3.3.1 Low capacity traffic

For low capacity traffic, 12 pairs of 800 KHz and 24 pairs of 400 KHz channels would be reserved in the band edge channels. These channels could handle 2 and 1 DS1's respectively using 64 QAM.

3.3.2 Medium capacity

The 4 GHz band medium capacity channels would include 6 pairs of 5 MHz channels and 24 pairs of 1.6 MHz channels. Using 64 QAM or an equivalent modulation with a minimum spectral efficiency of 3.7 bits/Hz, these medium capacity channels could carry 4, 8, or 12 DS1's using occupied bandwidths of 1.6, 3.2, or 5 MHz, respectively. This channelization meets the current spectral efficiency requirement of 1152 equivalent voice channels in a 20 MHz bandwidth, as defined in Section 21.122 of the Commission's Rules.

Under this plan, microwave operators could upgrade from 4 to 12 DS1's without a frequency change, by initially coordinating the center 1.6 MHz sub-channel and protecting the full 5 MHz channel for future growth with a frequency coordination company. The 1.6 MHz channels on either side of the center channel would be used for systems that were unlikely to grow or for systems where no other channels were available.

3.3.3 High density traffic

High capacity traffic at 4 GHz would remain in the 20 MHz channels in the center of the band, although the band edge channels could be used as a last resort by the frequency planner. Each high capacity 20 MHz RF channel also would be divided into two 10 MHz sub-channels for 1 DS3 traffic.

3.3.4 Coordination with satellites

The 4 GHz 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 satellite users must be resolved before significant new point-to-point users may be introduced into this band.

First, a large number of licensed satellite earth stations have been installed over the years around existing 4 GHz microwave systems. Since the earth stations are much more susceptible to interference than terrestrial microwave, it is almost impossible to coordinate new 4 GHz paths in many urban areas. Even in rural areas, the frequency coordination process can be expensive since it may require on-site inspections of earth stations and field measurements to determine local shielding. Most existing 4 GHz paths were installed years ago, before earth stations became widespread.

To determine the extent of this situation, ANS commissioned earth station interference studies[4] in the New Orleans and Minneapolis metropolitan area. See Figures 6 and 7.

Figure 6 - New Orleans Satellite Interference Study

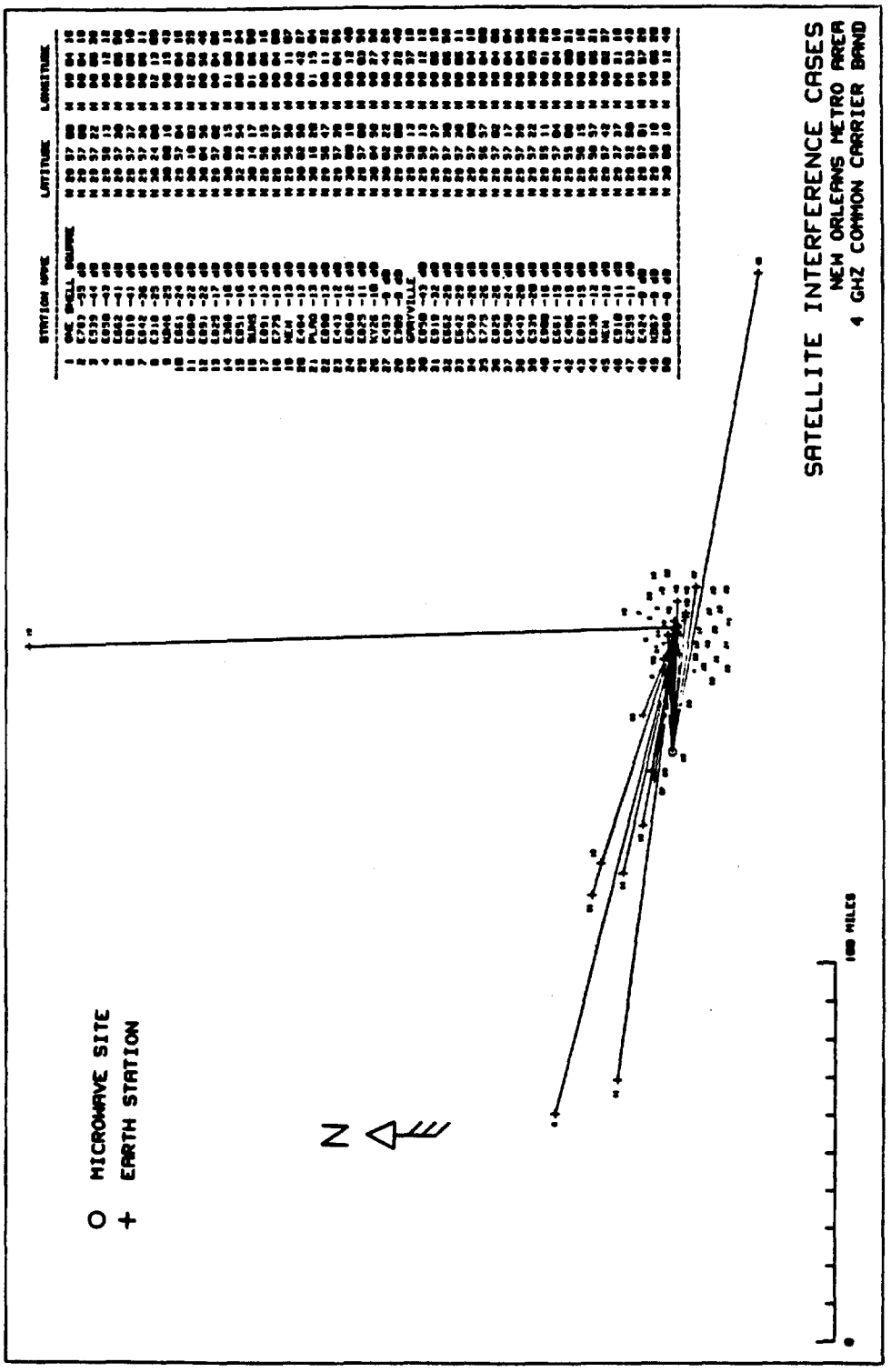
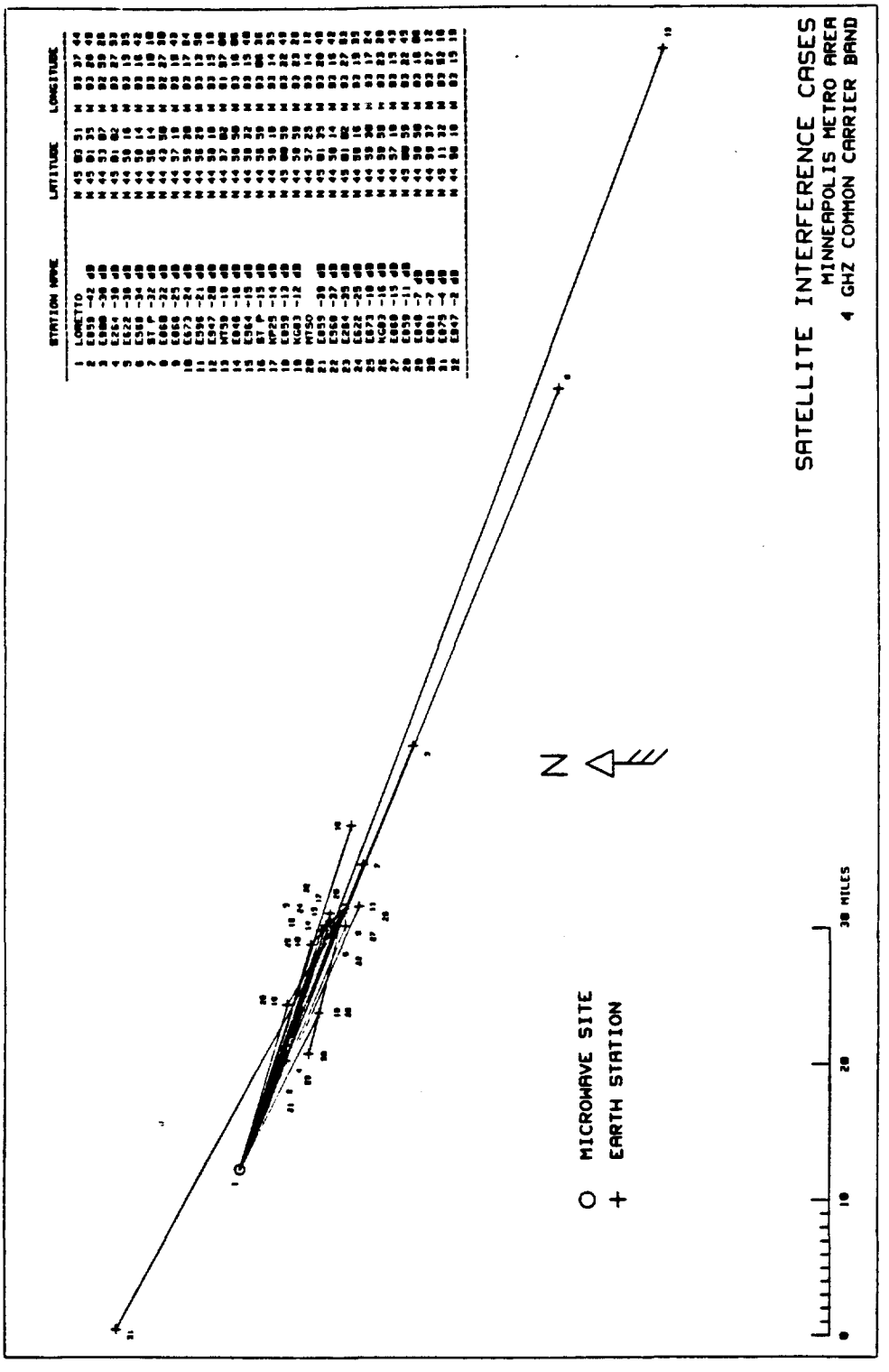


Figure 7 - Minneapolis Satellite Interference Study



In each metro area, an existing 6 GHz microwave path was selected and analyzed assuming it was a 4 GHz path. Each line on Figures 6 and 7 is a potential interference case from one of the microwave sites into an earth station. In the table in the upper right hand corner of Figures 6 and 7, the latitude and longitude of each earth station is listed along with a negative number designating by how many dB the interference objective was exceeded. In New Orleans, there were eight (8) cases exceeding 30 dB. In Minneapolis, there were 10 cases over 30 dB. In the opinion of the frequency planner, these paths are impossible to coordinate.

The second problem with the 4 GHz band involves unlicensed receive only earth stations. A substantial number of these earth stations have been installed in urban and rural areas across the country[5]. Although technically these systems are not protected against interference, the owners have invested considerable sums in their installations and are vocal when their reception is impaired. These earth stations also are providing a needed public service, delivering television to areas inadequately served by conventional broadcasters and cable systems.

Since unlicensed earth station owners are telephone customers, common carriers are reluctant to interfere with these systems if possible. As a result, common carriers prefer to use other frequency bands instead.

To prevent interference from point-to-point microwave into satellite earth stations, it is proposed that the satellite transponders at the edges of the 4 GHz band not be used except on a secondary basis. This could be done by narrowing the primary frequency allocation for the satellite services by 40 MHz on each band edge. Point-to-point microwave operators would then have a reasonable chance of finding frequencies in the 4 GHz band.

3.3.5 ANS proposes a long-term transition period for its proposed 4 GHz band reallocation.

ANS' proposed reallocation would not be implemented immediately. It would be phased in over a ten to fifteen year period. This would be consistent with the time over which the existing 2 GHz users are expected to move from their current frequencies.

Various factors will contribute to relieving the congestion in the 4 GHz band during this ten to fifteen year transition period. Many satellite licenses are migrating to the 11 GHz band as this band becomes more economical than 4 GHz. The anticipated useful life for most existing 4 GHz satellites will expire during this proposal transition period. Thus, if satellite licensees are on notice that the 40 MHz band edges of the 4 GHz band would be reallocated in 10 to 15 years, they could plan accordingly without adversely affecting existing systems. Moreover, earth station owners only would be required to incur a nominal expense to receive satellites operating at higher bands.

3.4 Lower 6 GHz common carrier band

The proposed lower 6 GHz band channelization plan is contrasted in Figures 8 and 9.

EXISTING (REGULAR T) LOWER 6 GHz CHANNEL PLAN

(ALL FREQUENCIES IN MHz)

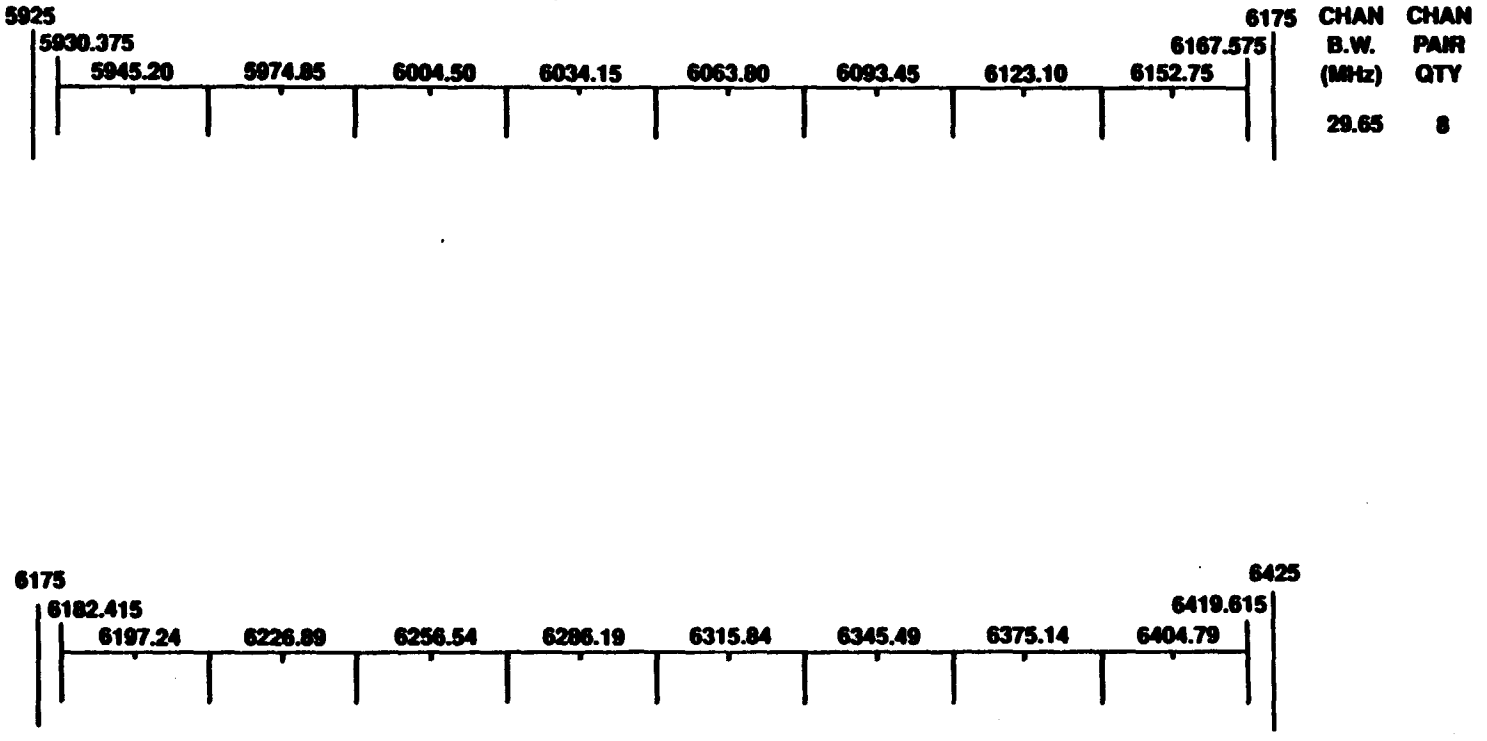


Figure 8 - Existing Lower 6 GHz plan

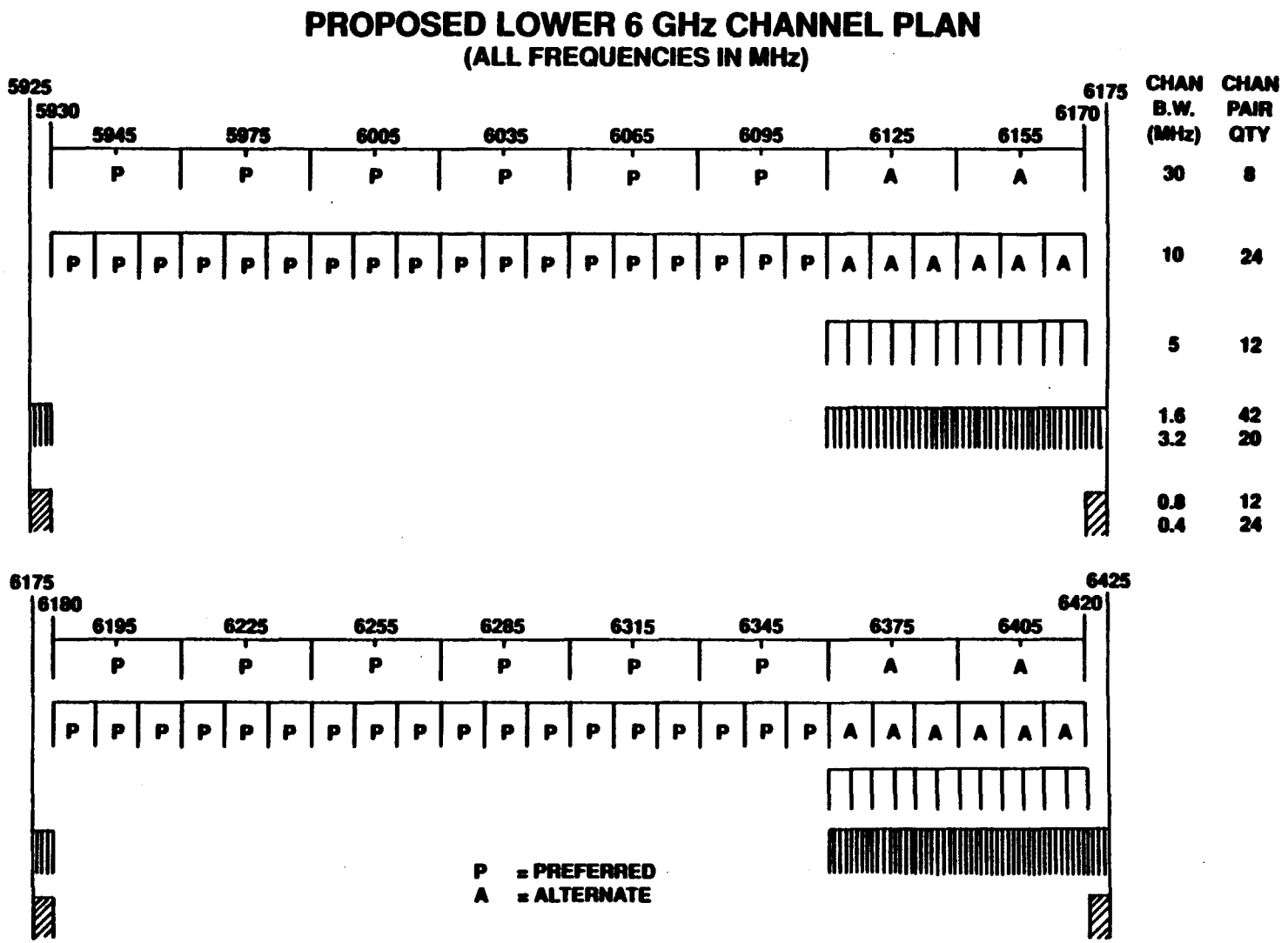


Figure 9 - Proposed Lower 6 GHz plan

3.4.1 Medium capacity traffic

Under ANS' plan, this band is divided into eight 30 MHz channel pairs across the band based on the standard "T" plan that is used in most microwave systems today. Of these pairs, two channels would be used primarily for medium capacity traffic using a plan similar to the 4 GHz. High capacity traffic also could be provided on these channels as a last resort.

3.4.2 High capacity traffic

The remaining six pairs of 30 MHz channels would be used for high capacity traffic. These channels would be sub-divided into three 10 MHz channels for 1 DS3 traffic. Systems could be upgraded from 1 to 3 DS3 capacity by selecting the center 10 MHz channel and protecting the full 30 MHz channel for future growth with a frequency coordination company. This is a similar procedure to the 1.6 to 5 MHz medium capacity upgrades. The two 10 MHz channels, at the sides of the center channel, would be used for systems unlikely to upgrade or for systems where other channels were not available.

3.4.3 Low capacity traffic

Using the proposed plan, there would be a 10 MHz center gap between the upper and lower halves of the lower 6 GHz band and two 5 MHz bands at both ends of the band. This spectrum would be used for 400 KHz, 800 KHz, and 1.6 MHz low capacity traffic using a channelization plan similar to the 4 GHz plan. To maintain adequate transmit-to-receive separation, one frequency would be selected from the lower guard band and another would be selected from the center gap. Similarly, other pairs of frequencies could be selected from the center gap and the upper guard band. Since these guard bands are seldom used, they will be easy to coordinate.

A possible growth plan for N+1 frequency diversity systems is depicted in Figure 10. This plan will allow up to 5 frequency pairs to be stacked on a common transmit/receive antenna without 2A-B intermodulation products. For more than 5 frequency pairs, separate transmit and receive antennas are required. The RF channels normally used for medium capacity traffic would be the last channels

added under this plan. This 4+1 system will meet the needs of the expected SONET compatible multiline radio systems (OC-12 composed of a 4 + 1 OC-3 radio system).

6 GHZ COMMON CARRIER BAND
GROWTH PLAN FOR N+1 FREQUENCY DIVERSITY SYSTEMS

	GROWTH STAGE	1	2	3	4	5	6	7	8
UPPER BAND	POLARIZATION	H(V)		V(H)			H(V)		V(H)
	FREQUENCY	25T	23T	26T	22T	24T	21T	27T	28T
LOWER BAND	FREQUENCY	11T	15T	13T	12T	14T	16T	18T	17T
	POLARIZATION	H(V)			V(H)		V(H)		H(V)

SYSTEM CONVERTED
TO SEPARATE TRANSMIT
AND RECEIVE ANTENNAS

FREQUENCIES

11T – 5945.20 MHZ	21T – 6197.24 MHZ
12T – 5974.85 MHZ	22T – 6226.89 MHZ
13T – 6004.50 MHZ	23T – 6256.54 MHZ
14T – 6034.15 MHZ	24T – 6286.19 MHZ
15T – 6063.80 MHZ	25T – 6315.84 MHZ
16T – 6093.45 MHZ	26T – 6345.49 MHZ
17T – 6123.10 MHZ	27T – 6375.14 MHZ
18T – 6152.75 MHZ	28T – 6404.79 MHZ

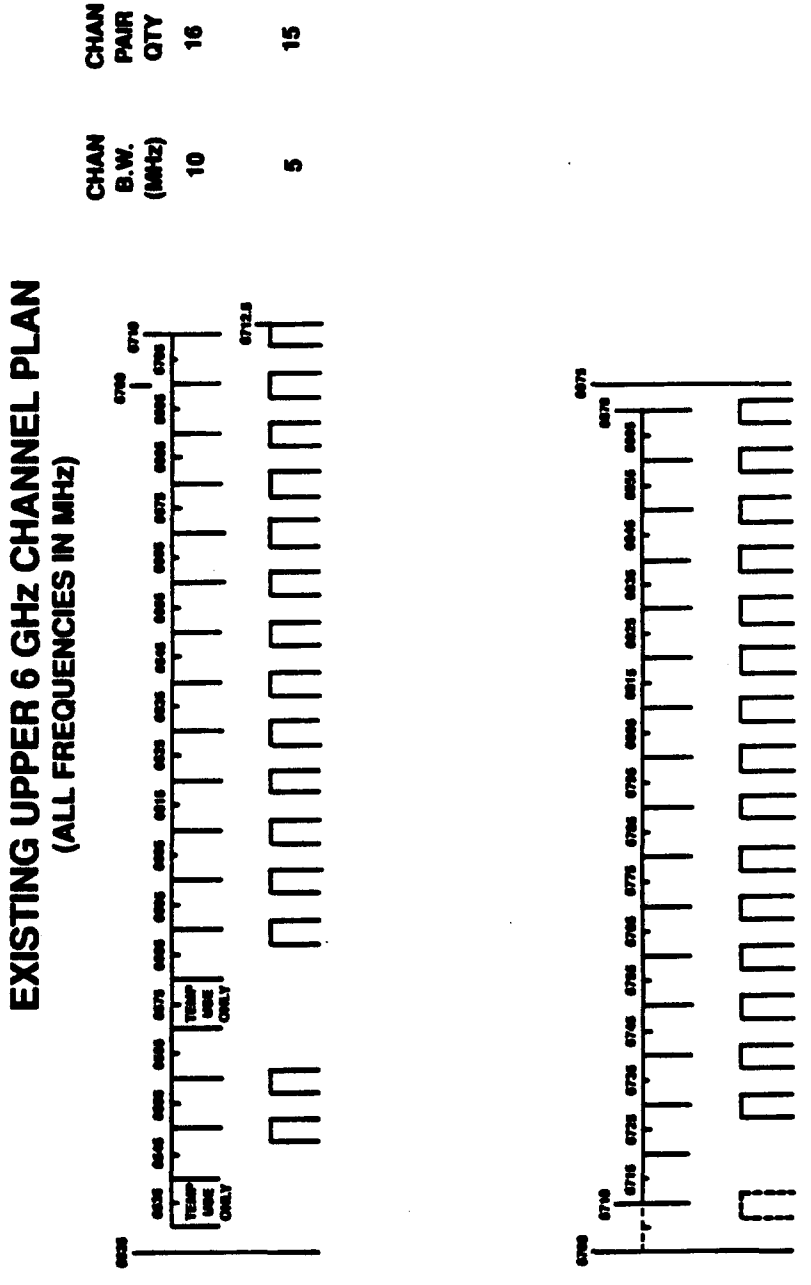
Figure 10 - Frequency Growth Plan

3.5 Upper 6 GHz private op-fixed band

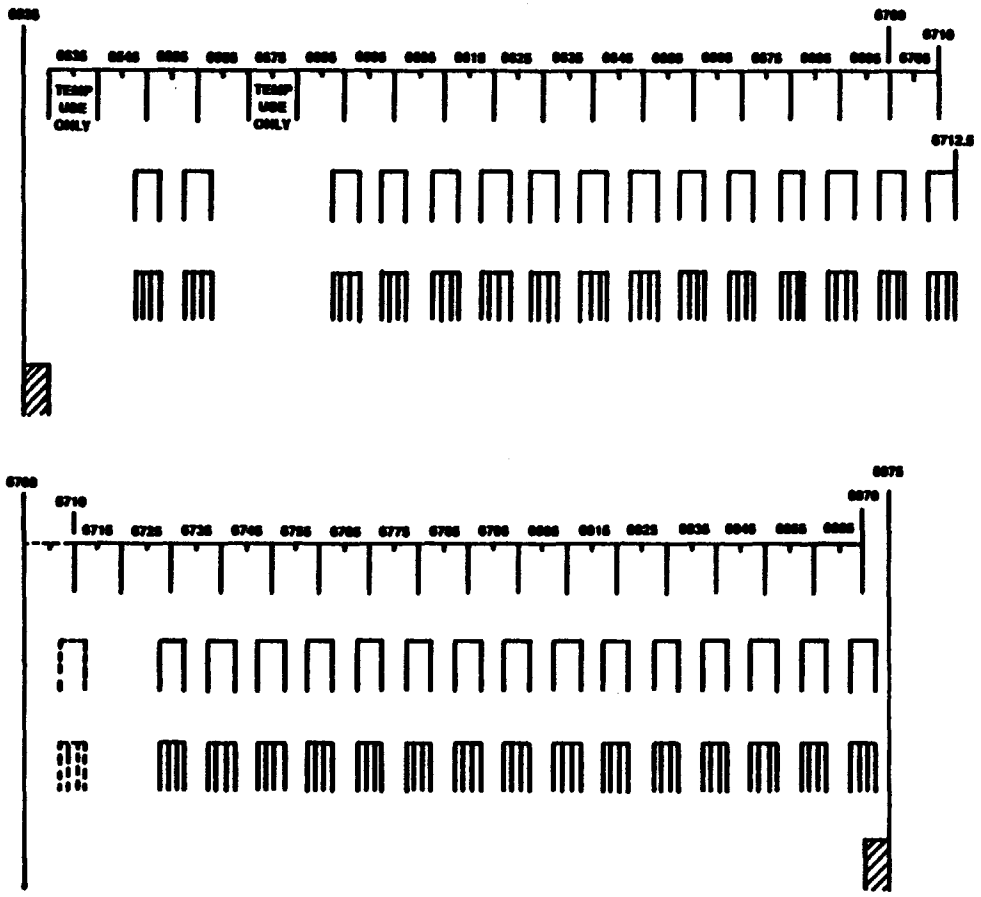
The proposed upper 6 GHz channel plan is depicted in Figures 11 and 12. This plan is similar to the current plan, except that the low capacity 800 KHz channels at the band edges are subdivided into 400 KHz channels.

To improve spectrum utilization further, the existing 5 MHz medium capacity channels would be subdivided into optional 1.6 MHz channels. This plan would provide channelization identical to the medium capacity channels in the 4 and 6 GHz common carrier bands. This would allow radio manufacturers to design common modulators for all bands. Upgrades from 4 to 12 DSl's then could be implemented in the same manner as in the other bands.

Figure 11 - Existing Upper 6 GHz plan



PROPOSED UPPER 6 GHz CHANNEL PLAN
(ALL FREQUENCIES IN MHz)



CHAN B.W. (MHz)	CHAN PAIR QTY
10	16
5	15
1.6	45
0.8	6
0.4	12

Figure 12 - Proposed Upper 6 GHz plan

3.6 3.6 to 3.7 GHz band

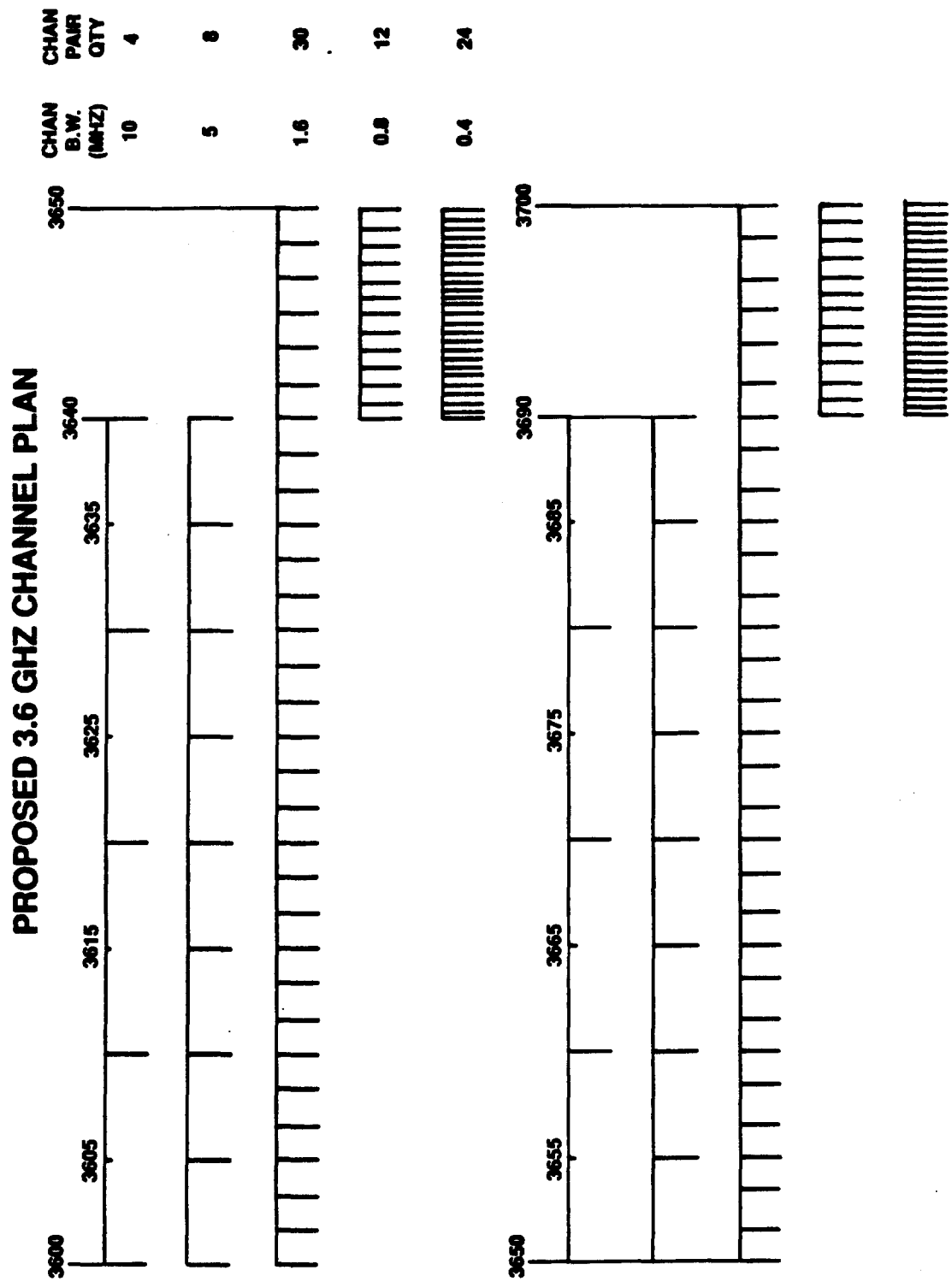
This little used band is currently shared between government and non-government users. The International Telecommunications Union has authorized the band from 3.5 to 3.7. GHz for fixed terrestrial use. As a result, the Commission could allow point-to-point microwave into this band.

ANS proposes that the non-government use be reallocated to fixed point-to-point use. It could be shared by government and non-government users. For the common carrier and private op-fixed users the band would be shared on a co-primary basis as the 23 GHz band is today.

The channelization plan, depicted in Figure 13, is similar to the 4 and lower 6 GHz bands. This plan provides RF bandwidths from 400 KHz to 10 MHz, which is similar to the channelization plans proposed later on which accommodate the needs of low, medium and high capacity users.

Reallocation of the 3.6 to 3.7 GHz band would avoid the satellite coordination requirements in the 3.7 to 4.2 GHz band. Moreover, this band has propagation characteristics which are comparable to the 2 GHz band.

Figure 13 - Proposed 3.6 to 3.7 GHz Band Channelization



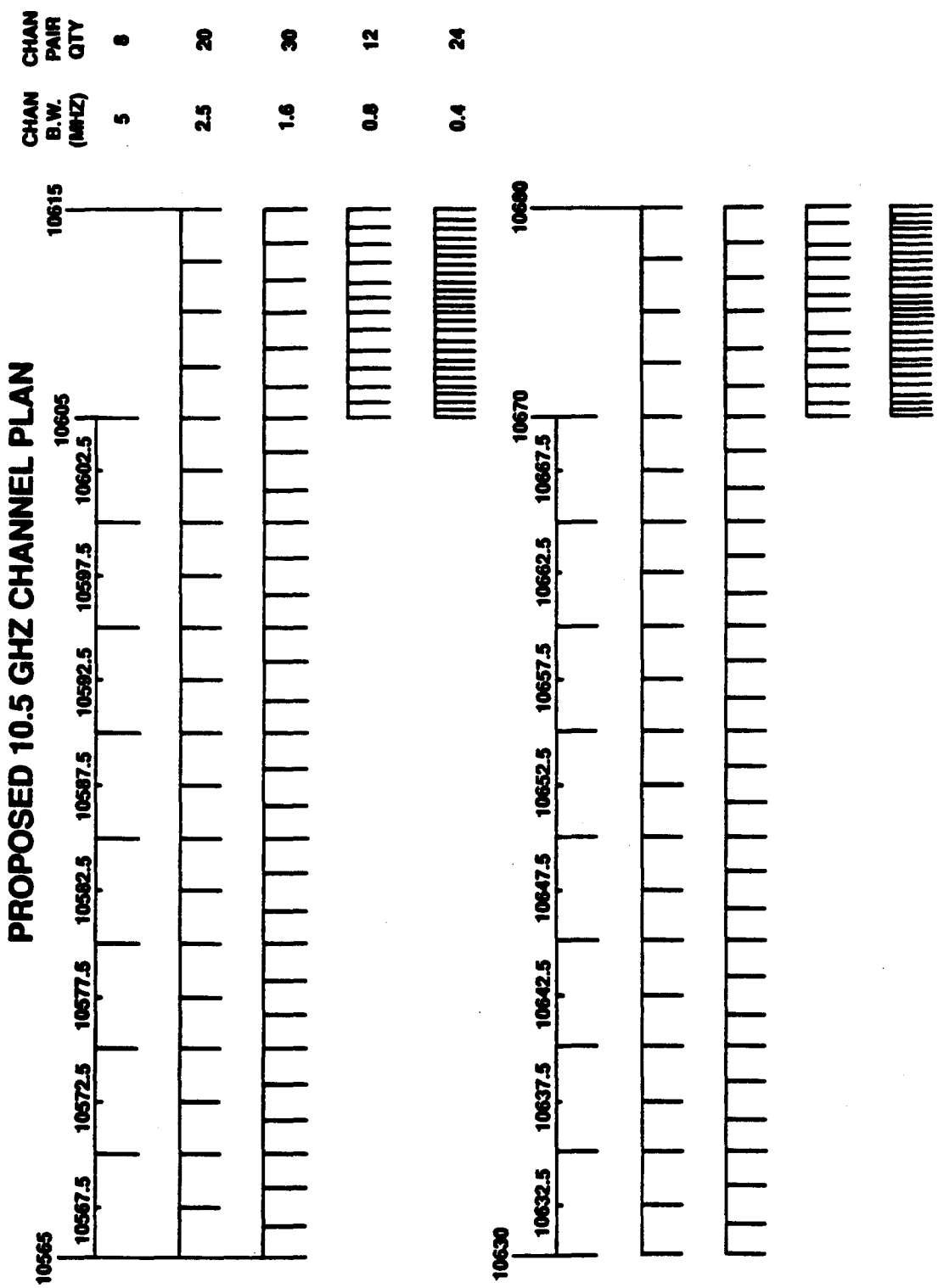
3.7 10.5 GHz band

The proposed 10.55 to 10.68 GHz band channelization is depicted in Figure 14. Two 15 MHz sections of the band are reserved for point-to-point microwave and the remaining 100 MHz is allocated to the point-to-multipoint DEMS. An optional 3.75 MHz frequency channelization recently was approved for the point-to-point section of the band, which is not shown on Figure 11. Although many licenses were issued when DEMS initially was established, few systems actually have been installed.

A proposed frequency channelization for the 10 GHz band is depicted in Figure 12. The current point-to-point channels would remain unchanged. The point-to-multipoint section of the band would be divided into eight pairs of 5 MHz channels, twenty pairs of 2.5 MHz channels, and thirty pairs of 1.6 MHz sub-channels for medium capacity traffic. Part of this band also would be used for low capacity traffic using 800 and 400 KHz bandwidths.

The 10 GHz band is useful on short paths in urban areas where frequency congestion is a problem (i.e., less than 10 miles). However, since it is affected by rain outage, 10 GHz is not used on long paths and paths requiring high reliability. In these applications, the lower frequency bands are preferred. Therefore, the path length requirements for this band will remain unchanged.

Figure 14 - Proposed 10.5 GHz Band Channelization



3.8 11 GHz common carrier band

The 11 GHz plan changes are depicted in Figures 15 and 16. Channel bandwidths of 10 and 30 MHz are used. This is a departure from the traditional use of 40 MHz channels for this band. The 10 MHz channels are appropriate for lower density operation. The 30 MHz channels, rather than 40 MHz channels, are appropriate. As with the lower bands, 30 MHz bandwidth is adequate for typical high density channel requirements. With the new channelization, 16 rather than 12 duplex channels will be available. This will be a much needed improvement in spectrum efficiency.

EXISTING (DE) 11 GHz CHANNEL PLAN

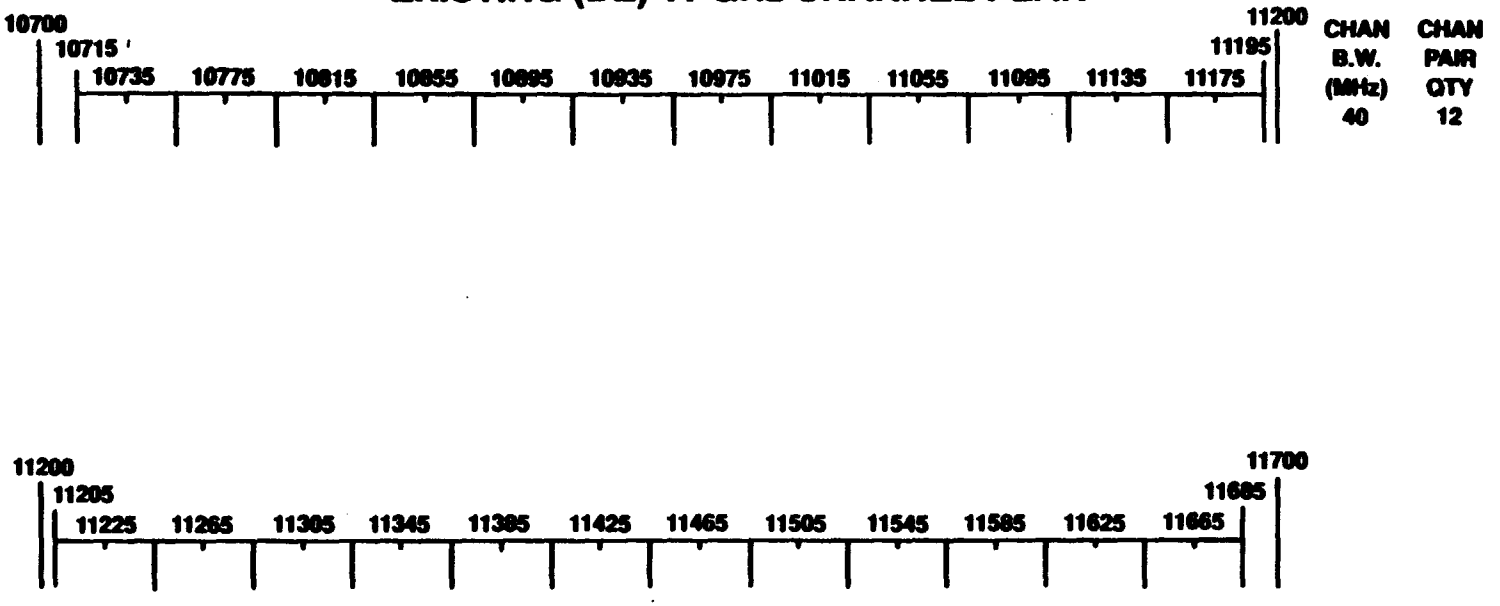
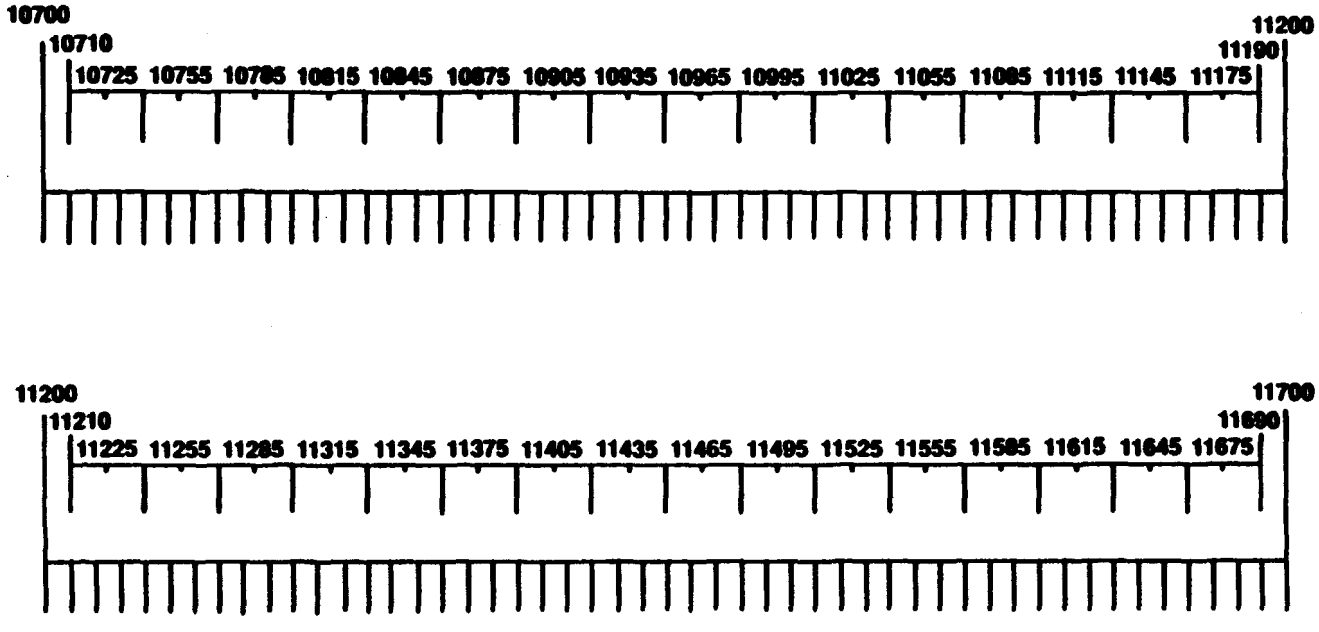


Figure 15 - Current 11 GHz Band Channelization

PROPOSED 11 GHZ CHANNEL PLAN



CHAN B.W. (MHZ)	CHAN PAIR QTY
30	16
10	50

Figure 16 - Proposed 11 GHz Band Channelization

4.0 Necessary rule changes to facilitate co-primary use

Specific amendments to reallocate the 3.6, 4, L6, U6, 10 and 11 GHz bands, as detailed in Section 3.0, are required. Other rule changes are necessary to facilitate co-primary use of these bands. These changes include reallocation of these bands under Part 2, frequency diversity limitations, antenna characteristics, minimum system loading, frequency band channel allocations, minimum path length requirements, frequency planning and coordination criteria, bandwidth limitations, power limitations and automatic transmit power control.

Herein, ANS includes the text of the rules that must be amended to effectuate its proposals. In the text of the current rule, ANS italicizes the language that must be changed. In the text of the proposed rule, ANS italicizes the necessary revisions.

4.1 Frequency Plan

With the limited spectrum available in the bands above 3 GHz, ANS proposes making displaced common carrier and private op-fixed microwave users eligible to use the 3.6-3.7, 4, lower 6, upper 6, 10.5, and 11 GHz bands on a co-primary basis.

To implement this proposed operating plan for the bands above 3 GHz, a specific frequency plan must be established. Instead of relying upon industry to develop an ad hoc plan, ANS herein proposes a frequency plan that will meet the needs of the displaced 2 GHz low and medium capacity users without compromising the needs of high capacity users.

4.1.1 Proposed Commission Rule Changes

ANS sets forth its proposed frequency plans in the Appendix attached hereto. These proposed frequency plans should be added to Sections 21.701 and 94.65.

In addition, the following sentences should be added to Note 1 of Section 25.202 (a) (1):

> All frequencies licensed after the year 2007 for the frequency ranges 3,700 MHz to 3,740 MHz and 4,160 MHz to 4,200 MHz will be secondary to fixed point-to-point microwave users.

4.2 Band Reallocation

As detailed in Section 3.0 herein, reallocation of specific bands above 3 GHz is necessary. To implement such reallocation, the Part 2 Table of Frequency Allocations must be revised as detailed in the attached Tables.