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May 31, 1995

VIA HAND DELIVERY

EX PARTE OR LATE FILED

William F. Caton
Acting Secretary
Federal Communications Commission
1919 M Street, N.W.
Room 222
Washington, D.C. 20554

Re: *Gen. Docket No. 90-54, MM Docket No. 94-131 and PP Docket No. 93-253 -- Written Ex Parte Presentation*

Dear Mr. Caton:

For the past several years, The Wireless Cable Association International, Inc. has been advocating revisions to the manner in which the Commission determines the protected service area ("PSA") afforded Multipoint Distribution Service ("MDS") and Instructional Television Fixed Service ("ITFS") stations. Those revisions would expand the PSA of many stations, in some cases into areas where interference will be caused from stations proposed prior to the adoption of the new PSA definition. Rather clearly, that interference will have to be accepted -- no licensed or previously proposed facility should be required to make modifications merely because the PSA definition has changed.

To avoid future disputes where "grandfathered" interference exists, WCAI has urged the Commission to clearly establish the circumstances under which the station that causes the "grandfathered" interference will be permitted to make subsequent facility modifications. Specifically, WCAI has consistently urged that areas in which "grandfathered" interference occurs should be excluded from the PSA definition -- an approach that provides the interfering station reasonable flexibility to make subsequent modifications, while assuring the station that suffers "grandfathered" interference that no new areas of its expanded PSA will suffer interference in the future.

In meetings with the staff, it has been suggested that the number of areas in which "grandfathered" interference will occur are minimal. As is discussed in the accompanying report by T. Lauriston Hardin, P.E., "Possible Impact of Expanded Protected Service Area On Digital Operation," (the "Hardin Report"), that may be true with respect to the MDS, but is not the case with respect to the ITFS. The Commission's rules have permitted many more

ITFS stations than MDS stations to be closely-spaced. That fact has significant implications for the future. Indeed, by analyzing a typical major market, the Hardin Report illustrates how adoption of WCAI's approach is essential to the coming transition of wireless cable to digital transmission technology. Simply stated, unless the "grandfathered" interference areas suffered by closely-spaced ITFS stations are excluded from the PSA definition, it may prove impossible for many major market wireless cable systems to implement digital technology.

Should you have any questions regarding the Hardin Report, please contact either Mr. Hardin (804-853-3238) or the undersigned.

Respectfully submitted,

Paul J. Sinderbrand

Counsel for The Wireless Cable Association International, Inc.

Enclosure

cc: Barbara Kreisman
Keith Larson
Robert L. Schmidt
T. Lauriston Hardin

POSSIBLE IMPACT OF EXPANDED PROTECTED SERVICE AREA ON DIGITAL OPERATION

T. Lauriston Hardin, P.E.
Hardin and Associates, Inc.

Introduction

Presently pending before the Commission is a proposal first forwarded by the Wireless Cable Association International ("WCAI") which requests a change in the rules concerning the size and shape of the Protected Service Area ("PSA") of an MMDS station. Fundamentally, this proposal would change the PSA to have its dimensions based upon the Effective Isotropic Radiated Power ("EIRP") of the station along that given azimuth. The result for an omni-directional station would be an increase in the radius of the PSA from the present 15 miles to approximately 20-35 miles, depending on final EIRP of the station.

To implement its proposal, WCAI would have the Commission exclude from the newly added portion of the PSA any area that is not be afforded protection by an existing station or pending application as presently configured. This would mean that as regards that adjacent market station, the PSA of the study station would have a section "carved out" as regards interference protection. This feature of the proposal is critical to the expansion of wireless cable service, especially into the realm of digital transmission.

Digital Transmission

As digital transmission has taken on a new importance for wireless cable operators, testing of digital transmission and its effect on analog transmission in the wireless cable services in the area of interference has been recently undertaken. The major finding of this testing is that the present analog cochannel and adjacent channel interference criteria, 45 dB and 0 dB respectively, are acceptable interim standards for implementation of digital transmission. Given these findings, which will be the subject of a petition for declaratory ruling to be filed with the Commission within next few weeks, the rights of licensees with respect to areas of new interference caused solely by an expansion of the PSA garners new significance.

Example of the Impact

Largely because the FCC's rules and policies have limited the number of MDS stations in close proximity to each other, an analysis of the impact of the expanded PSA on MDS stations would yield a limited number of cases where new areas of interference will be caused by PSA expansion, However, this type of analysis only uncovers the tip of the iceberg. As wireless cable systems' operations are dependent on leased excess capacity of ITFS licensees to create a "critical mass" of channels, one must consider the impact of the expanded PSA on ITFS

operations as well. One must remember that ITFS licensees who lease their excess time are allowed to request an MDS type PSA to be effective during the hours they are leasing their air time.

Because the FCC's ITFS rules have permitted the short-spacing of ITFS stations, the impact of an expanded PSA on the ITFS is more dramatic. This can be illustrated by examining one large urban market. As shown in Figure 1, from an ITFS standpoint, the urban market is ringed by ITFS stations or applications in four adjacent rural markets. Figure 1 depicts the present 15 mile radius PSA of each of these omni-directional station as well as the expanded 35 mile radius PSA of each station. The configuration of the urban system is an example of one preferred configuration of the station to operate as a fully configured and channel complemented wireless cable system. Clearly, the urban system station has unobstructed line of sight to many areas of the PSA of each rural station, both within the present PSA and the newly expanded PSA.

Two of the rural markets are examined in detail to provide more illumination of the impact of the newly expanded PSA. Data for the first rural market station is included as Figure 2. As shown therein, the urban system configuration as a $25W_{avg}$ station will cause no interference to the presently configured first rural system PSA. Note that the 45 dB Desired-to-Undesired ("D/U") contour lies outside of the PSA. However, as the first rural system's PSA is expanded, new areas of interference now exist. If the rural system PSA was allowed to stand without mitigation of the new interference areas, the urban system station would not be able to implement its plans for digital operation. It is interested to observe that with Precision Frequency Control and Precise Offset operation with its associated analog interference mitigation capabilities, the urban system station could operate with the expanded rural system PSA. **The impact, therefore, is clearly an impact on the migration to digital operation.**

As situation similar to the first rural system case will occur in a second rural system as demonstrated by the data included in Figure 3. In the case of the second rural system the situation is made worse by the fact that areas behind the rural system transmit site relative to the urban system transmit site have a line-of-sight. These areas will not have the interference protection afforded by the front to back ratio of the receiving antenna. Clearly from the analysis, it would be tantamount to impossible for the urban system to eliminate this area of interference without the provisions of elimination of this area of interference as outlined above.

Impact on Future Collocation

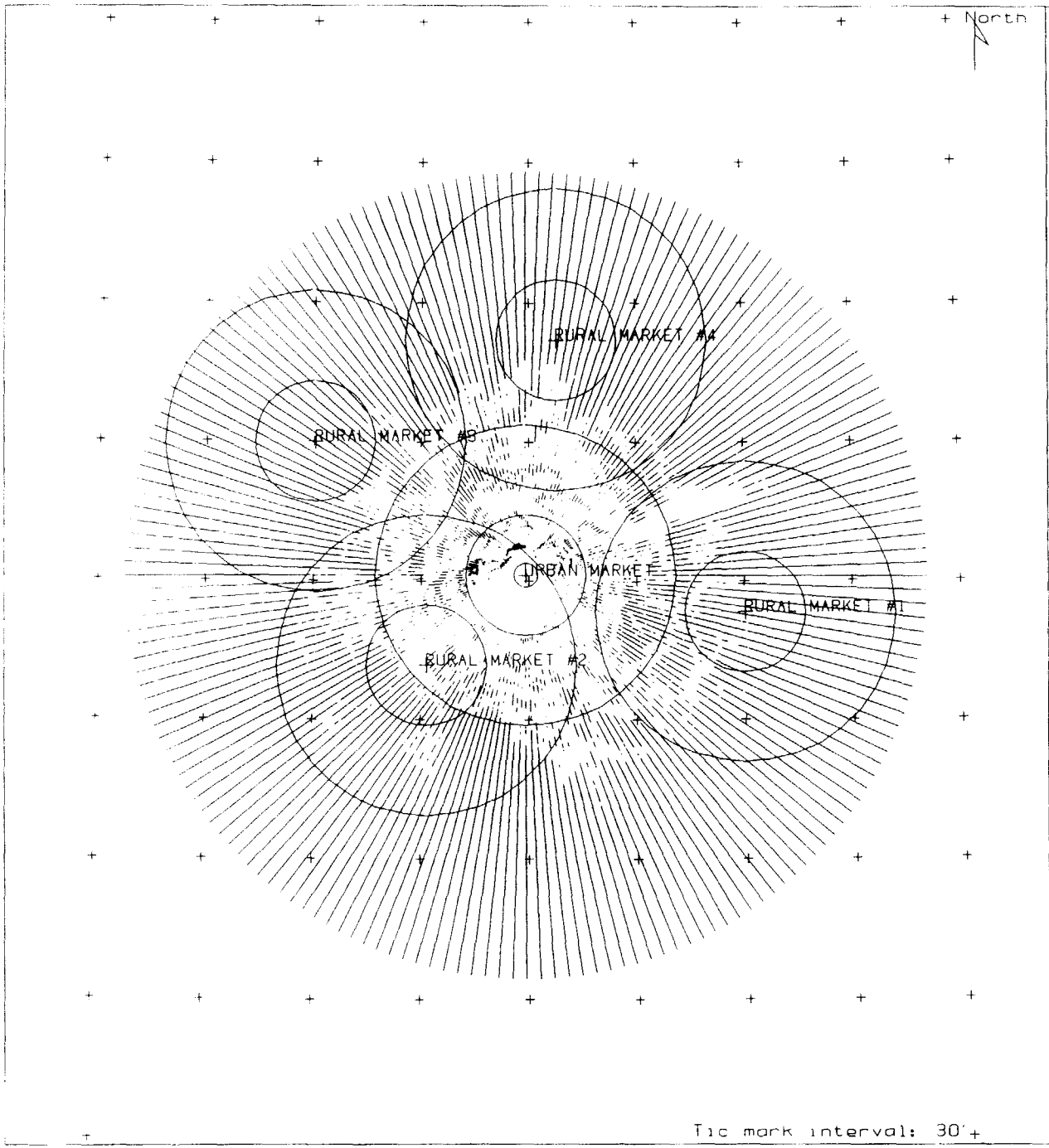
One additional area should be considered. In many markets, including many major markets, all of the wireless cable channels have not yet been collocated and configured in the most advantageous manner. As such, the impact of the expanded PSA, given the significant number of rural ITFS only markets adjacent to major markets, could be to slow or stop this collocation and conformation process. **The result would be a slowing of implementation of wireless cable in many markets and the associated loss of a competitive force in those markets.**

Conclusion

As clearly demonstrated by the examples included herein, careful consideration of the implementation of changes to the PSA rules is in order. **It is apparent that one must allow for exclusion of new areas of interference which are created solely by the expansion of the PSA. Without such an exclusion, expansion of wireless cable would be significantly negatively impacted.**

FIGURE 1

RADIO SHADOW MAP OF URBAN SYSTEM MARKET WITH ADJACENT MARKETS AND PSA OF EACH



RADIO SHADOW MAP

K Factor: 1.333
RX Ant. Height: 30.0 feet AGL

Line-of-Sight/Shadowed Areas

Line-of-Sight Areas

Shadowed Areas

Site	Ant Elv AMSL (feet)	ERPd (dBW)	Ant. Type	Ant. Orient (degs)	Latitude & Longitude
1	2049.0	20.00	OMNI		N W

MILES

20 0 20 40 60 80

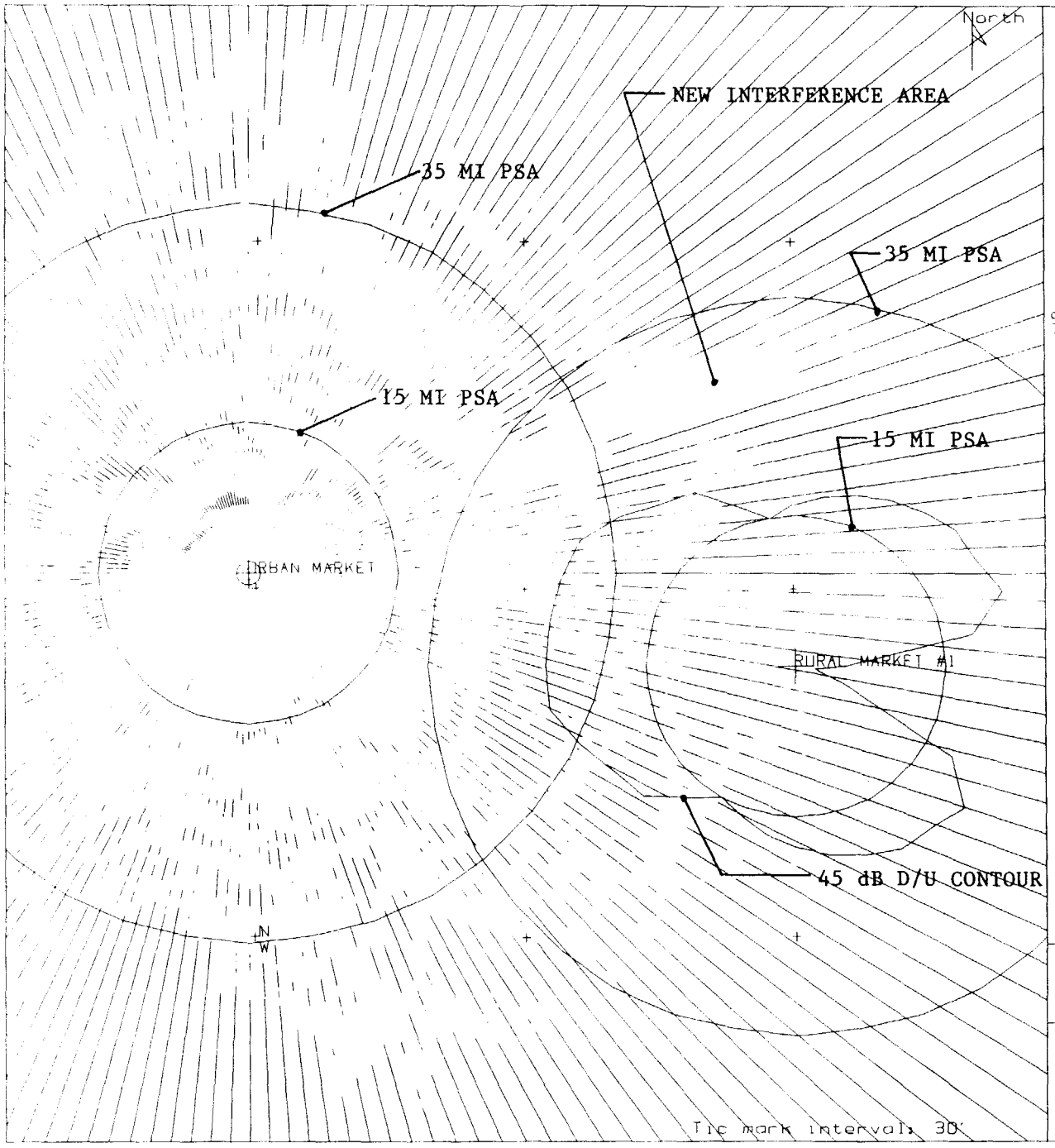
PSA ANALYSIS

URBAN MARKET AND SURROUNDING SYS

19 MAY 95

FIGURE 2

DETAILED ANALYSIS OF FIRST RURAL SYSTEM MARKET



RADIO SHADOW MAP

K Factor: 1.333
RX Ant. Height: 30.0 feet AGL

Line-of-Sight/Shadowed Areas

Line-of-Sight Areas

Shadowed Areas

Site	Ant Elv AMSL (feet)	ERPd (dBW)	Ant. Type	Ant. Orient (degs)	Latitude & Longitude
1	2049.0	20.00	OMNI		N 00 00 00 W 00 00 00

MILES

10 0 10 20 30

PSA ANALYSIS

URBAN MARKET/RURAL MARKET #1

19 MAY 95

Hardin & Associates, Inc.

Station Characteristics	Desired	Undesired
Name:	PRESENT SITE	DESIRED SITE
Service Area:	RURAL SITE #1	URBAN MARKET
Call Sign:		
Frequency (MHz):	2645 (G1)	2645 (G1)
Latitude:	: :	: :
Longitude:	: :	: :
Polarization:	V	H
Tx Power (dBm):	43	44
Line Loss (dB):	6	6.5
Tx Ant Gain (dBi):	13	14
Tx Ant Pattern:	HMD-VO	HMD-HO
Tx Ant Orientation:	0	0
Tx Ant Height ('AGL):	750	800
Tx Site Elevation ('AMSL):	745	1249

Cochannel Interference Analysis

Interference Criterion: 45 dB

Cochannel calculations for the remaining channels in the group will not vary from the results shown below.

4/3 Earth radius Radio Horizons with 30' Rcv Ant

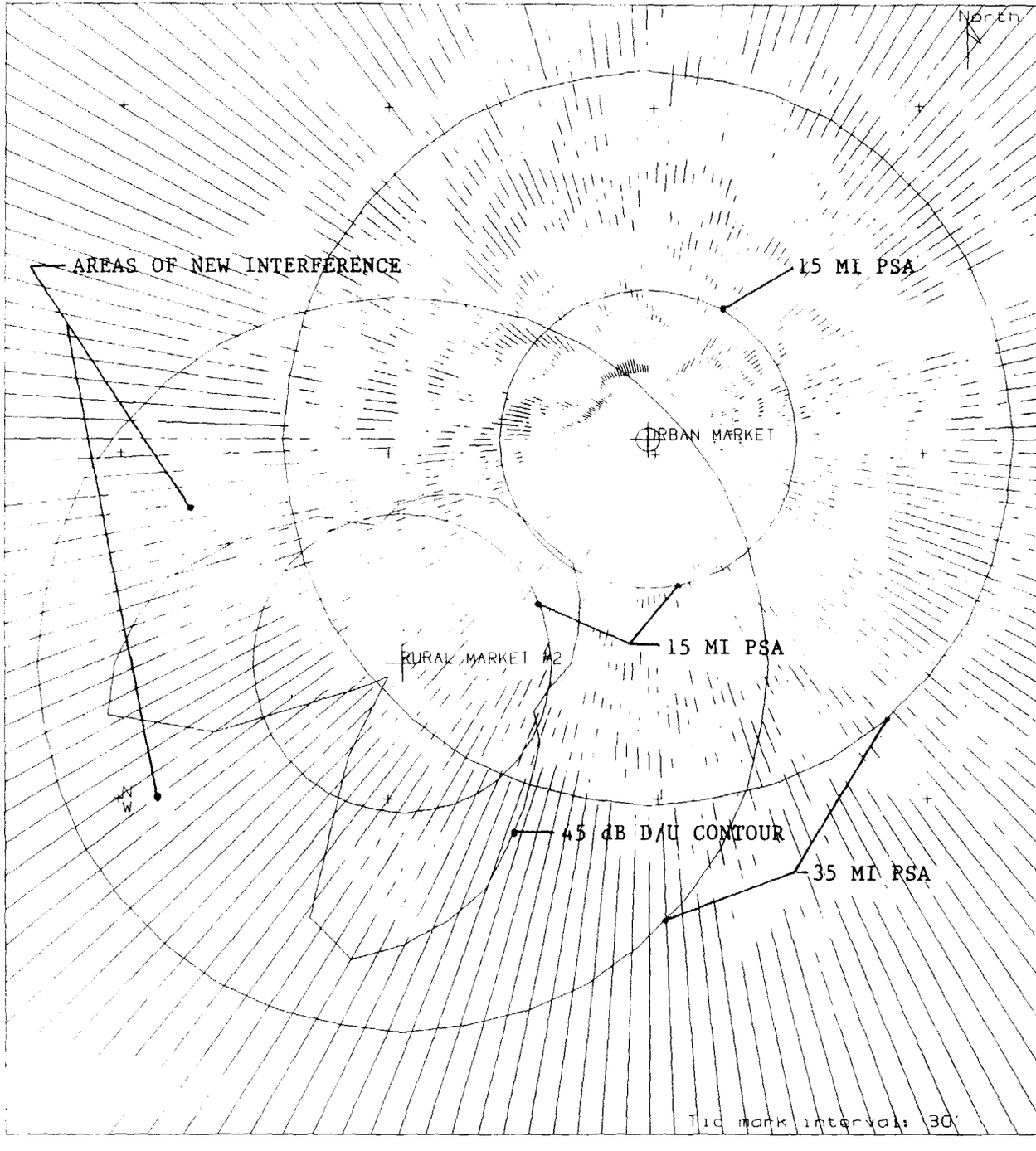
Desired Station:	46.5	MI
Undesired Station	47.7	MI
Distance between stations:	55.4	MI
Bearing desired/undesired:	279.9	Deg

Distance from Desired (miles)

Bearing	0.5	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
0	75.9	69.3	63.3	59.8	57.2	55.3	53.7	52.3	51.2	50.2	49.2	48.4	47.7	47.0	46.3	45.8	45.2	44.7	44.2	43.8	43.4	43.0	42.6	42.3	41.9	41.6	41.3	41.0	40.8	40.5	40.3	40.0	39.8	39.6	39.4	39.2
10	75.4	69.4	63.4	59.8	57.4	55.4	53.9	52.5	51.4	50.4	49.5	48.7	48.0	47.3	46.7	46.2	45.6	45.2	44.7	44.3	43.9	43.5	43.2	42.8	42.5	42.2	41.9	41.7	41.4	41.2	40.9	40.7	40.5	40.3	40.1	40.0
20	75.4	69.4	63.4	59.9	57.5	55.6	54.0	52.7	51.6	50.6	49.8	49.0	48.3	47.6	47.1	46.5	46.0	45.6	45.1	44.7	44.3	44.0	43.6	43.3	43.0	42.8	42.5	42.2	42.0	41.8	41.5	41.3	41.1	40.9	40.8	40.6
30	75.4	69.4	63.5	60.0	57.6	55.7	54.2	52.9	51.8	50.8	50.0	49.2	48.6	47.9	47.4	46.8	46.4	45.9	45.5	45.1	44.7	44.4	44.1	43.8	43.5	43.2	43.0	42.7	42.5	42.3	42.0	41.8	41.6	41.5	41.3	41.1
40	75.4	69.4	63.5	60.1	57.7	55.8	54.3	53.0	52.0	51.0	50.2	49.5	48.8	48.2	47.6	47.1	46.7	46.2	45.8	45.4	45.1	44.8	44.4	44.1	43.9	43.6	43.4	43.1	42.9	42.7	42.5	42.3	42.1	41.9	41.7	41.6
50	75.4	69.5	63.6	60.1	57.7	55.9	54.4	53.2	52.1	51.2	50.4	49.7	49.0	48.4	47.9	47.4	46.9	46.5	46.1	45.7	45.4	45.1	44.7	44.5	44.2	43.9	43.7	43.4	43.2	43.0	42.8	42.6	42.4	42.3	42.1	41.9
60	75.4	69.5	63.6	60.2	57.8	56.0	54.5	53.3	52.3	51.3	50.5	49.8	49.2	48.6	48.1	47.6	47.1	46.7	46.3	46.0	45.6	45.3	45.0	44.7	44.4	44.2	43.9	43.7	43.5	43.3	43.1	42.9	42.7	42.6	42.4	42.2
70	75.5	69.5	63.6	60.2	57.9	56.1	54.6	53.4	52.3	51.5	50.7	50.0	49.3	48.7	48.2	47.7	47.3	46.9	46.5	46.1	45.8	45.5	45.2	44.9	44.6	44.4	44.2	43.9	43.7	43.5	43.3	43.1	42.9	42.8	42.6	42.5
80	75.5	69.5	63.6	60.3	57.9	56.1	54.7	53.4	52.4	51.5	50.7	50.0	49.4	48.8	48.3	47.8	47.4	47.0	46.6	44.3	43.9	43.6	43.3	43.0	39.8	39.5	39.3	39.1	38.9	38.7	35.5	35.3	35.1	34.9	34.8	34.6
90	64.5	58.5	52.7	49.3	46.9	45.1	42.7	41.5	40.5	39.6	38.8	38.1	37.5	36.9	36.1	34.6	34.2	33.8	33.4	33.0	32.7	32.4	32.1	31.8	30.9	30.6	30.4	30.2	30.0	29.7	29.6	29.4	29.2	29.0	28.9	28.7
100	59.5	53.5	47.7	44.3	41.9	40.1	38.7	37.5	36.5	35.6	34.8	34.1	33.5	32.9	32.4	31.9	31.5	31.1	30.7	30.4	30.0	29.7	29.4	29.2	28.9	28.6	28.4	28.2	28.0	27.8	27.6	27.4	27.2	27.1	26.9	26.7
110	64.5	58.5	52.7	49.3	46.9	45.1	43.7	41.5	40.5	39.6	38.8	38.1	37.5	36.9	36.4	34.6	34.2	33.8	33.4	33.0	32.7	32.4	32.1	31.8	31.6	30.6	30.4	30.2	29.9	29.7	29.6	29.4	29.2	29.0	28.9	28.7
120	75.5	69.5	63.6	60.3	57.9	56.1	54.7	53.4	52.4	51.5	50.7	50.0	49.4	48.8	48.3	47.8	47.4	47.0	46.6	44.3	43.9	43.6	43.3	43.0	42.8	39.5	39.3	39.1	38.9	38.7	38.5	35.3	35.1	34.9	34.8	34.6
130	75.5	69.5	63.6	60.2	57.9	56.1	54.6	53.4	52.3	51.4	50.7	49.9	49.3	48.7	48.2	47.7	47.3	46.9	46.5	46.1	45.8	45.5	45.2	44.9	44.6	44.4	44.2	43.9	43.7	43.5	43.3	43.1	42.9	42.8	42.6	42.5
140	75.4	69.5	63.6	60.2	57.8	56.0	54.5	53.3	52.2	51.3	50.5	49.8	49.2	48.6	48.1	47.6	47.1	46.7	46.3	45.9	45.6	45.3	45.0	44.7	44.4	44.2	43.9	43.7	43.5	43.3	43.1	42.9	42.7	42.6	42.4	42.2
150	75.4	69.5	63.6	60.1	57.7	55.9	54.4	53.2	52.1	51.2	50.4	49.7	49.0	48.4	47.9	47.4	46.9	46.5	46.1	45.7	45.4	45.0	44.7	44.5	44.2	43.9	43.7	43.4	43.2	43.0	42.8	42.6	42.4	42.3	42.1	41.9
160	75.4	69.4	63.5	60.1	57.7	55.8	54.3	53.0	52.0	51.0	50.2	49.5	48.8	48.2	47.6	47.1	46.7	46.2	45.8	45.4	45.1	44.7	44.4	44.1	43.9	43.6	43.3	43.1	42.9	42.7	42.5	42.3	42.1	41.9	41.7	41.6
170	75.4	69.4	63.5	60.0	57.6	55.7	54.2	52.9	51.8	50.8	50.0	49.2	48.6	47.9	47.4	46.8	46.4	45.9	45.5	45.1	44.7	44.4	44.1	43.8	43.5	43.2	42.9	42.7	42.5	42.2	42.0	41.8	41.6	41.5	41.3	41.1
180	75.4	69.4	63.4	59.9	57.5	55.6	54.0	52.7	51.6	50.6	49.8	49.0	48.3	47.6	47.1	46.5	46.0	45.6	45.1	44.7	44.3	44.0	43.6	43.3	43.0	42.7	42.5	42.2	42.0	41.7	41.5	41.3	41.1	40.9	40.7	40.6
190	75.4	69.4	63.4	59.8	57.3	55.4	53.9	52.5	51.4	50.4	49.5	48.7	48.0	47.3	46.7	46.2	45.6	45.1	44.7	44.3	43.9	43.5	43.2	42.8	42.5	42.2	41.9	41.7	41.4	41.2	40.9	40.7	40.5	40.3	40.1	39.9
200	75.9	69.8	63.3	59.8	57.2	55.3	53.7	52.3	51.2	50.1	49.2	48.4	47.7	47.0	46.3	45.8	45.2	44.7	44.2	43.8	43.4	43.0	42.6	42.2	41.9	41.6	41.3	41.0	40.8	40.5	40.3	40.0	39.8	39.6	39.4	39.2
210	78.8	72.7	66.4	62.8	60.1	58.1	56.5	54.6	52.5	50.9	49.5	48.1	47.3	46.6	45.9	45.3	44.8	44.2	43.7	43.2	42.8	42.4	42.0	41.6	41.3	40.9	40.6	40.3	40.0	39.7	39.5	39.2	39.0	38.8	38.5	38.3
220	80.2	74.2	67.9	64.2	61.5	59.4	57.6	56.1	54.7	53.4	52.3	51.2	50.2	49.3	48.5	47.9	46.8	45.7	44.7	43.7	42.7	41.8	41.3	40.9	40.5	40.2	39.8	39.5	39.2	38.9	38.6	38.3	38.0	37.8	37.6	37.3
230	81.7	75.6	69.3	65.6	62.8	60.6	59.0	57.4	56.0	54.7	53.6	52.5	51.5	50.6	49.8	48.9	48.1	47.3	46.6	45.9	45.2	44.5	43.7	43.2	42.8	42.4	41.0	40.1	39.2	37.9	37.6	37.3	37.0	36.7	36.4	36.2
240	83.2	77.1	70.6	67.2	64.4	62.2	60.3	58.7	57.4	56.1	55.0	53.9	52.8	51.9	50.9	50.1	49.3	48.5	47.7	47.0	46.3	45.6	44.8	44.2	43.6	43.0	42.3	41.8	41.2	40.5	39.9	39.2	38.8	38.4	37.6	36.3
250	84.3	78.2	72.1	68.4	65.6	63.6	61.7	60.2	58.8	57.5	56.3	55.3	54.3	53.3	52.4	51.7	50.8	50.0	49.2	48.4	47.6	46.9	46.2	45.5	44.8	44.0	43.4	42.7	42.0	41.4	40.8	40.0	39.5	38.8	38.2	37.7
260	84.3	78.2	72.0	68.4	65.7	63.6	61.9	60.4	59.1	57.9	56.8	55.8	54.8	54.0	53.1	52.4	51.6	50.9	50.2	49.5	48.9	48.3	47.5	46.9	46.2	45.5	44.9	44.2	43.4	42.7	42.1	41.4	40.6	40.0	39.2	38.5
270	84.3	78.2	72.0	68.4	65.7	63.6	61.8	60.3	59.0	57.8	56.7	55.7	54.7	53.8	53.0	52.2	51.4	50.7	49.9	49.2	48.6	47.9	47.3	46.6	46.0	45.4	44.8	44.2	43.6	43.0	42.4	41.8	41.2	40.6	40.0	39.4
280	84.3	78.2	72.0	68.3	65.7	63.6	61.8	60.3	59.0	57.7	56.6	55.6	54.7	53.8	52.9	52.1	51.3	50.6	49.9	49.1	48.5	47.8	47.1	46.5	45.8	45.2	44.6	43.9	43.3	42.7	42.1	41.4	40.8	40.1	39.5	38.8
290	84.3	78.2	72.0	68.4	65.7	63.6	61.8	60.3	59.0	57.8	56.7	55.7	54.7	53.8	53.0	52.2	51.4	50.7	49.9	49.3	48.6	47.9	47.3	46.6	46.0	45.4	44.8	44.2	43.6	43.0	42.4	41.8	41.2	40.6	40.0	39.4
300	84.3	78.2	72.0	68.4	65.7	63.6	61.9	60.4	59.1	57.9	56.8	55.8	54.8	54.0	53.1	52.4	51.6	50.9	50.2	49.5	48.9	48.3	47.5	46.8	46.1	45.4	44.7	44.1	43.4	42.6	42.1	41.3	40.6	39.8	39.2	38.4
310	84.3	78.2	72.1	68.4	65.6	63.6	61.7	60.1	58.8	57.5	56.3	55.3	54.3	53.3	52.4	51.5	50.6	50.0	49.2	48.4	47.6	46.9	46.2	45.4	44.7	44.0	43.4	42.7	42.0	41.4	40.6	40.1	39.4	38.9	38.2	37.6
320	83.2	77.1	70.9	67.0	64.4	62.2	60.3	58.7	57.3	56.1	55.0	53.9	52.8	51.9	51.0	50.1	49.3	48.5	47.7	47.0	46.3	45.4	44.8	44.2	43.6	42.9	42.3	41.8	41.1	40.5	39.9	39.2	38.8	38.5	37.7	36.3
330	81.7	75.6	69.3	65.6	62.8	60.6	58.8	57.2	55.8	54.6	53.6	52.5	51.4	50.5	49.6	48.8	48.1	47.3	46.6	45.9	45.2	44.3	43.7	43.2	42.8	41.9	41.0	40.1	39.3	37.9	37.6	37.3	37.0	36.7	36.4	36.2
340	80.2	74.2	67.9	64.2	61.5	59.4	57.6	56.1	54.7	53.5	52.3	51.2	50.2	49.2	48.5	47.9	46.8	45.7	44.7	43.7	42.7	41.8	41.3	40.9	40.5	40.2	39.8	39.5	39.2	38.9	38.6	38.3	38.1	37.8	37.6	37.3
350	78.8	72.5	66.3	62.7	60.1	58.2	56.0	54.2	52.5	50.9	49.5	48.1	47.3	46.6	45.9	45.3	44.8	44.2	43.7	43.3	42.8	42.4	42.0	41.6	41.3	40.9	40.6	40.3	40.0	39.7	39.5	39.2	39.0	38.8	38.6	38.4

FIGURE 3

DETAILED ANALYSIS OF SECOND RURAL SYSTEM MARKET



RADIO SHADOW MAP

K Factor: 1.333
RX Ant. Height: 30.0 feet AGL

Line-of-Sight/Shadowed Areas

Line-of-Sight Areas

Shadowed Areas

Site	Ant Elv AMSL (feet)	ERPd (dBW)	Ant. Type	Ant. Orient (degs)	Latitude & Longitude
1	2049.0	20.00	OMNI		N 00 00 00 W 00 00 00

MILES

10 0 10 20 30

PSA ANALYSIS

URBAN MARKET/RURAL MARKET #2

19 MAY 95

Hardin & Associates, Inc.

Station Characteristics	Desired	Undesired
Name:	PRESENT SITE	DESIRED SITE
Service Area:	RURAL MARKET #2	URBAN MARKET
Call Sign:		
Frequency (MHz):	2645 (G1)	2645 (G1)
Latitude:	: :	: :
Longitude:	: :	: :
Polarization:	V	H
Tx Power (dBm):	47	44
Line Loss (dB):	6.5	6.5
Tx Ant Gain (dBi):	14	14
Tx Ant Pattern:	HMD-VO	HMD-HO
Tx Ant Orientation:	0	0
Tx Ant Height ('AGL):	856	800
Tx Site Elevation ('AMSL):	1021	1249

Cochannel Interference Analysis

Interference Criterion: 45 dB

Cochannel calculations for the remaining channels in the group will not vary from the results shown below.

4/3 Earth radius Radio Horizons with 30' Rcv Ant

Desired Station:	49.1	MI
Undesired Station	47.7	MI
Distance between stations:	33.4	MI
Bearing desired/undesired:	47.3	Deg

Distance from Desired (miles)

Bearing	0.5	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
0	82.2	76.0	69.6	65.6	62.8	60.4	58.5	56.7	55.1	53.8	52.5	51.2	50.1	49.0	47.8	46.8	46.0	44.4	42.9	41.3	40.8	40.4	40.0	39.6	39.2	38.9	38.6	38.3	38.1	37.8	37.6	37.5	37.3	37.1	37.0	36.9
10	83.6	77.4	71.0	67.2	64.3	61.8	59.9	58.0	56.5	55.0	53.7	52.4	51.1	49.9	48.8	47.7	46.7	45.8	44.7	43.7	42.6	42.0	40.5	38.5	37.6	37.2	36.8	36.5	36.2	35.9	35.7	35.5	35.3	35.2	35.1	34.9
20	84.4	78.2	72.0	68.2	65.5	63.3	61.3	59.5	57.9	56.5	55.2	53.8	52.7	51.4	50.2	49.0	47.8	46.7	45.6	44.5	43.5	42.4	41.3	40.4	39.3	38.1	37.2	34.7	33.8	33.5	33.2	32.9	32.7	32.5	32.4	32.3
30	84.4	78.2	71.9	68.2	65.4	63.2	61.3	59.7	58.2	56.9	55.6	54.5	53.4	52.3	51.3	50.3	49.3	48.2	47.0	45.9	44.8	43.5	42.2	40.9	39.7	38.3	37.0	35.6	34.4	33.1	30.6	29.2	28.9	28.6	28.5	28.5
40	84.4	78.2	71.9	68.1	65.3	63.1	61.2	59.6	58.1	56.7	55.4	54.2	53.1	52.0	50.9	49.9	48.9	47.8	46.8	45.8	44.8	43.7	42.7	41.6	40.5	39.3	38.1	36.5	34.5	32.3	29.8	27.3	24.8	21.2	21.2	21.5
50	84.4	78.2	71.9	68.1	65.3	63.1	61.2	59.5	58.0	56.7	55.4	54.2	53.0	51.9	50.8	49.8	48.7	47.7	46.7	45.6	44.6	43.5	42.3	41.2	39.9	38.6	37.2	35.7	34.0	32.1	29.8	27.0	21.9	15.2	12.8	15.1
60	84.4	78.2	71.9	68.1	65.4	63.1	61.3	59.6	58.1	56.8	55.5	54.3	53.2	52.1	51.1	50.1	49.1	48.1	47.2	46.2	45.2	44.2	43.0	41.6	40.3	38.9	37.4	35.7	34.1	32.5	30.7	28.7	26.2	25.9	25.8	25.9
70	84.4	78.2	72.0	68.2	65.4	63.2	61.4	59.8	58.3	57.0	55.8	54.5	53.2	52.1	50.9	49.7	48.6	47.5	46.2	45.1	44.0	42.8	41.6	40.5	39.3	38.3	37.1	35.9	34.5	32.0	31.7	31.4	31.1	30.9	30.8	30.7
80	84.1	78.0	71.6	67.8	64.9	62.6	60.5	58.8	57.3	55.7	54.4	53.0	51.7	50.7	49.5	48.3	47.1	46.1	45.1	44.0	43.2	42.1	40.9	40.2	38.7	38.8	35.9	35.5	35.2	34.9	34.6	34.4	34.2	34.1	33.9	33.8
90	82.9	76.7	70.2	66.3	63.5	61.0	59.1	57.3	55.8	54.3	52.9	51.6	50.6	49.4	48.4	47.3	46.2	45.1	44.3	43.3	41.7	39.8	39.3	38.9	38.5	38.1	37.8	37.5	37.3	37.0	36.8	36.6	36.4	36.3	36.2	36.1
100	81.3	75.1	68.7	64.9	62.0	59.6	57.8	56.0	54.5	53.1	51.9	50.6	49.4	48.5	47.3	45.6	44.0	42.9	42.4	41.9	41.5	41.0	40.7	40.3	40.0	39.7	39.4	39.1	38.9	38.7	38.5	38.3	38.2	38.0	37.9	37.8
110	79.9	73.7	67.5	63.6	60.6	58.4	56.4	54.9	53.1	51.6	49.6	47.7	46.9	46.2	45.5	44.9	44.4	43.9	43.4	42.9	42.5	42.2	41.8	41.5	41.2	40.9	40.7	40.4	40.2	40.0	39.9	39.7	39.5	39.4	39.3	39.1
120	78.5	72.4	66.3	61.7	58.2	55.2	53.6	52.2	51.0	50.0	49.1	48.2	47.5	46.8	46.2	45.7	45.1	44.7	44.2	43.8	43.5	43.1	42.8	42.5	42.2	42.0	41.8	41.5	41.3	41.1	41.0	40.8	40.7	40.5	40.4	40.3
130	75.5	69.4	63.4	59.9	57.4	55.4	53.9	52.5	51.4	50.4	49.5	48.8	48.1	47.4	46.8	46.3	45.8	45.4	45.0	44.6	44.3	43.9	43.7	43.4	43.1	42.9	42.7	42.5	42.3	42.1	41.9	41.8	41.6	41.5	41.3	41.2
140	75.5	69.5	63.5	60.0	57.5	55.7	54.1	52.8	51.7	50.8	50.0	49.2	48.5	47.9	47.4	46.9	46.4	46.0	45.6	45.3	45.0	44.7	44.4	44.1	43.9	43.6	43.4	43.2	43.0	42.9	42.7	42.5	42.4	42.3	42.1	42.0
150	75.5	69.5	63.6	60.1	57.7	55.9	54.4	53.1	52.1	51.1	50.3	49.6	49.0	48.4	47.9	47.4	47.0	46.6	46.2	45.9	45.6	45.3	45.0	44.7	44.5	44.3	44.1	43.9	43.7	43.5	43.4	43.2	43.1	42.9	42.8	42.7
160	75.5	69.6	63.7	60.3	57.9	56.1	54.6	53.4	52.4	51.5	50.7	50.0	49.4	48.8	48.3	47.9	47.4	47.0	46.7	46.4	46.1	45.8	45.5	45.3	45.0	44.8	44.6	44.4	44.2	44.1	43.9	43.8	43.6	43.5	43.3	43.2
170	75.6	69.6	63.7	60.4	58.0	56.2	54.8	53.6	52.6	51.7	51.0	50.3	49.7	49.2	48.7	48.2	47.8	47.4	47.1	46.8	46.5	46.2	45.9	45.7	45.5	45.3	45.1	44.9	44.7	44.5	44.4	44.2	44.1	43.9	43.8	43.7
180	75.6	69.7	63.8	60.5	58.1	56.4	55.0	53.8	52.8	52.0	51.2	50.6	50.0	49.4	49.0	48.5	48.1	47.8	47.4	47.1	46.8	46.5	46.3	46.1	45.8	45.6	45.4	45.2	45.1	44.9	44.7	44.6	44.4	44.3	44.2	44.1
190	75.6	69.7	63.9	60.5	58.2	56.5	55.1	54.0	53.0	52.2	51.4	50.8	50.2	49.7	49.2	48.8	48.4	48.0	47.7	47.4	47.1	46.8	46.6	46.3	46.1	45.9	45.7	45.5	45.4	45.2	45.0	44.9	44.7	44.6	44.5	44.4
200	75.6	69.7	63.9	60.6	58.3	56.6	55.2	54.1	53.1	52.3	51.6	50.9	50.4	49.9	49.4	49.0	48.6	48.2	47.9	47.6	47.3	47.0	46.8	46.6	46.3	46.1	45.9	45.7	43.6	43.4	43.3	43.1	40.0	39.8	39.7	39.6
210	75.6	69.7	63.9	60.7	58.4	56.7	53.3	52.2	51.2	47.4	46.7	46.0	42.5	42.0	41.5	38.1	37.7	37.4	37.0	36.7	36.4	36.2	35.9	35.7	35.5	35.3	35.1	34.9	34.7	34.6	34.4	33.3	33.1	33.0	32.8	32.7
220	62.3	56.4	50.0	46.7	44.4	42.7	41.3	40.2	38.3	37.5	36.7	36.1	35.5	35.0	34.6	34.2	33.3	32.9	32.6	32.3	32.0	31.8	31.5	31.3	31.1	30.9	30.7	30.5	29.8	29.6	29.5	29.3	29.2	29.1	28.9	28.8
230	59.6	53.7	48.0	44.7	42.4	40.7	39.3	38.2	37.3	36.5	35.7	35.1	34.6	34.1	33.6	33.2	32.8	32.4	32.1	31.8	31.5	31.3	31.0	30.8	30.6	30.4	30.2	30.0	29.8	29.7	29.5	29.3	29.2	29.1	28.9	28.8
240	57.6	51.7	52.9	49.7	47.4	45.7	44.3	43.2	42.2	41.4	40.7	40.1	39.5	39.0	37.6	37.1	36.7	36.4	36.1	35.8	34.2	33.9	33.7	33.4	33.2	33.0	32.8	32.6	31.8	31.6	31.4	31.3	31.2	31.0	30.9	30.8
250	75.6	69.7	63.9	60.6	58.4	56.6	55.3	54.1	53.2	52.4	51.6	51.0	50.4	49.9	49.5	49.0	48.6	48.3	48.0	45.7	45.4	42.1	41.9	41.6	41.4	36.2	36.0	37.8	37.7	37.5	34.3	34.2	34.0	33.8	33.8	33.6
260	75.6	69.7	63.9	60.6	58.3	56.6	55.2	54.0	53.1	52.2	51.5	50.9	50.3	49.8	49.3	48.9	48.5	48.1	47.8	47.5	47.2	46.9	46.7	46.4	46.2	46.0	45.8	45.6	45.5	45.3	45.1	45.0	44.9	44.7	44.6	44.5
270	75.6	69.7	63.8	60.5	58.2	56.4	55.0	53.9	52.9	52.1	51.3	50.7	50.1	49.6	49.1	48.7	48.3	47.9	47.6	47.2	47.0	46.7	46.4	46.2	46.0	45.8	45.6	45.4	45.2	45.0	44.9	44.7	44.6	44.5	44.3	44.2
280	75.6	69.6	63.6	60.4	58.1	56.3	54.9	53.7	52.7	51.9	51.1	50.4	49.8	49.3	48.8	48.4	48.0	47.6	47.3	46.9	46.6	46.4	46.1	45.9	45.7	45.4	45.2	45.1	44.9	44.7	44.6	44.4	44.3	44.1	44.0	43.9
290	75.6	69.6	63.7	60.3	57.9	56.1	54.7	53.5	52.5	51.6	50.9	50.1	49.5	49.0	48.5	48.0	47.6	47.2	46.9	46.6	46.3	46.0	45.7	45.5	45.2	45.0	44.8	44.6	44.5	44.3	44.1	44.0	43.8	43.7	43.6	43.5
300	75.5	69.6	63.6	60.2	57.8	56.0	54.5	53.3	52.2	51.3	50.5	49.8	49.2	48.6	48.1	47.6	47.2	46.8	46.4	46.1	45.8	45.5	45.2	45.0	44.8	44.5	44.3	44.1	44.0	43.8	43.6	43.5	43.3	43.2	43.1	42.9
310	75.5	69.5	63.5	60.1	57.6	55.8	54.2	53.0	51.9	51.0	50.1	49.4	48.8	48.2	47.6	47.1	46.7	46.3	45.9	45.6	45.3	45.0	44.7	44.4	44.2	44.0	43.7	43.5	43.4	43.2	43.0	42.9	42.7	42.6	42.5	42.3
320	75.5	69.5	63.4	59.9	57.4	55.5	54.0	52.7	51.6	50.6	49.7	49.0	48.3	47.7	47.1	46.6	46.1	45.7	45.3	44.9	44.6	44.3	44.0	43.7	43.5	43.3	43.0	42.8	42.6	42.5	42.3	42.1	42.0	41.9	41.7	41.6
330	77.0	70.4	63.9	59.8	57.3	55.3	53.7	52.4	51.2	50.2	49.3	48.5	47.8	47.1	46.5	46.0	45.5	45.0	44.6	44.2	43.9	43.5	43.2	42.9	42.7	42.4	42.2	42.0	41.8	41.6	41.4	41.3	41.1	41.0	40.9	40.7
340	79.2	73.2	66.7	62.6	60.1	58.1	55.4	53.0	50.8	49.8	48.8	48.0	47.2	46.5	45.9	45.3	44.7	44.2	43.8	43.4	43.0	42.6	42.3	42.0	41.7	41.4	41.2	41.0	40.8	40.6	40.4	40.2	40.1	40.0	39.8	39.7
350	80.6	74.5	68.1	64.3	61.4	59.1	57.3	55.5	53.8	52.4	51.3	50.4	48.6	46.8	45.1	44.5	43.9	43.4	42.9	42.4	42.0	41.6	41.2	40.9	40.6	40.3	40.0	39.8	39.6	39.3	39.2	39.0	38.8	38.7	38.6	38.4