existing systems licensed under existing rules. The grandfathering of existing system routes (including radio system growth of existing paths) to allow reasonable expansion without excessive retuning should be allowed. Specifically, expansion of existing path fragments using existing frequency plans should be allowed without waiver after a valid showing to the FCC. The expansion, however, would have to comply with the then current coordination standards and procedures.

In this regard, special consideration should be given to analog systems. Since analog systems typically have a significant residual carrier, they are especially vulnerable to interference by and to other analog systems. If two plans in the same geographical area cause the center frequency of two analog systems to be offset relative to each other, both will experience significant interference to each other at the baseband frequency which is the difference of the two carriers' frequencies. Therefore, analog systems should be allowed to use the old frequency plans when necessary to achieve acceptable interference levels when frequency coordinating with existing analog systems. By contrast, digital systems, with their carrier suppression techniques, avoid this problem altogether. They coexist well with other digital and analog systems even if they are not on the same channel assignments.

Complex, Expensive Equipment

In the FNPRM, paragraph 28, DMC expresses concern regarding the use of spectrally efficient low capacity digital radios. The concern is that higher spectrum efficiency means greater complexity. Greater complexity would therefore equate to increased cost. ANS has not found that to be the case. Virtually all digital radios today employ coherent modulation (i.e., PSK, QPSK, QPRS, or QAM). The total complexity of these products is essentially the same for comparable data throughput. Radios employed at 10.5 GHz use relatively simple modulation methods when compared to similar capacity radios employed at 2 GHz. However, the radio sell prices are essentially the same. ANS observes that the radio sell price driver is competition, not complexity.

(1) 400 kHz bandwidth channels:

Transmit (receive) (MHz)	Receive (transmit) (MHz)
5925.2175	6175.2175
5925.6325	6175.6325
5926.0475	6176.0475
5926.4625	6176.4625
5926.8775	6176.8775
5927.2925	6177.2925
5927.7075	6177.7075
5928.1225	6178.1225
5928.5375	6178.5375
5928.9525	6178.9525
5929.3675	6179.3675
5929.7825	6179.7825
6170.2175	6420.2175
6170.6325	6420.6325
6171.0475	6421.0475
6171.4625	6421.4625
6171.8775	6421.8775
6172.2925	6422.2925
6172.7075	6422.7075
6173.1225	6423.1225
6173.5375	6423.5375
6173.9525	6423.9525
6174.3675	6424.3675
6174.7825	6424.7825

(2) 800 kHz bandwidth channels:

Transmit (receive) (MHz)	Receive (transmit) (MHz)
5925.425	6175.425
5926.255	6176.255
5927.085	6177.085
5927.915	6177.915
5928.745	6178.745
5929.575	6179.575
6170.425	6420.425
6171.255	6421.255
6172.085	6422.085
6172.915	6422.915
6173.745	6423.745
6174.575	6424.575

6595	6755 ADD
6605	6765
6615	6775
6625	6785
6635	6795
6645	6805
6655	6815
6665	6825
6675	6835
6685	6845
6695	6855
6705	6865
6535 2	6575 2

1 These frequencies may be assigned for unpaired use.
2 Available only for emergency restoration, maintenance bypass, or other temporary-fixed purposes. Such uses are authorized on a non- interference basis to other frequencies in this band. Interference analysis required by Section 94.63(a) does not apply to this frequency pair.

(j) 10.550 to 10.680 MHz. 5 MHz maximum authorized bandwidth, 65 MHz separation:

(1) 400 kHz bandwidth channels:

Transmit (receive) (MHz)	Receive (transmit) (MHz)
10605.2175	10670.2175
10605.6325	10670.6325
10606.0475	10671.0475
10606.4625	10671.4625
10606.8775	10671.8775
10607.2925	10672.2925
10607.7075	10672.7075
10608.1225	10673.1225
10608.5375	10673.5375
10608.9525	10673.9525
10609.3675	10674.3675
10609.7825	10674.7825
10610.2175	10675.2175
10610.6325	10675.6325
10611.0475	10676.0475
10611.4625	10676.4625
10611.8775	10676.8775
10612.2925	10677.2925
10612.7075	10677.7075
10613.1225	10678.1225
10613.5375	10678.5375
10613.9525	10678.9525

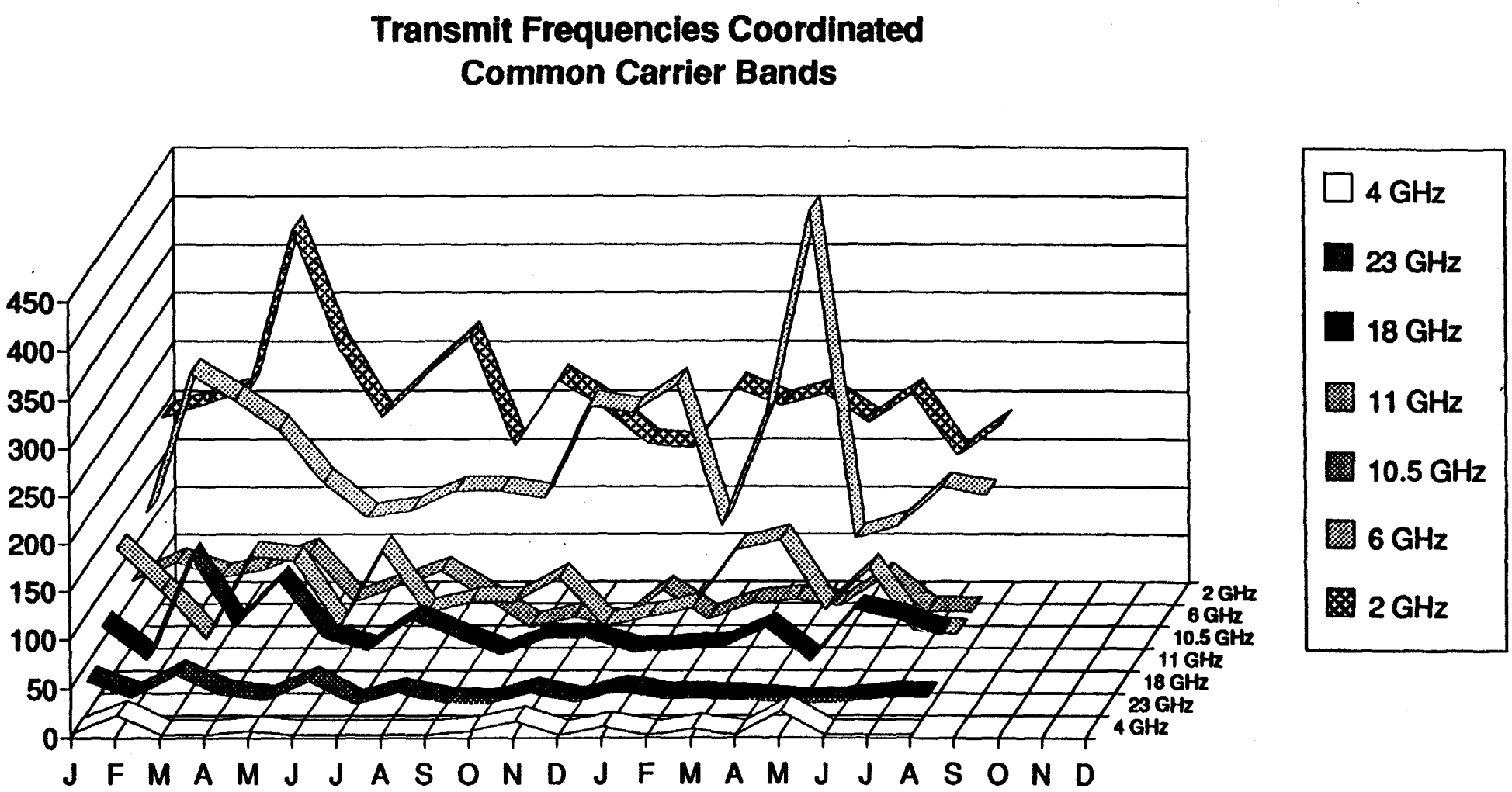

Figure 1 - Common Carrier Paths Coordinated by Band

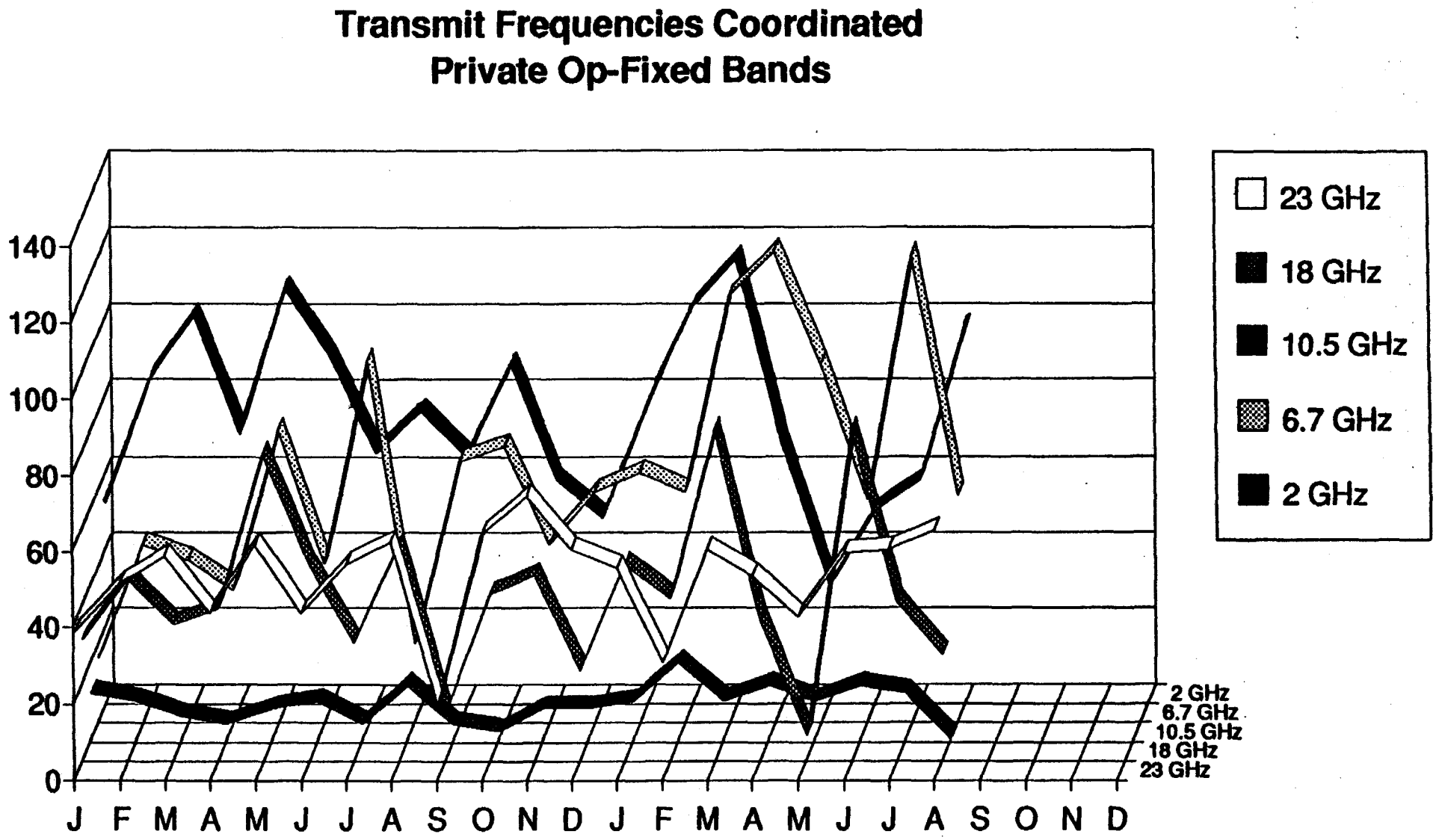

Figure 2 - Private Op-Fixed Paths Coordinated by Band

Transmit Frequencies Coordinated

Microwave Bands (1 – 25 GHz)

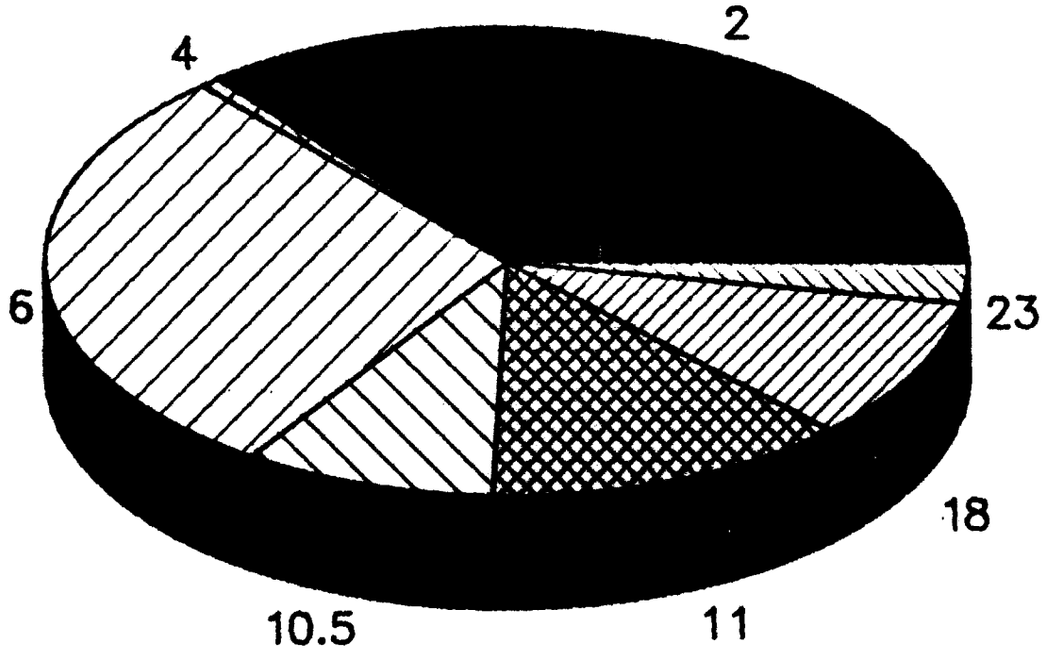

Figure 3 - Total Common Carrier Paths Coordinated by Band

Transmit Frequencies Coordinated

Microwave Bands (1 – 25 GHz)

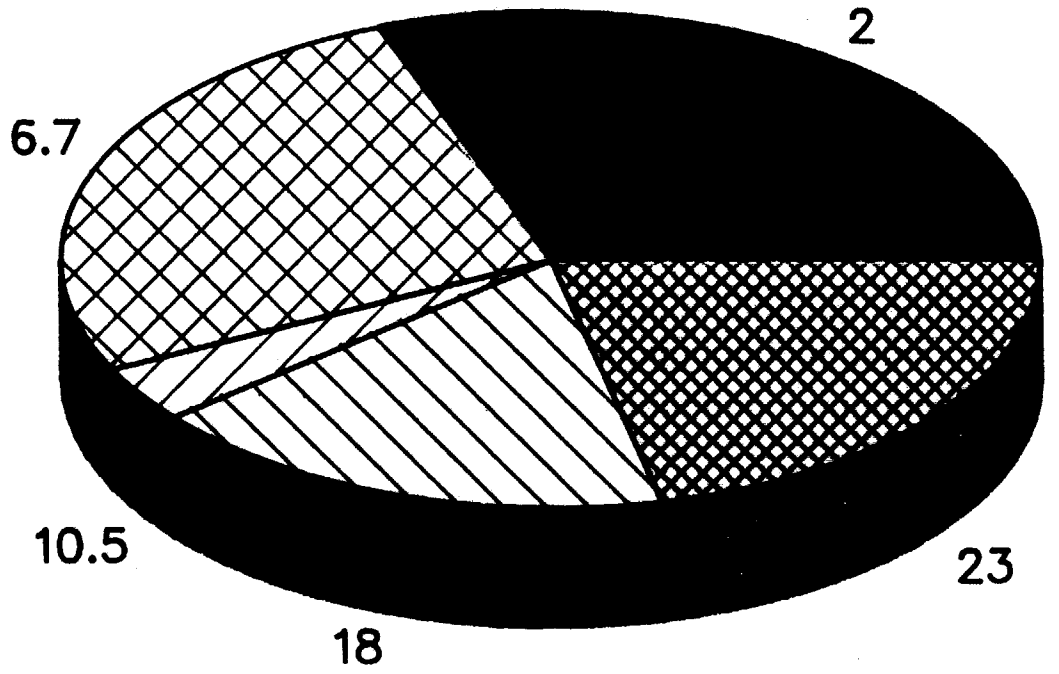

Figure 4 - Total Private Op-Fixed Paths Coordinated by Band

(This figure was generated by Comsearch 7/92.)

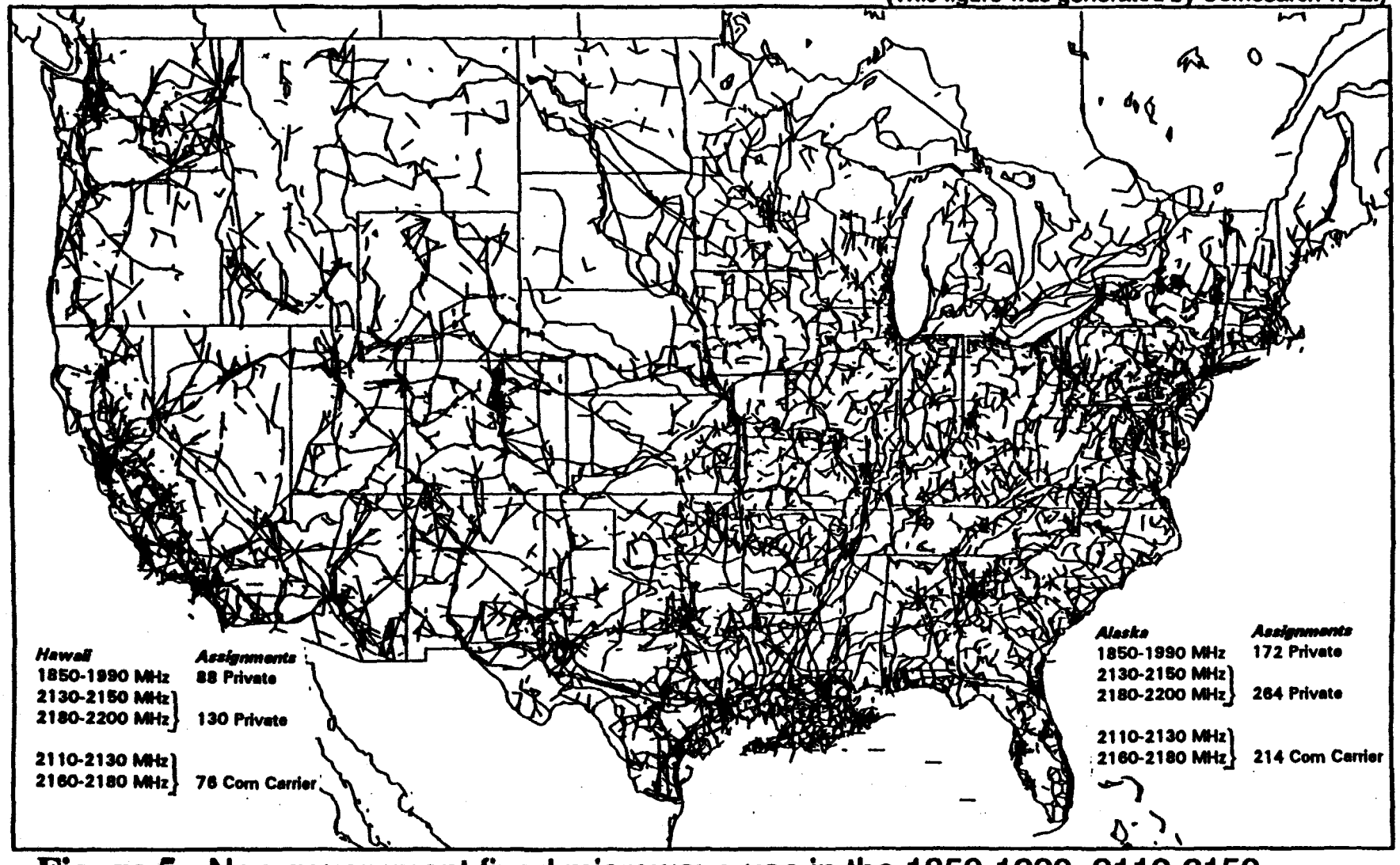

Figure 5 - Non-government fixed microwave use in the 1850-1990, 2110-2150, and 2160-2200 MHz bands.

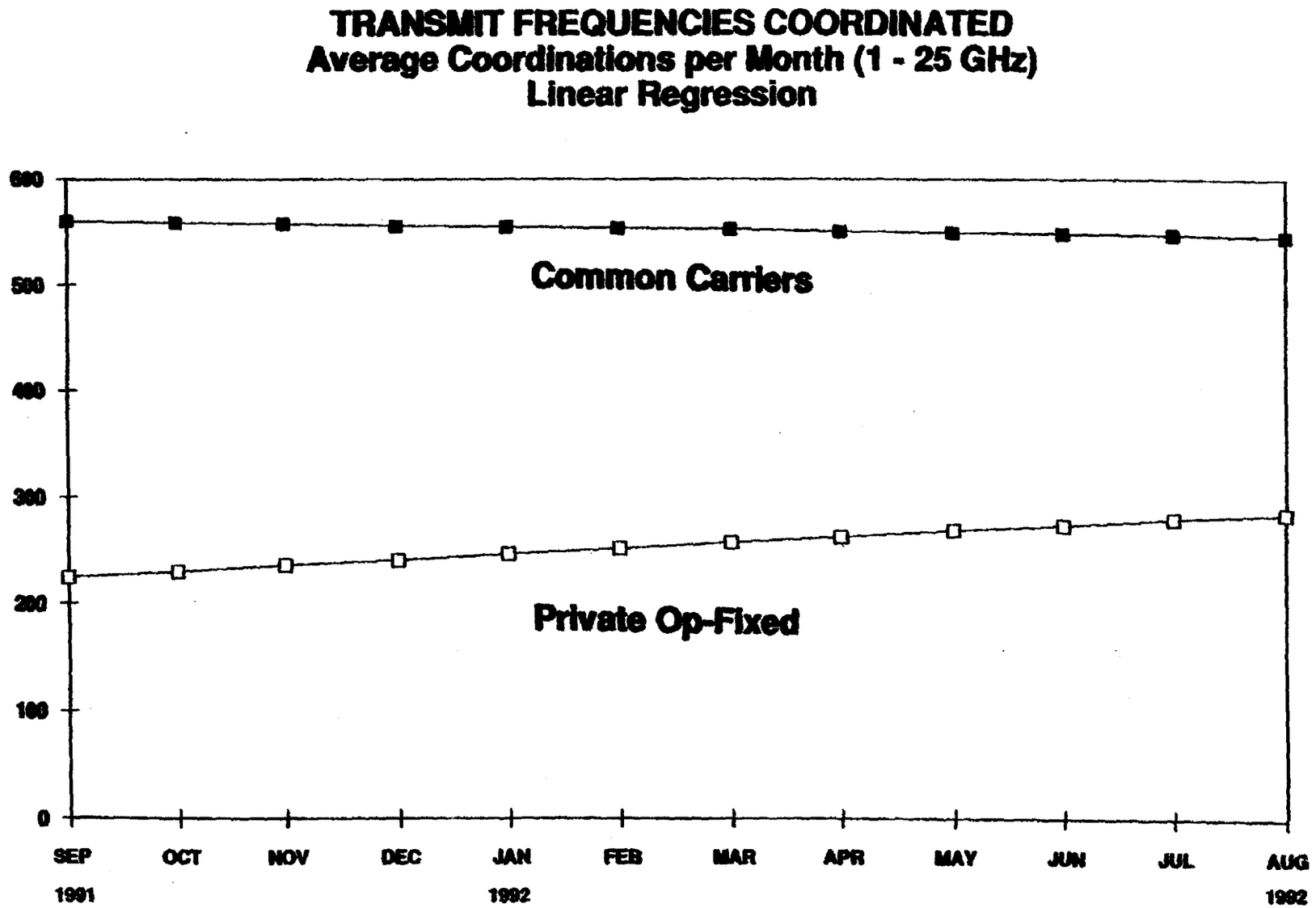

Figure 6 - Trend for Total Path Coordinations