ALCATEL

NETWORK SYSTEMS

TYPICAL MEDIUM AND LOW CAPACITY RADIOS (continued)

Frequency (GHZ)	Manufacturer	Radio Name	Traffic Loading	Channel Bandwidth	Modem Method	FCC Type Number
5.9 - 6.8	ALCATEL	MDR-5106	12 DS1 *	5.0 MHZ	64 QAM	JF6-9206
5.9 - 6.8	ALCATEL	MDR-5206	8 DS1 *	3.2 MHZ	64 QAM	JF6-9204
5.9 - 6.8	ALCATEL	MDR-5306	4 DS1 *	1.6 MHZ	64 QAM	JF6-9205
6.5 - 6.8	ALCATEL	DTR6-26	16 DS1	10.0 MHZ	16 QAM	FHM49A DTR6-26-2
6.5 - 6.8	ALCATEL	DTR6-13	8 DS1	5.0 MHZ	16 QAM	FHM49A DTR6-13-2
6.5 - 6.8	DMC	QUANTUM 6	16 DS1	10.0 MHZ	16 QAM	DYHDMC6QDSU-16
6.5 - 6.8	DMC	QUANTUM 6	8 DS1	5.0 MHZ	16 QAM	DYHDMC6QDSU-08
5.9 - 6.8	HARRIS	DVM6-12T	12 DS1 *	5.0 MHZ	49 QPRS	BCK9GK DVM6-12T-1
5.9 - 6.8	HARRIS	DVM6-8T	8 DS1	5.0 MHZ	25 QPRS	BCK9GK DVM6-8T-1

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NETWORK SYSTEMS

TYPICAL MEDIUM AND LOW CAPACITY RADIOS

Frequency (GHZ)	Manufacturer	Radio Name	Traffic Loading	Channel Bandwidth	Modem Method	FCC Type Number
1.8 - 2.2	ALCATEL	MDR-5102	12 DS1 *	3.5 MHZ	256 QAM	JF6-8804
1.8 - 2.2	ALCATEL	MDR-5202	8 DS1 *	3.2 MHZ	64 QAM	JF6-8903
1.8 - 2.2	ALCATEL	MDR-5302	4 DS1 *	1.6 MHZ	64 QAM	JF6-8904
1.8 - 2.2	ALCATEL	MDR-5402	12 DS1 *	5.0 MHZ	64 QAM	JF6-9102
1.8 - 2.0	ALCATEL	DTR2-26	16 DS1	10.0 MHZ	16 QAM	FHM49A DTR2-26-2
1.8 - 2.0	ALCATEL	DTR2-13	8 DS1	5.0 MHZ	8 QAM	FHM49A DTR2-13-2
1.8 - 2.2	HARRIS	DVM2-8T	8 DS1	5.0 MHZ	25 QPRS	
2.1 - 2.2	HARRIS	URBANET 2	4 DS1 *	1.6 MHZ	49 QPRS	BCK9GK DM2-7A-6-1
2.1 - 2.2	HARRIS	URBANET 2	2 DS1	1.6 MHZ	9 QPRS	BCK9GK DM2-3A-3-4
2.1 - 2.2	HARRIS	URBANET 2	1 DS1	800 KHZ	9 QPRS	BCK9GK DM2-3A-1-3
1.8 - 2.2	TELESCIENCES	2G/12DS1	12 DS1 *	3.5 MHZ	128 QAM	IVO-2G-12DS1
1.8 - 2.2	TELESCIENCES	2G/8DS1	8 DS1	3.5 MHZ	32 QAM	IVO-2G-8DS1
1.8 - 2.2	TELESCIENCES	2G/4DS1	4 DS1	3.5 MHZ	8 QAM	IVO-2G-4DS1
1.8 - 2.2	TELESCIENCES	2G/4DS1N	4 DS1 *	1.6 MHZ	64 QAM	IVO-2G-4DS1N
1.8 - 2.2	W. MULTIPLEX	ONE-2000	132 VF *	1.6 MHZ	ANALOG	HZB-12000
1.8 - 2.2	W. MULTIPLEX	ONE-2000	48 VF *	800 KHZ	ANALOG	HZB-12000
3.7 - 4.2	TELESCIENCES	DR4A	12 DS1	7.0 MHZ	25 QPR	

* This radio will meet the spectrum efficiency requirements proposed by Alcatel.

ALCATEL
NETWORK SYSTEMS

TYPICAL HIGH CAPACITY RADIOS

Frequency (GHZ)	Manufacturer	Radio Name	Traffic Loading	Channel Bandwidth	Modem Method	FCC Type Number
1.8 - 2.0	ALCATEL	MDR-4102	1 DS3 *	10 MHZ	64 QAM	JF6-8705
1.8 - 2.0	HARRIS	DVM2-45	1 DS3 *	10 MHZ	64 QAM	
1.8 - 2.0	TELESCIENCES	DR2J	1 DS3 *	10 MHZ	49 QPR	
3.7 - 4.2	ALCATEL	MDR-4104	1 DS3 *	10 MHZ	64 QAM	
3.7 - 4.2	ALCATEL	MDR-4204	2 DS3 *	20 MHZ	64 QAM	JF6-8908
3.7 - 4.2	N. TELECOM	RD-4A	2 DS3 *	20 MHZ	64 QAM	
5.9 - 6.4	ALCATEL	MDR-4106C	1 DS3 *	10 MHZ	64 QAM	JF6-8803
5.9 - 6.4	ALCATEL	MDR-4206	2 DS3 *	30 MHZ	16 QAM	JF6-8801
5.9 - 6.4	ALCATEL	MDR-4306	3 DS3 *	30 MHZ	64 QAM	JF6-8814
5.9 - 6.4	AT&T	DR6-30-135	3 DS3 *	30 MHZ	64 QAM	DR6-30-135E
5.9 - 6.4	HARRIS	unknown	1 DS3	15 MHZ?		
5.9 - 6.4	HARRIS	DM6-90	2 DS3 *	30 MHZ		
5.9 - 6.4	NEC	6G135-800	3 DS3 *	30 MHZ	64 QAM	
5.9 - 6.4	N. TELECOM	RD-6C	3 DS3 *	30 MHZ	64 QAM	CXP7UJRD6C1
5.9 - 6.4	TELESCIENCES	6G/1DS3	1 DS3 *	10 MHZ	64 QAM	IVO-6G-1DS3
6.5 - 6.8	ALCATEL	MDR-4106U	1 DS3 *	10 MHZ	64 QAM	JF6-8609
6.5 - 6.8	DMC	QUANTUM 6	1 DS3 *	10 MHZ	64 QAM	DYHDMC6QSU-45
6.5 - 6.8	HARRIS	DVM6-45	1 DS3 *	10 MHZ	64 QAM	BCK9GK DVM6-4564-1
6.5 - 6.8	TELESCIENCES	6G/1DS3	1 DS3 *	10 MHZ	64 QAM	IVO-6G-1DS3
10.7 - 11.7	ALCATEL	MDR-4111A	1 DS3 *	10 MHZ	64 QAM	JF6-8914
10.7 - 11.7	ALCATEL	MDR-4211	2 DS3 *	30 MHZ	16 QAM	JF6-8802
10.7 - 11.7	ALCATEL	MDR-4311	3 DS3 *	30 MHZ	64 QAM	JF6-8815
10.7 - 11.7	AT&T	DR-11-135	3 DS3 *	30 MHZ	64 QAM	DR11-40A-135
10.7 - 11.7	DMC	QUANTUM 11	1 DS3	15 MHZ	16 QAM	
10.7 - 11.7	NEC	11G135-800	3 DS3 *	30 MHZ	64 QAM	
10.7 - 11.7	N. TELECOM	RD-11C	3 DS3 *	30 MHZ	64 QAM	

* This radio will meet the spectrum efficiency requirements proposed by Alcatel.

ALCATEL
NETWORK SYSTEMS

COMPETITION

THE FOLLOWING RADIOS ARE CURRENTLY TYPE ACCEPTED WITH THE FCC

FREQUENCY (GHZ)	MANUFACTURER	RADIO NAME	TRAFFIC LOADING	CHANNEL BANDWIDTH	MODULATION	NOTE
5.9 - 6.8	ALCATEL	MDR-5106	12 DS1	5.0 MHZ	64 QAM	(1)
5.9 - 6.8	HARRIS	DVM6-12T	12 DS1	5.0 MHZ	49 QPRS	(1)
5.9 - 6.8	TELESCIENCES	6G/12DS1	12 DS1	5.0 MHZ	128 QAM	(1)
10.5 - 10.7	TELESCIENCES	10G/12DS1	12 DS1	3.5 MHZ	128 QAM	(1)
5.9 - 6.8	ALCATEL	MDR-5206	8 DS1	3.2 MHZ	64 QAM	(1)
10.5 - 10.7	HARRIS	DVM10-8T	8 DS1	3.75 MHZ	49 QPRS	(2)
5.9 - 6.8	TELESCIENCES	6G/8DS1	8 DS1	3.5 MHZ	32 QAM	(2)
10.5 - 10.7	TELESCIENCES	10G/8DS1	8 DS1	3.5 MHZ	32 QAM	(2)
5.9 - 6.8	ALCATEL	MDR-5306	4 DS1	1.6 MHZ	64 QAM	(1)
2.1 - 2.2	HARRIS	URBANET 2	4 DS1	1.6 MHZ	49 QPRS	(1)
2.1 - 2.2	TELESCIENCES	2G/4DS1N	4 DS1	1.6 MHZ	64 QAM	(1)

NOTE:

(1) THIS RADIO MEETS THE ALCATEL SPECTRUM EFFICIENCY REQUIREMENTS

(2) THIS RADIO COULD MEET THE SPECTRUM EFFICIENCY REQUIREMENTS WITH FILTER CHANGES

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NETWORK SYSTEMS

Alcatel's Modified Plan Does Not Favor One Manufacturer

Alcatel's Modified Plan obsoletes five Alcatel radios

DTR2-13	8 DS-1
DTR2-26	16 DS-1
DTR6-13	8 DS-1
DTR6-26	16 DS-1
MDR-5111	12 DS-1

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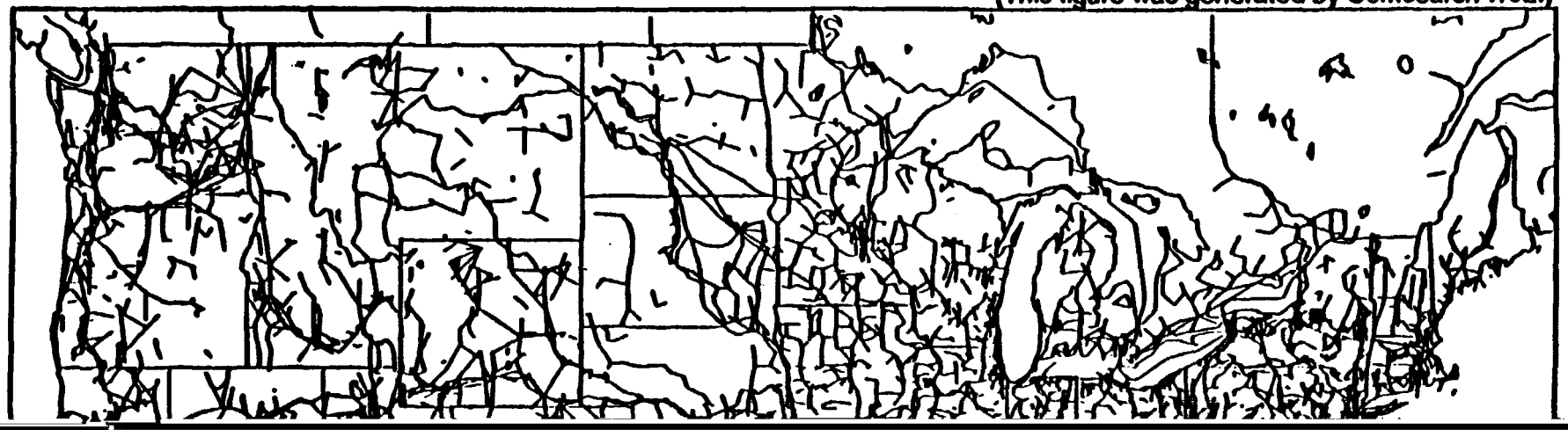
The Alcatel Modified Plan is Designed with the 2 GHz Users' Needs in Mind

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



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2 GHz Installed Base

Part 04 Statistics

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2 GHz Installed Base
Part 21 Statistics

- 6,822 digital frequencies

Channel Loading (Voice CH)	% of Sales (Alcatel Experience)	Channel BW Required (MHz)	Digital Capacity (# of DS1's)
96	35	1.6	4
192	30	3.2	8
288	35	3.5	12

- Approximately 35% of channels carry 96 CH or less

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2 GHz Installed Base Statistics

Frequency (MHz)	Allocated Channel BW (MHz)	# of Lic Freq	# of Analog Freq	# of Digital Freq	Avg Path Length (MI)
1850-1990 (Part 94)	5, 10	9,258	8,060	1,198	19.8
2110-2130 & 2160-2180 (Part 21)	3.5 (max)	6,823	1	6,822	17.9
2130-2150 & 2180-2200 (Part 94)	0.8, 1.6	13,035	13,035	0	15.1

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2 GHz INSTALLED BASE

SUMMARIZED STATISTICS

- 29,116 LICENSED FREQUENCIES
- APPROXIMATELY 16,100 (55%) CARRY 96 CHANNELS OR LESS
- APPROXIMATELY 25,000 (86%) CARRY 300 CHANNELS OR LESS

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NETWORK SYSTEMS

COMPARISON OF RF CHANNEL CAPACITY

If all 16,100 frequencies carrying 96 channels were moved

Using 2.5 MHz RF Channels
Required spectrum = 2.5 MHz x 16,100 = 40,250 MHz

Using 1.6 MHz RF Channels
(1.66 MHz bandwidth to include spectrum remnant)
Required spectrum = 1.66 MHz x 16,100 = 26,726 MHz

1.6 MHz RF channel requires 13,524 MHz <u>less</u> spectrum !!!

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Joint Commenters Incorrectly Question the Economic Justification for 400 and 800 kHz Channels

- A significant number of current 2 GHz users use 800 kHz channels (45% of existing 2 GHz users use 0.8 or 1.6 MHz channels)
- 400 kHz channels may be useful in the future for PCS one DS-1 intercell connections
- JC's plan does not accommodate these needs

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Only Alcatel's Modified Plan is Spectrally Efficient

- Alcatel's Modified Plan results in 50% more transmission capacity than JC's plan
- JC's plan creates channel overlaps - Alcatel's does not
- Alcatel's plan facilitates capacity upgrades - JC's does not because of polarization and frequency conflicts
- JC's 1.25 MHz channels block wideband 30 MHz channels
  - Alcatel's 400 and 800 kHz channels do not because they are restricted to segregated spectrum

Alcatel's Modified Plan Promotes Path Reliability

- Joint Commenters incorrectly claim that Alcatel's higher spectrum efficiency requirements adversely affect path reliability
- Lower spectral efficiency makes sense at higher frequencies where greater system gain is more difficult to find than spectrum

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NETWORK SYSTEMS

PATH RELIABILITY

RADIOS WITH A HIGHER SYSTEM GAIN WILL HAVE A BETTER PATH RELIABILITY

FREQUENCY (GHZ)	MANUFACTURER	RADIO NAME	TRAFFIC LOADING	CHANNEL BANDWIDTH	MODULATION	SYSTEM GAIN
5.9 - 6.8	ALCATEL	MDR-5206	8 DS1	3.2 MHZ	64 QAM	110 dB
5.9 - 6.8	HARRIS	DVM6-8T	8 DS1	5.0 MHZ	25 QPRS	110 dB
6.5 - 6.8	DMC	QUANTUM 6	8 DS1	5.0 MHZ	16 QAM	108 dB

SYSTEM GAIN = RADIO TRANSMIT POWER - RECEIVER THRESHOLD (10-6 BER)

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PATH RELIABILITY

HIGH CAPACITY RADIOS

FREQUENCY (GHZ)	MANUFACTURER	RADIO NAME	TRAFFIC LOADING	CHANNEL BANDWIDTH	MODULATION	SYSTEM GAIN
10.7 - 11.7	ALCATEL	MDR-4211	2 DS3	30 MHZ	16 QAM	104 dB
10.7 - 11.7	ALCATEL	MDR-4211A	2 DS3	20 MHZ	64 QAM	99 dB

SYSTEM GAIN = RADIO TRANSMIT POWER - RECEIVER THRESHOLD (10-6 BER)

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Alcatel's Modified Plan Only Minimally Increases Cost

- Equipment designed for either channel plan requires coherent radios

  - no substantial cost difference for any coherent demodulator

- PA requirements are only slightly greater for the more spectrally efficient transmitters
- Alcatel has both radios - the cost difference between the two types of radios is only 3 to 5%

Frequency

Plan

Comparisons

ALCATEL
NETWORK SYSTEMS

Specific Frequency Band Comments

4 GHz

- JCs make no provision for narrow band channels
- JCs propose new 40 MHz channels
  - strongly opposed by satellite interests
- Alcatel has proposed Modified Plan with some satellite industry acceptance
- Alcatel's Modified Plan accommodates low capacity users

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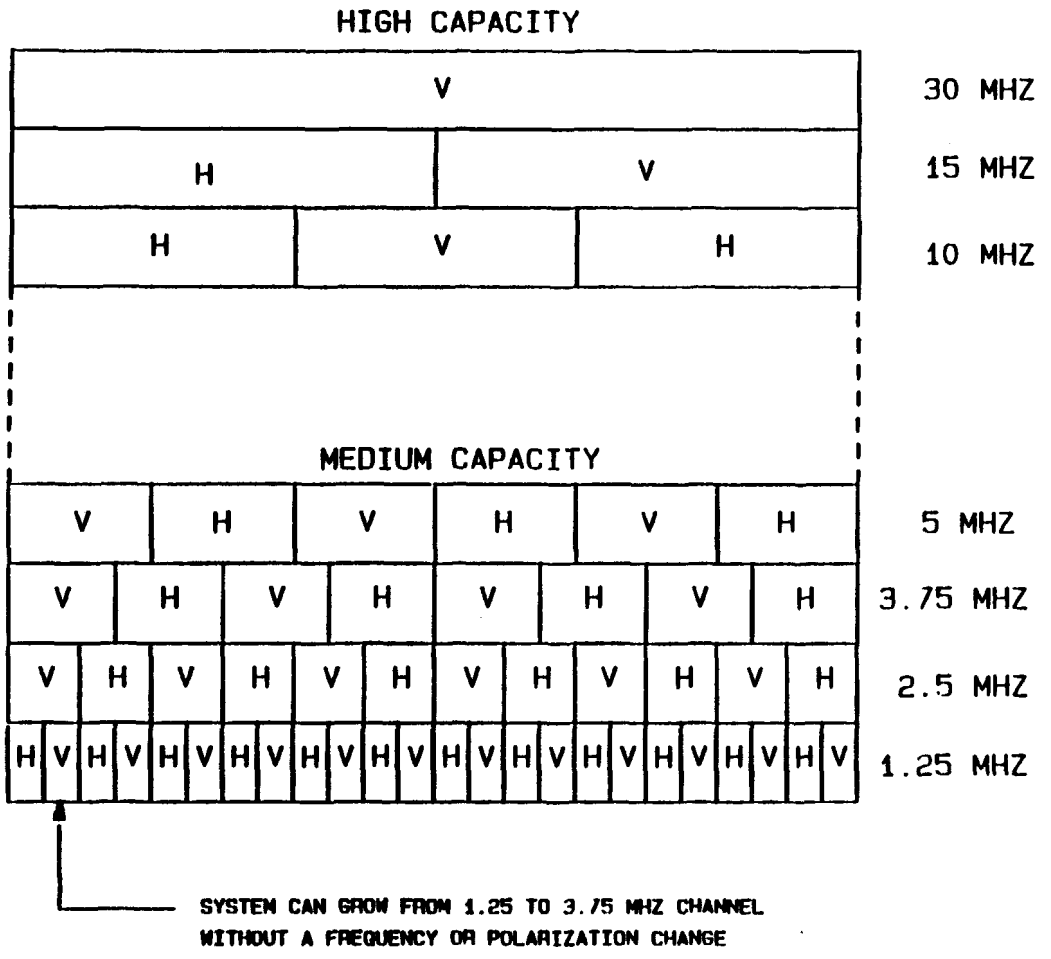
Specific Frequency Band Comments

Lower 6 GHz

- Alcatel plan has 50% more transmission capacity
- With Alcatel's Modified Plan, a two DS-1 channel will not block a 3 DS-3 channel
- JC's 3.75 MHz channels can block multiple channels

TIA CHANNEL PLAN – LOWER 6 GHZ BAND

SYSTEM GROWTH PLAN



V = VERTICAL POLARIZATION

H = HORIZONTAL POLARIZATION

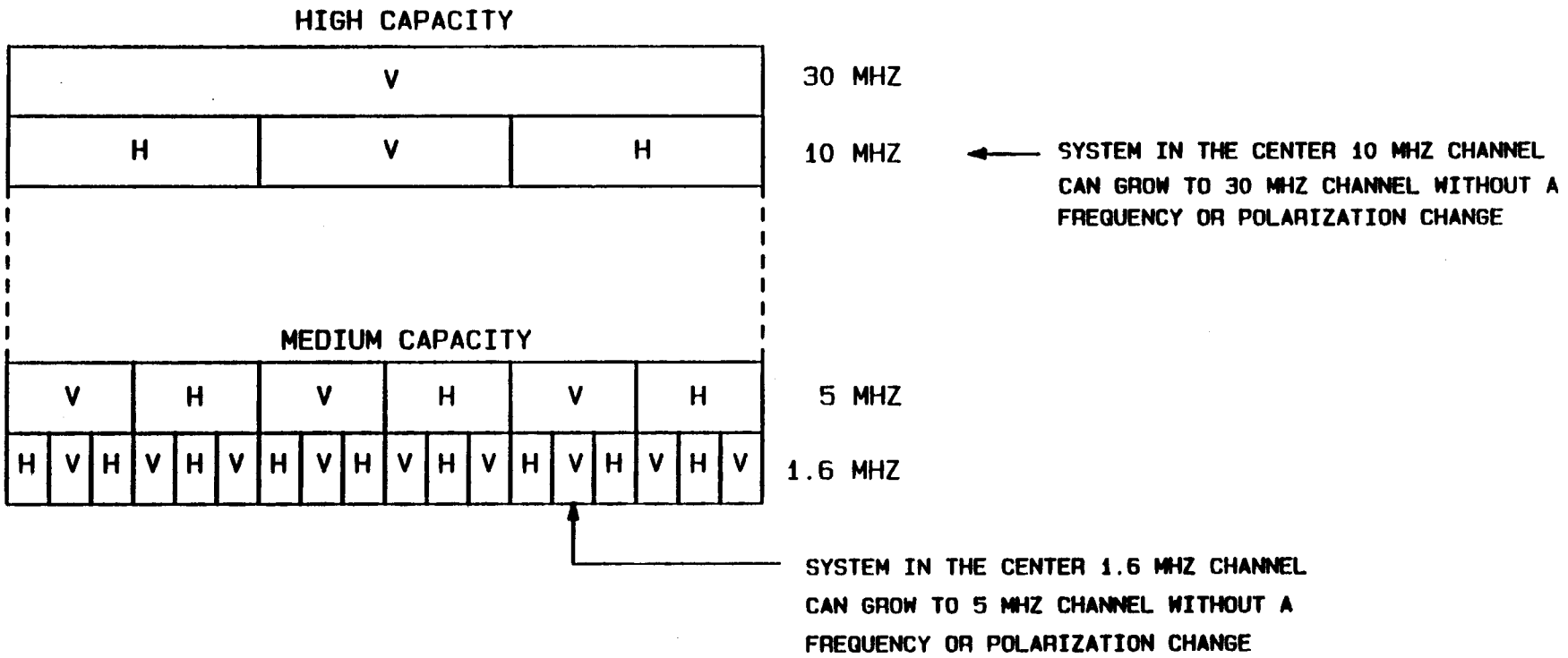
NOTES:

1. SYSTEM IN THE CENTER 10 MHZ CHANNEL CAN GROW TO 30 MHZ WITHOUT A FREQUENCY OR POLARIZATION CHANGE
2. FREQUENCY CHANGES ARE REQUIRED FOR THE FOLLOWING CASES:
   - GROWTH FROM 1.25 TO 2.5 MHZ CHANNELS
   - GROWTH FROM 2.5 TO 3.75 MHZ CHANNELS
   - GROWTH FROM 3.75 TO 5.0 MHZ CHANNELS
   - GROWTH FROM 5 TO 10 MHZ CHANNELS
   - GROWTH FROM 10 TO 15 MHZ CHANNELS
   - GROWTH FROM 15 TO 30 MHZ CHANNELS
3. POLARIZATION CHANGES WILL BE REQUIRED IN SOME CASES
4. DUE TO CONFLICTING CHANNEL BANDWIDTHS AND POLARIZATION PLANS, SOME CHANNELS WILL BE BLOCKED

Figure 16

MODIFIED CHANNEL PLAN – LOWER 6 GHZ BAND

SYSTEM GROWTH PLAN



NOTE:

1. FREQUENCY CHANGE IS REQUIRED TO GROW FROM 5 TO 10 MHZ CHANNEL
2. POLARIZATION CHANGE MAY ALSO BE REQUIRED
3. LOW CAPACITY 400 AND 800 KHZ CHANNELS IN RESERVED SPECTRUM (BAND EDGES/GUARD BANDS)

V = VERTICAL POLARIZATION
H = HORIZONTAL POLARIZATION

Figure 18

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NETWORK SYSTEMS

Specific Frequency Band Comments

Upper 6 GHz

- Alcatel plan has 50% more capacity
- JC's plan blocks emergency restoration channel 1A
- JC's plan has large frequency remnants
- JC's 5 and 10 MHz pairings are incompatible for capacity upgrades
- JC's interstitial 5 MHz problem
- JCs eliminated current band edge 800 kHz channels

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Specific Frequency Band Comments

11 GHz

- JCs remove two existing 40 MHz DE channels
- JC's 10 and 30 MHz plans have large frequency remnants
- With JC's plan, three DS-3 radios cannot be used in approximately half the United States
- JC's low capacity channels block high capacity channels