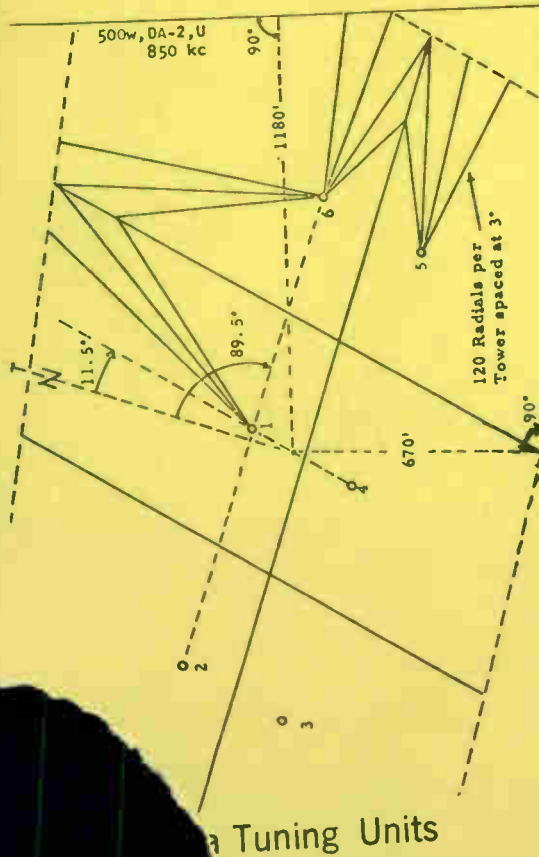
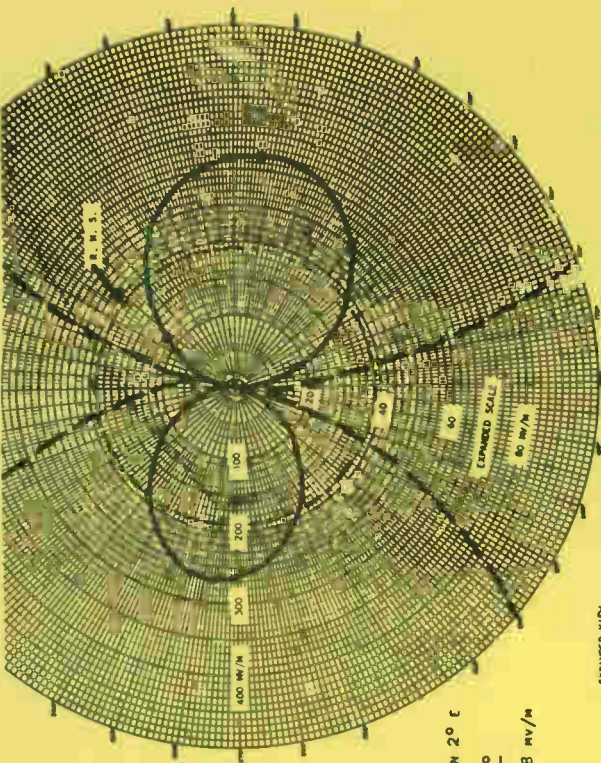
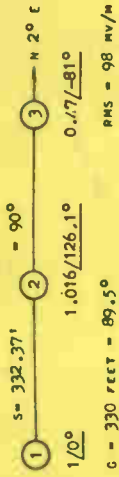


AM Antenna Phasing

# NRC

AM Field Intensity



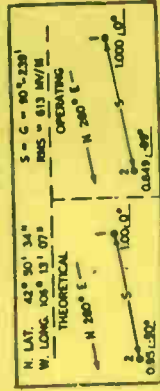
Tuning Units

535 KHz to 1605 KHz

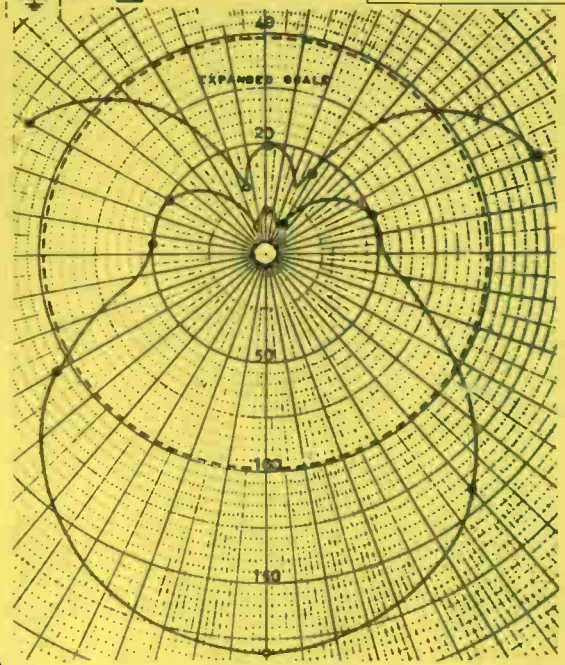
# CANADIAN AMERICAN NIGHT PATTERN BOOK

N	71°	38°	54°	26°
W	104°	51°	70°	71°

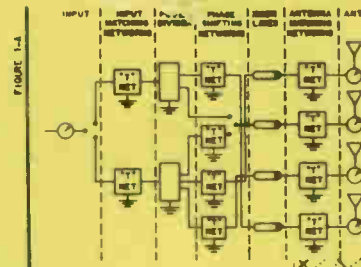
EXPANDED VIEW  
MEASURED RADIAL VALUES



FULLTIME AM



AM Antenna Phase Monitors



Remote Control

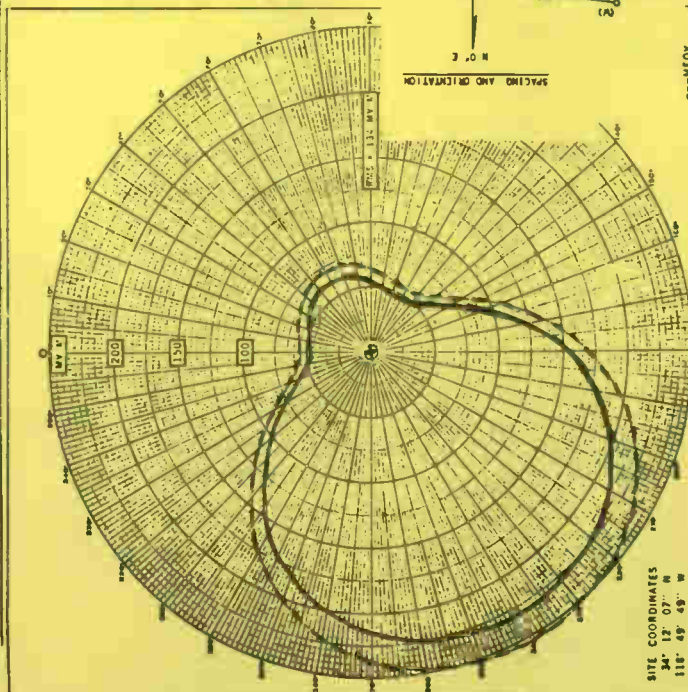
Facilities changes

MEASURED HORIZONTAL RADIATION PATTERN  
NIGHTTIME  
UNATTENUATED FIELD INTENSITY  
AT ONE MILE

PHASE SAMPLING LOOPS

New stations

APPLICANT	CENTRAL FLORIDA BROADCASTING CO.
LOCATION	DELAND, FLORIDA (WK13)
FREQUENCY	740 kHz
POWER	500 W (DA-1) 500 W (DA-2)



PROPOSED DAYTIME HORIZONTAL PLANE RADIATION PATTERN

PROPOSED OPERATION  
850 kHz  
0.5 kW U DA-2  
Pattern No. 700204D

AMES GARR & ASSOCIATES  
Computing Electronics Engineers

CONEJO BROADCASTERS  
THOUSAND OAKS, CALIFORNIA

1975



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The Publishing Committee of the National Radio Club takes great pleasure in dedicating this Pattern Book to the senior Editor of DX NEWS,

## Ernest R. Cooper

Ernie Cooper's weekly column, MUSINGS OF THE MEMBERS, has appeared in each issue of DX NEWS for the last 27 years and has been a cornerstone of the NRC since the first Musing appeared in 1947. The volunteer workers who have produced this volume feel that it is only appropriate to dedicate it to the Editor whose unpaid volunteer efforts over the past 27 years have made the NRC the world leader in the medium wave DX hobby!

## CREDITS

This volume is the result of volunteer and unpaid efforts of many club members. Several hundred man-hours were consumed during the various phases of the project:

Obtaining patterns and information: Wes Boyd, Paul K. Hart, Charles Schaffer and Russell J. Edmunds. Valuable assistance was also provided by: Steve Taafe, Tom McCormack, Doc Hardester, Scott Brockway, Craig Cook, Joe Kureth, Ernie Wesolowski, Jerry Robertson, Pierre Tremblay, Andy Rugg, John Oldfield, Bill Feidt, and Eric Norberg.

Scaling and drawing patterns: Wes Boyd and John Silliman.

Keying: John Silliman, Wes Boyd, Gordon P. Nelson, Mark Katz, George Kelly and Jerry Starr.

Typing: Don Erickson, Glenn Cooper, Jerry Starr, Wes Boyd, Rick Briggs and John Silliman.

Composition and formatting: Wes Boyd, Gordon P. Nelson, George Kelly, Mark Katz and Russell J. Edmunds.

Printing: Colson Printing, Nashville, N. C.

UPDATERS for the NRC Night Pattern Book are published regularly in DX NEWS, and are subsequently available through the NRC Reprints Service. A complete set of Updaters for this second printing of the 1975-76 edition of the Pattern Book will be available from the NRC Publications Service, P.O. Box 401, Gales Ferry, CT 06335. The cost of these Updaters is \$1.00 to members and \$2.00 to non-members for the complete set as of the time of any order. Subsequent orders for additional updates will be treated as a new order for the complete set.

## FOREWARD

The second edition of the NRC Night Pattern Book was made possible through the cooperation of club members and owners of the previous publication. Suggestions from DXers, broadcasters and other owners have been included in this book. Without their suggestions, consideration and cooperation, this edition would not have been possible. Similar books are available in the "over \$100" price range, but we feel that our Night Pattern Book is equally informative at a price which makes it available to a much wider audience.

Our previous edition only showed directional patterns for stations operating in the U.S. and Canada. This edition not only includes new or changed patterns, but also limited time stations that were omitted from the previous book. Also included are Mexican stations operating at powers over 1000 watts. As in the previous book, Canadian low power repeaters are not shown. Hawaiians are not shown as there are no directional stations in the 50th state, and we felt it was too far removed from the mainland to merit estimating coverage. The 107 broadcast band frequencies have been reduced to 77 pages by doubling and tripling up on some frequencies. Class IV (graveyard) Canadian patterns will be found on a separate map page at the end of the book.

Patterns shown are the actual measured horizontal radiation patterns as licensed by the appropriate governmental body. Presentation is the polar plot showing measured field intensity in millivolts per meter (mV/m) at one mile. Most patterns in this book are at the 300 mV/m scale, but most stations with powers of 10,000 watts or more are drawn at the 900 mV/m scale to help reduce clutter on some frequencies. Those patterns drawn at the 900mV/m scale are marked "\*" near the key number. Patterns without such indication are all drawn at the 300 mV/m scale. An example is the page for 750-760-770-780. Here KFMB San Diego (5kw) appears to have similar coverage to KOB or KCRL (both 50kw) until you look for the "\*" indication on these two stations. These two patterns would actually be three times larger than shown, but the reduced scale avoids clutter.

Limited time stations use the same scaling procedure, but are drawn with dashed lines to distinguish them from fulltime facilities. Stations operating nondirectionally are represented by estimated average field in mV/m for the appropriate class of station. In all cases, however, patterns shown do not indicate actual station coverage.

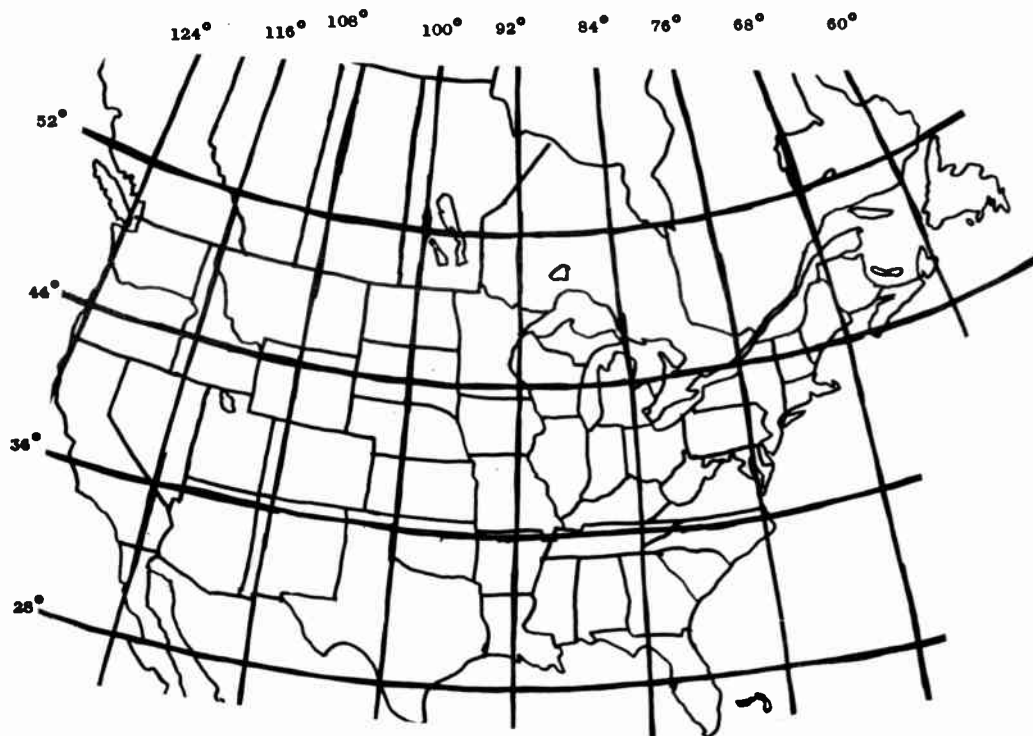
Approximately 1400 patterns have been scaled and drawn for this edition of the NRC Night Pattern Book. As in the previous edition, there were a few patterns which eluded us, and these are marked as "not available". Missing patterns as well as corrections, additions and other changes will appear in DX News to allow you to keep your book as up to date as possible.

Articles have been included on the basics of directional antenna patterns, treaties and allocations, understanding polar plot patterns, estimating daytime coverage, night coverage and others. Most of these are slightly condensed versions of articles which previously

## About the NRC

The maps used are not the common Mercator projection, but a modified Lambert projection. In most cases bearings are close enough to being straight lines so that corrections are unnecessary. North is not uniformly directed towards the top of the page but varies in direction from east coast to west coast. It's best to judge true north by state boundaries, etc. (See attached map.)

We suggest that DX'ers be careful when discussing patterns with stations in reception reports. Should you log a station with an indicated null in your direction, don't jump to the conclusion that the pattern is out of adjustment. Technical complications associated with conductivity, skywave propagation, tilting of layers of the ionosphere, auroral conditions and other highly variable factors can allow such receptions.



The National Radio Club is the largest and oldest hobby group dealing exclusively with medium-wave DX'ing (established in 1933). The NRC's magazine-bulletin, DX NEWS, is published weekly during the winter DX season for a total of 30 issues per year and is crammed with information specifically by and for the MW DX'er. In our latest publication year we carried more than 1000 pages of information exclusively for the MW DX'er - feature and technical articles, the latest FCC and DOT information, plus page upon page of invaluable tips from our membership telling what's actually being heard. The NRC was the first DX club to produce a handy-sized bulletin by commercial printing - not mimeograph.

The NRC is a nonprofit, volunteer-operated club, and membership dues go to pay the expenses of printing and mailing DX NEWS for the membership, and for other essential club services. Since each member's dues pays for his portion of the NRC's operating costs, and for his share of postage, dues are dependent upon postal rates. At present rates the dues are \$14.00 yearly for First Class mail delivery and \$15.00 for domestic Air Mail. Special airmail rates can be arranged for overseas members. If you're an active MW DX'er or just getting started, you'll get a wealth of unique information by joining the NRC today!

The NRC offers numerous special publications for members and non-members alike, although most prices to members are discounted. Our other major effort is our Domestic Station Log, currently in its 3rd edition in its current format. This book lists all U.S. and Canadian stations on AM by frequency and gives addresses, powers, pattern types, network, schedules etc. We also publish Reprint Reference Manuals including many former articles from DX NEWS on such subjects as Antennas and Receivers, as well as offering Xerox reprints of many other important articles. Our introductory booklet entitled "Getting Started In Medium Wave DX'ing" contains many articles on introductory phases of the hobby and is free with every new membership. Non-members may obtain the book for the regular price. We are even now working on still further publishing efforts.

NRC'ers are among the friendliest people around, and informal gatherings and get-togethers take place in many parts of the country. Our annual conventions held over every Labor Day weekend attract many members from the U.S., Canada and foreign countries for a long weekend of DX discussions, station tours, shoptalk and general partying...

# HOW TO USE THIS BOOK

In the allocation of frequencies, the F.C.C. (Federal Communications Commission) and the C.R.T.C. (Canadian Radio-Television Commission) specify the signal intensity contours that are to be protected from interference. At the same time they specify the minimum field the station should develop over the city of license, and the minimum field the station itself should develop. Exact fields vary with the class of station, and the sub-classifications. In the U.S. the F.C.C. requires the following minimum fields (stated in millivolts per meter, or mV/m).

**Class I Stations:**

225 mV/m one mile from the antenna, for 1000 watts nondirectional.

**Class II & III Stations:**

175 mV/m one mile from the antenna, for 1000 watts nondirectional.

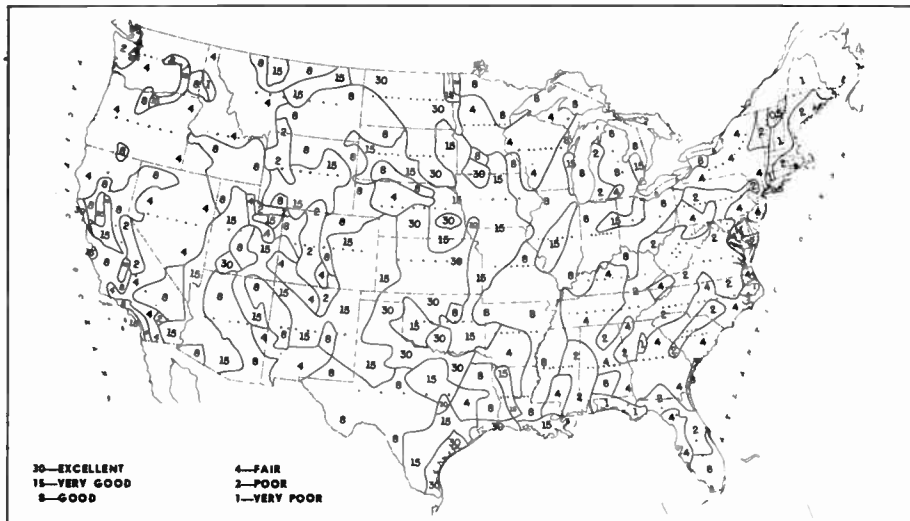
**Class IV Stations:**

150 mV/m one mile from the antenna, for 1000 watts nondirectional (75 mV/m for 250 watts and 47.5 mV/m for 100 watts).

Few stations actually operate at these minimum fields. Most operate with fields about 10% above the minimum. Class IV's usually develop closer to 175 mV/m; Class III's develop closer to 190 mV/m; Class II's develop closer to 220 mV/m; and Class I's develop around 240 mV/m, if not more. (The minimum requirements for Class II & III stations are the same, but most Class II's develop more field than Class III's, and almost as much as most Class I's.)

A station's primary service area is that area where groundwave isn't subject to interference. This primary service area depends upon the station's frequency, power and the ground conductivity. To show how conductivity varies across the U.S., a copy of the F.C.C.'s R-3 conductivity map has been included. Values are stated in millimhos (mmhos), a unit of conductivity.

**ESTIMATED GROUND CONDUCTIVITY**



Class I stations are protected to the 0.1mV/m contour daytime. All the other classes are protected to the 0.5 mV/m contour. The distance from the station's antenna to this contour depends on frequency as much as it depends on power. In the U.S. stations are licensed at powers of 250, 500, 1000, 2500, 5000, 10000, 25000 and 50000 watts. (The 100 watt power was dropped in the mid '60s, and the 2500 watt power is new.) Canadian powers are 100, 250, 500, 1000, 2500, 5000, 10000, 15000, 25000 and 50000 watts.

The field strength of any station varies according to the square of its power, so it is possible to calculate the field at powers other than 1000 watts using the fields mentioned earlier. Increasing to twice the power increases the field to 141.4%; halving power reduces the field to 70.7%. An increase to four times the power doubles the field, while reducing to one fourth power reduces the field to half. Going to five times the power increases the field to 224%, and a reduction to one fifth reduces the field to 44.7%. Increasing to ten times the power increases the field to 316%; reducing to one tenth reduces the field to 31.6%. An increase in power of 50 times increases the field to 707%, and a reduction to one fiftieth reduces the field to 14.1%.

**Class IV Stations:**

Power Watts	Minimum Field	Average Field
1000	150mV/m	175mV/m
500	106	124
250	75	88
100	47	55

**Class III Stations:**

Power Watts	Minimum Field	Average Field
5000	392mV/m	425mV/m
1000	175	190
500	124	134

**Class I Stations:**

Power Watts	Minimum Field	Average Field
50000	1596mV/m	1702mV/m
10000	714	761
5000	505	538
1000	225	240

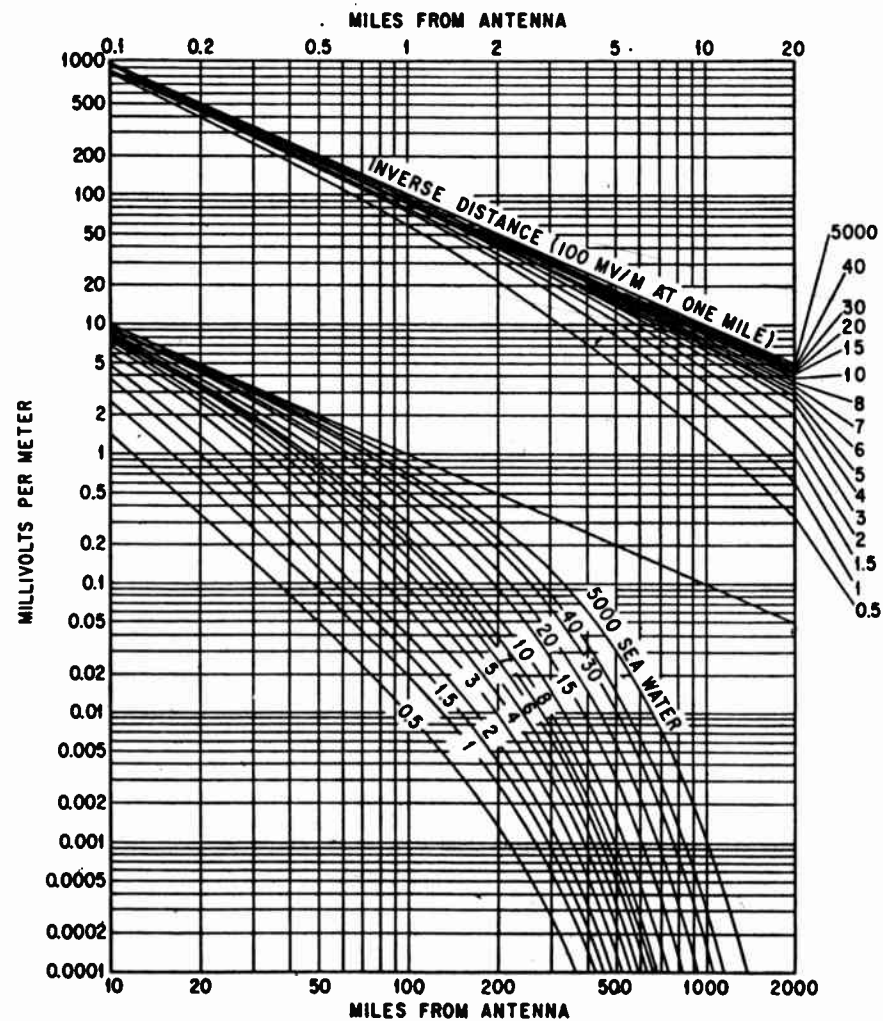
**Class II Stations:**

Power Watts	Minimum Field	Average Field
50000	1241mV/m	1560mV/m
10000	555	697
5000	392	493
1000	175	220

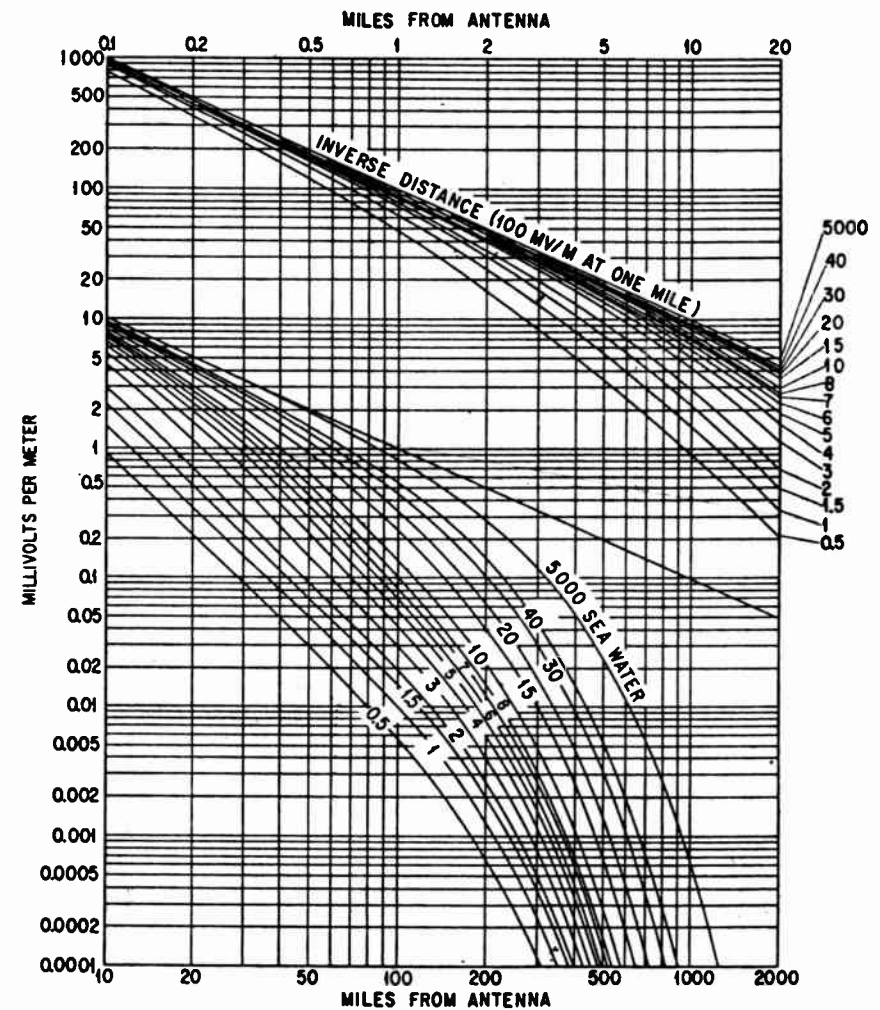
A change in power by a factor of two is a change of 3 decibels (dB), or about half an S unit. Changing by a factor of four is a change of 6 dB, or just under one S unit. A factor of five is a change of 7 dB, or just over one S unit. Going by a factor of ten is a 10 dB change, or about 1½ S units. Changing power by a factor of 50 is a change of 17 dB, or just under 3 S units.

Looking at the field in mV/m, you'll note tremendous changes in field as power increases. The actual change is really much less when you consider the change in decibels for the same power increase.

The conductivity graphs in this article represent the effect of conductivity upon attenuation at different frequencies. These graphs are similar to those in older N.A.B. (National Association of Broad-

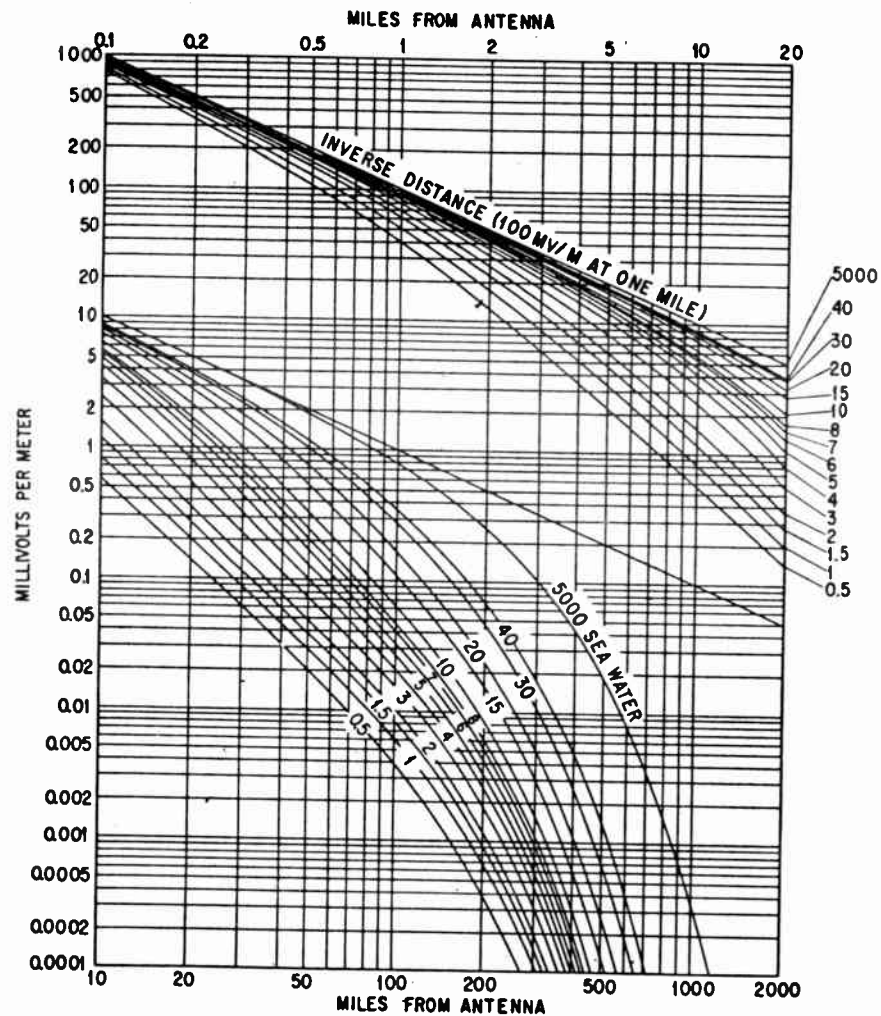


GRAPH 1. Groundwave field intensity vs. distance, 540-560 kc. Computed for 550 kc,  $\epsilon = 15$ , and the ground conductivities expressed in mmhos/m for which the curves are labeled.

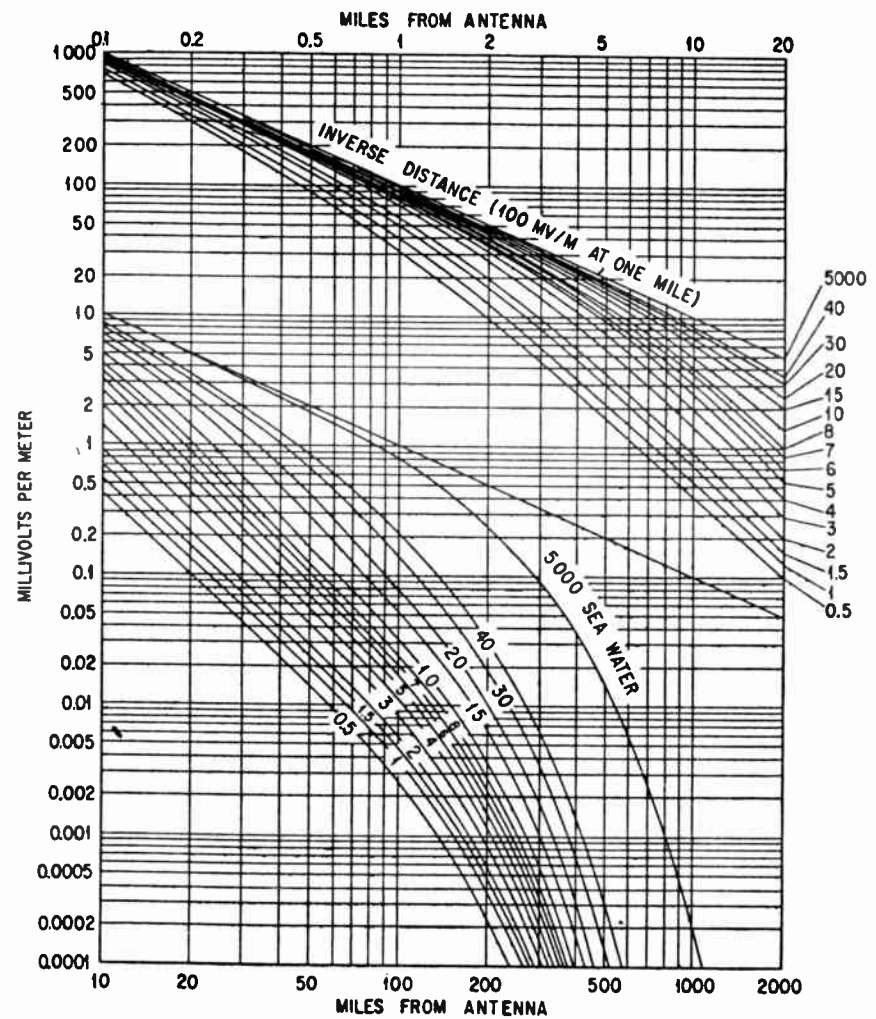


GRAPH 7. Groundwave field intensity vs. distance, 720-760 kc. Computed for 740 kc,  $\epsilon = 15$ , and the ground conductivities expressed in mmhos/m for which the curves are labeled.

These graphs show groundwave field intensity curves plotted against distance for different values of conductivity. The reference 100 mV/m assumes that the station has the power and efficiency for an inverse-distance field of 100 mV/m at one mile.



GRAPH 12. Groundwave field intensity vs. distance, 970-1030 kc. Computed for 1000 kc,  $\epsilon = 15$ , and the ground conductivities expressed in mmhos/m for which the curves are labeled.



GRAPH 16. Groundwave field intensity vs. distance, 1250-1330 kc. Computed for 1290 kc,  $\epsilon = 15$ , and the ground conductivities expressed in mmhos/m for which the curves are labeled.

These graphs show groundwave field intensity curves plotted against distance for different values of conductivity. The reference 100 mV/m assumes that the station has the power and efficiency for an inverse-distance field of 100 mV/m at one mile.

casters) Engineering Handbooks, and are simplified versions of similar F.C.C. graphs. Only five graphs are shown in this article to show changes across the broadcast band. There are actually some 20 graphs used to cover the entire band in both the N.A.B. and F.C.C. publications.

Looking at the graph for 550 kHz, the top curve for 5000 mmhos intersects 100mV/m at one mile, and 10mV/m at 10 miles. This shows that the unattenuated field is dependent only on distance. It also shows that groundwave field is inversely proportional to distance.

Again using the graph for 550 kHz, we'll find the distance to the 0.5mV/m contour for a 5000 watt Class III station in a conductivity of 10 mmhos. First we must use the previous values of the field in mV/m at one mile, and then convert this figure to a totally different figure to be used in finding the 0.5mV/m distance on the graphs.

The field of 0.5mV/m is also 500uV/m (microvolts per meter), so we must multiply 500uV/m times 100mV/m (the scale used on the graphs) to find an answer of 50,000. Now divide this by 425mV/m (the average field of a 5000 watt Class III station) to arrive at the figure of 118 uV/m. Convert this field back to mV/m, for a field of 0.12mV/m to be used on the graphs.

Go down the left hand portion of the graph until you find the field of 0.12 mV/m. Follow this directly across the page until it intersects with the curve for a conductivity of 10 mmhos. From this point go straight down the page and read the mileage. In this example our 5000 watt Class III station develops 0.5 mV/m out about 150 miles from the antenna.

Finding the distance to any other contour uses the same procedure. Find the field you want, convert that field into uV/m, and multiply it by 100. Divide that answer by the field in mV/m for the power and class of station desired. Convert that answer to mV/m and find it on the left hand side of the graphs. Follow this out to the desired conductivity, then down the page to find the mileage.

The following chart gives the necessary "graph fields" for finding the 0.5 mV/m contour of a Class III station developing 190 mV/m at one mile.

Power, watts	Average Field, mV/m	Graph Field, uV/m
250	95	526
1000	190	263
5000	425	118
10000	600	83
50000	1343	37
250000	3000	17
1000000	6000	8.5

Using these fields and the system described previously, the distance to the 0.5 mV/m contour has been calculated at different frequencies and powers. Because of the distances involved, these were not calculated at powers over 50 kW on lower frequencies. All estimates are based on conductivity of 10 mmhos.

550 kHz Watts	0.5 mV/m Miles	740 kHz Watts	0.5 mV/m Miles	1000 kHz Watts	0.5 mV/m Miles
250	74	250	54	250	40
1000	105	1000	77	1000	55
5000	155	5000	108	5000	77
10000	195	10000	122	10000	87
50000	230	50000	168	50000	122
		250000	215	250000	160

1290 kHz Watts	0.5 mV/m Miles	1600 kHz Watts	0.5 mV/m Miles
250	32	250	23½
1000	41	1000	31
5000	58	5000	46
10000	66	10000	52
50000	93	50000	75
250000	126	250000	105
1000000	155	1000000	130

Remember that these figures are based on the assumption that a Class III station could operate at powers over 5000 watts, and on a clear channel. The sole purpose of this chart is to show what powers are required to produce similar coverage as frequency increases, using the same type antenna and with the same ground conductivity.

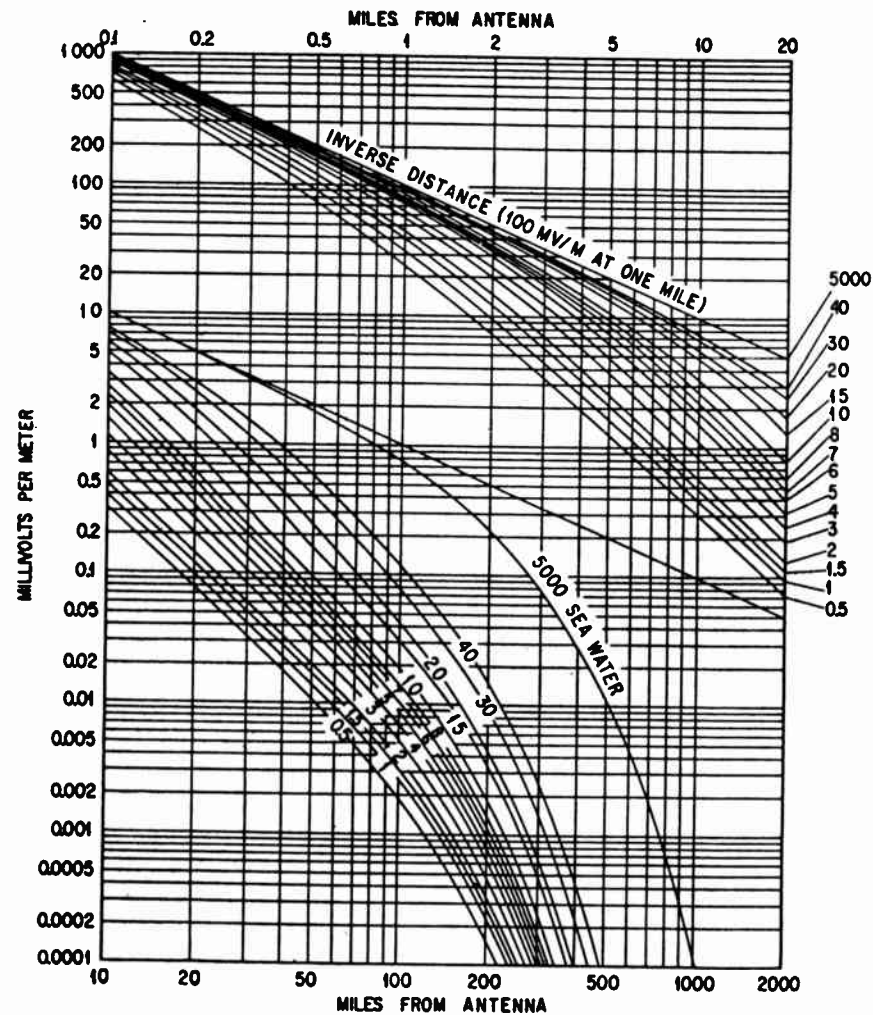
Notice that 5000 watts on 550 kHz would have similar coverage to 50,000 watts on 1000 kHz, or about two million watts up on 1600 kHz. A station with 50,000 watts on 1290 kHz would have slightly less coverage than 1000 watts down on 550 kHz. Using 50,000 watts on 1600 kHz would develop almost identical coverage to that of a 250 watt station on 550 kHz.

It's also possible to estimate coverage on other frequencies using these same graphs. As an example, a 1000 watt station on 1000 kHz has coverage of 55 miles, and on 1290 kHz, 41 miles. The midpoint between these mileages is 48 miles, while the midfrequency is 1145 kHz. Had a graph for 1140 kHz actually been used, the coverage would have come out to 47 miles, so our estimate of 48 miles is quite close.

The distance to the 0.5 mV/m contour also varies as values of conductivity change. In the following chart conductivities of 2 mmhos, 5 mmhos and 20 mmhos were used to find the distance to our 5000 watt, Class III station's 0.5 mV/m contour.

Freq. in kHz	Distance in Miles:		
	2 mmhos	5mmhos	20 mmhos
550	61	101	207
640	52	87	185
740	44	72	160
840	40	64	140
940	35	56	123
1000	33	52½	113
1140	29½	45½	98
1210	27½	42½	91
1290	26½	39½	85
1350	25	37½	79
1470	23½	34½	73
1560	21½	31½	67





GRAPH 19A. Groundwave field intensity vs. distance, 1560-1640 kc. Computed for 1600 kc,  $\epsilon = 15$ , and the ground conductivities expressed in mmhos/m for which the curves are labeled.

# WMBS RADIO, Uniontown

## 590 KC 1000 WATTS

IS ONE OF THE BEST BUYS  
IN THE ENTIRE COUNTRY.

WMBS Radio  
590 KC  
1000 Watts

surpasses coverage  
given by  
50,000 watts  
on 1110 KC

**FREQUENCY and POWER  
relationship**

FREQUENCY RANGES	WATTS OF POWER					
	250 MILES RADIUS	1000 MILES RADIUS	5000 MILES RADIUS	10,000 MILES RADIUS	25,000 MILES RADIUS	50,000 MILES RADIUS
540-560	110	170	225	278	312	335
570-590	108	162	220	268	310	325
600-620	103	153	200	250	300	318
630-650	101	150	195	240	290	310
660-680	100	140	190	235	278	305
690-710	96	135	185	228	265	300
720-760	90	130	170	200	220	265
770-810	82	120	160	185	210	235
820-860	78	110	150	175	192	225
870-910	72	98	137	160	180	210
920-960	70	96	130	150	165	200
970-1030	64	87	120	140	155	185
1040-1100	61	84	115	135	149	175
1110-1170	55	74	110	120	145	160
1180-1240	53	72	98	115	130	155
1250-1330	50	65	90	110	115	142
1340-1420	48	62	86	100	112	135
1430-1510	38	53	80	90	103	130
1520-1600	30	50	74	87	98	115

All the above estimated .5MV/M contours assuming a ground conductivity of 20 and a 1/2 wave antenna in all cases. Estimations based on FCC conductivity curves dated 1954.

The figures in the conductivity of 20 mmhos follow rather closely those in WMBS's "Frequency and Power Relationship" chart. Differences are due to WMBS estimating coverage using a half wave antenna, while our estimates are for a quarter wave antenna. Further proof is found in a statement found on the coverage map of KSFO in San Francisco, stating "With 5000 watts at 560 on the dial, KSFO delivers a strong, clear signal to an area greater than that which could be reached by a station with 250,000 watts at 1110 kHz, or a station with two million watts at 1500 kHz."

These examples give a good idea of how radically a station's pattern can affect reception of that station in different directions. With patterns like these in wide use across the U.S. and Canada, it is obvious that many mysteries of strong or poor reception can be explained with the information contained here in the NRC Pattern Book.

\*\*\*\*\*

HOW DIRECTIONAL PATTERNS ARE PRODUCED ON THE BCB  
\* Wes Boyd, WHOT

The NRC Night Pattern Book contains some 1,450 different directional patterns. We're sure some questions will arise as to how such patterns are created. It is beyond the scope of this article to much more than scratch the surface of this subject. This is due mostly to the math involved which has been omitted here.

A basic rule of thumb is the number of towers in an array equals the number of nulls in the final pattern. This can be twisted around quite a bit as we will see later, but for the most part it's accurate enough to be very useful.

In our examples we will be dealing with ideal conditions. In reality, this is almost impossible due to buildings, power lines, etc. So rather than add more complexity to an already confusing subject, we will deal with ideal conditions.

A single vertical tower in a fixed location fed with a specific power will radiate equally in all directions. Now we assume a straight line running north and south of this tower. With the addition of a second tower, we can now create several basic directional patterns.

Phasing and spacing of this second (identical) tower controls the actual pattern. Null depth control and pattern shaping is accomplished by magnitude changes between the towers.

Moving tower #2 to a location 180 degrees north of tower #1, we develop a figure 8 pattern if both towers have equal power and magnitude. The field between tower #1 and tower #2 is 180 degrees out of phase and causes mutual cancellation. Identical conditions exist in the other direction allowing nulls to form north and south of the towers. Figure #1 is such a pattern.

An additional phase shift of 90 degrees on tower #2 will create a basic cardioid pattern. To the north, the field from tower #2 leads the field from tower #1 by 180 degrees thus the two will cancel out. Moving south of the towers we find that the fields combine and create a lobe. Figure #2 shows a cardioid. The field to the side of the towers creates a field some 41% stronger than nondirectional operation would.

Most arrays of more than two towers are only combinations of the simple patterns just explained. Additional towers in a figure 8 pattern will narrow the lobes and widen the nulls. Other towers could be used for a "dog leg" effect but we'll explain this later. Figure #3 shows such a figure 8.

We could use four towers for a figure 8 pattern. Here two basic figure 8 patterns are formed by each set of two towers. These interact mutually on each other for a pattern similar to that in figure #4.

Such interaction can be used with cardioids to form patterns with little power in very wide nulls. Two cardioids interacting will narrow the lobe and make it more powerful (figure #5). Still another cardioid could be added to achieve a pattern similar to figure #6.

Additional towers in an array are not always used to deepen/widen nulls or to create powerful lobes. They can be used to create "cloverleaf" or "dog leg" patterns for additional coverage.

The "dog leg" is created by having a tower offset in respect to the other towers. This allows the pattern to be twisted as shown in figure #7. You will note a small side lobe and similar small lobes in other multiple tower arrays. These are a product of the interaction of the two patterns.

"Cloverleaf" patterns can look like a cloverleaf or modified to look like figure #8. Most likely this is a combination of both cloverleaf and dog leg. It's really quite hard to say as there are so many possible combinations to achieve any specific pattern.

End fire arrays consist of three/four or more towers and the interaction of several different patterns. Figures #9 and #10 show how such patterns are created.

In figure #9 we use three towers to achieve the final pattern. Towers #1 and #2 create a figure 8 while towers #1 and #3 create a cardioid pattern. The interaction of these two patterns will give the final pattern shown.

The pattern obtained in figure #10 uses three basic patterns. Two are basic figure 8 patterns with magnitude changes. This simple means one tower has more power than another and so develops greater field in that direction. Such magnitude changes are used on two figure 8 patterns.

Our first figure 8 is between towers #1 and #2 with the magnitude being greater in tower #2. Another figure eight is developed between towers #1 and #3 with the greater magnitude on tower #1. Finally a cardioid develops between towers #1 and #4. The interaction of these patterns creates the final pattern shown.

If necessary, such multiple patterns can interact upon themselves. Figure #11 shows a pattern developed with the combination of two of the patterns we developed in figure #9.

As mentioned earlier, it's well beyond the scope of this article to do much more than scratch the surface. However, we hope some questions have been answered.

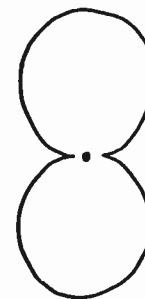


FIGURE #1

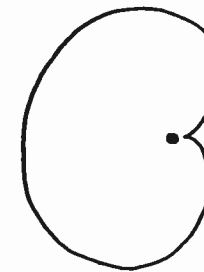


FIGURE #2



VARIATIONS IN VERTICAL PATTERNS

-Wes Boyd



FIGURE #4

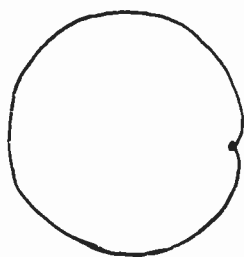


FIGURE #5



FIGURE #6



FIGURE #7



FIGURE #8



FIGURE #9

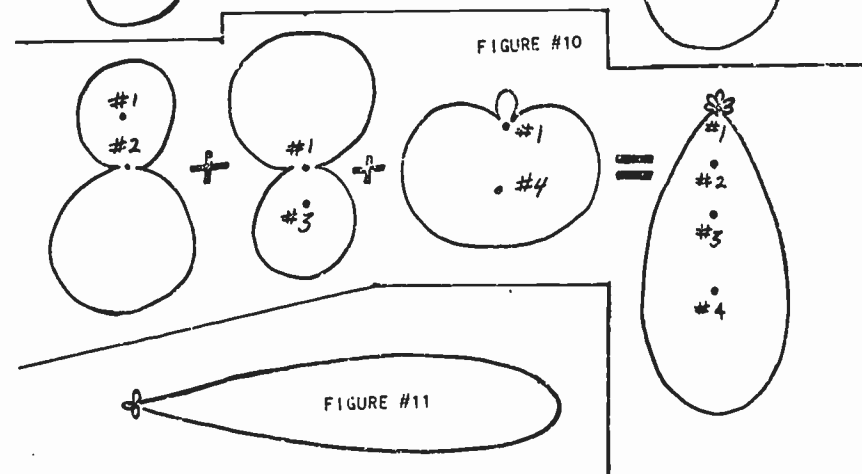


FIGURE #10

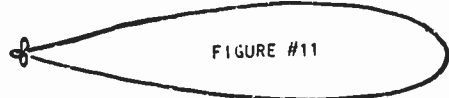


FIGURE #11

This article is intended to answer some of the questions from owners of the first edition of the NRC Night Pattern Book. The patterns shown are the measured patterns; however, these are measured at ground level (zero degrees). They make no attempt to show any skywave radiation that may exist. In reality, the FCC doesn't acknowledge such radiation at angles much above 50 degrees.

Figure #1 is information available in the FCC's Rules and Regulations. It indicates vertical radiation at different antenna heights for 1,000 watts non directional on the left hand side. The right hand side shows everything scaled to 100 mv/m; however, we won't be using this section.

With the left hand section we can read the field in mv/m at one mile. It can be noted that shorter towers have much more skywave radiation than taller ones. In most cases the possible use of such towers is offset by the increased cost for them.

The bottom line indicates the field, and we can see a 0.25 wavelength tower develops 180 mv/m at one mile. This can be increased to 200 mv/m by going to a tower 0.311 wavelength but both are very similar. If height were increased to 0.5 wavelength, the field increases to 230 mv/m, with reduced skywave. A further increase to 0.625 wavelength increases to 280 mv/m with even less skywave signal.

We could reach similar fields with a 0.25 wavelength tower but the power required isn't licensed by the FCC. To reach 230 mv/m, we would need about 1,500 watts and for 280 mv/m, we need about 2,000 watts.

Increasing height much beyond 0.5 wavelength does increase the field at one mile BUT also develops a secondary lobe. This can be seen in figure #1 at an angle of about 60 degrees and a field of about 80 mv/m. In most cases this is outside of most stations' coverage when it returns to earth. However, KDKA-1020, Pittsburgh, Penna., uses such a tower and has problems. Our secondary lobe returns and causes interference with normal groundwave signal. This creates a "hole" with severe fading from about 45 to about 70 miles from the transmitter.

Figure #2 shows different tower heights required by the FCC for the different classes of stations. We can also estimate what the tower height should be at 0.25, 0.5, and 0.625 wavelength at different frequencies. It should be noted that the tallest towers are required for clear channel class I stations; however, they also are to serve the largest areas.

A class I station operating on 600 kHz (if the FCC would allow it) would have a tower height of about 550 feet unless limited to 500 feet by the FAA. In reality, most stations stay closer to 0.25 wavelength towers which would be closer to 400 feet tall. Class II and III stations on this frequency could use towers of about 300 feet. In these cases, the height is less than 0.25 wavelength and the skywave is increased.

Some stations on upper frequencies do use tall towers for the increased coverage. Many of these can be spotted in the NRC Night Pattern Book by the increased coverage of stations of similar power. Some will not be very obvious due to poor conductivity around the transmitter, keeping the field at one mile reduced from what it might reach.

WHOT-1330 has its night transmitter site on an old strip mine. This will keep the field down from what it might achieve at a better site. However, it still has more coverage than other 1,000 watters with similar patterns.

Compare the patterns on 1410 kHz of WING/WPOP and KQV/WDOV. These all use 5,000 watts full time and the patterns of the examples are very similar. WING and WPOP show the Dayton station is using tall towers or is located at a very excellent site. The same is true when you compare KQV/WDOV but the Pittsburgh station uses towers of over 0.5 wavelength for the additional coverage.

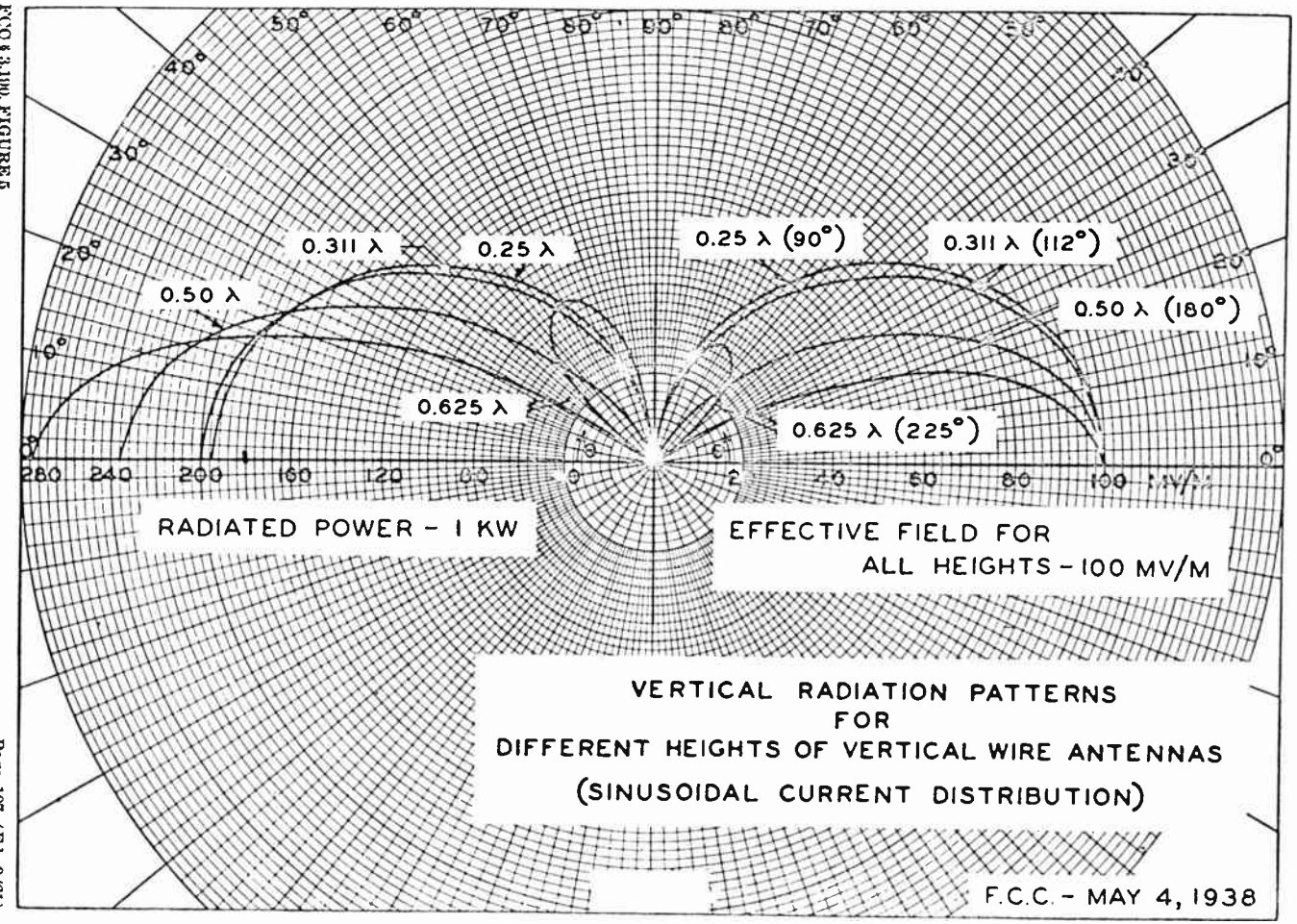
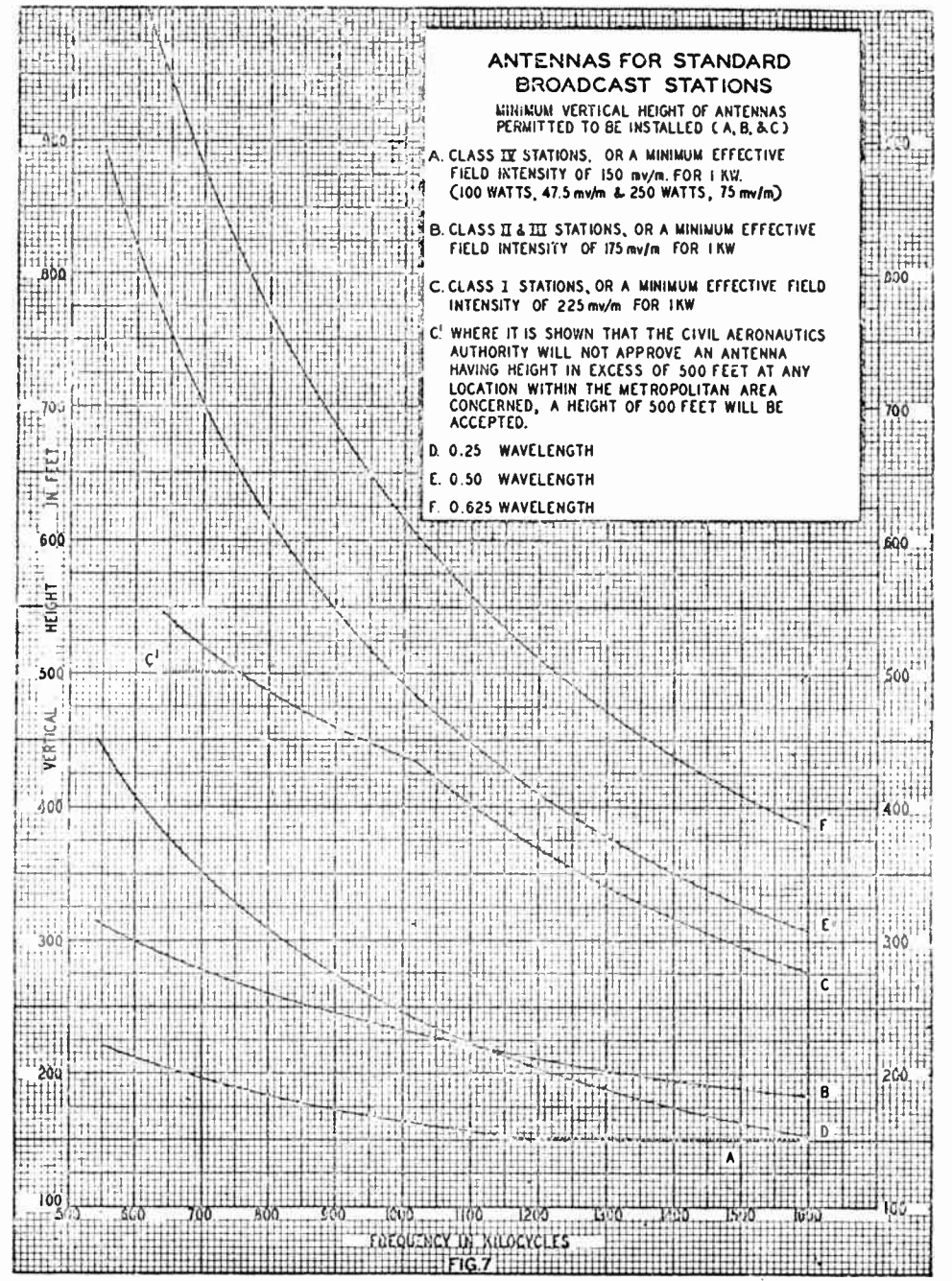


Fig. 1



FCC § 3.190, FIGURE 7

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Fig. 2

# Basics of Directional Patterns

by Paul K. Hart\*

As the population increases in the United States and Canada, more media services of all types are required. This includes medium wave broadcasting where greater choice of programming material is available and as a consequence more stations can be supported by advertising revenue. All stations legally transmitting in the U.S. and Canada are licensed by the F. C. C. in Washington or the D. O. T. in Ottawa, in keeping with the international treaty obligations contained in the North American Regional Broadcasting Agreement (N. A. R. B. A.). A more detailed discussion of the relationship between channel allocations and the N. A. R. B. A. will be found elsewhere in this book.

With more than 5,000 stations in the U.S. and Canada operating on only 107 channels, many stations have been forced to make use of directional transmitting antennas to reduce interference to an acceptable level. Many stations now operate with highly sophisticated directional antennas in order to meet the strict interference criteria contained in the F. C. C. and D. O. T. rules and regulations.

It is important to realize that the formal interference criteria established by the licensing agencies are based upon the ordinary home-type broadcast receiver. DXers with highly sophisticated receiving equipment are often able to hear distant stations even though the listener is located in a null of the transmitter antenna pattern. When reporting reception to these highly directional stations it is therefore most important to stress in your reception report that you are a DXer and not a regular listener with "ordinary" receiving equipment.

The allocation of frequencies by the F. C. C. and D. O. T. involves specification of a signal intensity contour of the station coverage area which must be protected from objectionable interference from other licensed stations. This contour level varies with the class of the station on the channel (i. e., Clear, Regional, or Local).

The primary service area of a station is the region where the ground-wave signal is free from objectionable interference from other licensed stations. The secondary coverage area is the region covered by the sky-wave signal; while the secondary coverage area may be protected from interference from other stations by F. C. C./D. O. T. rules and regulations, fading and other propagation effects may prove important in actual practice.

During the daylight hours the sky-wave signal is almost totally absorbed in the lower ionosphere at broadcast band frequencies; thus secondary coverage of any particular station exists only at night. There is also an intermittent coverage area located just on the edge of the ground-wave daytime service area; this area is outside the regular primary service area and is often subject to extreme fading and distortion as the result of destructive interference between the station's own sky-wave and ground-wave signals.

Directional antenna systems are used to provide primary and secondary coverage without interference to existing stations on the same and nearby frequencies. The problem of satisfying all of the interference criteria specified by the licensing agency can be very complex in actual practice, often necessitating elaborate engineering studies and costly directional antenna arrays.

Suppose a new station is proposed to operate on 1420 with 1,000 watts day and night.

In another town 25 miles away there is a station operating on 1430 with 500 watts non-directional daytime. The new facility must provide protection to the existing coverage of the second station. Since the second station does not operate at night, secondary protection is not required. However, other stations operating on 1420 will suffer interference unless radiation is limited towards them at night. This may require 4, 5, 6 or even more towers in the transmitting array.

In this case the station might require two different patterns, one for daytime and one for night. The exact values for these antenna fields are set forth in the rules and regulations in accordance with the interference criteria. Care must be taken in designing directional patterns so they not only protect the required stations but provide adequate coverage throughout the primary coverage area.

A common tactic near coastlines is to locate the transmitter inland so the peak of the pattern covers the city of interest and then goes out to sea; while fine for foreign DXers, this common approach often results in very weak radiation in the direction of the opposite coast. Similar tactics are often used by stations close to the borders. Many stations reduce power at night in conjunction with pattern changes to limit the interference to the required level. In recent years more stations have been using separate transmitter sites for day and night operation.

Bear in mind that the pattern is a graphical representation of field intensity generated by the combination of the transmitter and antenna system. All of the patterns shown in this volume are polar plot patterns showing field intensity at one mile from the antenna as measured at ground level (0 degrees elevation). This style of presentation is used because it is the form in which data must be supplied to the licensing agencies; additional discussion of the relationship between pattern size, field strength, and S-units will be found elsewhere in this volume.

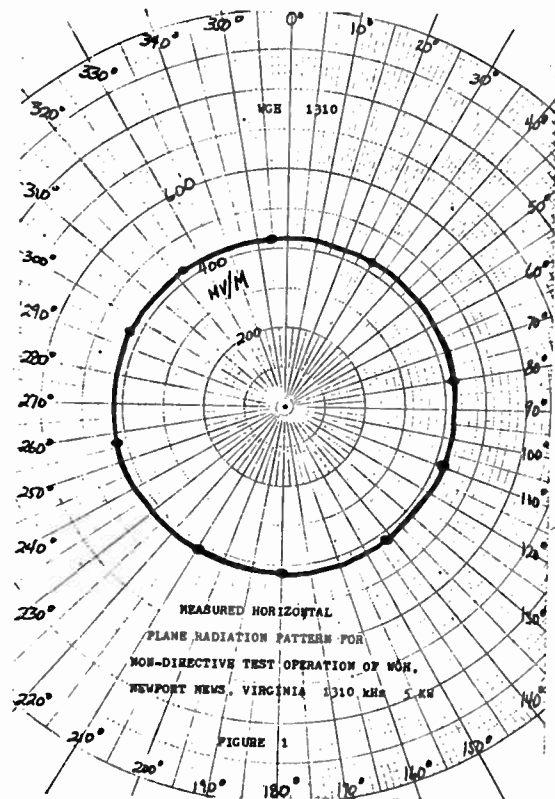
Were a station to test with 50,000 watts into a dummy load antenna, the field strength at one mile might well be unmeasurable - this is the extreme case of an inefficient antenna! The same station with identical power loaded properly into an efficient antenna would produce a very high field strength at one mile. The less efficient the antenna, the weaker the field strength produced by a particular transmitter power. This illustrates a basic fact: transmitter output power alone is not the only factor which determines station coverage - antenna efficiency and directionality must also be considered if actual receptions are to make any sense at all.

Figure 1 is the non-directional daytime pattern for WGH, Newport News, Virginia on 1310 kHz. This pattern is unusual because it is almost perfectly non-directional in practice as well as theory. The bearings around the outside indicate the compass heading FROM THE ANTENNA referred to TRUE NORTH corresponding to 0 degrees (or 360 degrees) at the top of the plot. The distance from the center of the pattern to the curve in any direction is proportional to the signal intensity in millivolts per meter (mV/m), the standard measure of field strength, as measured one mile from the antenna. Figure 1 shows that the 5,000 watt WGH transmitter generates a field of 420 mV/m in all directions. Were the transmitter power reduced to 1,000 watts, this field drops to 188 mV/m - or a bit less than half the 5,000 watt coverage (remember that the field strength varies as the square of the power). If WGH wanted to increase the field from 420 mV/m to 840 mV/m (twice the coverage), they would have to increase transmitter power to 20,000 watts.

Another concept essential to any discussion of directional patterns is the RMS field. The RMS field shown on the patterns in this article is the field strength a station would generate

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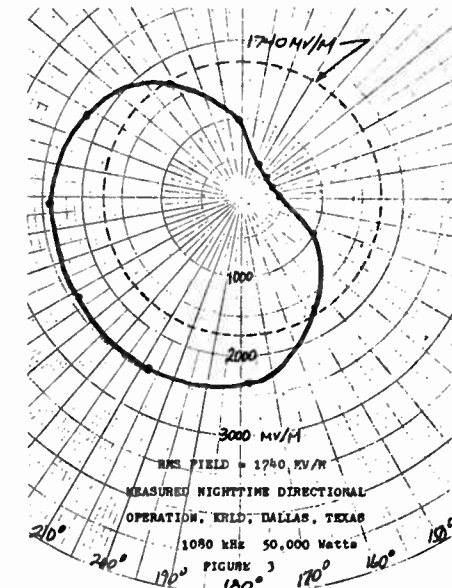
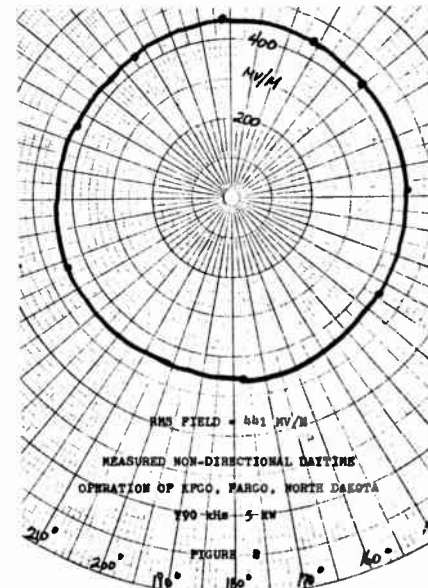
\* condensed and abridged from the original article in DX NEWS by permission of the author by Wes Boyd and Gordon Nelson.



if all of the station's power were radiated in a PERFECT CIRCLE. The non-directional pattern of WGH is almost a perfect circle so the RMS will be very close to 420 mV/m.

Figure 2 is the non-directional daytime pattern of KFGO, Fargo, N.D. on 790 kHz. Note that even though this station has but a single tower and is therefore supposedly non-directional, the coverage is not actually uniform in all directions. This is caused by factors such as non-uniform ground conductivity and such terrain features as buildings, power lines, and other structures. Since the pattern is not perfectly circular, a separate RMS value is given, 441 mV/m. Notice that WGH's RMS is only 420 mV/m compared with KFGO's 441 mV/m while both use the same transmitter power. This indicates that KFGO is using its transmitter power more effectively and more of it is being translated into field strength. For the most part the RMS is a useful indicator of the efficiency of the transmitter/antenna combination.

The F. C. C. and D. O. T. require that certain minimum values of field strength be generated with assigned powers for all stations. These minimum fields vary with the power and class of the station. The stations which are required to have the most efficient antennas are the Class I (Clear Channel) stations; this explains why these stations have huge antennas and vast coverage areas. The least strict requirements are for Local and daytime stations, although in no case will the F. C. C. permit new construction of an antenna less than 150 feet in height.

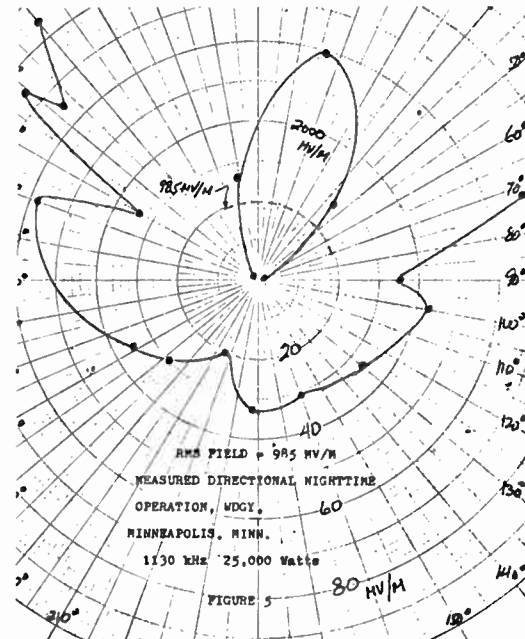
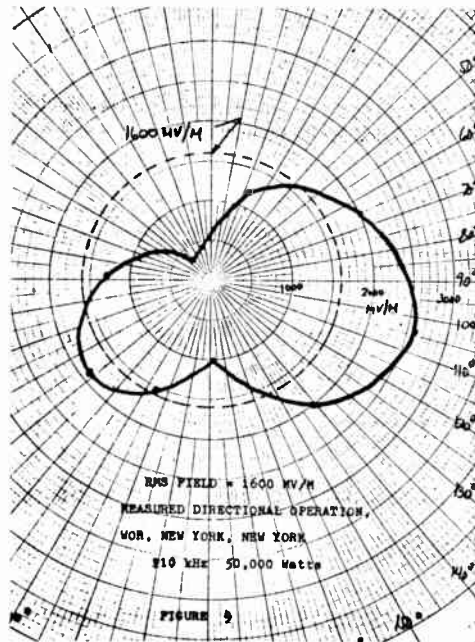


Directional patterns on the broadcast band are produced by employing multiple vertical towers and driving each tower with a definitely established and carefully maintained fraction of the total transmitter output power. As a result of tower spacing and electrical tuning networks, the radiated power is altered in amplitude and phase as required to produce cancellation or reinforcement effects which create the pattern. The design and construction of directional patterns is a very complex business and beyond the scope of this article. One simple rule-of-thumb of value to DXers is that the number of nulls in the pattern is equal to the number of towers in the directional array. This is not always the case but it holds often enough to be useful. In the remainder of this article we will deal with the final measured patterns without going too deeply into the details of the antennas themselves. DXers interested in more details are referred to the numerous articles which have appeared in DX NEWS and which are available as reprints from NRC headquarters.

The polar plot patterns shown here are of some stations selected to illustrate typical situations for discussion. The original sheets have details including tower location, phasing, spacing, height, and orientation which are not included in the interest of simplicity.

Figure 3 shows 50,000 watt KRLD in Dallas on 1080 kHz. This pattern is typical of the simplest types using two towers aligned along a line of peak and null. The RMS value of 1740 mV/m indicates a very good antenna efficiency. This pattern protects WTIC, Hartford, Conn., and WTIC mutually protects KRLD. Notice the direction of the very broad peak in the pattern. All of West and South Texas (along with most of the Southwest) lies in the KRLD secondary coverage area, thus guaranteeing interference-free reception over a wide area at night.

Figure 4 is WOR, New York City, on 710 kHz. This is a non-symmetrical pattern produced by a three tower array in a triangular layout. There are many other fulltime stations on 710 but they have patterns which protect WOR and are located a good distance from New York City. The main lobe covers N.Y.C., Long Island, and most of New England. Wor's southwest lobe covers New Jersey and a large portion of Pennsylvania. The RMS value of 1,600 mV/m indicates good antenna efficiency; it is lower than some other 50,000 watt stations however. This is because as antenna arrays become increasingly complex, the RMS produced for the same power input usually drops because of the power losses in the associated power lines and tuning



networks.

Figure 5 is WDCY, Minneapolis, Minn. on 1130 kHz. This pattern was achieved with 25,000 watts and a complex 9 tower system. In this pattern the nulls off the back of the array are so deep that a separate expanded scale is necessary to plot them. It is a safe bet that WDCY's transmitter is located to the south or southwest of Minneapolis-St. Paul area. His signal in these cities and to the north must be fantastic, but the signal must drop off quite rapidly to the south of the transmitter site.

On 1130 the primary stations are KWKH Shreveport, La., WNEW New York City, and CKWX Vancouver, B.C. All 3 stations operate with 50,000 watts full time; however the location of the 3 leaves a "dead spot" on 1130 in the mid-west. In this "dead spot" the trio of WCAR Detroit, Mich., WISN Milwaukee, Wis., and WDCY Minneapolis, Minn. operate with powers ranging from 10,000 to 50,000 watts. All 3 of these "secondary" stations operate under very strict rules so that none of them interfere with each other or any of the primary stations. Due to the relatively close geographical spacing of these "secondary" stations (all with high power) very sophisticated patterns are required. All three stations operate with patterns that are very similar.

Looking back at KRLD's night pattern you will notice that the pattern crosses the RMS field at 150 and 330 degrees. If you lived along either of these bearings the power from KRLD is 50,000 watts whether the pattern is used or not. If you lived in the "back" of the pattern the signal would be less than 50,000 watts. Along the bearing of 60 degrees the power at night is about 3,000 watts. For those in Arizona wondering why KRLD is so powerful for 50,000 watts, the power at a bearing of 260 degrees is almost 100,000 watts.

In the case of the WDCY pattern the power along a bearing of 17 degrees is almost 300,000 watts. At the same time WDCY's power at 180 degrees is less than 50 watts. The peak value of the curve on a bearing of 17 degrees for WDCY is almost 3,000 mV/m. This is more than KRLD achieves (2450 mV/m maximum) and KRLD has a more efficient antenna system! Considering that WDCY's pattern uses 1/4 wavelength towers while KRLD uses 1/2 wavelength towers the power from WDCY's narrow high intensity beam is fantastic.

## NARBA ALLOCATIONS AND PRIORITY COUNTRIES

Here is a breakdown of the broadcast band frequencies and priorities as set by the N.A.R.B.A. To make this useful as possible we have omitted all regional and local channels.

540	Canada I-A, Mexico I-A	1010	Canada I-A
640	USA I-A, Canada I-B	1020	USA I-A
650	USA I-A	1030	USA I-A
660	USA I-A	1040	USA I-A
670	USA I-A	1050	Mexico I-A
680	USA I-B	1060	Mexico and USA I-B
690	Canada I-A, Mexico I-B	1070	Canada and USA I-B
700	USA I-A	1080	USA I-B
710	USA I-B	1090	Mexico and USA I-B
720	USA I-A	1100	USA I-A
730	Mexico I-A	1110	USA I-B
740	Canada I-A, Mexico I-D	1120	USA I-A
750	USA I-A	1130	USA and Canada I-B
760	USA I-A	1140	Mexico and USA I-B
770	USA I-A	1160	USA I-A
780	USA I-A	1170	USA I-B
800	Mexico I-A	1180	USA I-A
810	USA I-B	1190	Mexico and USA I-B
820	USA I-A	1200	USA I-A
830	USA I-A	1210	USA I-A
840	USA I-A	1220	Mexico I-A
850	USA and Mexico I-B	1500	USA I-B
860	Canada I-A	1510	USA I-B
870	USA I-A	1520	USA I-B
880	USA I-A	1530	USA I-B
890	USA I-A	1540	Bahamas I-A, USA I-B
900	Mexico I-A	1550	Canada and Mexico I-B
940	Canada and Mexico I-B	1560	USA I-B
990	Canada I-A	1570	Mexico I-A
1000	Mexico and USA I-B	1580	Canada I-A

## Abbreviations

### CLASS OF OPERATION:

DA -1	Unlimited hours of operation; same pattern day and night
DA -2	Unlimited hours; different patterns day and night
DA -N	Unlimited hours of operation; directional nights only
ND	Nondirectional

### MISCELLANEOUS:

CP	Construction Permit
mV/m	millivolts per meter
kw	kilowatt
kHz	kilohertz
NARBA	North American Regional Broadcast Agreement
FCC	Federal Communications Commission
DOT	Department of Transport (Canada)
RMS	Root mean square

SITING OF DIRECTIONAL MW STATIONS

\*Wes Boyd

In construction of directional antenna systems, several factors must be considered. #1. Protection to existing stations on the same or on adjacent frequencies. #2. Providing maximum coverage of the city of license. #3. The expense of land in locations that could be used. #4. Coverage of adjacent communities if desired or necessary.

These requirements make transmitter site placement very unique. As an example, we shall look at some typical class IV installations. Normally these operate with 1,000 watts daytime, 250 watts night non directional. Most such stations have towers of 150 feet or a bit taller.

Several stations operating on these frequencies will use excellent antenna systems to obtain maximum coverage. In most cases this also involves coverage to a larger adjacent city. With careful transmitter placement, they can obtain coverage in cities several miles away that normally wouldn't be covered.

EXAMPLES:::

WENZ 1450 Highland Springs (Richmond), Virginia; the city of license is about 5 miles east of Richmond. By locating the transmitter about 1 1/2 miles to the west of Highland Springs, that city receives excellent coverage. This also places the transmitter about 3 1/2 miles east of Richmond and also provides rather good coverage of that city.

WEXL 1340 Royal Oak, Michigan, is some 5 miles north of Detroit. As with WENZ transmitter placement allows coverage of the larger city. In this case, the transmitter is 1 1/2 miles south of Royal Oak. Such a location offers excellent coverage of both the city of license and Detroit.

WVON 1450 Cicero, Illinois, and WOPA 1490 Oak Park, Ill., both are located in areas that provide excellent coverage of Chicago. These communities are adjacent to Chicago on the city's west side. From here, transmitter sites on top of buildings in the area will have great coverage.

Such rooftop installations are not always used to provide maximum coverage. If properly used, they can increase or decrease coverage. Location of antennas of one-quarter wavelength on buildings of the same height will reduce coverage. A shorter building would provide more coverage; however, not as much as one over one-quarter wavelength tall would.

Among other stations using transmitter placement to serve communities other than the city of license: WNIA 1230 New York; WJMO 1490 Ohio; WLPM 1450 Virginia; WSMY 1400 N.C.; WFOG 1230 Georgia; WXVW 1450 Indiana.

Several years ago the F.C.C. made an attempt to limit the number of radio stations in larger communities. At the time, many stations were licensed to these cities and used the F.C.C.'s ruling to become licensed fulltime. If the city had adequate service, they wouldn't license any more fulltime stations for it. This allowed daytimers to relicense the stations to suburban cities without (in the F.C.C.'s terms) local service.

These stations would become licensed for fulltime operation. Then with careful transmitter placement, be able to serve the larger community anyhow. The coverage was not as good as it could be (or should be) to serve these larger cities. However, poor night coverage is better than signing off the air. Some of these included WCUE 1150, Akron, Ohio; WVOL 1470 Nashville, Tenn., and KUDL 1380, Kansas City.

During this same era, other stations went on the air as daytimers licensed to suburban cities. Then after several years, finally were given permission to operate fulltime. In both cases, the stations placed transmitters so they would provide coverage of the larger communities. These include WHOT 1330, WPAT 930, KDAY 1580, KQRS 1440, WYOO 980, etc.

In most cases, the area to be served determines the shape of the pattern more than the protection to existing stations does. Many stations could have lower power or less complicated patterns if the extra communities were not wanted in the coverage area.

KFXD 580 Nampa, Idaho, wouldn't require such a night pattern if coverage of Boise, Idaho, wasn't wanted. On such a lower frequency, the coverage is tremendous even at lower power levels. The large west lobe has enough signal

to let the transmitter be several miles from Nampa. Since Boise is about 10 miles east of Nampa, the transmitter could be midway between them. Such a location allows the front lobe to serve the city of license while the lobe to the northeast will provide a very good signal in Boise.

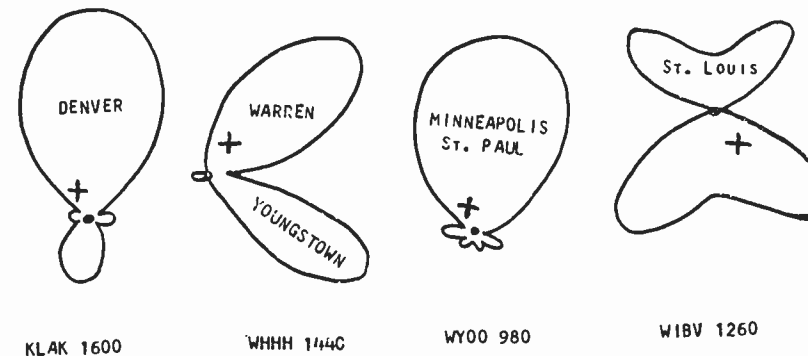
Similar transmitter placement was used by WSAR 1480 Fall River, Mass. With a location west of Fall River, the east lobe covers the city of license. At the same time, the secondary lobe north/northwest covers Providence, R.I.

WTSN 1270 Dover, N.H., has a location just west of Dover. This allows Dover to be in the main lobe east. The back lobe provides coverage of Rochester, N.H., for a secondary coverage. At the same time, the front lobe is powerful enough to provide a good signal in Portsmouth.

WIBX 950 and WRUN 1150 Utica, New York, use transmitter placement to provide coverage of Rome, New York, (10 miles away) but both used different systems. WIBX 950 has a location to the west of Utica so it lies in the east lobe. This allows Rome to be covered by the lobe to the North. WRUN 1150 is located to the northwest of Utica so it lies in the southeast lobe. The lobe to the northwest then covers Rome.

Dallas/Fort Worth, Texas, provides similar problems in transmitter placement. Of the stations here, KLIF 1190 is the most unique. Protection to WOAI 1200, KVOO 1170 and other 1190 stations are required. The pattern used offers this protection but makes coverage of both cities difficult. Transmitter location near Irving, Texas, (northwest of Dallas) allows Dallas to be served with the lobe to the southeast. Then the main lobe southwest will cover Fort Worth with signals of excellent quality. With this pattern coverage of both cities is impossible unless the transmitter is in this area.

In coastal areas (New York City and Los Angeles are excellent examples), the stations have transmitters several miles inland. If stations in this area had moderate power and patterns aimed at the larger city, they would be almost as strong as stations licensed there. Others are licensed to communities surrounded by larger cities. They place the transmitter 10 miles away from the larger city and with power lobes cover both cities to serve the city of license. KDAY 1580 and KROQ 1500 in California are great examples of this.





SOME QUANTITATIVE ASPECTS OF VERTICAL PATTERNS

\*Chris Lucas

The NRC Night Pattern Book has been a great aid to DXers. A glance is all it takes to see if a station nulls toward you or has a lobe in your direction. If you have compared the patterns shown with actual listening experiences, you will note some stations which should be heard are not while some with nulls in your direction are quite audible. This article will explain why this is so and should help you obtain more information from the pattern book.

The patterns shown in the pattern book indicate the electrical field strength in different directions from the transmitter due to radiation in the horizontal or ground plane. When considering nighttime skywave we must deal with radio waves leaving the antenna system at some angle above ground. This angle of elevation will be referred to as angle B in the following discussion. Radio waves at broadcast band frequencies normally propagate at night by reflection off the E layer of the ionosphere. The shorter the distance from the transmitter the greater the elevation of angle B. For single hop transmission beyond 700 miles, angle B is quite small. In this case the pattern book gives a good idea of how a station will be received. However, at distances progressively less than 700 miles, angle B becomes progressively larger and the pattern becomes considerably altered from the groundwave pattern indicated in the pattern book. However, only a certain type of pattern is applicable.

We will ignore for now that radio waves radiate preferentially in a ground plane. An antenna system composed of two or more towers located along a straight line produces a pattern with a special kind of symmetry. The pattern in three dimensions is symmetrical about a line connecting the bases of the towers. From here on this will be referred to as the "axis of symmetry". For the ground plane patterns shown in the pattern book, the two-dimensional pattern produced is symmetrical about an axis of symmetry.

EXAMPLES: WROW 590's pattern is symmetrical about an axis running almost N & S. That of WICC 600 is symmetrical about an NW-SE axis, as is WTOR 610. WVNJ 620 has an axis of symmetry running more or less N & S. WINR 680's axis goes NE-SW, while WELM 1410 is nearly N & S.

The results of this article can not be applied unless you know which axis of symmetry corresponds to the line in which the towers lie. Also it is not necessary to have in-line towers to produce a symmetrical pattern. Four towers located at the corners of a square will also produce a symmetrical pattern. Any calculations based on this article are accurate only if the towers are actually along a line.

At this point we will introduce another angle which we will call angle A. This is an acute angle between the axis of symmetry and a line from the transmitter to the receiver. A definition of this angle is shown in Figure #1.

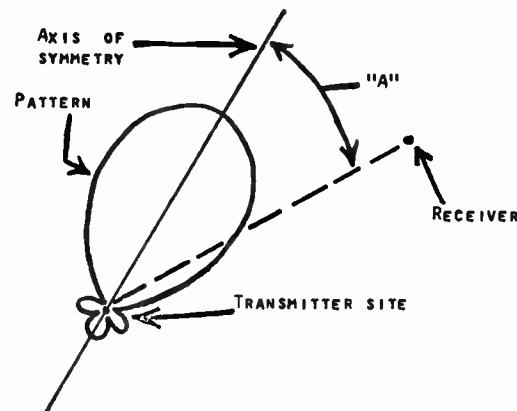


FIGURE 1  
DEFINITION  
OF ANGLE A.

Angle B has been defined as the elevation angle, and it varies with the transmitter-receiver separation. This separation is always measured along the great circle paths. Some trigonometry gives the following expression for the cosine of angle B.

$$\cos B = \frac{(3960 + H) \sin \left( \frac{D}{7920} \right)}{\sqrt{(31,363,200 + 7920 H) \left( 1 - \cos \frac{D}{7920} \right) + H^2}}$$

In this expression the arguments of the sine and cosine are in radians, and measured in miles. H is the reflection height and D is the transmitter-to-receiver distance along the surface of the earth. For distances under 700 miles and an assumed reflection height of 65 miles, this expression simplifies to:

$$\cos B = \frac{(0.509) D}{\sqrt{0.254 D^2 + 4225}}$$

This expression will provide an answer with less than 1% error. Figure II is a graph of cosine B versus the transmitter-receiver distance D.

In determining the radiation pattern at angle B, we must look at the point on radiation pattern given in the pattern book and not at angle A. In reality, we should look at angle C which is obtained from the equation:

$$\begin{aligned} \cos C &= (\cos A) \cdot (\cos B) \\ C &= \text{ARC COS} (\cos A) \cdot (\cos B) \end{aligned}$$

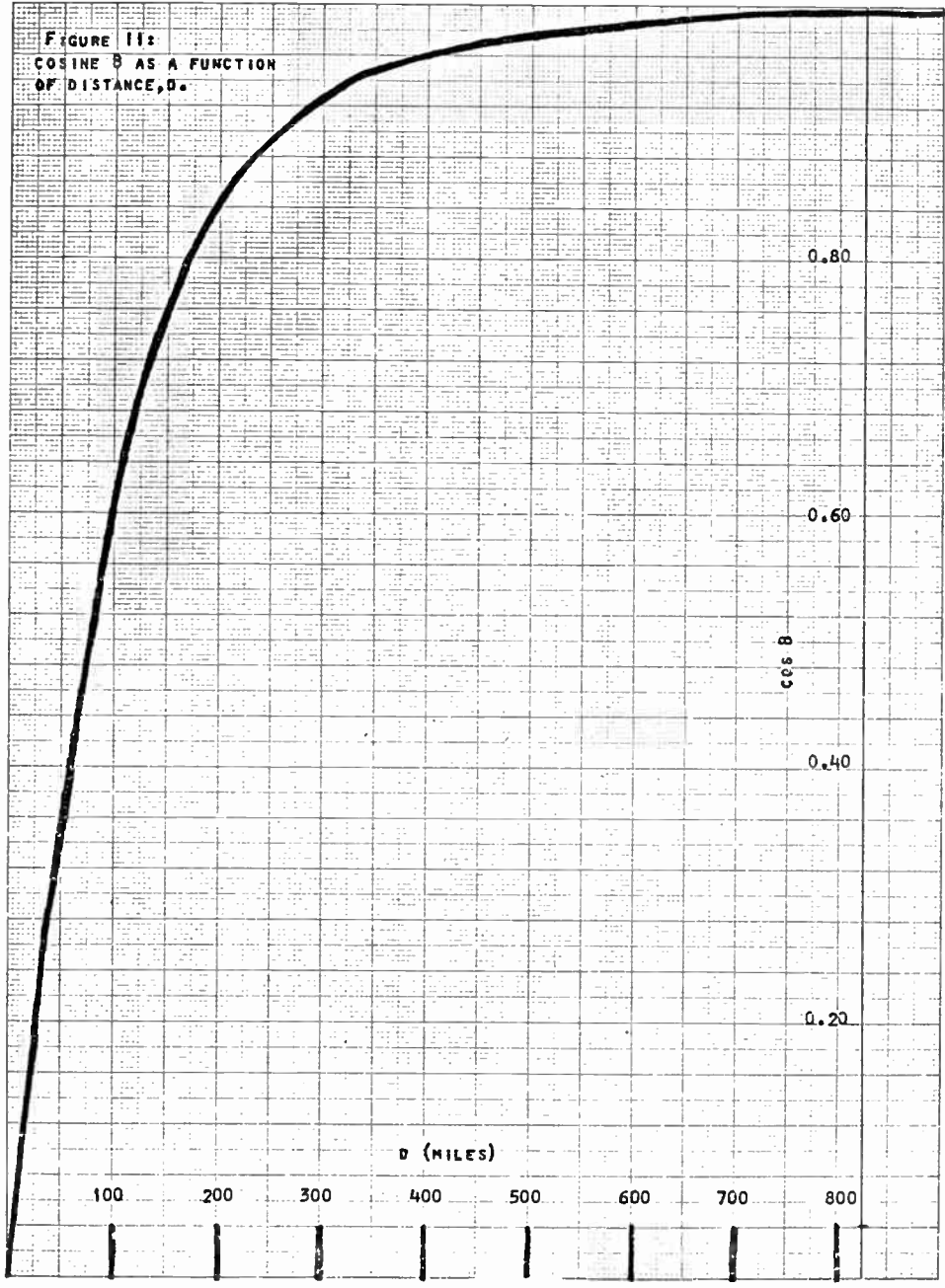
In effect for skywave we must look at the pattern more broadside to the axis of symmetry than we would for groundwave. A few examples will help to make this clear.

Let's evaluate the signal WHOT 1330 has towards Flint, Michigan, where another station operates on the same frequency. Figure III shows the pertinent angles. In this example D is 210 miles and A is 56 degrees. A look at figure II shows that cos B is 0.858 for the distance of 210 miles. Cos A is 0.559 thus cos C = cos A · cos B = (0.559) · (0.858) = 0.480. This then makes the magnitude of angle C 61.3 degrees, and corresponds to a field strength of about 100 mv/m instead of the approximately 150 mv/m measured at angle A. It becomes apparent that this null near angle C was designed to protect the Flint, Michigan, station.

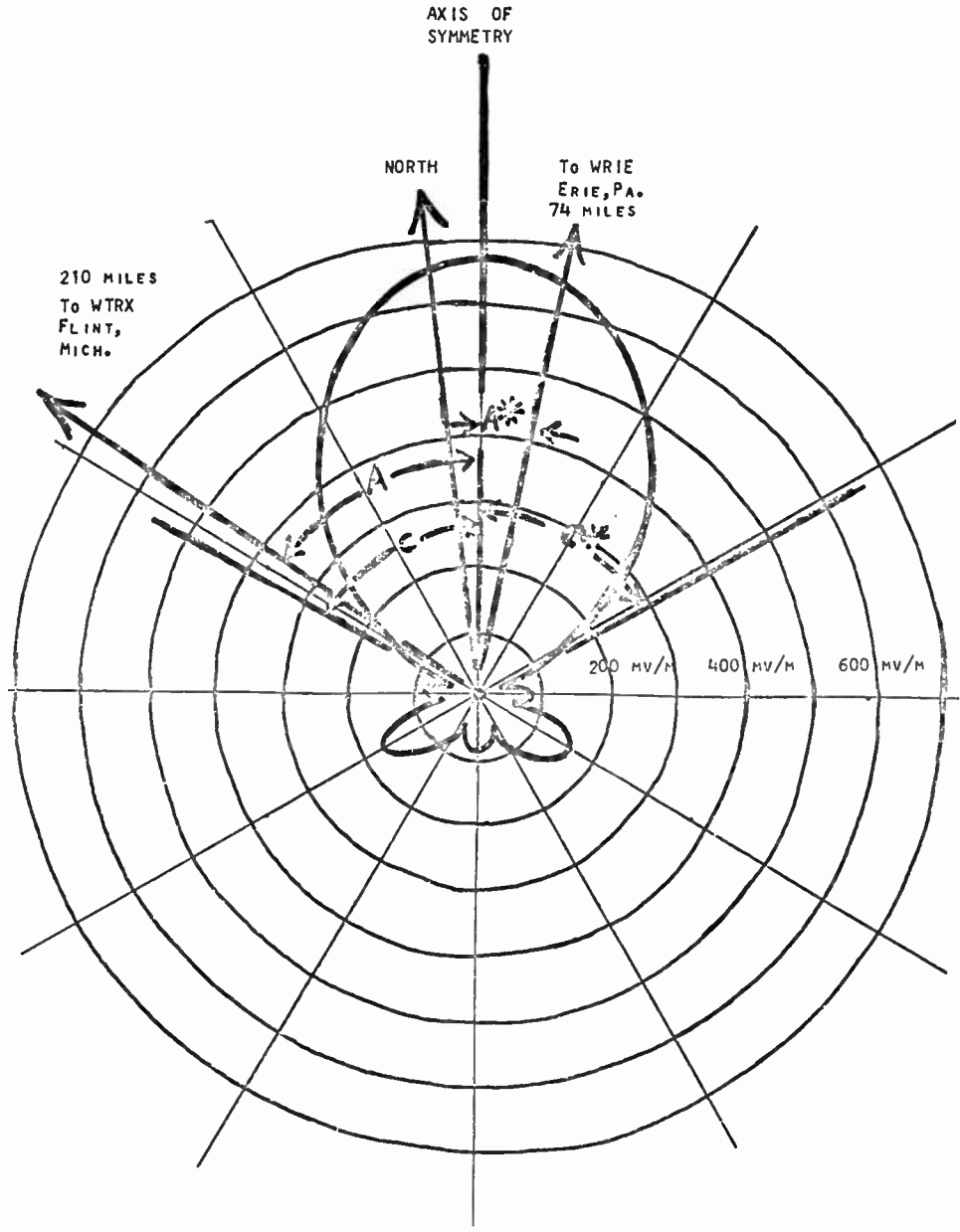
Example #2: Here we will evaluate the signal that WHOT 1330 directs towards Erie, Pa., where another station operates on 1330 kHz. The pattern might indicate to you that WHOT doesn't protect this station at all, but this is not the case. Using figure III again we find the angles of interest, A\* and C\*. The \* being used to distinguish these angles from those used in connection with the station in Flint, Michigan. For this example, D = 74 miles and A = 11 degrees. Figure III tells us the value of cos B in this case is 0.502 and cos A is 0.982. Thus cos C = cos A · cos B = (0.982) · (0.502) = 0.493. This makes the magnitude of angle C 60.5 degrees, and this corresponds to a field strength of 120 mv/m at one mile towards Erie and lies quite close to the null. The groundwave radiation towards Erie is much higher (at angle A) at about 640 mv/m at one mile. This is a prime example of where a location seems to be in a lobe while it is really in a null as far as skywave is concerned. There is considerable error possible in these examples mostly due to the small size of the patterns in the pattern book and the slight errors that inevitably occurred in the drawing of these patterns. If we had the exact pattern of WHOT and knew the exact bearing of the axis of symmetry we may have found that Erie and Flint lie directly in the null instead of within a few degrees of the null.

Example #3: In this example, we will evaluate the signal received at Ithaca, New York, from WPTR 1540 Albany, New York. Figure IV shows the angles involved. For this example we have D = 142 miles and the corresponding cos B = 0.746 (Figure II) thus A = 29 degrees and cos A = 0.875.

Therefore cos C = cos A · cos B = (0.875) · (0.746) = 0.652 hence C = 49.3



**FIGURE III: PATTERN OF WHOT CAMPBELL, OHIO AND THE ANGLES USED**  
**IN CALCULATING SKYWAVE RADIATION TOWARDS ERIE, PA. AND FLINT, MICHIGAN.**



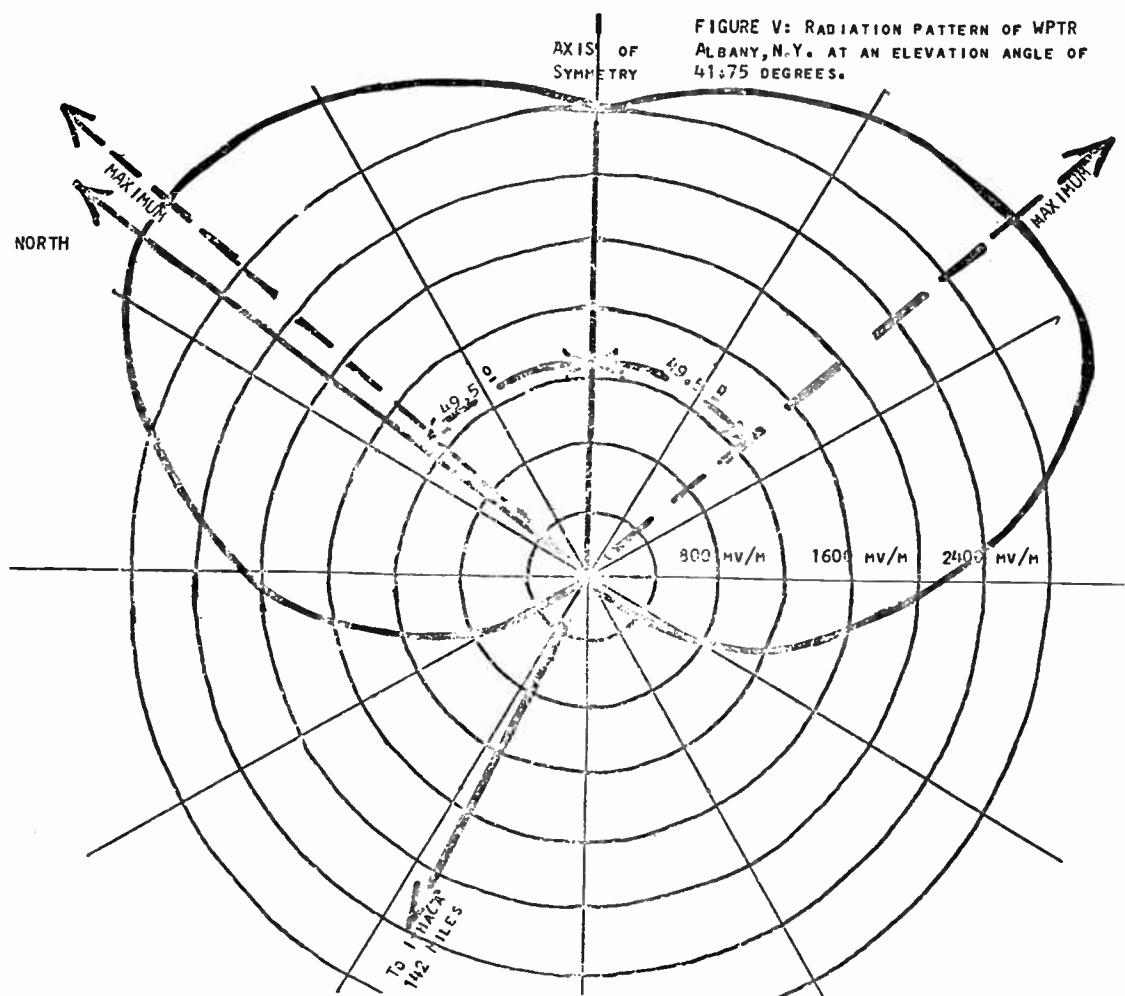
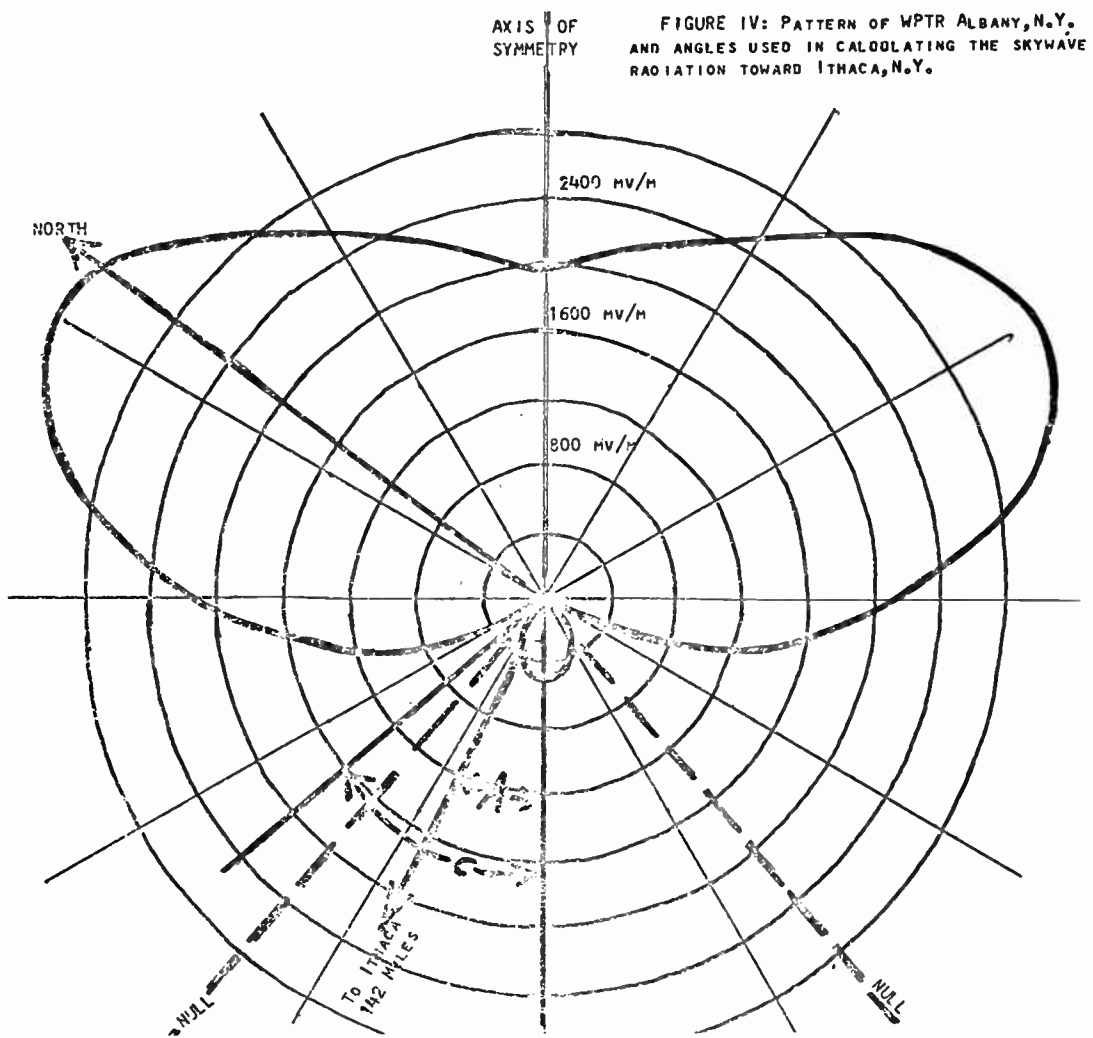
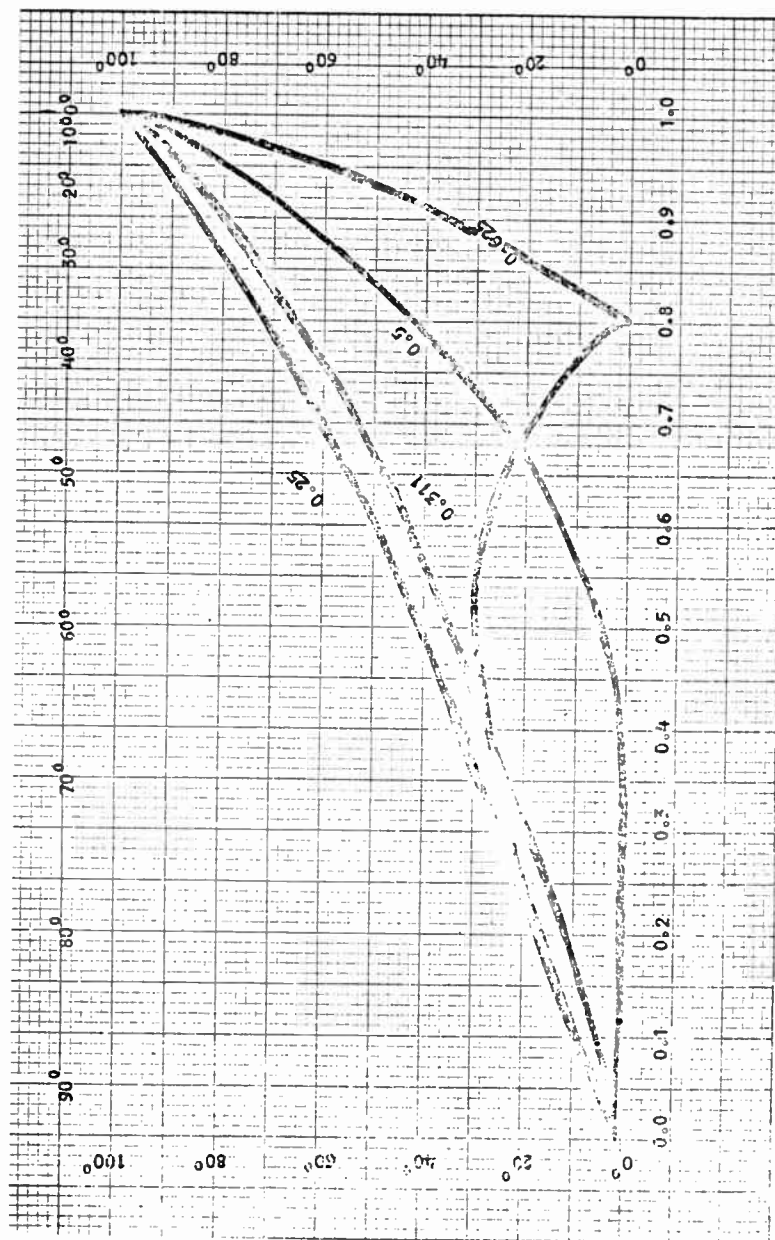


Fig. VI



degrees. This angle is very close to the null and it is difficult to get a value for the field strength at one mile. However, this should be a field of about 100 mv/m. It should be pointed out that the radial at angle C is on the other side of the null from the radial towards Ithaca at angle A. Ground-wave signal towards Ithaca is approximately 300 mv/m at one mile at angle A.

Example #4: Instead of calculating the field at one point, we can calculate the entire pattern corresponding to radiation at a certain elevation angle (B). If we continue the case just considered, we can calculate the entire pattern. First we evaluate the pattern at an elevation angle of 41.75 degrees corresponding to the transmitter-receiver distance of 142 miles ( $\cos B = 0.746$ ). Several representative points can be taken and the resulting angle C and field strength evaluated. This has been done but to save space, the calculations won't be shown, rather the resulting pattern is shown in figure V. The pattern shows that if you were to circle the transmitter at a distance of 142 miles, you would get the strongest field in approximately North and East directions, 49.5 degrees from the axis of symmetry. These locations are a few miles west of Plattsburgh, New York, and the southern part of Boston, Mass. The weakest signals lie across the axis of symmetry to the southwest of Albany, 10 miles west of Scranton, Pa. We note the rear lobe has disappeared and that the pattern itself is somewhat smoother. This smoothness at high radiation angles is a general result.

You will remember that we assumed that transmitter towers radiate equally well at all angles above the horizon; this is just not true. However, the effect is the same whether a station is nondirectional (single tower) or directional (multiple towers). As angle B increases, the strength of radiation generally decreases. Extremely tall towers have peculiar variations in field strength with increasing B. Figure VI shows the relative radiation at various elevation angles B compared to radiation in the horizontal plane. It is plotted in  $\cos B$  since we have been working directly with this quality in this article. Note that of  $\cos B$  of about 0.80 the radiation drops to zero for a  $5/8$  wavelength antenna. This value of  $\cos B$  corresponds to a transmitter-receiver distance of about 168 miles (see figure II). At this distance from a station using a  $5/8$  wavelength antenna, virtually no skywave will be received. It should be noted that the taller towers radiate a stronger signal in the ground plane than the shorter towers do. A radio station using a  $5/8$  wavelength tower has a ground plane field strength of almost double that of a station using a  $1/4$  wavelength antenna on the same frequency.

The pattern obtained for WPTR is not correct in magnitude although it is correct in shape (figure V). We would have to know the height of WPTR's towers if we were to get the correct magnitude of the pattern. If they were  $1/2$  wavelength tall, figure VI shows the field strength is 34% of that in the ground plane ( $B = 41.75$  degrees,  $\cos B = 0.746$ ). Should these towers be  $5/8$  wavelength tall, then the appropriate factor is 12%.

Local WTKO 1470 recently began nighttime operation from four in-line towers on the south end of Ithaca. These towers seem to be  $5/8$  wavelength tall which means it should be difficult to receive them 165 to 170 miles from the transmitter. Reception would be difficult in Toronto, Ontario; Punxsutawney, Penna.; or Plainfield, New Jersey.

If a station uses towers of two or more different heights, as is often done, the results of calculations shown in this article will not be accurate even though the towers do lie in a straight line.

We should mention that the radiation pattern at some elevation angles can be different from the ground plane pattern shown in the pattern book. Especially for large angles which correspond to transmitter-receiver distances of less than 150 miles. If you are broadside to a station's antenna system, the pattern stays the same in your direction. Regardless of the distance, a null remains a null and a lobe remains a lobe.

# NRC PUBLICATIONS

## SPECIAL INTERNATIONAL AGREEMENTS

Still another set of "clear channels" are shared as Class II frequencies with other countries. Those shared with Canada are 1070 and 1130. Those shared with Mexico are: 850-1000-1060-1090-1140 and 1190.

There are many other "Gentlemen's Agreements" that allow operations on other frequencies. Such U.S. operations are: New York City on 1010 and 1050 kHz, Cleveland on 1220 kHz, Santurce, P.R. on 730, and Alaska on 800 and 900 kHz. Similar agreements allow Canada to operate on 640-730-800-900-1050-1220 and 1580 kHz. Additional special arrangements permit Mexico to operate on 660-760-830 and 1030 kHz.

Further treaty agreements allow U.S. operations on certain Canadian I-A channels: 740-860-990 and 1580 kHz; these stations must be located a specified distance from the Canadian border and must employ directional antennas to limit radiation to Canada to prespecified levels.

If the preceding special agreements were not enough to confuse the overall pattern, additional special arrangements allocate 1540 as Class I-A for the Bahama Islands, and 620 as Class I-C to the Dominican Republic. We will not consider the allocations for Cuba since most have not been honored since the Liberation government came to power.

Along with all these agreements as the use of frequencies, each country has its own rules for maximum transmitter power within the NARBA guidelines. While the U.S. and Canada limit power to 50 kw (recall that a NARBA I-A channel can contain a station operating with more than 50 kw), Mexico permits operation in excess of 50 kw. Regional channels in the U.S. are limited to 5,000 watts, but in Canada many stations operate with 10,000 or 50,000 watts on these channels. The regional channel power limit in Mexico is 25,000 watts. Local channels in the U.S. and Canada are very similar - almost all stations operate 1,000 daytime and 250 watts nondirectional at night.

There are some 15 or 20 stations in the U.S. operating with directional antennas in the daytime. Since Class IV stations are licensed for the most part as 250 watts nondirectional, the directional antennas are used to limit interference to adjacent channels at the 500 or 1000 watt level.

The few Canadians operating full-time with directional antennas are not difficult to understand either. These simply limit the power toward the U.S. to levels approaching the field strength they would achieve with 250 watts nondirectional. In all cases they have large lobes directed to the North.

Mexicans operating on local channels seem to have 3 different sets of rules, all dependent upon the location of the station. Those within 62 miles of the border operate with 250 watts nondirectional full-time. Those from 62 to 93 miles operate 1,000 watts day and 250 watts nondirectional at night. All others operate with 1,000 watts day and 500 watts nondirectional at night.

The NRC is proud to announce its list of companion publications to the Domestic Station Log. All of these items are available from the National Radio Club, P.O. Box 127, Boonton, N.J. 07005.

## DOMESTIC LOG

This spiral-bound volume contains listings of all U. S. and Canadian AM stations including locations, addresses, powers, antenna operations, networks, schedules and other useful information. Cost is \$6.25 to members and \$7.50 to non-members. Orders from other than North America please enquire for applicable rates.

## NIGHT ANTENNA PATTERN BOOK

This spiral-bound volume features the nighttime directional antenna patterns of Canadian and U.S. stations on map pages of 11 x 14 inches. These patterns are drawn to scale from official government sources. Commercial publications of this sort cost more than ten times as much for this most valuable DX reference. Cost to members is \$6.50 post-paid and to non-members \$7.50 in U.S. and Canada. (New edition 1975)

## ANTENNA REFERENCE MANUAL

This manual is a compilation of numerous articles on the subject of antennas for MW DXers which have appeared in the pages of DX NEWS over the past several years in one handy volume. Includes data on air- and ferrite-core loops, antenna tuners for longwires, and beverage antennas, along with various coupling devices. 60 pages; 5½ x 8½ booklet format. \$2.25 in the U.S. and Canada.

## GETTING STARTED IN MEDIUM WAVE DX'ing

This booklet is designed to assist the novice DXer in pursuit of the hobby. It includes introductory articles on foreign and domestic DX'ing as well as related topics. Included are articles on reception reports and safety and preventive maintenance of your DX gear. All members who pay the New Member Fee automatically receive a copy of this booklet. For non-members the cost is \$1.25 in the U.S. and Canada.

## RECEIVER REFERENCE MANUAL

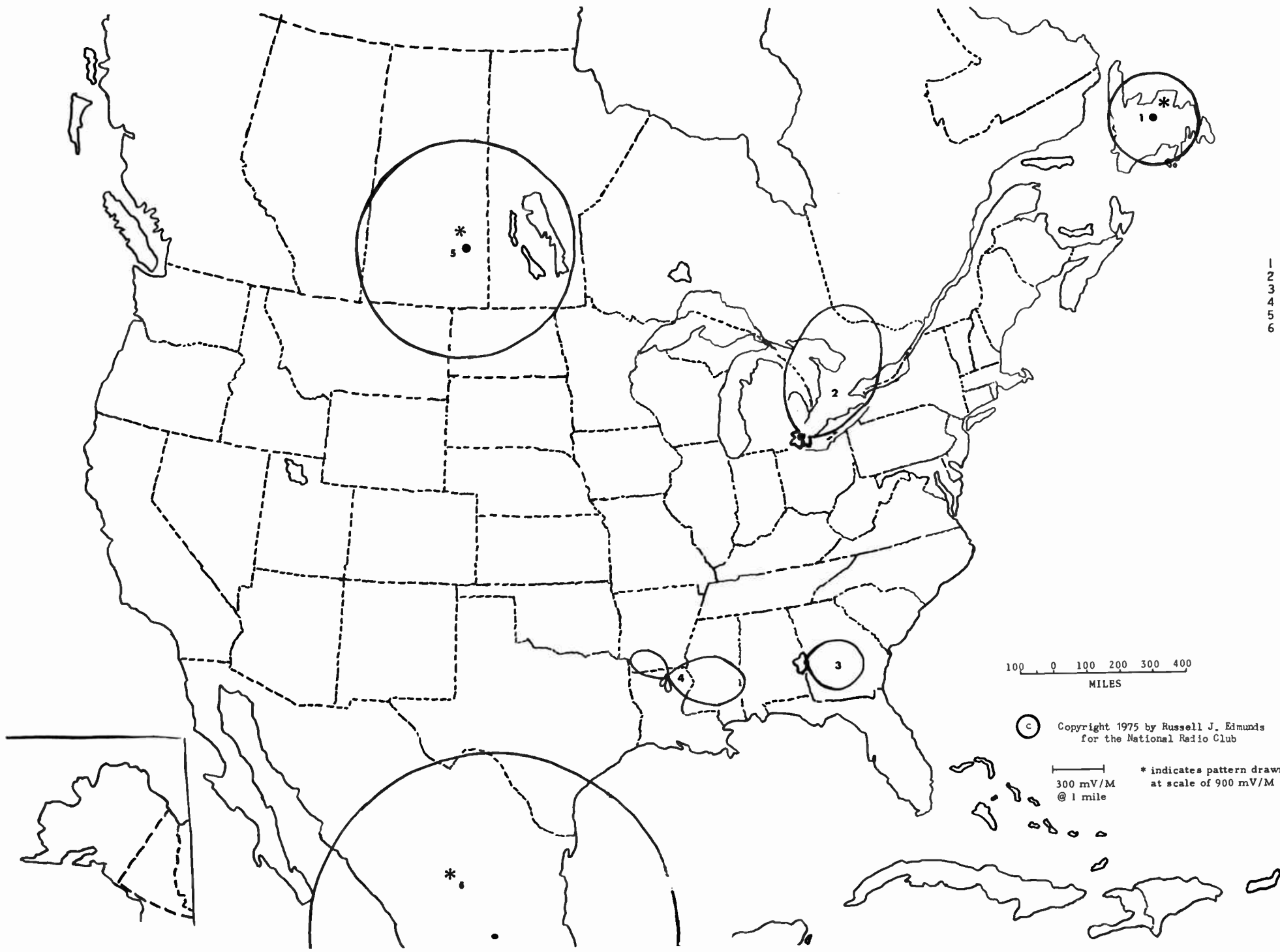
This manual is similar to the above manual on antennas, except that the subject is DX receivers. It includes useful articles on receiver modifications and accessories, and reviews of many of the commonly used BCB DX receivers currently available. A must for the serious DX'er/experimenter. 72 pages, 5½ x 8½ booklet format. \$2.50 U.S. and Canada.

## LOG & PATTERN BOOK UPDATERS

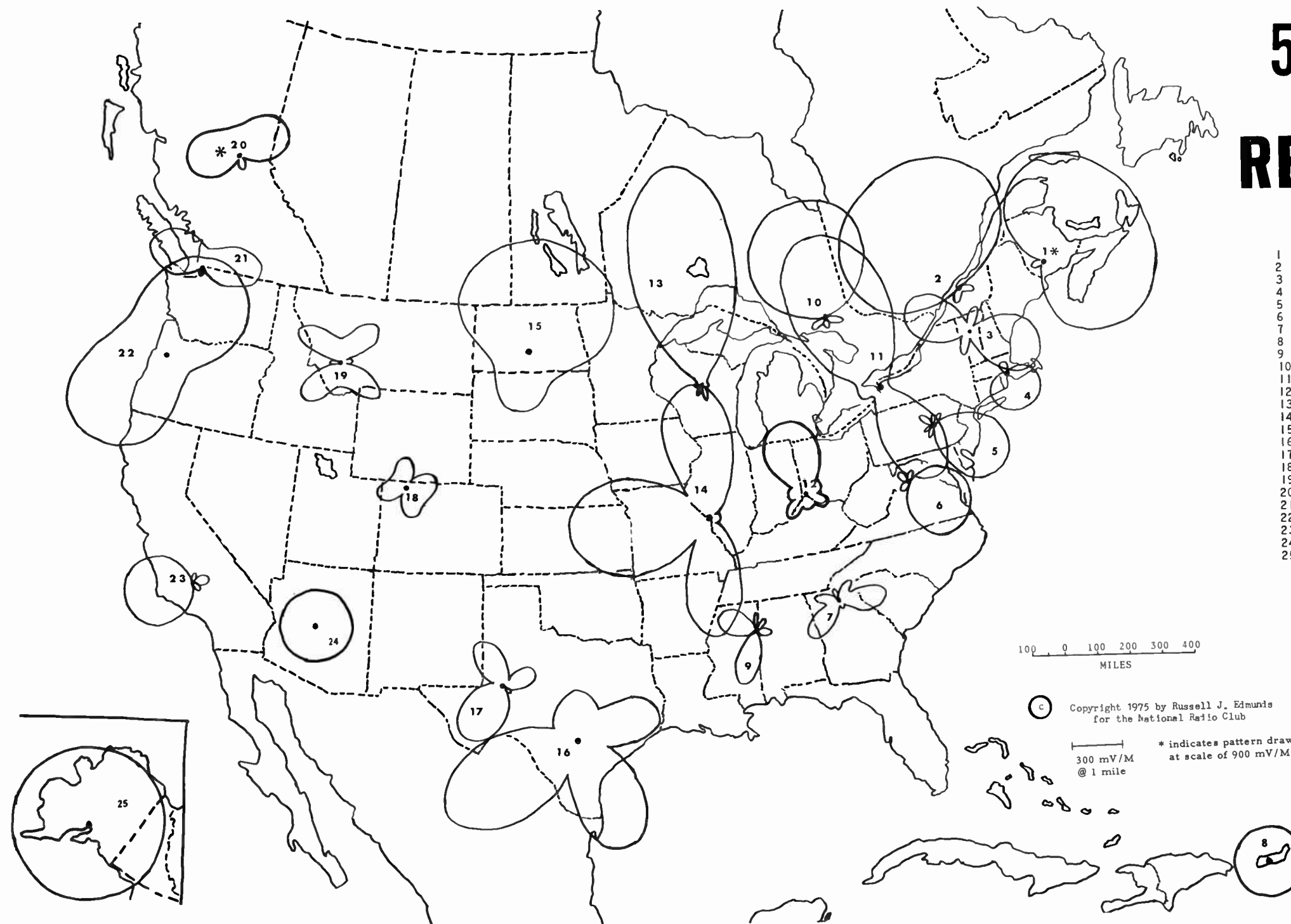
Periodic updaters for the NRC Domestic Station Log and the NRC Night-time Antenna Pattern Book are published in the pages of DX NEWS. Non-members may obtain reprints of these updaters in composite by ordering them through the NRC Reprint Service. Cost is \$1.00 for members and \$2.00 for non-members, covering all updaters from time of the most recent edition of the Log or Pattern Book to the date of the order.

# 540 KHZ CLEAR

call	class	location
1	CBT	ND GRAND FALLS
2	CBEF	DA-1 WINDSOR
3	WDAK	DA-N COLUMBUS
4	KNOE	DA-2 MONROE
5	CBK	ND WATROUS
6	XEWA	ND SAN LUIS POTOSI



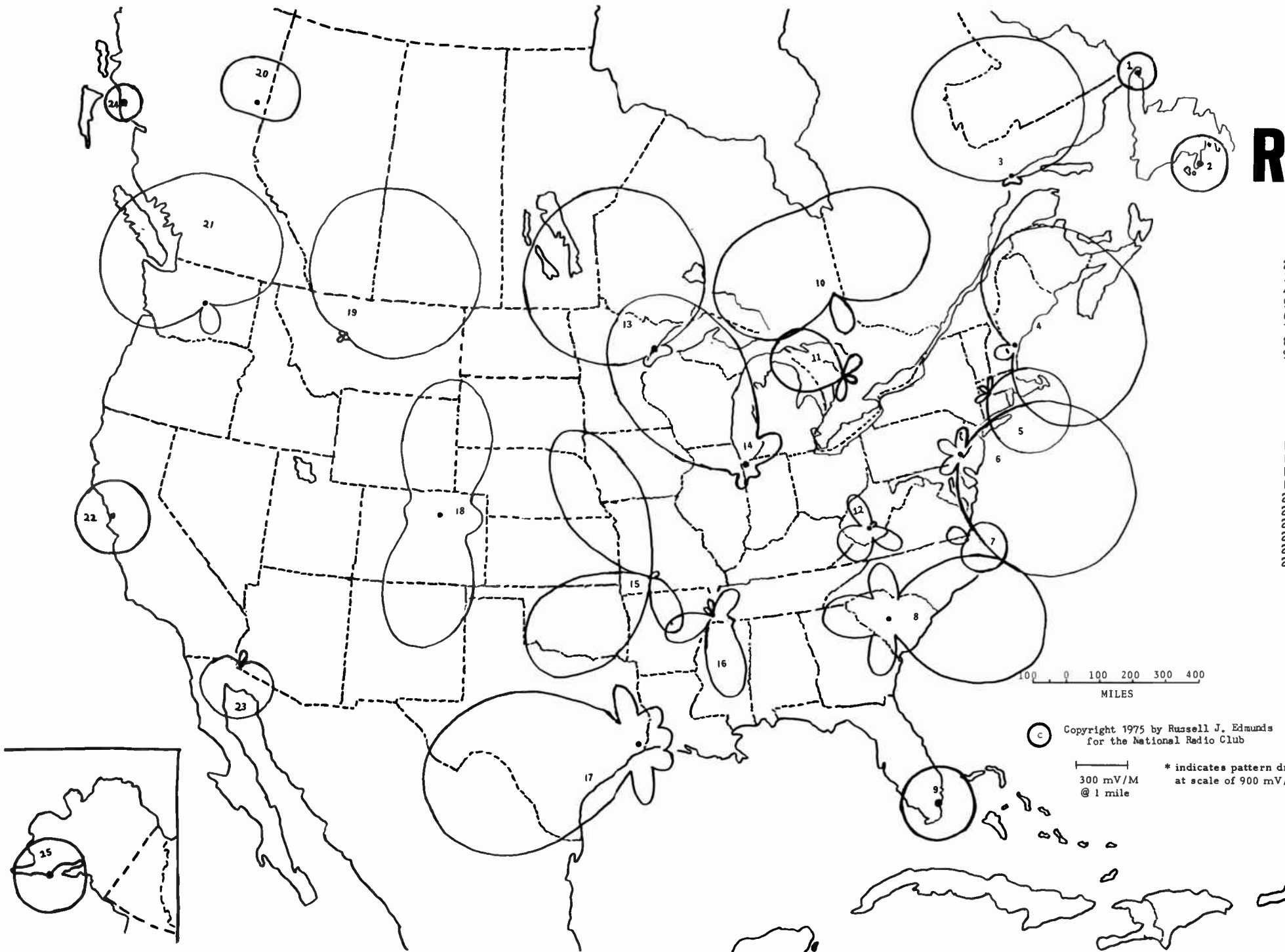
# 550 KHZ REGIONAL



call	class	location
1	CFNB	DA-2 FREDERICKTON
2	CHLN	DA-2 TROIS-RIVIERES
3	WDEV	DA-2 WATERBURY
4	WGNG	DA-N PAWTUCKET
5	WHLM	DA-2 BLOOMSBURG
6	WSVA	DA-N HARRISONBURG
7	WGGA	DA-N GAINESVILLE
8	WPAB	ND PONCE
9	WCBI	DA-2 COLUMBUS
10	CHNO	DA-2 SUDBURY
11	WGR	DA-N BUFFALO
12	WKRC	DA-2 CINCINNATI
13	WSAU	DA-2 WAUSAU
14	KSD	DA-N ST. LOUIS
15	KFYR	DA-N BISMARCK
16	KTSA	DA-N SAN ANTONIO
17	KCRS	DA-2 MIDLAND
18	KRAI	DA-N CRAIG
19	KBOW	DA-N BUTTE
20	CKPG	DA-N PRINCE GEORGE
21	KAR1	DA-2 BLAINE
22	KOAC	DA-2 CORVALLIS
23	KAFY	DA-N BAKERSFIELD
24	KOY	ND PHOENIX
25	KENI	ND ANCHORAGE

# 560 KHZ REGIONAL

call	class	location
1	C	ND ST. ANTHONY
2	CHCM	ND MARYSTOWN
3	CKCN	DA-2 SEPT-ILES
4	WGAN	DA-1 PORTLAND
5	WHYN	DA-1 SPRINGFIELD
6	WFIL	DA-2 PHILADELPHIA
7	WGAI	DA-2 ELIZABETH CITY
8	WIS	DA-N COLUMBIA
9	WQAM	ND MIAMI
10	CJKL	DA-N KIRKLAND LAKE
11	CFOS	DA-2 OWENS SOUND
12	WJLS	DA-N BECKLEY
13	WEBC	DA-2 DULUTH
14	WIND	DA-2 CHICAGO
15	KWTO	DA-N SPRINGFIELD
16	WHBO	DA-2 MEMPHIS
17	KLVI	DA-N BEAUMONT
18	KLZ	DA-1 DENVER
19	KMON	DA-N GREAT FALLS
20	CKNL	DA-N FORT ST. JOHN
21	KPO	DA-N WENATCHEE
22	KSFO	ND SAN FRANCISCO
23	KBLU	DA-N YUMA
24	CHTK	ND PRINCE RUPERT
25	KVOK	ND KODIAK

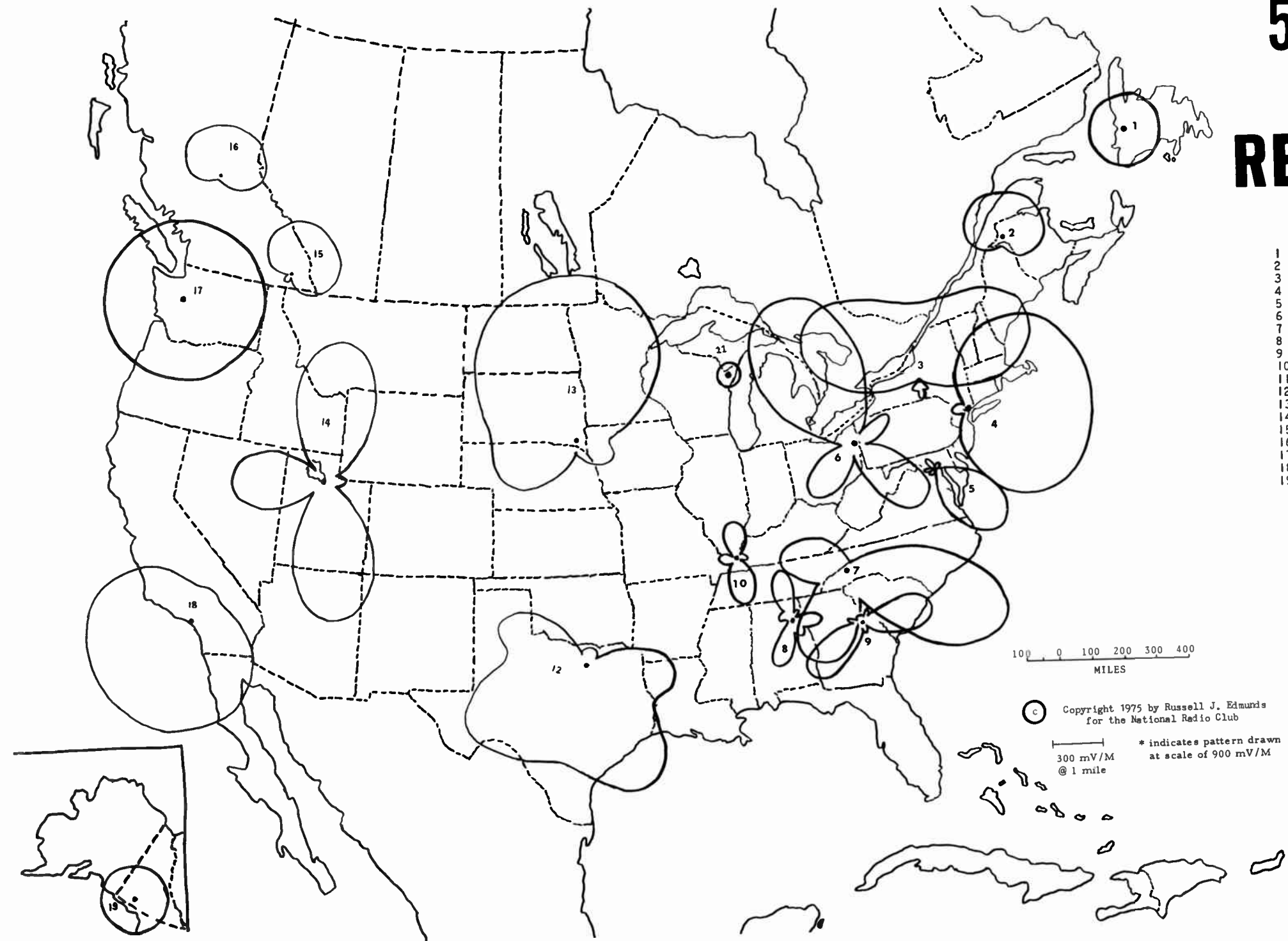




# 570 KHZ

## REGIONAL

call	class	location
1	CFCB	ND CORNER BROOK
2	CJEM	DA-N EDMUNDSTON
3	WSYR	DA-2 SYRACUSE
4	WMCA	DA-1 NEW YORK
5	WGMS	DA-2 BETHESDA
6	WKBN	DA-N YOUNGSTOWN
7	WWNC	DA-N ASHEVILLE
8	WAAX	DA-N GADSDEN
9	WACL	DA-N WAYCROSS
10	WKYX	DA-2 PADUCAH
11	WMAM	ND MARINETTE
12	WFAA	DA-2 DALLAS
13	WNAX	DA-N YANKTON
14	KLUB	DA-1 SALT LAKE CITY
15	CKEK	DA-1 CRANBROOK
16	CKCO	DA-2 QUESNEL
17	KVI	ND SEATTLE
18	KLAC	DA-N LOS ANGELES
19	CFWH	ND WHITEHORSE



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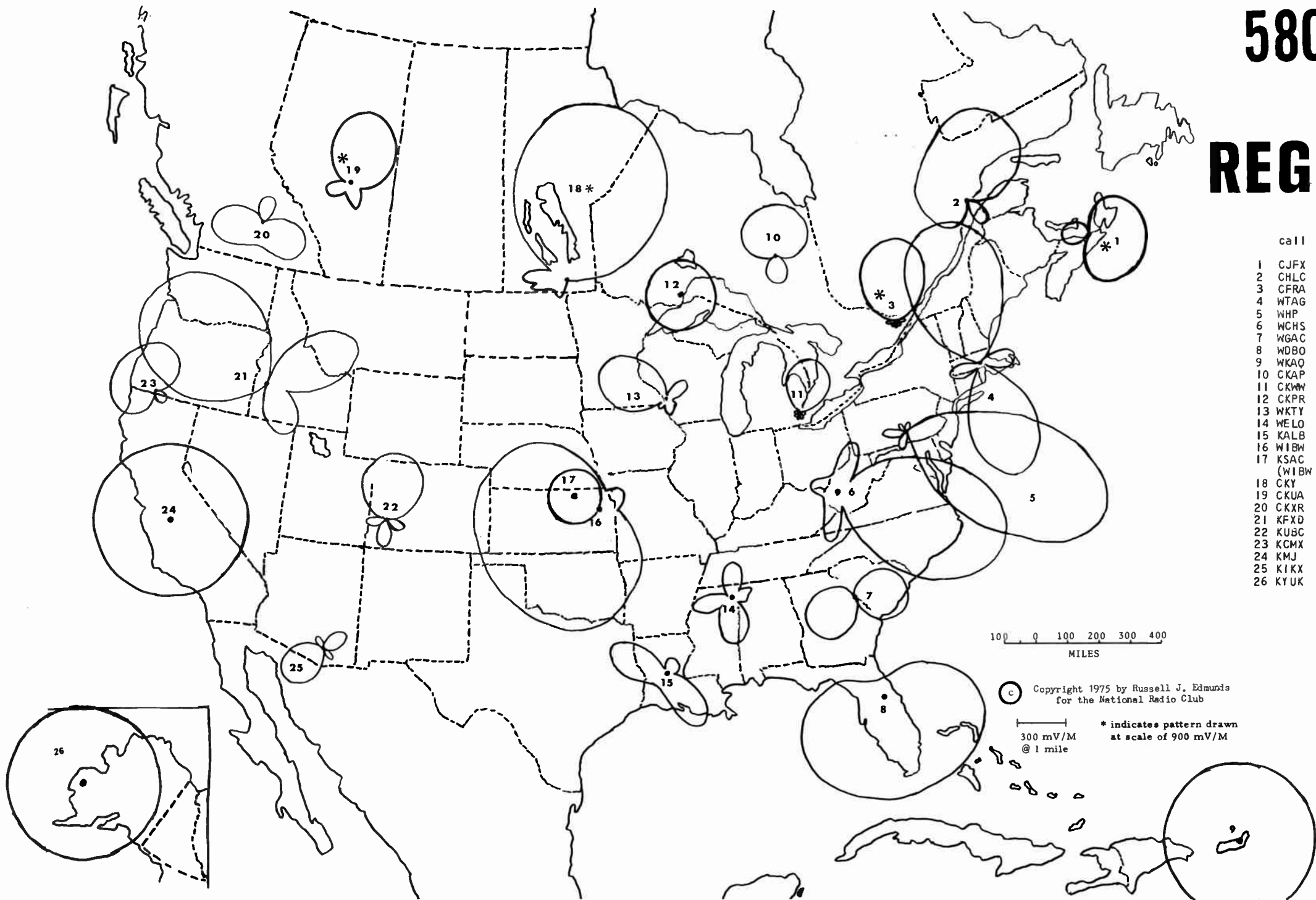
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300 mV/M @ 1 mile \* indicates pattern drawn at scale of 900 mV/M

# 580 KHZ

## REGIONAL

call	class	location
1	CJFX	DA-1 ANTIGONISH
2	CHLC	DA-2 HAUTERIVE
3	CFRA	DA-N OTTAWA
4	WTAG	DA-2 WORCESTER
5	WHP	DA-N HARRISBURG
6	WGHS	DA-N CHARLESTON
7	WGAC	DA-N AUGUSTA
8	WDBO	DA-N ORLANDO
9	WKAQ	ND SAN JUAN
10	CKAP	DA-N KAPUSKASING
11	CKWV	DA-1 WINDSOR
12	CKPR	ND THUNDER BAY
13	WKTY	DA-2 LA CROSSE
14	WELO	DA-2 TUPELO
15	KALB	DA-N ALEXANDRIA
16	WIBW	DA-N TOPEKA
17	KSAC	ND MANHATTEN
(WIBW & KSAC SHARE TIME)		
18	CKY	DA-2 WINNIPEG
19	CKUA	DA-2 EDMONTON
20	CKXR	DA-2 SALMON ARM
21	KFXD	DA-N NAMPA
22	KUBC	DA-N MONTROSE
23	KCMX	DA-2 ASHLAND
24	KMJ	ND FRESNO
25	KIKX	DA-N TUCSON
26	KYUK	ND BETHEL



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300 mV/M  
@ 1 mile

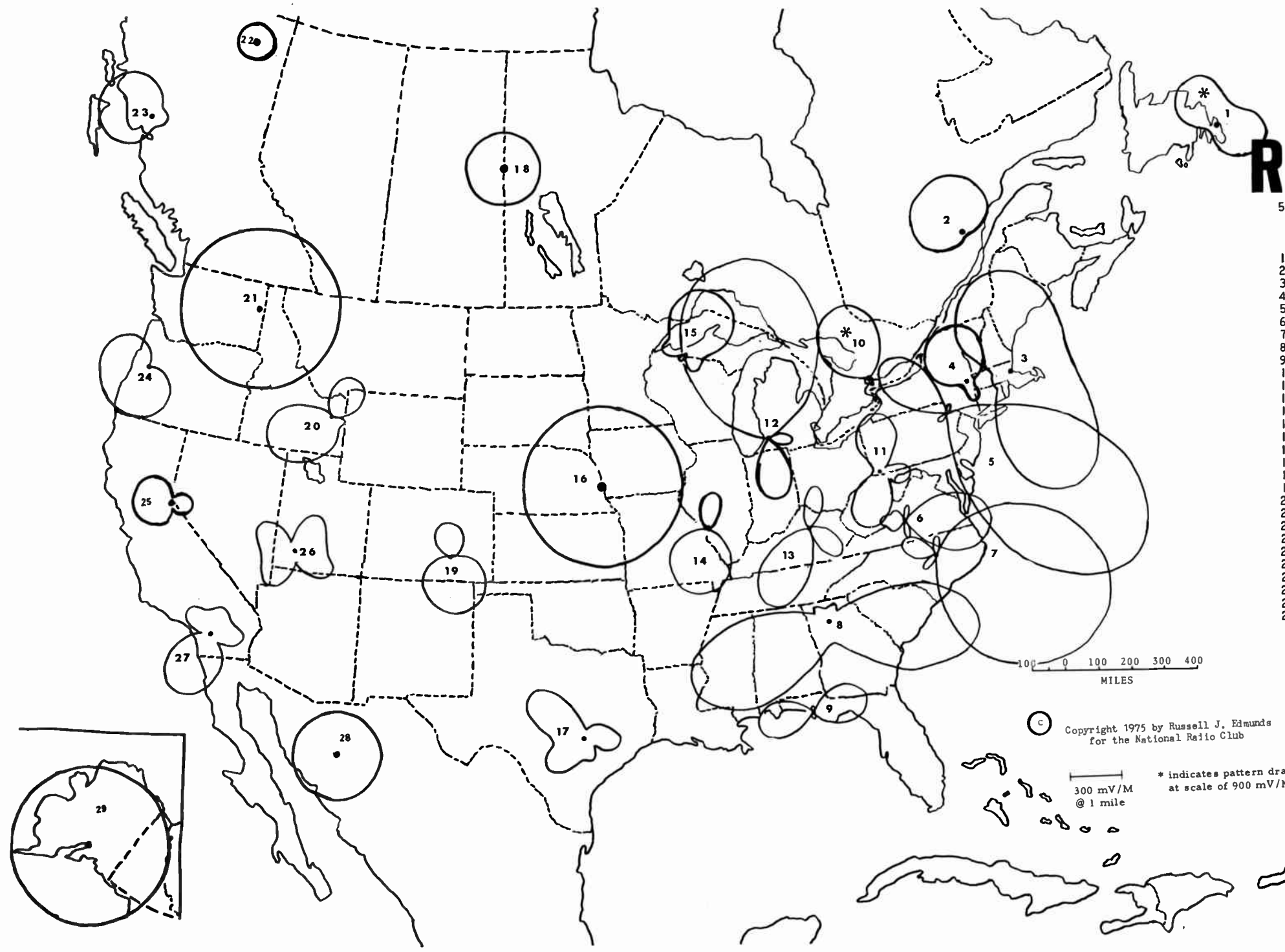
\* indicates pattern drawn  
at scale of 900 mV/M

# 590 KHZ

# REGIONAL

590

call	class	location
1	VOCM	DA-N ST. JUHNS
2	CKRS	DA-1 JUNQUIERE
3	WEEI	DA-1 BOSTON
4	WROW	DA-2 ALBANY
5	WARM	DA-2 SCRANTON
6	WLVA	DA-2 LYNCHBURG
7	WGTM	DA-2 WILSON
8	WPLO	DA-N ATLANTA
9	WDLP	DA-N PANAMA CITY
10	CKEY	DA-2 TORONTO
11	WMBS	DA-N UNIONTOWN
12	WKZO	DA-N KALAMAZOO
13	WVLK	DA-2 LEXINGTON
14	WRTH	DA-2 WOOD RIVER
15	WJMS	DA-N IRONWOOD
16	WOW	ND OMAHA
17	KLBJ	DA-N AUSTIN
18	CFAR	ND FLIN FLON
19	KCSJ	DA-2 PUEBLO
20	KID	DA-N IDAHO FALLS
21	KHQ	ND SPOKANE
22	CFNL	ND FORT NELSON
23	CFTK	DA-1 TERRACE
24	KUGN	DA-N EUGENE
25	KTHU	DA-N S. LAKE TAHOE
26	KSUB	DA-N CEDAR CITY
27	KFXM	DA-2 SAN BERNARDINO
28	XEHQ	ND HERMOSILLO
29	KHAR	ND ANCHORAGE

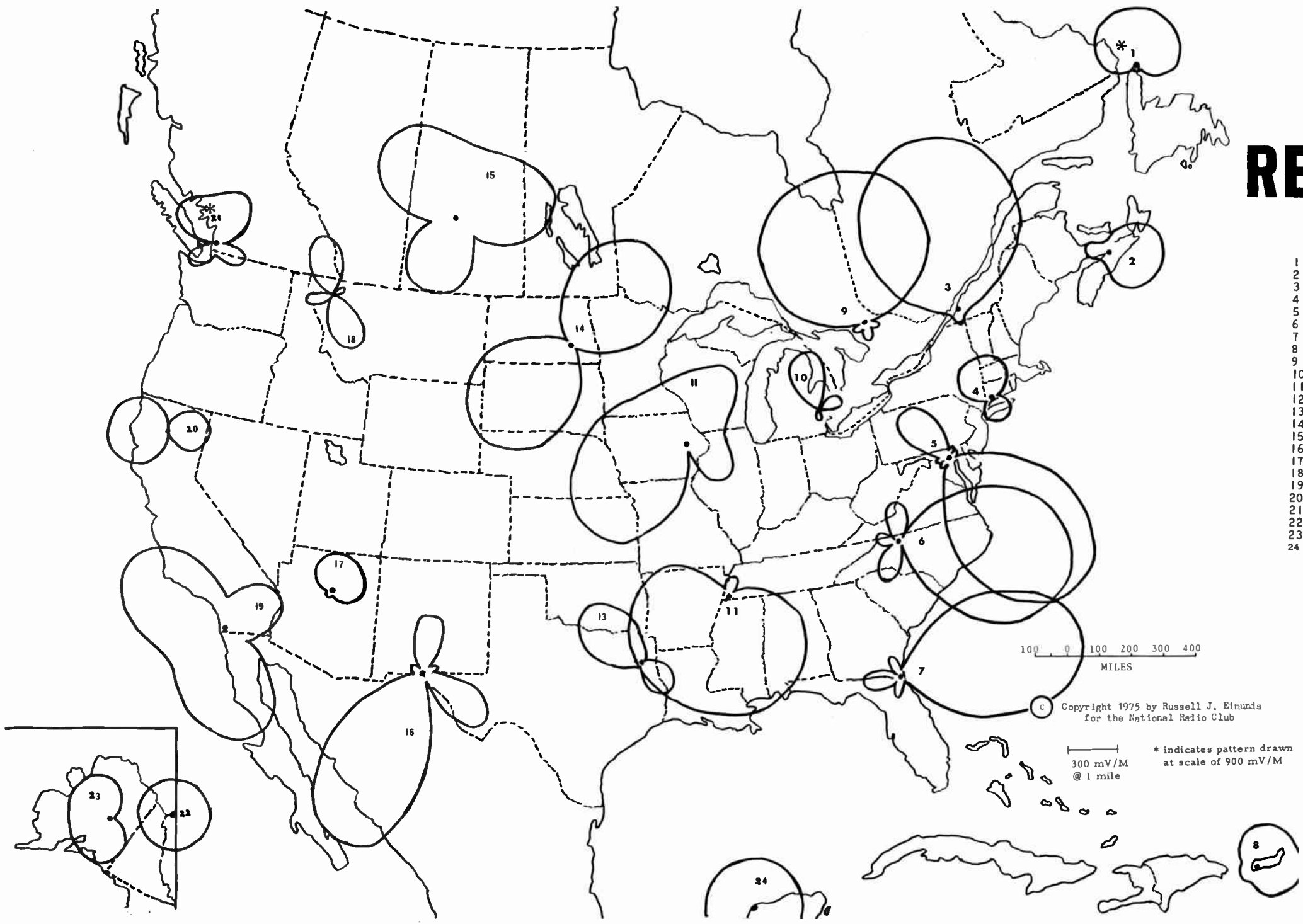


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300 mV/M  
@ 1 mile  
\* indicates pattern drawn  
at scale of 900 mV/M

# 600 KHZ REGIONAL



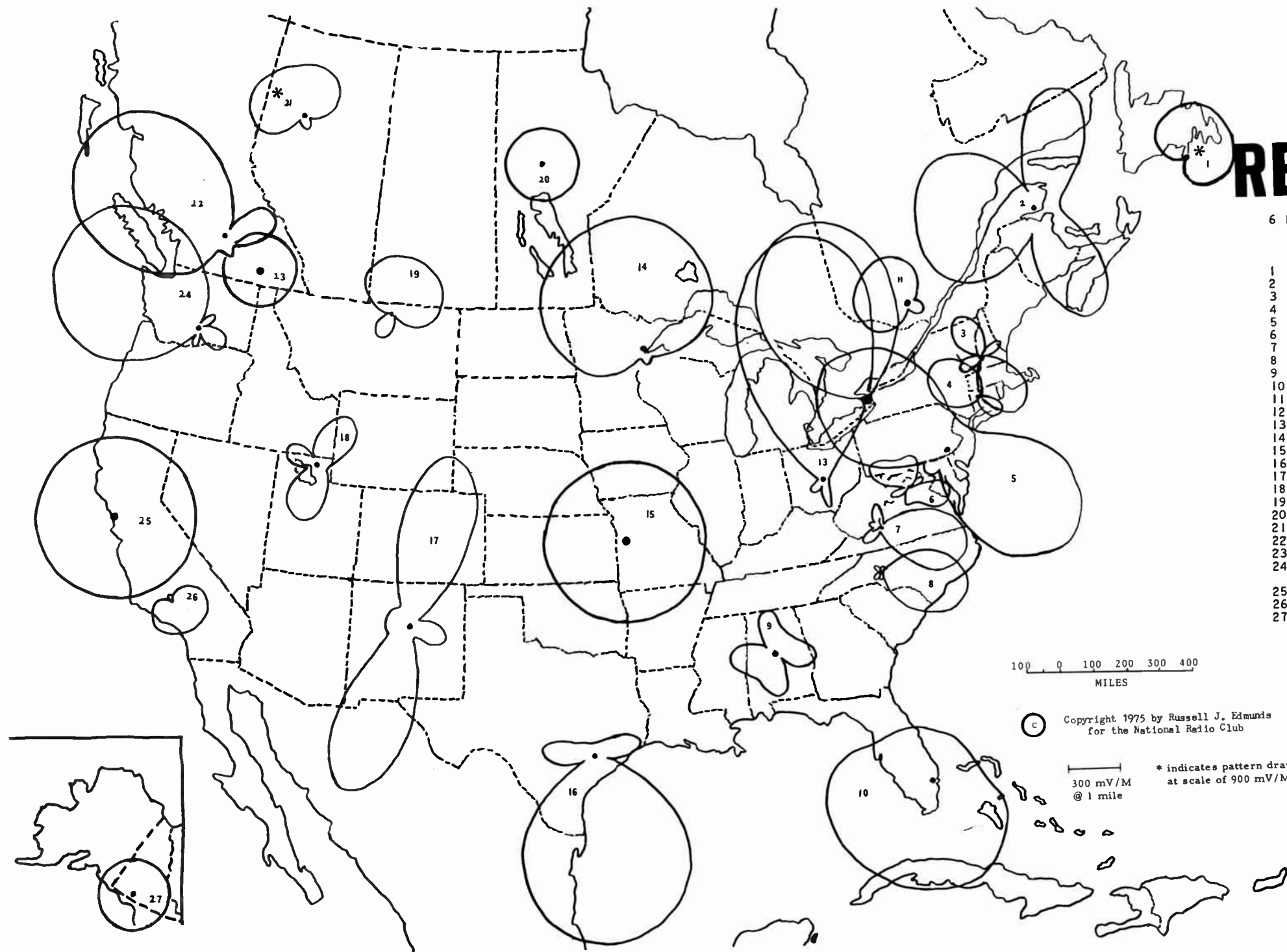
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2 CKCL	DA-1	TRURO
3 CFCF	DA-1	MONTREAL
4 WICC	DA-2	BRIDGEPORT
5 WCAO	DA-1	BALTIMORE
6 WSJS	DA-2	WINSTON-SALEM
7 WMBR	DA-N	JACKSONVILLE
8 WAEL	DA-1	MAYAGUEZ
9 CFCH	DA-2	NORTH BAY
10 WTAC	DA-2	FLINT
11 WREC	DA-2	MEMPHIS
12 WMT	DA-N	CEDAR RAPIDS
13 KTBB	DA-N	TYLER
14 KSJB	DA-1	JAMESTOWN
15 CFQC	DA-N	SASKATOON
16 KR0D	DA-N	EL PASO
17 KCLS	DA-N	FLAGSTAFF
18 KGEZ	DA-2	KALISPELL
19 KOGO	DA-1	SAN DIEGO
20 KVCV	DA-1	REDDING
21 CJOR	DA-1	VANCOUVER
22 C	ND	TUKTOYAKTUK
23 KTNC	DA-N	NORTH POLE
24 XEZ	ND	MERIDA

# 610 KHZ

# REGIONAL

610 khz

call	class	location
1	CJOX	DA-2 GRAND BANK
2	CHNC	DA-1 NEW CARLISLE
3	WGIR	DA-2 MANCHESTER
4	WSNG	DA-2 TORRINGTON
5	WIP	DA-2 PHILADELPHIA
6	WHPL	DA-2 WINCHESTER
7	WSLS	DA-2 ROANOKE
8	WAYS	DA-2 CHARLOTTE
9	WSGN	DA-N BIRMINGHAM
10	WIOD	DA-2 MIAMI
11	CKML	DA-N MONT LAURIER
12	CKTB	DA-1 STE. CATHERINES
13	WTVN	DA-N COLUMBUS
14	KDAL	DA-N DULUTH
15	WDAF	ND KANSAS CITY
16	KILT	DA-2 HOUSTON
17	KRKE	DA-N ALBUQUERQUE
18	KVNU	DA-N LOGAN
19	KOJM	DA-2 HAVRE
20	CHTM	ND THOMPSON
21	CKYL	DA-N PEACE RIVER
22	CHNL	DA-N KAMLOOPS
23	CJAT	ND TRAIL
24	KONA	DA-2 KENNEWICK/ RICHLAND/PASCO
25	KFRC	ND SAN FRANCISCO
26	KAVL	DA-2 LANCASTER
27	CKRW	ND WHITEHORSE



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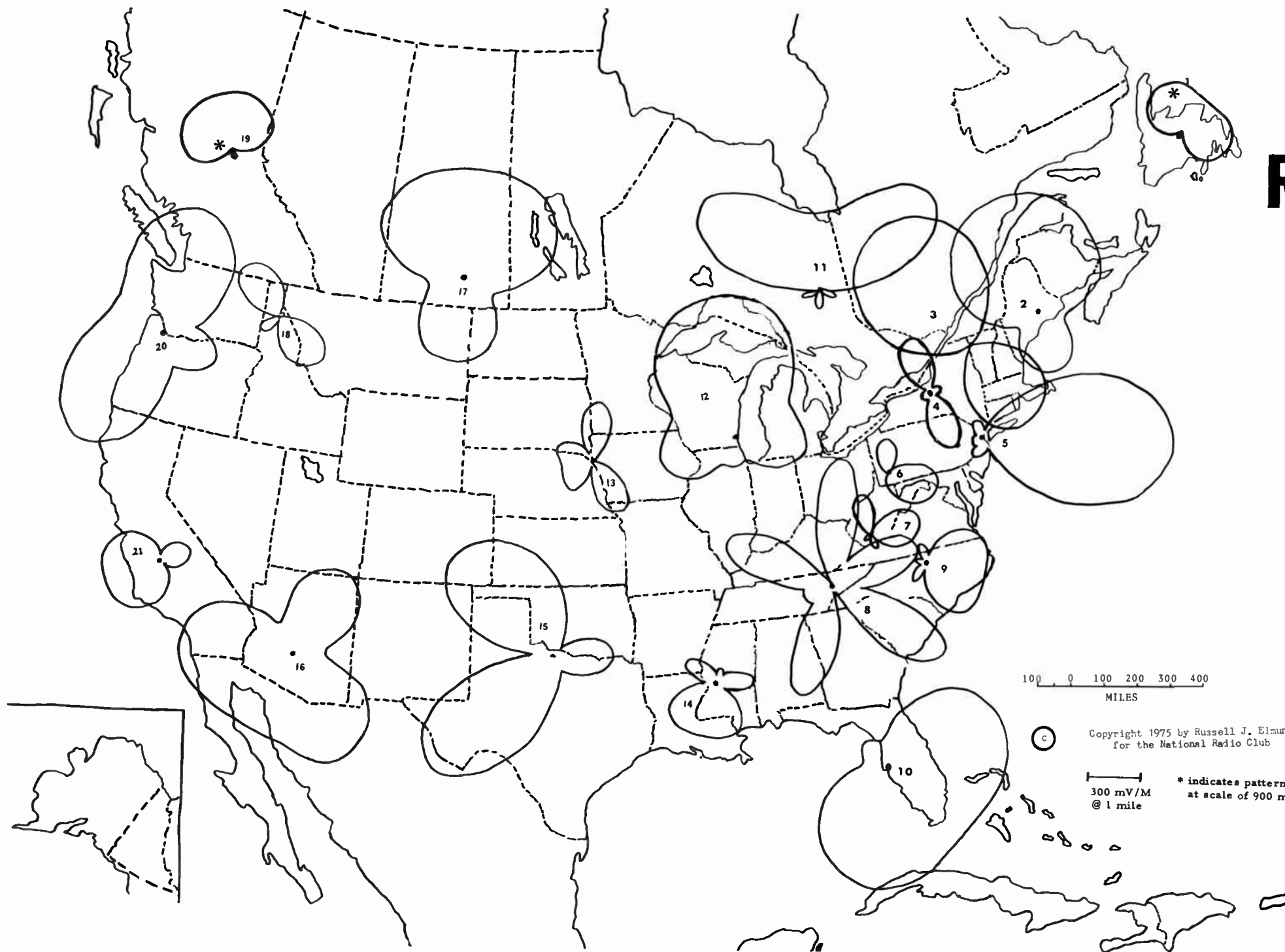
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300 mV/M  
@ 1 mile

\* indicates pattern drawn  
at scale of 900 mV/M

# 620 KHZ

## REGIONAL



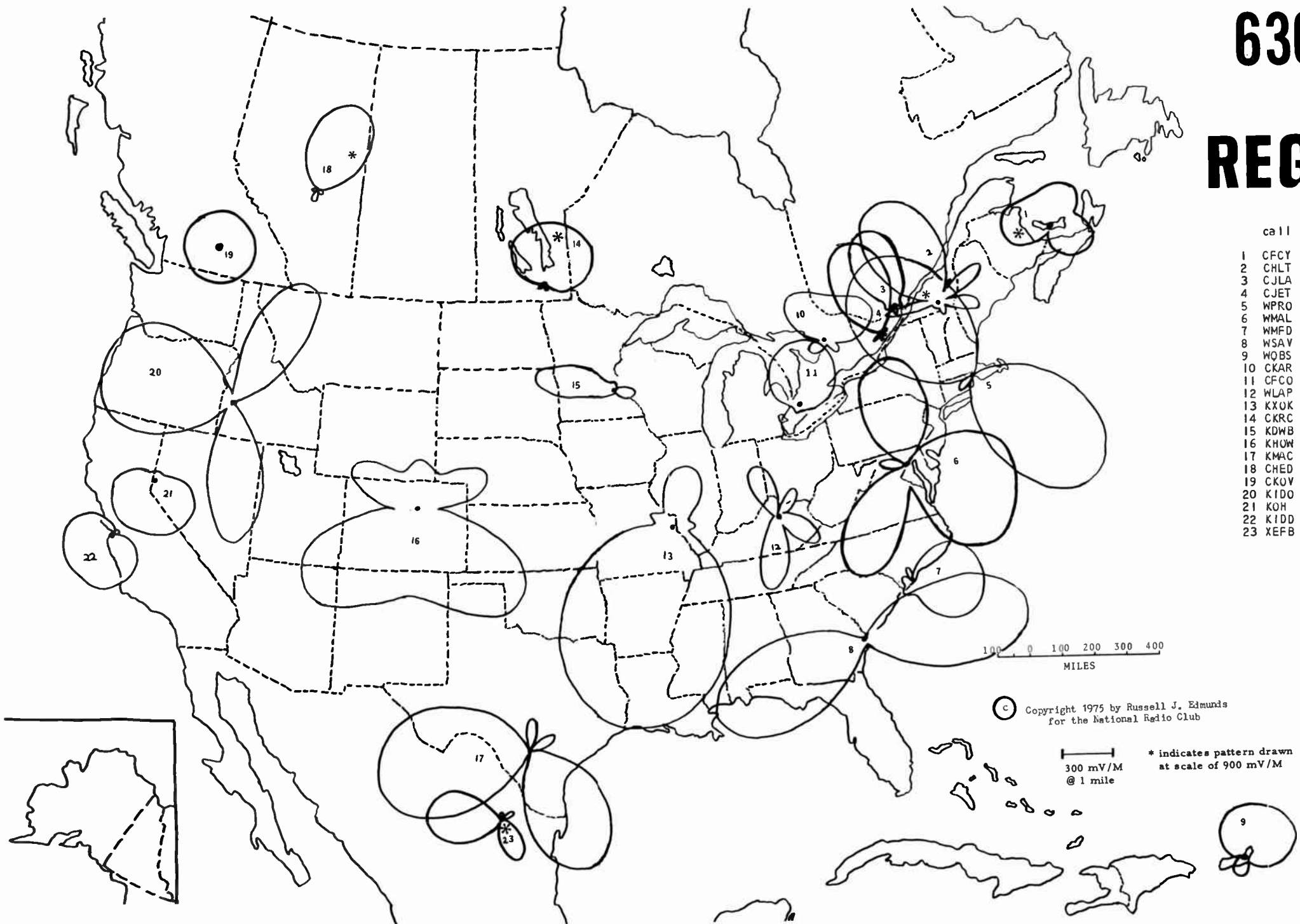
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1	DA-1	GRAND FALLS
2	DA-N	BANGOR
3	DA-2	BURLINGTON
4	DA-N	SYRACUSE
5	DA-2	NEWARK
6	DA-2	GREENSBURG
7	DA-N	BECKLEY
8	DA-2	KNOXVILLE
9	DA-2	DURHAM
10	DA-N	ST. PETERSBURG
11	DA-2	TIMMINS
12	DA-2	MILWAUKEE
13	DA-2	SIoux CITY
14	DA-N	JACKSON
15	DA-N	WICHITA FALLS
16	DA-N	PHOENIX
17	DA-N	REGINA
18	DA-N	WALLACE
19	DA-N	PRINCE GEORGE
20	DA-1	PORTLAND
21	DA-N	HANFORD

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300 mV/M @ 1 mile \* indicates pattern drawn at scale of 900 mV/M

# 630 KHZ REGIONAL



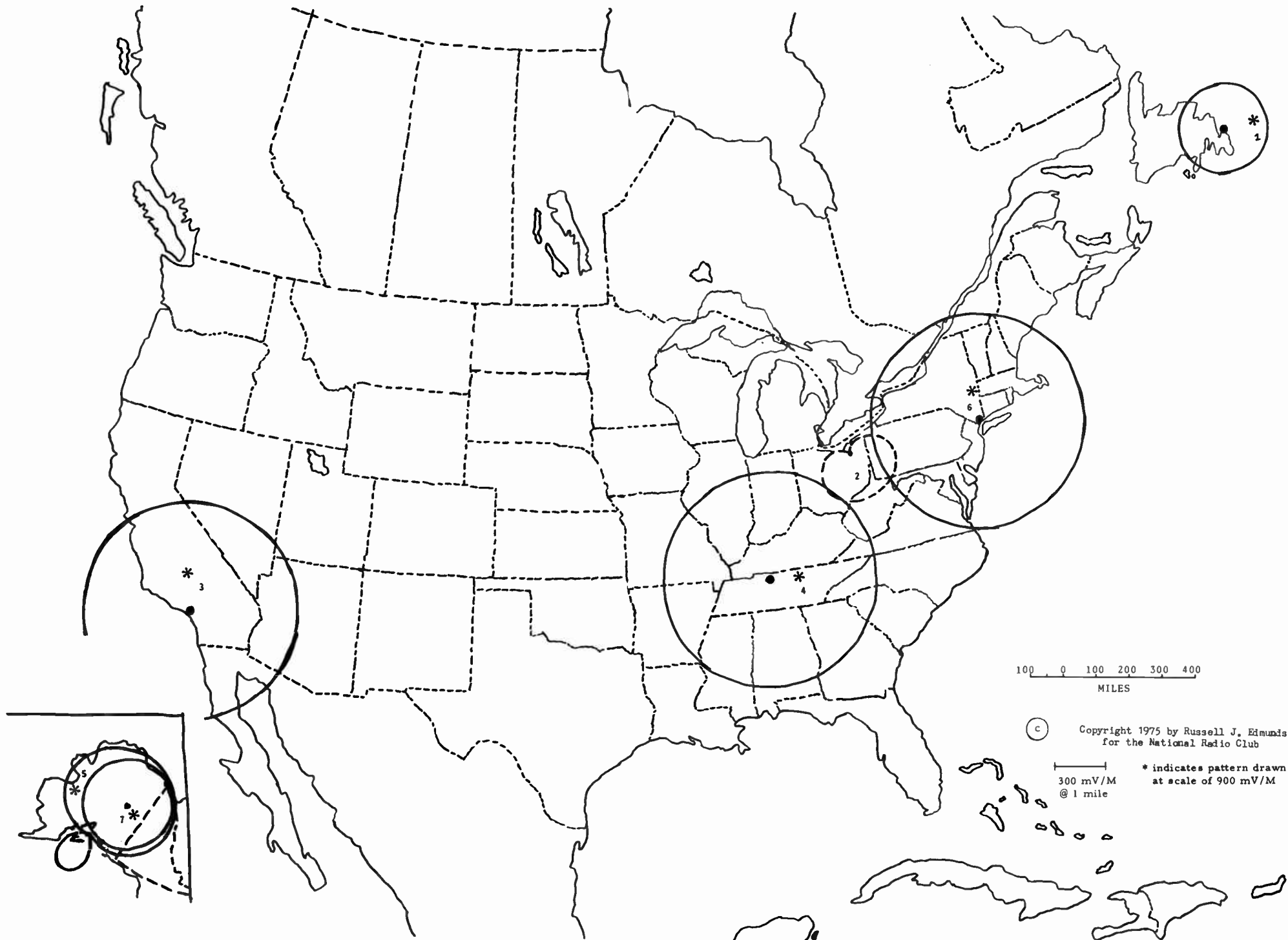
call	class	location
1	CFCY	DA-2 CHARLOTTETOWN
2	CHLT	DA-2 SHERBROUKE
3	CJLA	DA-2 LACHUTE
4	CJET	DA-2 SMITH FALLS
5	WPRO	DA-N PROVIDENCE
6	WMAL	DA-2 WASHINGTON
7	WMFD	DA-2 WILMINGTON
8	WSAV	DA-N SAVANNAH
9	WQBS	DA-N SAN JUAN
10	CKAR	DA-N HUNTSVILLE
11	CFCO	DA-2 CHATHAM
12	WLAP	DA-1 LEXINGTON
13	KXOK	DA-2 ST. LOUIS
14	CKRC	DA-2 WINNIPEG
15	KDWB	DA-2 ST. PAUL
16	KHOW	DA-N DENVER
17	KMAC	DA-2 SAN ANTONIO
18	CHED	DA-2 EDMONTON
19	CKOV	ND KELOWNA
20	KIDO	DA-2 BOISE
21	KOH	DA-N RENO
22	KIDD	DA-2 MONTEREY
23	XEFB	DA-2 MONTEREY

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300 mV/M @ 1 mile \* indicates pattern drawn at scale of 900 mV/M

# 640 650 KHZ 660 CLEAR



call	class	location
640		
1 CBN	ND	ST. JOHN'S
2 WHLO	DA-1	AKRON (L)
3 KF1	ND	LOS ANGELES
650		
4 WSM	ND	NASHVILLE
5 KYAK	DA-2	ANCHORAGE
660		
6 WNBC	ND	NEW YORK
7 KFAR	ND	FAIRBANKS

100 0 100 200 300 400  
MILES

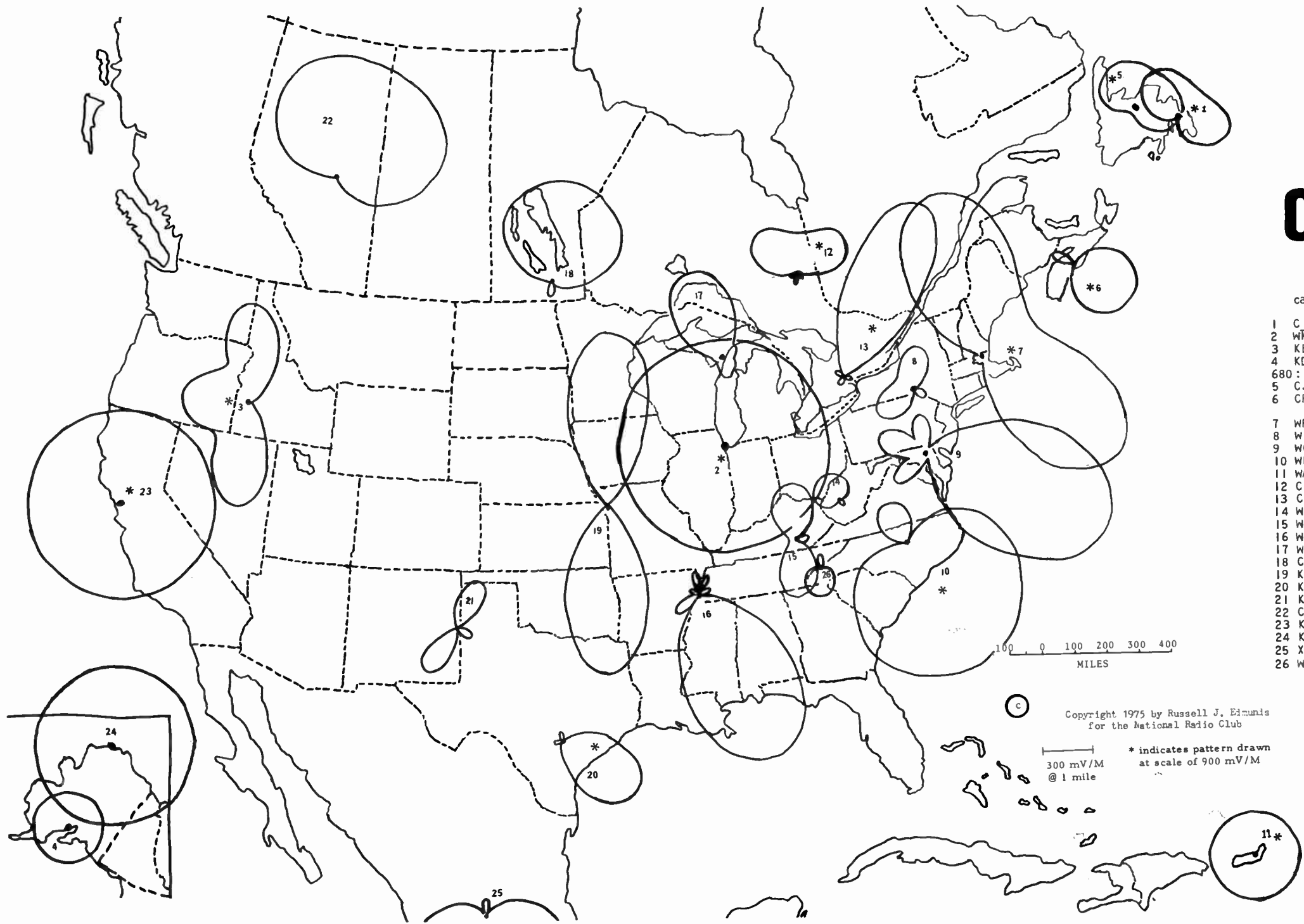
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300 mV/M @ 1 mile \* indicates pattern drawn at scale of 900 mV/M



# 670 680 KHZ

# CLEAR



call	class	location
1	C	DA-2 MUSGRAVETON
2	WMAO	ND CHICAGO
3	KBOI	DA-N BOISE
4	KDLG	ND DILLINGHAM
680:		
5	CJCN	DA-2 GRAND FALLS
6	CFDR	DA-2 DARTMOUTH (po 790)
7	WRKO	DA-2 BOSTON
8	WINR	DA-2 BINGHAMTON
9	WCBM	DA-2 BALTIMORE
10	WPTF	DA-N RALEIGH
11	WAPA	ND SAN JUAN
12	CKGB	DA-2 TIMMINS
13	CFTR	DA-2 TORONTO
14	WCAW	DA-2 CHARLESTON
15	WCTT	DA-N CORBIN
16	WMP5	DA-N MEMPHIS
17	WOBC	DA-2 ESCANABA
18	CJOB	DA-N WINNIPEG
19	KFEQ	DA-2 ST. JOSEPH
20	KKYX	DA-N SAN ANTONIO
21	KAWA	DA-1 CLOVIS
22	CHFA	DA-1 EDMONTON
23	KNBR	ND SAN FRANCISCO
24	K	ND BARROW
25	XELG	DA-N LEON
26	WMSJ	DA-N SYLVA

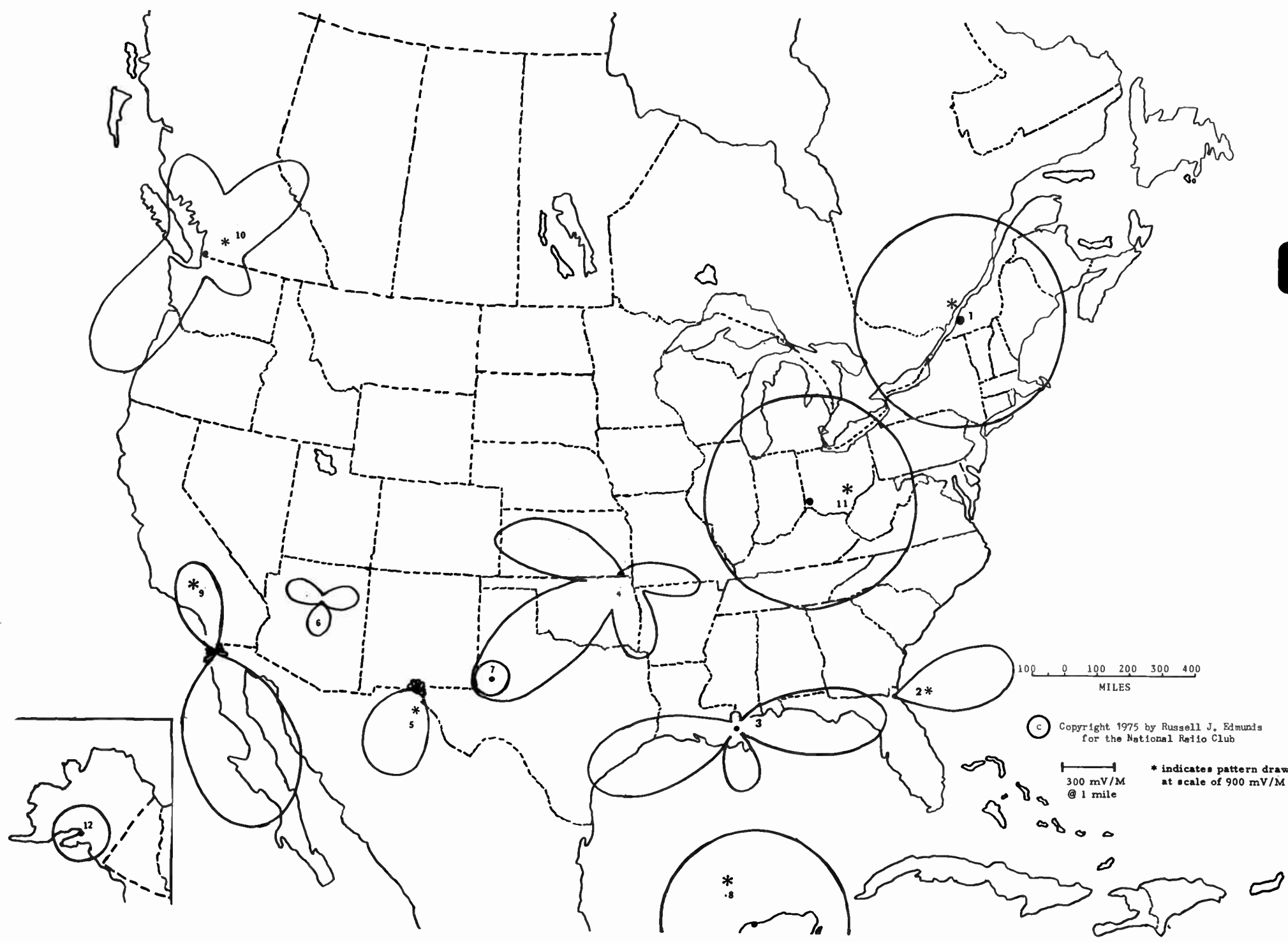
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MILES

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300 mV/M  
@ 1 mile

\* indicates pattern drawn  
at scale of 900 mV/M

# 690 700 KHZ CLEAR



call	class	location
1	ND	MONTREAL
2	DA-N	JACKSONVILLE
3	DA-2	NEW ORLEANS
4	DA-2	COFFEYVILLE
5	DA-2	EL PASO
6	DA-2	FLAGSTAFF
7	ND	LAMESA
8	ND	PROGRESO
9	DA-2	TIJUANA
10	DA-1	VANCOUVER
11	ND	CINCINNATI
12	ND	ANCHORAGE

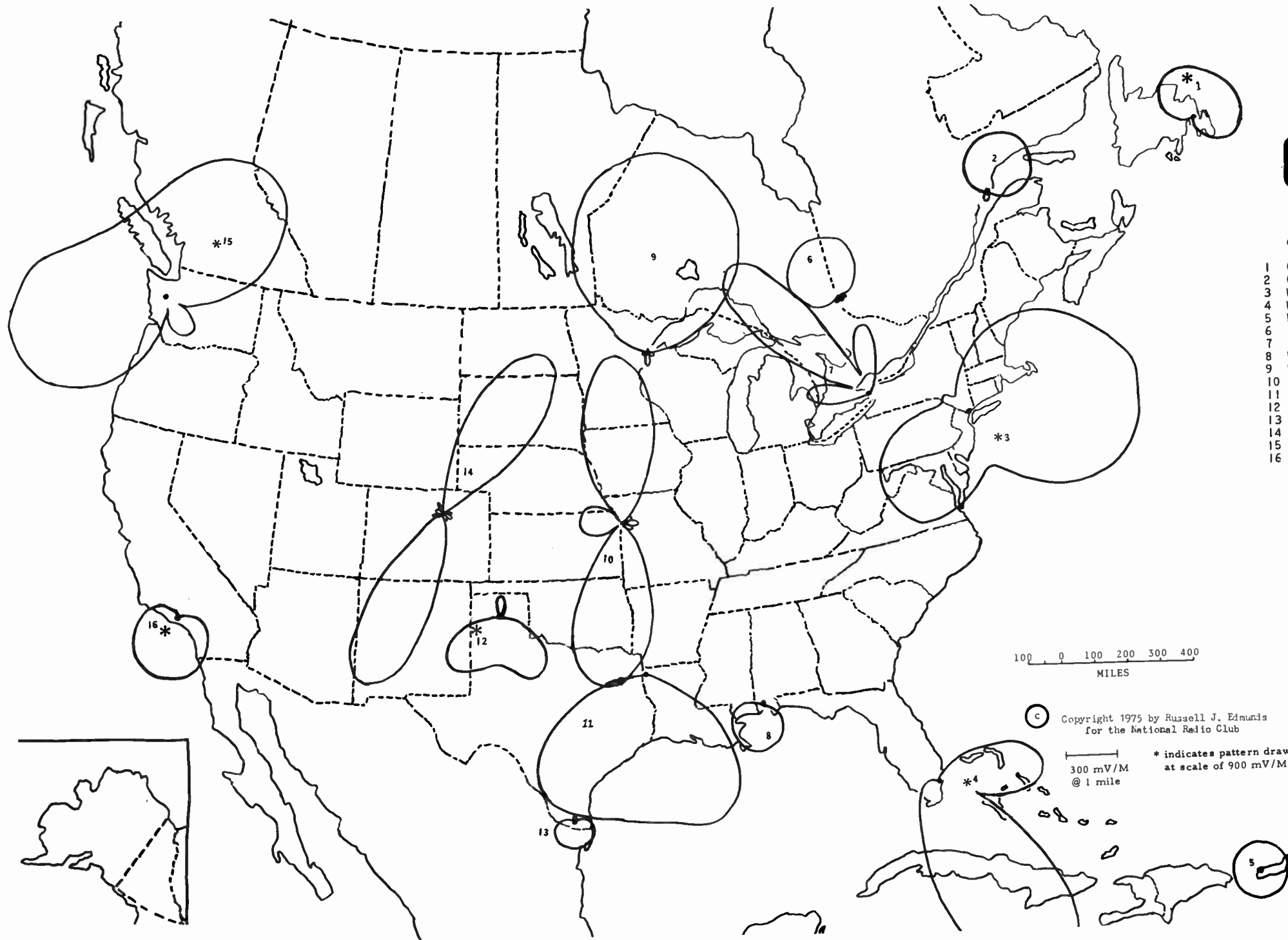
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MILES

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300 mV/M  
@ 1 mile

\* indicates pattern drawn  
at scale of 900 mV/M

# 710 KHZ CLEAR



call	class	location
1 CKVO	DA-1	CLARENVILLE
2 C	DA-1	PORT CARTIER
3 WOR	DA-1	NEW YORK
4 WGBS	DA-2	MIAMI
5 WKJB	ND	MAYAGUEZ
6 CKYM	DA-N	VILLE MARIE
7 CJRN	DA-2	NIAGARA FALLS
8 WKRG	DA-N	MOBILE
9 WDSM	DA-N	SUPERIOR
10 WHB	DA-2	KANSAS CITY
11 KEEL	DA-2	SHREVEPORT
12 KGNC	DA-2	AMARILLO
13 KURV	DA-N	EDINBURG
14 KERE	DA-1	DENVER
15 KIRO	DA-N	SEATTLE
16 KMPC	DA-N	LOS ANGELES

100 0 100 200 300 400  
MILES

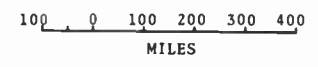
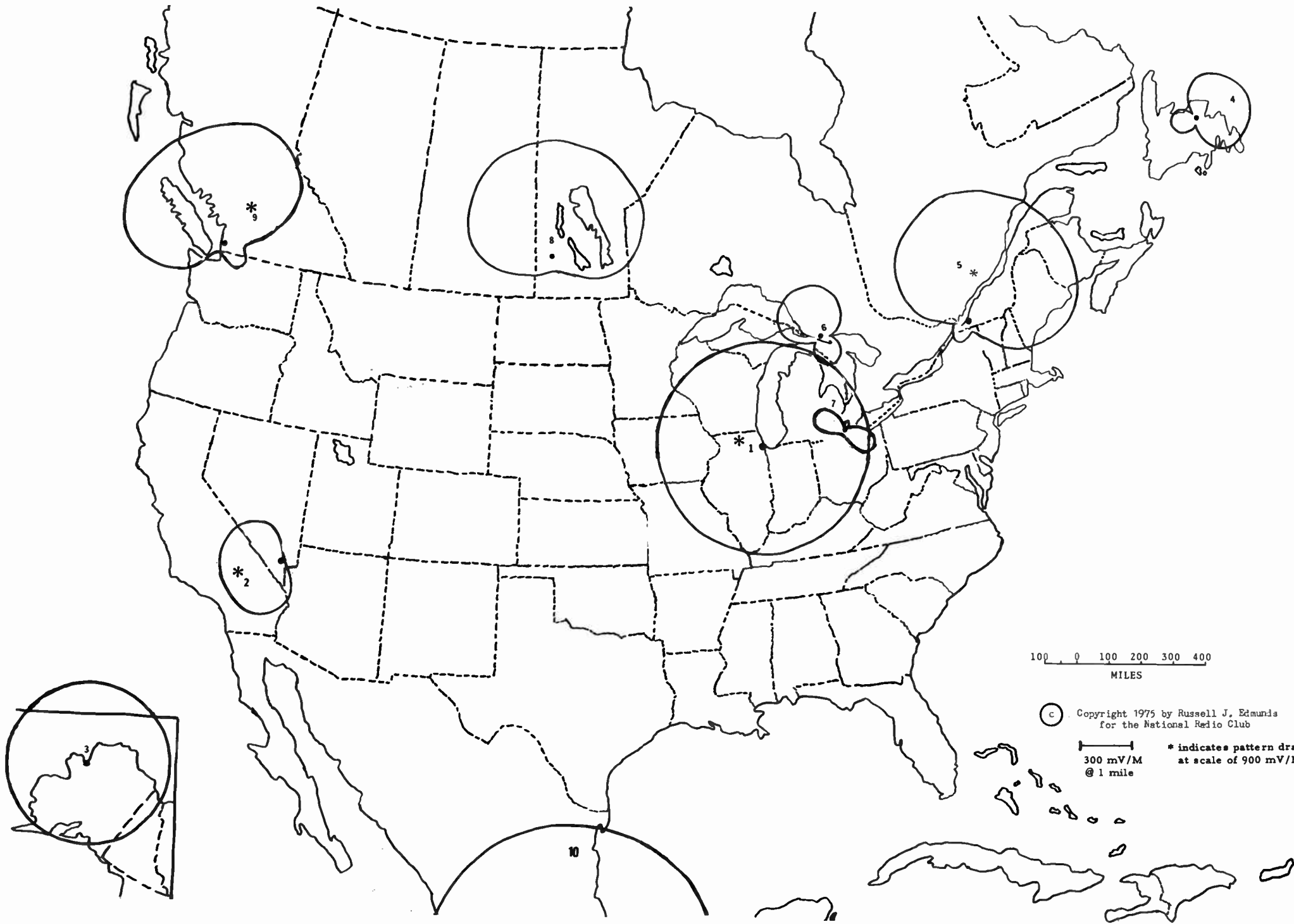
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300 mV/M @ 1 mile  
\* indicates pattern drawn at scale of 900 mV/M

**720  
730 KHZ**

**CLEAR**

call	class	location
720		
1 WGN	ND	CHICAGO
2 KDWN	DA-N	LAS VEGAS
3 KOTZ	ND	KOTZUBUE
730		
4 CKGA	DA-N	GANDER
5 CKAC	DA-1	MONTREAL
6 CJNR	DA-N	BLIND RIVER
7 CHYR-7	DA-2	LEAMINGTON *
8 CKDM	DA-N	DAUPHIN
9 CKLG	DA-2	VANCOUVER
*		night operation only on 730, day is on 710/CHYR
10 XEX	ND	MEXICO, DF



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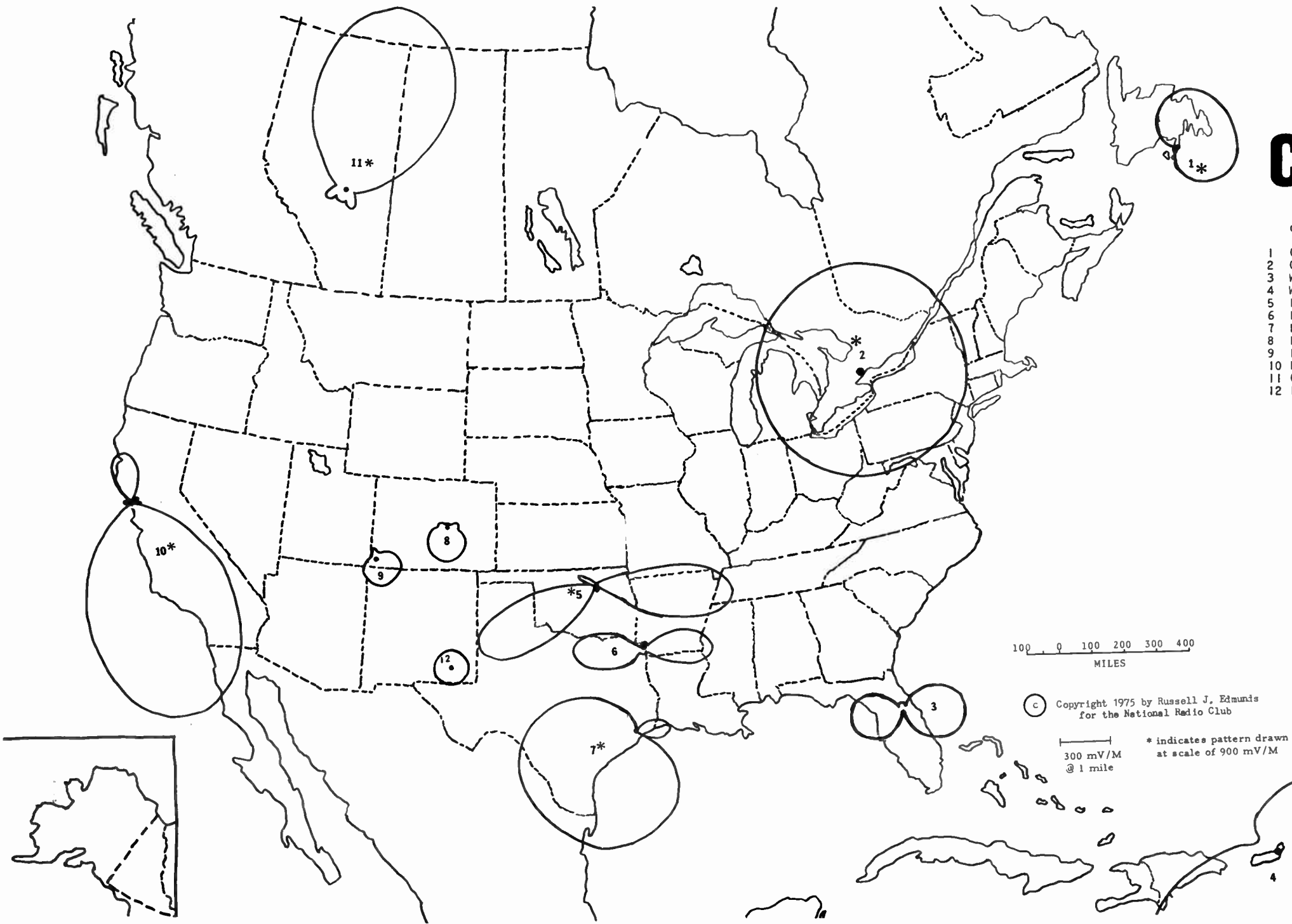
300 mV/M  
@ 1 mile

\* indicates pattern drawn  
at scale of 900 mV/M

# 740 KHZ

# CLEAR

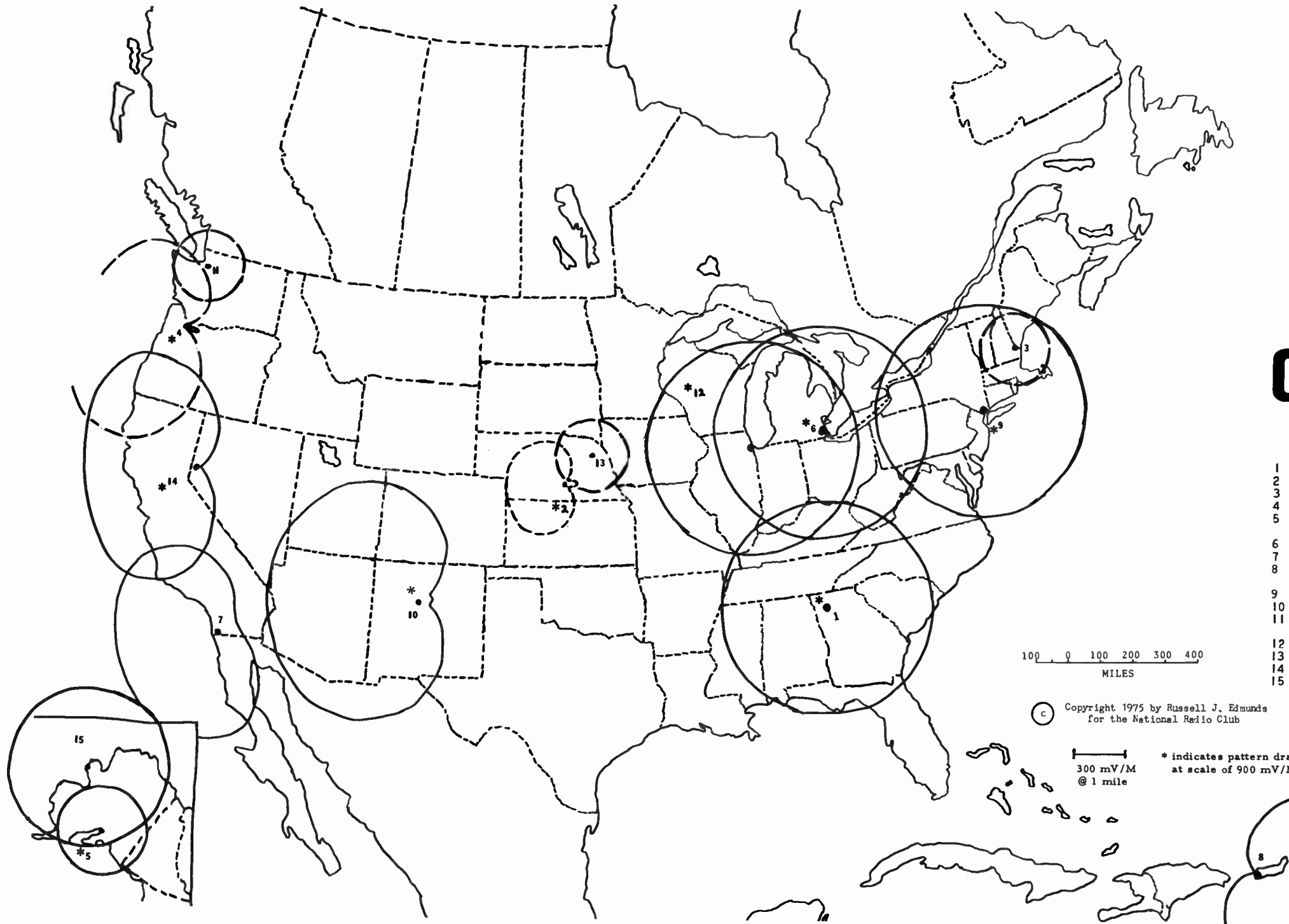
call	class	location
1	DA-N	MARYSTOWN
2	ND	TORUNTO
3	DA-N	ORLANDO
4	DA-1	SAN JUAN
5	DA-2	TULSA
6	DA-1	TEXARKANA
7	DA-2	HOUSTON
8	DA-N	COLORADO SPRINGS
9	DA-N	CORTEZ
10	DA-2	SAN FRANCISCO
11	DA-2	EDMONTON
12	ND	CARLSBAD



750  
760  
770  
780

KHZ

**CLEAR**



CALL	CLASS	LOCATION
1	WSB	ND ATLANTA
2	KMMJ	DA-1 GRAND ISLAND (L)
3	WHEB	ND PORTSMOUTH (L)
4	KXL	DA-1 PORTLAND (L)
5	KFQD	ND ANCHORAGE
6	WJR	ND DETROIT
7	KFMB	DA-N SAN DIEGO
8	WORA	DA-1 MAYAGUEZ
9	WABC	ND NEW YORK
10	KOB	DA-N ALBUQUERQUE
11	KXA	ND SEATTLE (L)
12	WBBM	ND CHICAGO
13	WJAG	ND NORFOLK (L)
14	KCRL	DA-N RENO
15	KNOM	ND NOME

100 0 100 200 300 400  
MILES

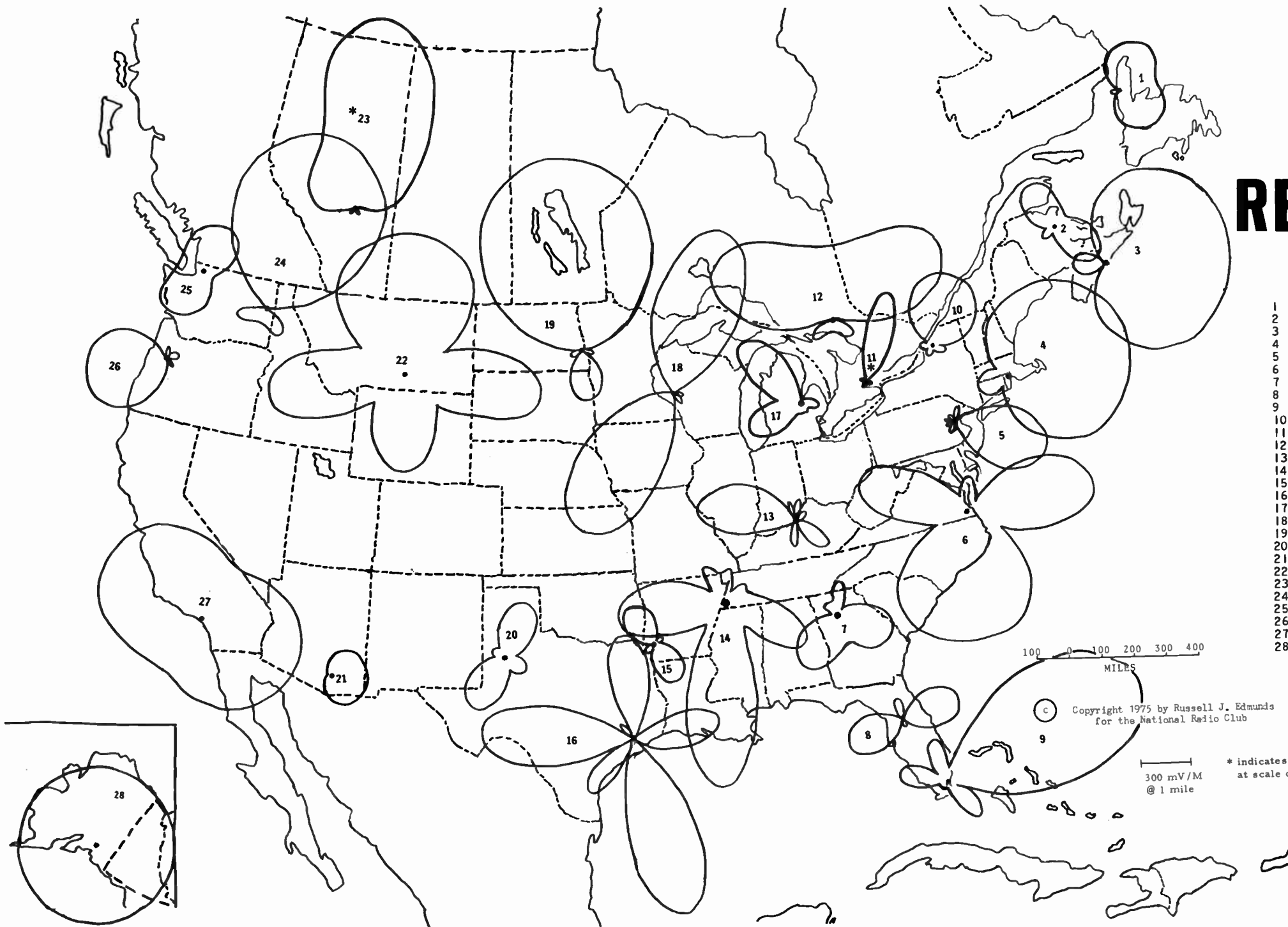
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300 mV/M  
@ 1 mile

\* indicates pattern drawn  
at scale of 900 mV/M

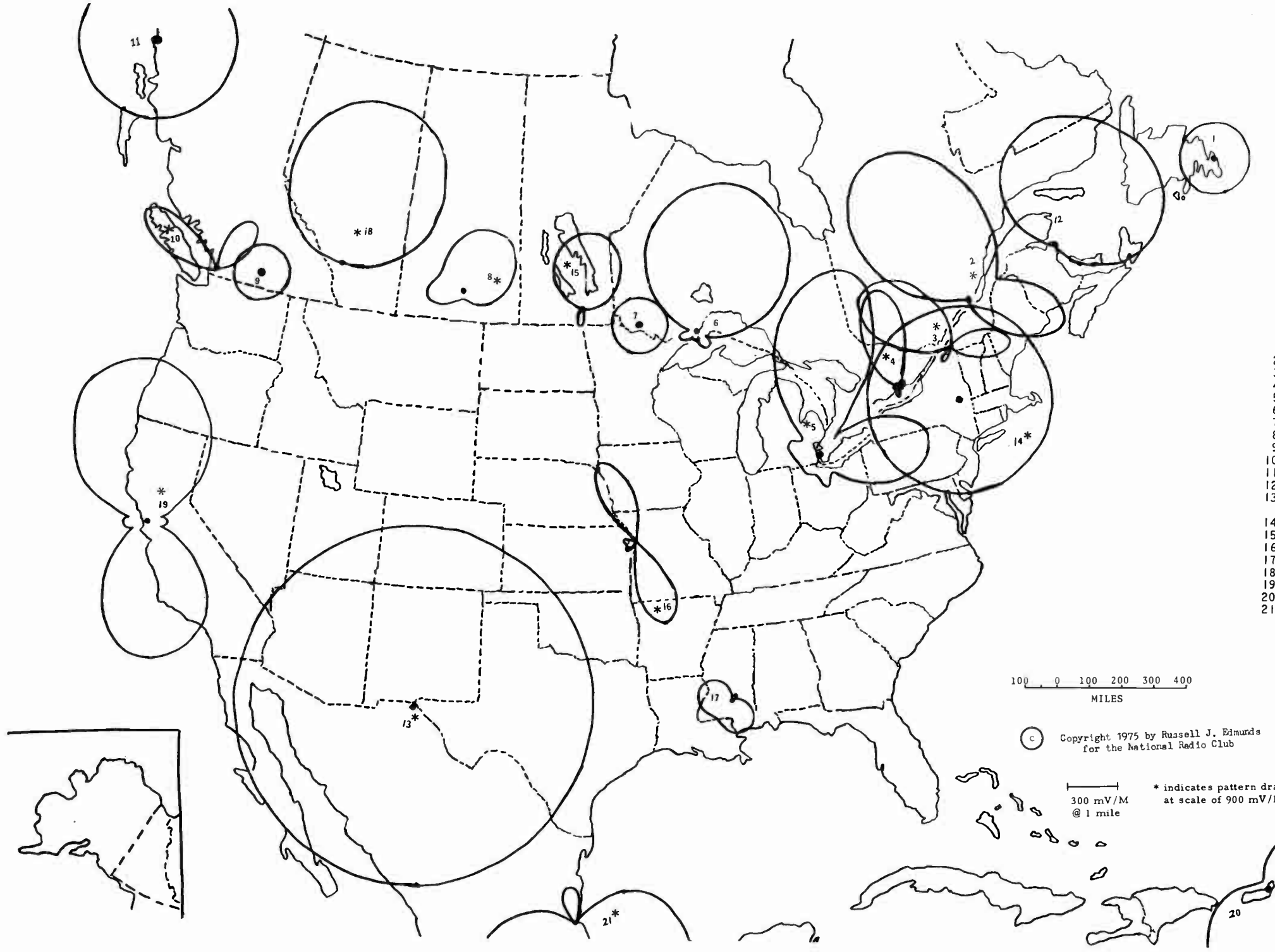
# 790 KHZ

## REGIONAL



call	class	location
1	DA-1	PORT-AUX-CHOIX
2	CFAN	NEWCASTLE
3	CFDR	DARTMOUTH
4	WEAN	PROVIDENCE
5	WAEB	ALLENTOWN
6	WTAR	NORFOLK
7	WOXI	ATLANTA
8	WLBE	LEESBURG-EUSTIS
9	WFUN	S. MIAMI-MIAMI
10	WMNY	WATERTOWN
11	CHIC	BRAMPTON
12	CKSO	SUDBURY
13	WAKY	LOUISVILLE
14	WMC	MEMPHIS
15	KOSY	TEXARKANA
16	KULF	HOUSTON
17	WSGW	SAGINAW
18	WEAO	EAU CLAIRE
19	KFGO	FARGO
20	KFYO	LUBBOCK
21	KCEE	TUCSON
22	KGHL	BILLINGS
23	CFCW	CAMROSE
24	KJRB	SPOKANE
25	KGMI	BELLINGHAM
26	KWIL	ALBANY
27	KABC	LUS ANGELES
28	KCAM	ND GLENNALLEN

# 800 810 CLEAR



call	class	location
800		
1 YOWR	ND	ST. JOHN'S
2 CHRC	DA-1	QUEBEC
3 CJAD	DA-2	MONTREAL
4 CJBO	DA-2	BELLEVILLE
5 CKLW	DA-2	WINDSOR
6 CBO	DA-1	THUNDER BAY
7 CFOB	ND	FORT FRANCIS
8 CHAB	DA-N	MOOSE JAW
9 CKOK	ND	PENTICTON
10 CJJC	DA-2	LANGLEY
11 KINY	ND	JUNEAU
12 CJVA	DA-N	CARAOUET
13 XEROK	ND	CD. JUAREZ
810		
14 WGY	ND	SCHENECTADY
15 CKJS	DA-1	WINNIPEG
16 KCMO	DA-N	KANSAS CITY
17 WSJC	DA-N	MAGEE
18 CHOR	DA-1	CALGARY
19 KGO	DA-1	SAN FRANCISCO
20 WKVM	DA-1	SAN JUAN
21 XEFW	DA-N	TAMPICO

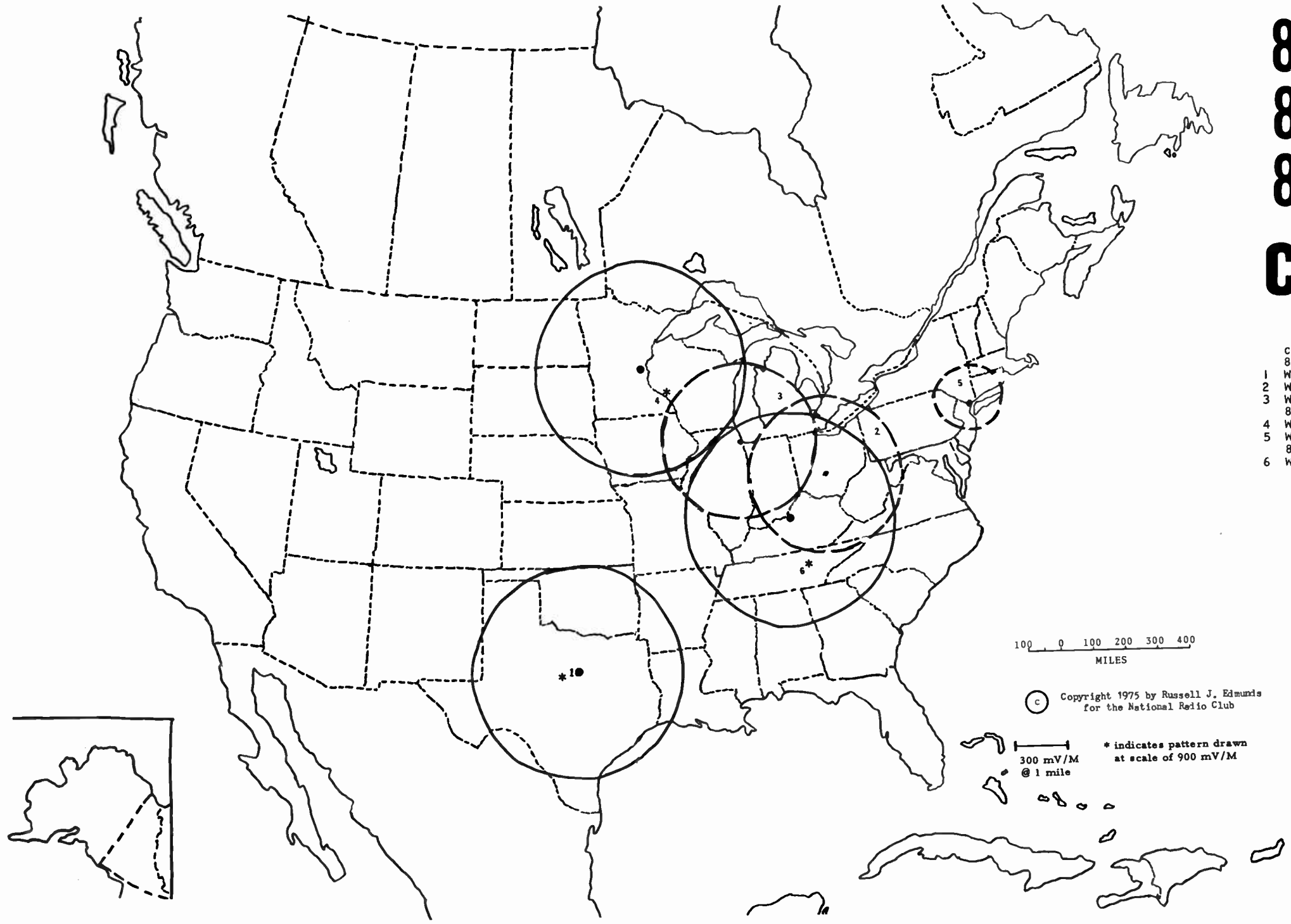
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MILES

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300 mV/M @ 1 mile \* indicates pattern drawn at scale of 900 mV/M



# 820 830 840 CLEAR



call	class	location
820		
1 WBAP	ND	FORT WORTH
2 WOSU	ND	COLUMBUS (L)
3 WAIT	ND	CHICAGO (L)
830		
4 WCCU	ND	MINNEAPOLIS
5 WNYC	DA-1	NEW YORK (L)
840		
6 WHAS	ND	LOUISVILLE

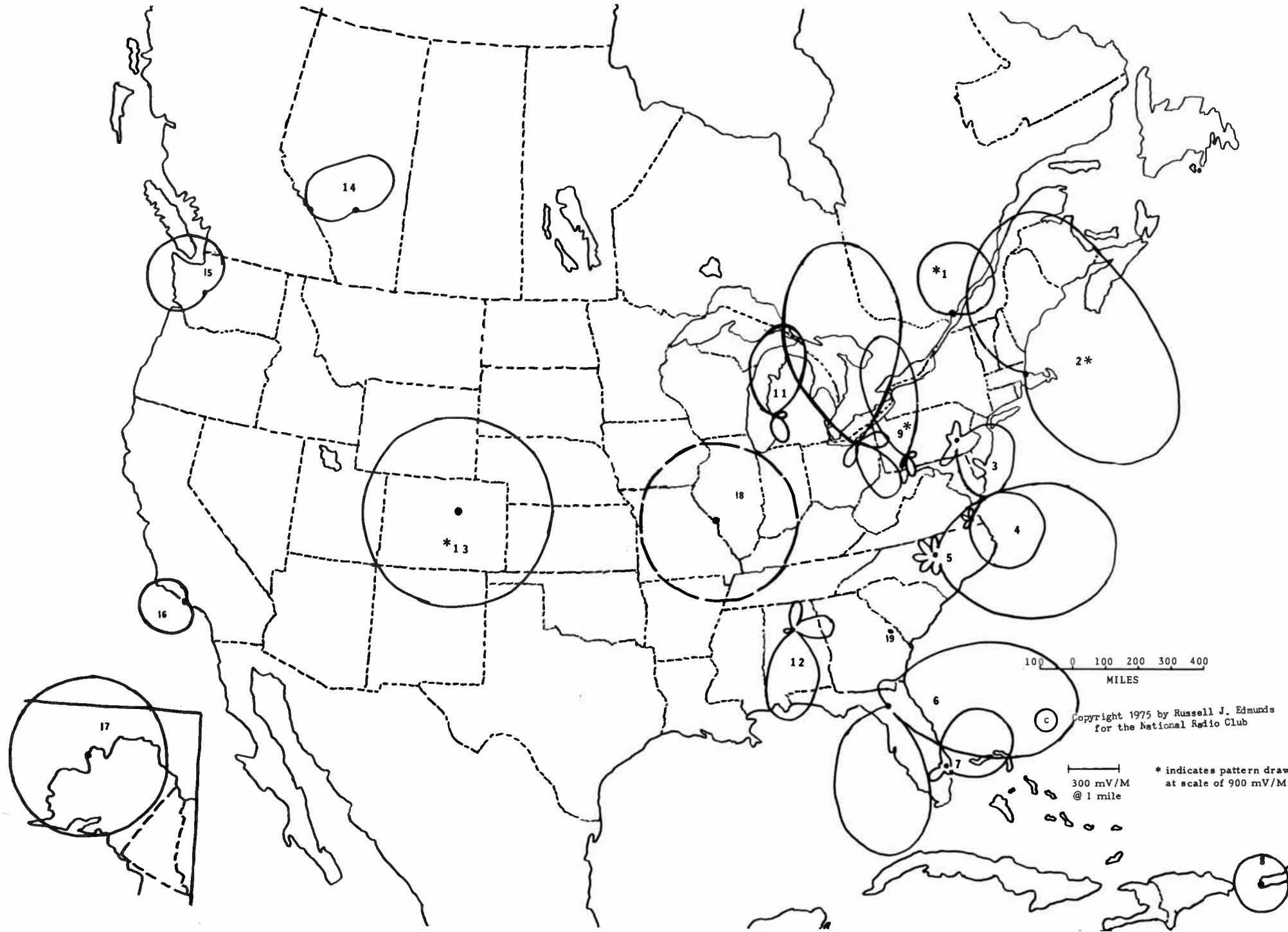
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MILES

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300 mV/M @ 1 mile  
\* indicates pattern drawn at scale of 900 mV/M

# 850 KHZ

# CLEAR



call	class	location
1 CKVL	DA-2	VERDUN
2 WHDH	DA-2	BOSTON
3 WEEU	DA-N	READING
4 WRAP	DA-2	NORFOLK
5 WKIX	DA-N	RALEIGH
6 WRUF	DA-N	GAINESVILLE
7 WEAT	DA-1	W. PALM BEACH
8 WABA	ND	AGUADILLA
9 WJAC	DA-1	JOHNSTOWN
10 WJW	DA-2	CLEVELAND
11 WKBZ	DA-1	MUSKEGON
12 WYDE	DA-2	BIRMINGHAM
13 KOA	ND	DENVER
14 CKRD	DA-N	RED DEER
15 KTAC	DA-2	TACOMA
16 KGOE	DA-2	THOUSAND OAKS
17 KICY	ND	NOME
18 KFUD	ND	CLAYTON (L)
19 W___	DA-N	STATESBORO

100 0 100 200 300 400  
MILES

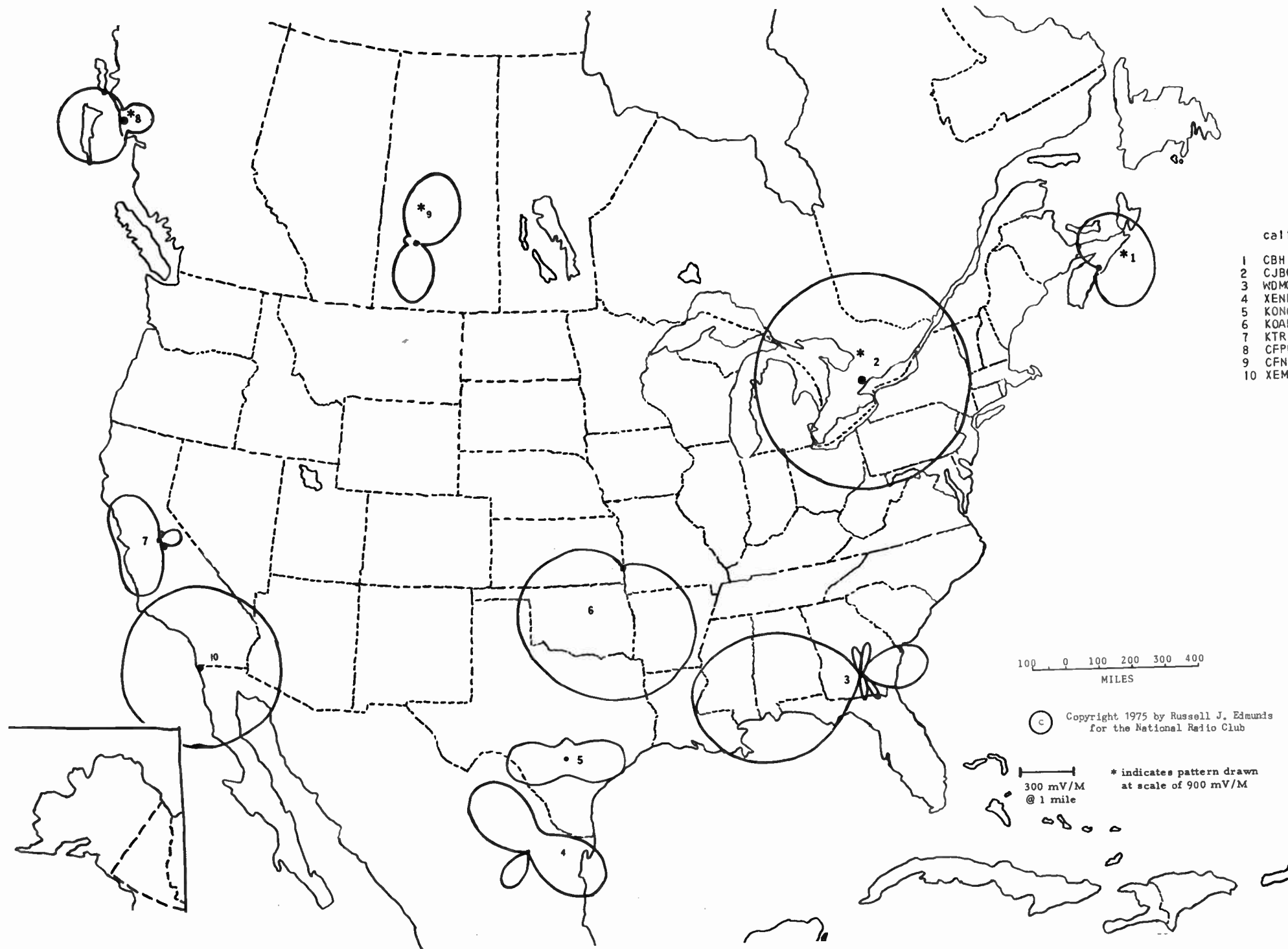
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300 mV/M  
@ 1 mile  
\* indicates pattern drawn  
at scale of 900 mV/M

# 860 KHZ

# CLEAR

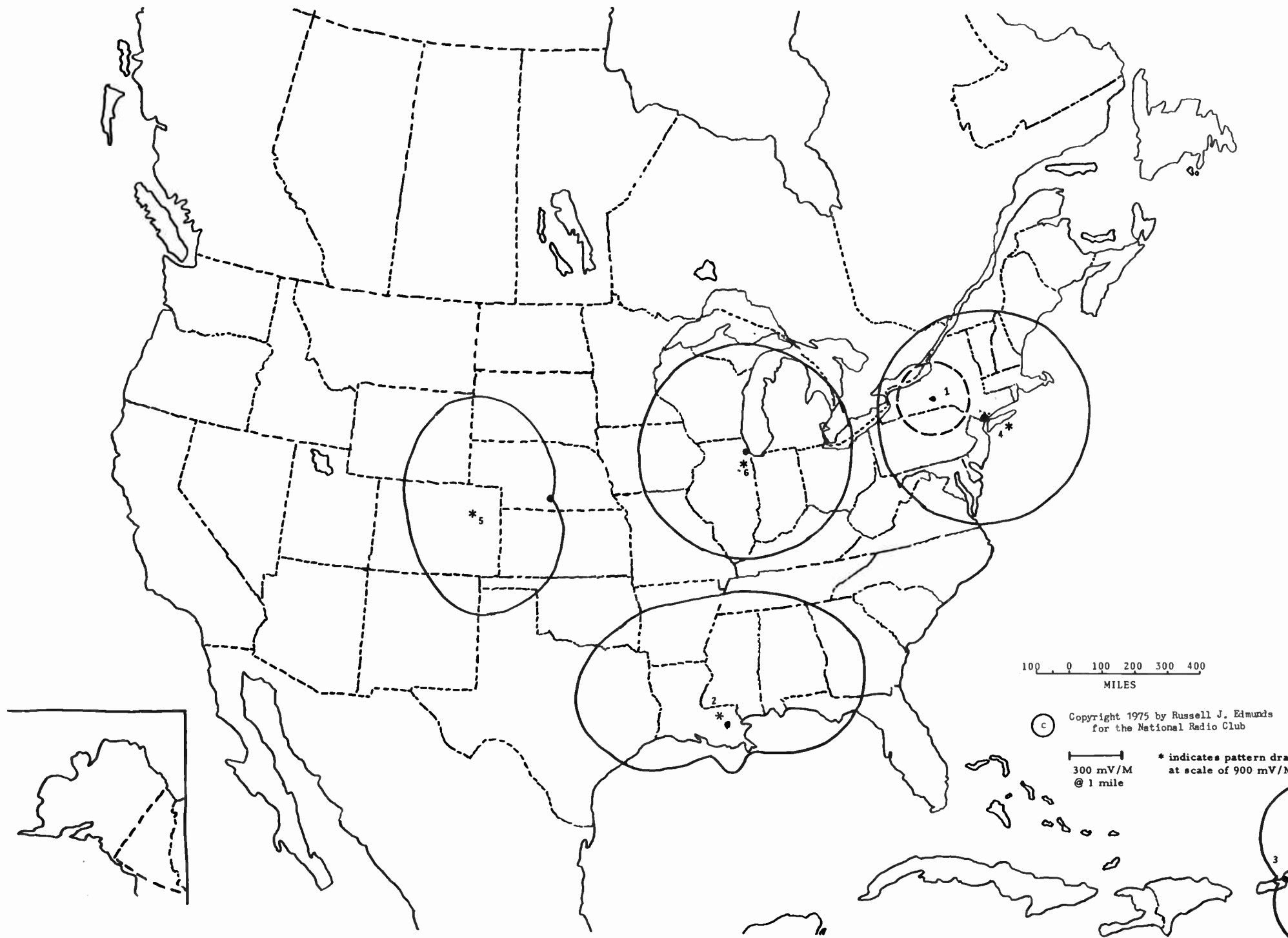
call	class	location
1	CBH	DA-N HALIFAX
2	CJBC	ND TORONTO
3	WDMG	DA-N DOUGLAS
4	XENL	DA-2 MONTERREY
5	KONO	DA-N SAN ANTONIO
6	KOAM	DA-N PITTSBURG
7	KTRB	DA-2 MODESTO
8	CFPR	DA-1 PRINCE RUPERT
9	CFNS	DA-2 SASKATOON (po 1170)
10	XEMU	ND TIJUANA



**870  
880 KHZ  
890**

**CLEAR**

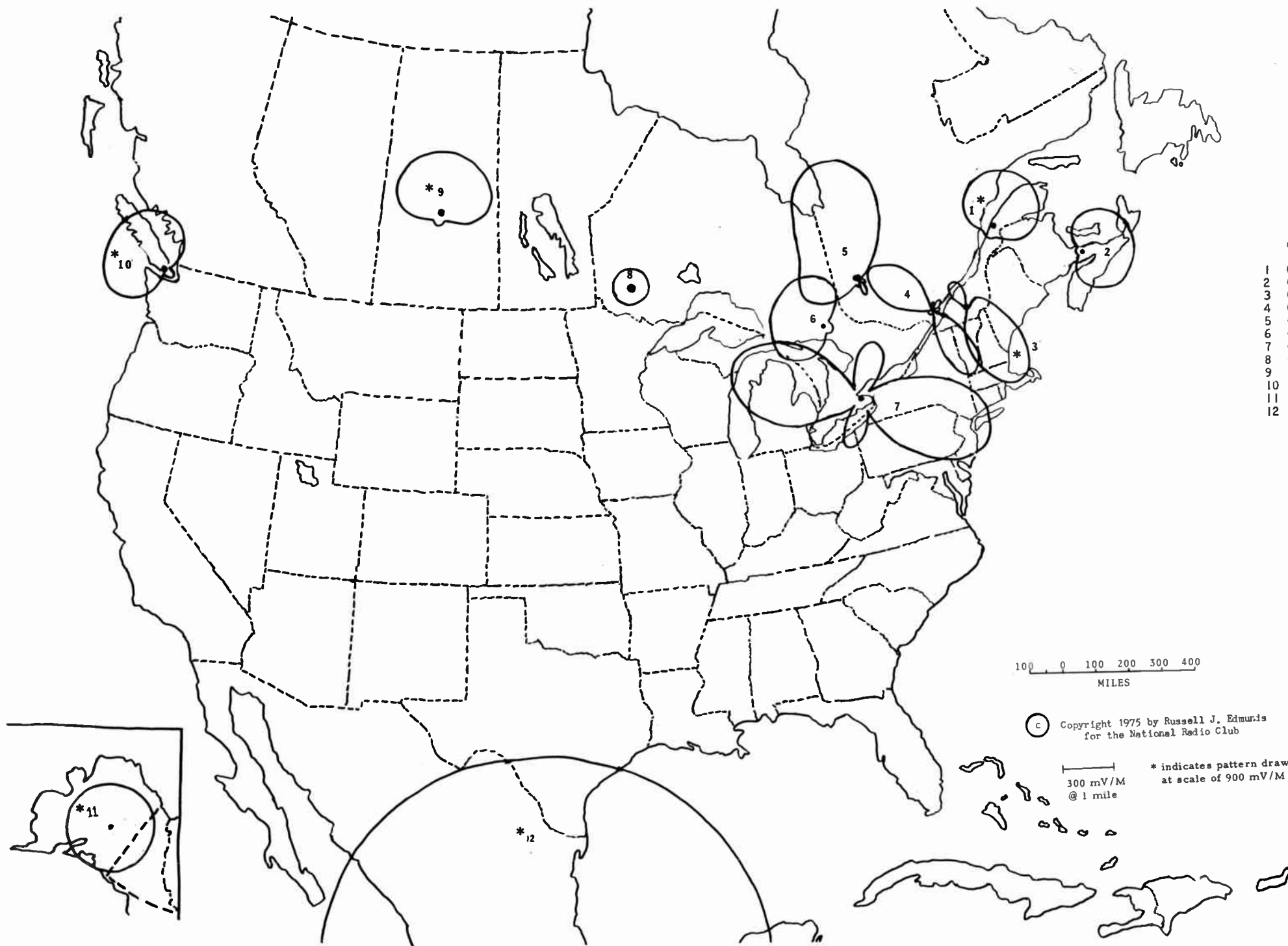
- |        |      |             |
|--------|------|-------------|
| 870    | ND   | ITHACA (L)  |
| 1 WHCU | DA-1 | NEW ORLEANS |
| 2 WWL  | DA-1 | SAN JUAN    |
| 3 WHOA | 880  |             |
| 4 WCBS | ND   | NEW YORK    |
| 5 KRYN | DA-1 | LEXINGTON   |
| 890    |      |             |
| 6 WLS  | ND   | CHICAGO     |



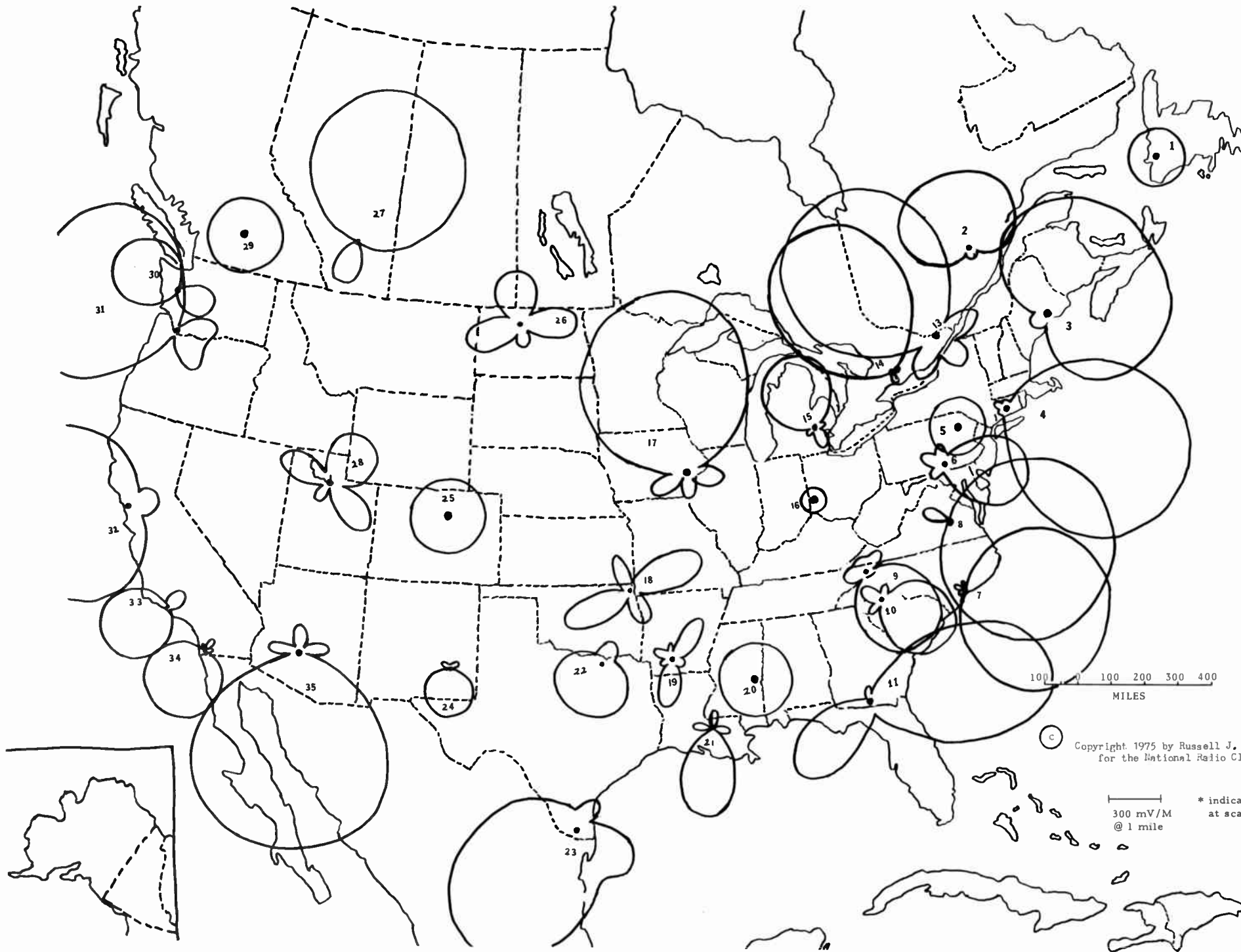
# 900 KHZ

# CLEAR

call	class	location
1 CJBR	DA-N	RIMOUSKI
2 CKDH	DA-2	AMERST
3 CKTS	DA-2	SHERBROOKE
4 CKJL	DA-1	ST. JEROME
5 CKVD	DA-1	VAL U'UR
6 CFBR	DA-2	SUDBURY
7 CHML	DA-1	HAMILTON
8 CKDR	NO	CRYDEN
9 CKBI	DA-2	PRINCE ALBERT
10 CJVI	DA-1	VICTORIA
11 KFRB	NO	FAIRBANKS
12 XEW	NO	MEXICO, DF



# 910 KHZ REGIONAL



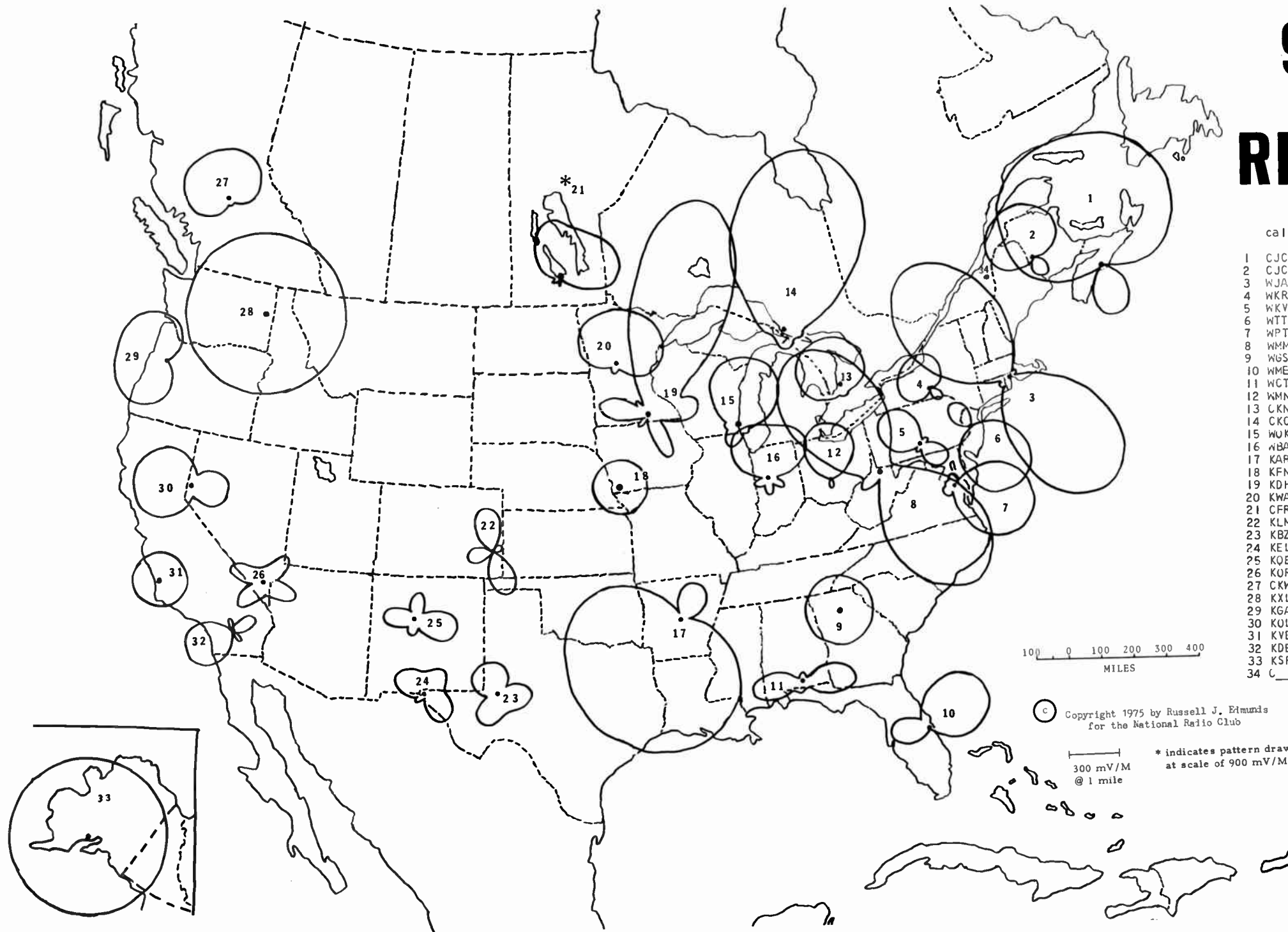
call	class	location
1	CFSX	ND STEPHENVILLE
2	CHRL	DA-N ROBERVAL
3	WABI	DA-N BANGOR
4	WKHQ	DA-2 NEW BRITAIN
5	WGBI	ND SCRANTON
6	WSBA	DA-2 YORK
7	WLAS	DA-N JACKSONVILLE
8	WRNL	DA-N RICHMOND
9	WJRC	DA-N JOHNSON CITY
10	WORD	DA-2 SPARTANBURG
11	WGAF	DA-N VALDOSTA
12	WPRP	ND PONCE
13	CBO	DA-1 OTTAWA
14	CKLY	DA-2 LINDSAY
15	WFDF	DA-1 FLINT
16	WPFB	ND MIDDLETOWN
17	WSUI	DA-2 IOWA CITY
18	KGLC	DA-1 MIAMI
19	KAMD	DA-2 CAMDEN
20	WOKK	ND MERIDIAN
21	WLCS	DA-1 BATON ROUGE
22	KIKM	DA-1 SHERMAN
23	KRIO	DA-2 MCALLEN
24	KBIM	DA-N ROSWELL
25	KPUF	ND DENVER
26	KCJB	DA-2 MINOT
27	CJUV	DA-2 URUMHELLER
28	KALL	DA-N SALT LAKE CITY
29	CFJC	ND KAMLOUPS
30	KIXI	DA-1 SEATTLE
31	KISN	DA-2 VANCOUVER
32	KNEW	DA-N OAKLAND
33	KOXR	DA-2 OXNARD
34	KDEO	DA-2 EL CAJON
35	KPHO	DA-N PHOENIX

100 200 300 400  
MILES

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300 mV/M  
@ 1 mile  
\* indicates pattern drawn  
at scale of 900 mV/M

# 920 KHZ REGIONAL



call	class	location
1	CJCH	DA-N HALIFAX
2	CJCJ	DA-1 WOODSTOCK
3	WJAP	DA-N PROVIDENCE
4	WKRT	DA-N CURTLAND
5	WKVA	DA-N LEWISTON
6	WTTM	DA-1 TRENTON
7	WPTX	DA-2 LEXINGTON PARK
8	WMMN	DA-N FAIRMONT
9	WGST	ND ATLANTA
10	WMEL	DA-N MELBOURNE
11	WCTA	DA-N ANDALUSIA
12	WMNI	DA-2 COLUMBUS
13	CKNX	DA-2 WINGHAM
14	CKCY	DA-2 SAULT STE. MARIE
15	WKY	DA-2 MILWAUKEE
16	WBAA	DA-N W. LAFAYETTE
17	KARN	DA-N LITTLE ROCK
18	KFNF	ND SHENANDOAH
19	KDHL	DA-2 FARI BAULT
20	KWAD	DA-N WADENA
21	CFRY	DA-2 PORTAGE LA PRAIRIE
22	KLMR	DA-N LAMAR
23	KBZB	DA-N ODESSA
24	KELP	DA-N EL PASO
25	KQEO	DA-N ALBUQUERQUE
26	KORK	DA-2 LAS VEGAS
27	CKWL	DA-N WILLIAMS LAKE
28	KXLY	ND SPOKANE
29	KGAL	DA-1 LEBANON
30	KOLU	DA-N RENO
31	KVEC	ND SAN LUIS OBISPO
32	KDES	DA-N PALM SPRINGS
33	KSRM	ND SULDATNA
34	C	ND LAC ETCHMIN (CP)

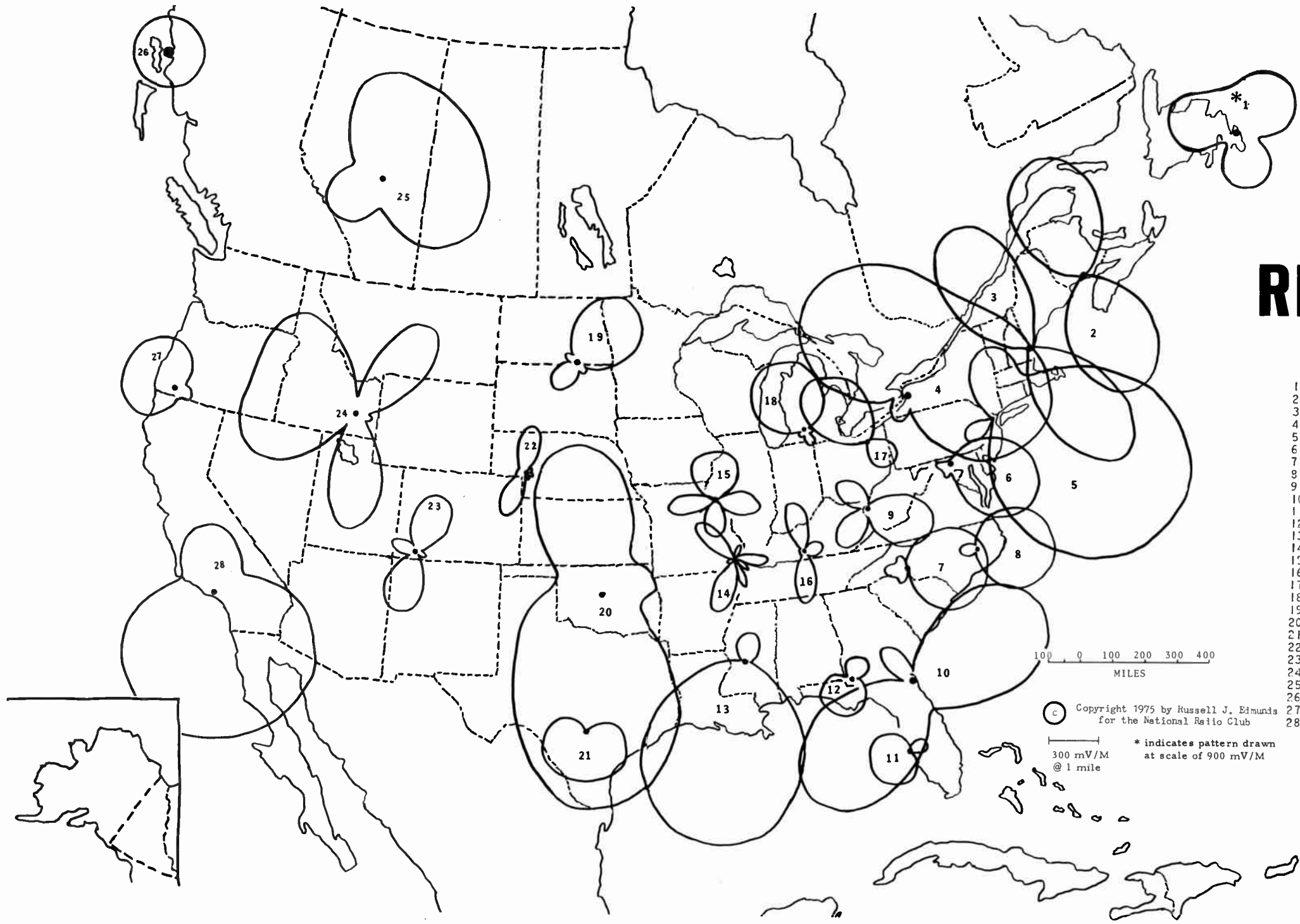
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MILES

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300 mV/M  
@ 1 mile  
\* indicates pattern drawn  
at scale of 900 mV/M

# 930 KHZ

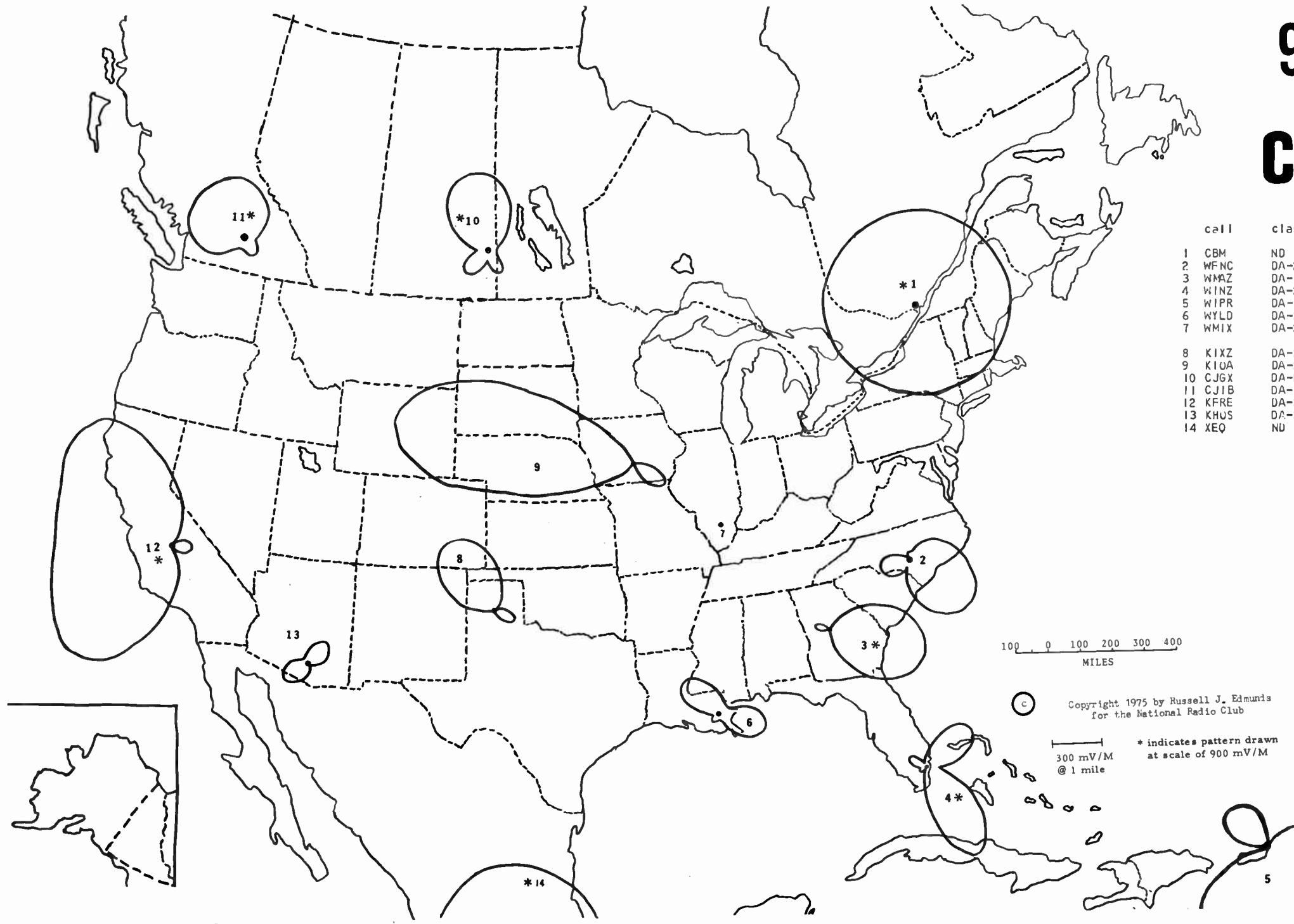
## REGIONAL



call	class	location
1	CJON	DA-2 ST. JOHN'S
2	CFBC	DA-2 ST. JOHN
3	WVNH	DA-N ROCHESTER
4	WBEN	DA-N BUFFALO
5	WPAT	DA-2 PATERSON
6	WFMD	DA-2 FREDERICK
7	WEOC	DA-N CHARLOTTE
8	WITK	DA-N WASHINGTON
9	WGNT	DA-N HUNTINGTON
10	WJAX	DA-N JACKSONVILLE
11	WKXY	DA-2 SARASOTA
12	WMGR	DA-N BAINBRIDGE
13	WSLI	DA-N JACKSON
14	KHOC	DA-N POPLAR BLUFF
15	WTRD	DA-N QUINCY
16	WKCT	DA-N BOWLING GREEN
17	WEOL	DA-2 ELYRIA
18	WBOC	DA-2 BATTLE CREEK
19	KSUN	DA-N ABERDEEN
20	WKY	DA-N OKLAHOMA CITY
21	KITE	DA-N TERRELL HILLS
22	KOGA	DA-N UGALLALA
23	KIUP	DA-N DURANGO
24	KSEI	DA-N POCATELLO
25	CJCA	DA-N EDMONTON
26	KTKN	ND KETCHIKAN
27	KAGI	DA-N GRANTS PASS
28	KHJ	DA-N LOS ANGELES



# 940 KHZ CLEAR



call	class	location
1	CBM	ND MONTREAL
2	WFNC	DA-2 FAYETTEVILLE
3	WMAZ	DA-N MACON
4	WINZ	DA-2 MIAMI
5	WIPR	DA-1 SAN JUAN
6	WYLD	DA-2 NEW ORLEANS
7	WMIX	DA-2 MOUNT VERNON (pattern not available)
8	KIXZ	DA-2 AMARILLO
9	KIOA	DA-2 DES MOINES
10	CJGX	DA-N YURKTON
11	CJIB	DA-N VERNON
12	KFRE	DA-2 FRESNO
13	KHUS	DA-2 TUSCON
14	XEQ	ND MEXICO, DF

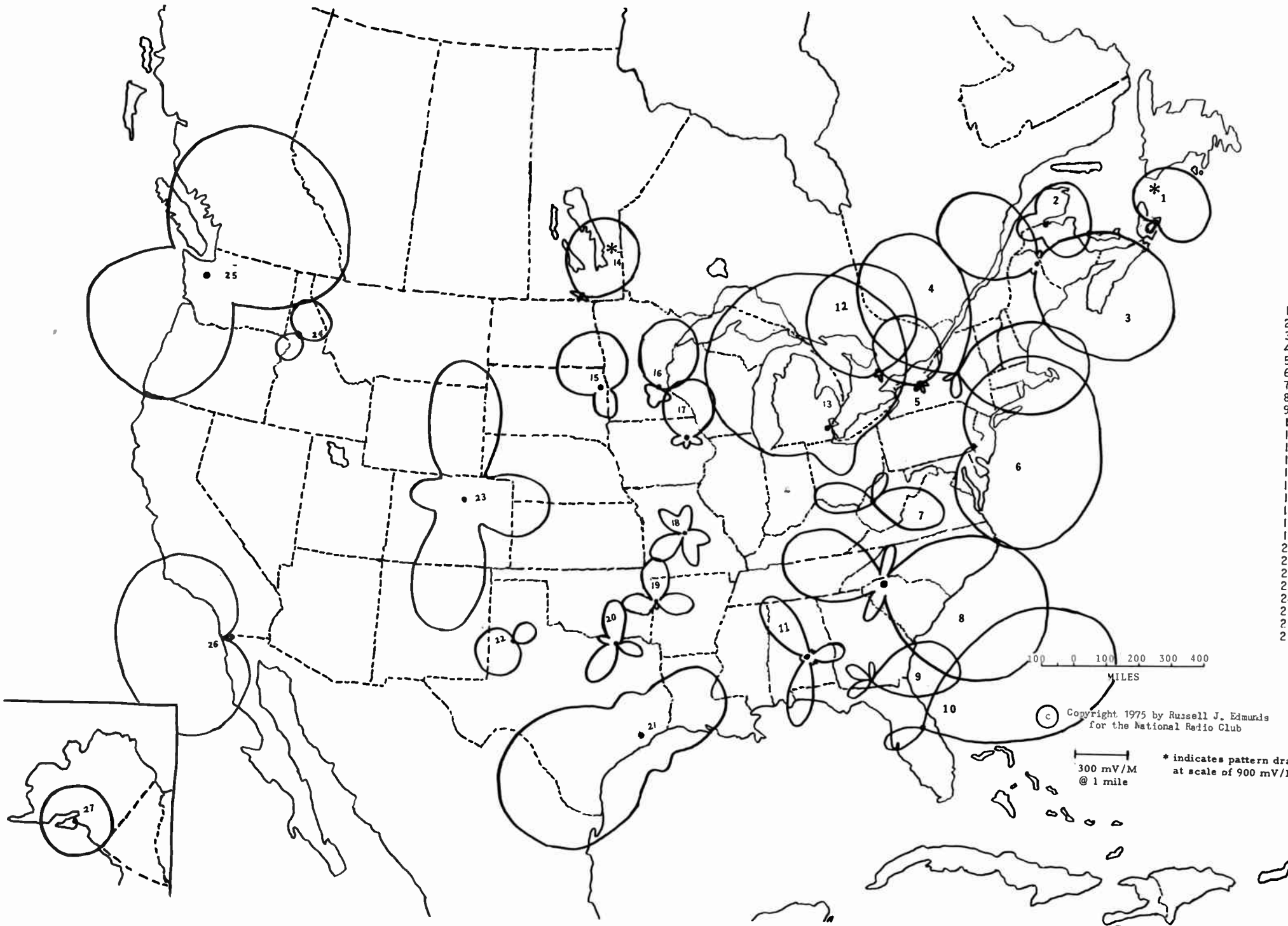
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MILES

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# 950 KHZ

## REGIONAL



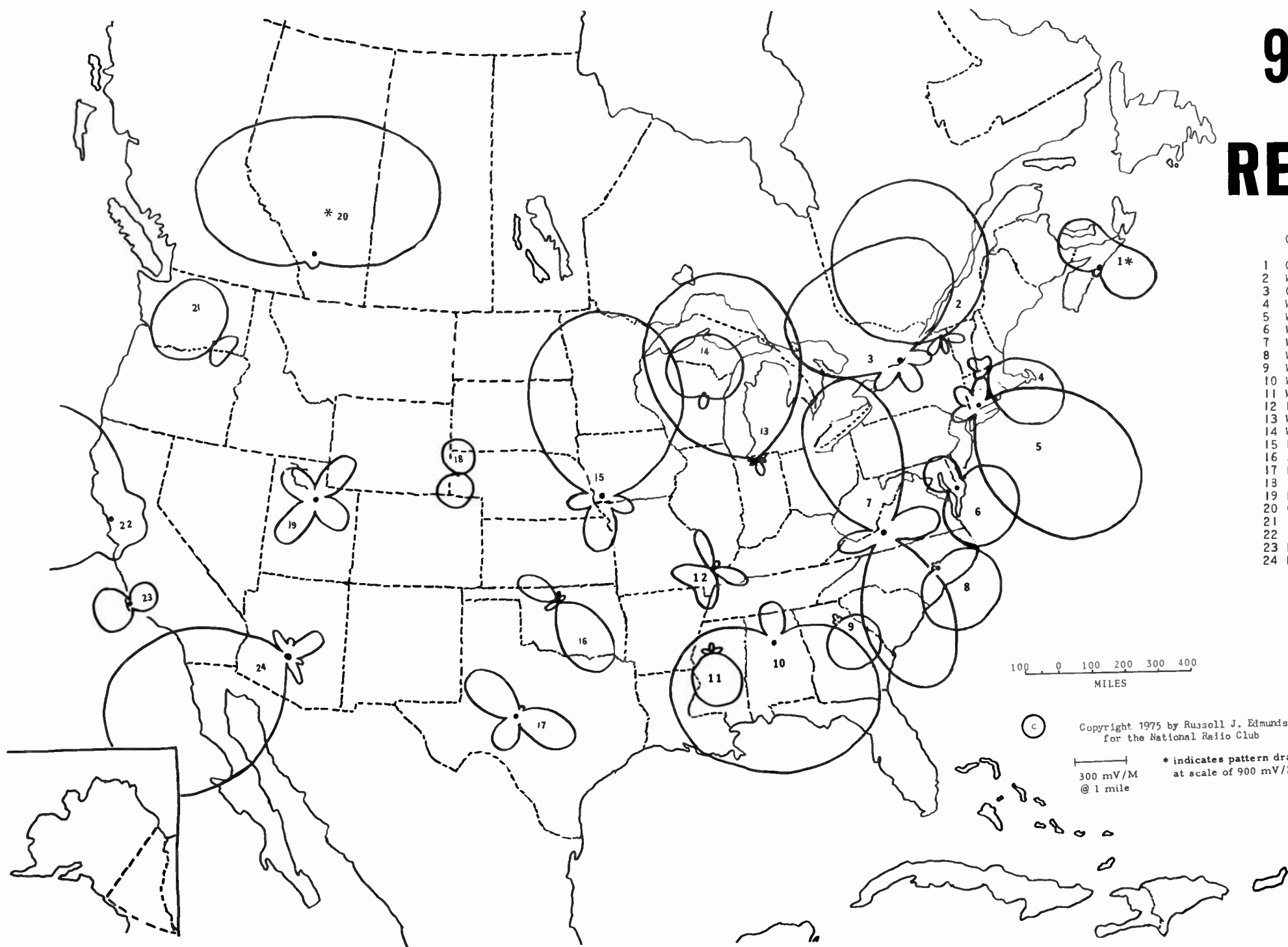
call	class	location
1	DA-1	SIDNEY
2	DA-2	CAMPBELLTON
3	DA-2	PRESQUE ISLE
4	DA-1	UTICA
5	DA-2	ROCHESTER
6	DA-N	PHILADELPHIA
7	DA-N	CHARLESTON
8	DA-N	SPARTANBURG
9	DA-N	VALUOSTA
10	DA-N	ORLANDO
11	DA-N	MONTGOMERY
12	DA-2	BARRIE
13	DA-N	DETROIT
14	DA-2	ALTONA
15	DA-N	WATERTOWN
16	DA-2	ST. LOUIS PARK
17	DA-2	OELWEIN
18	DA-N	JEFFERSON CITY
19	DA-N	FORT SMITH
20	DA-2	DENISON-SHERMAN
21	DA-N	HOUSTON
22	DA-2	LUBBOCK
23	DA-1	DENVER
24	DA-N	OROFINO
25	DA-N	SEATTLE
26	DA-2	TIJUANA
27	ND	SEWARD

100 0 100 200 300 400  
MILES

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300 mV/M @ 1 mile  
\* indicates pattern drawn  
at scale of 900 mV/M

# 960 KHZ REGIONAL



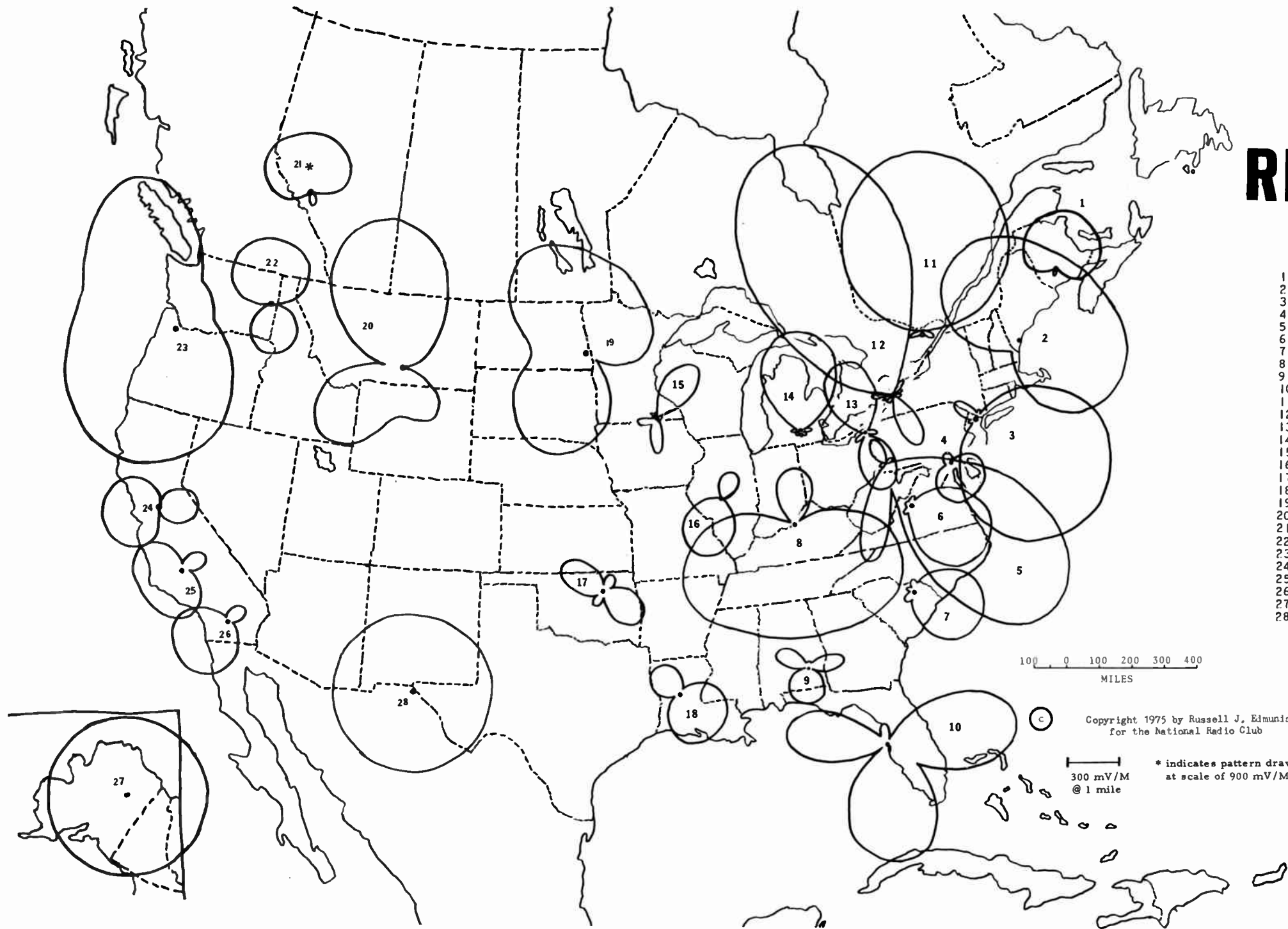
CALL	CLASS	LOCATION
1	CHNS	DA-N HALIFAX
2	WEAY	DA-2 PLATTSBURG
3	CKWS	DA-2 KINGSTON
4	WFGL	DA-2 FITCHBURG
5	WELI	DA-N NEW HAVEN
6	WBOC	DA-2 SALISBURY
7	WFIR	DA-N ROANOKE
8	WFTC	DA-N KINSTON
9	WRFC	DA-N ATHENS
10	WERC	DA-N BIRMINGHAM
11	WABG	DA-N GREENWOOD
12	KFVS	DA-N CAPE GIRARDEAU
13	WSBT	DA-2 SOUTH BEND
14	WTCH	DA-N SHAWANG
15	KMA	DA-N SHENANDOAH
16	KGWA	DA-1 ENID
17	KGKL	DA-N SAN ANGELO
18	KNED	DA-2 SCOTTSBLUFF
19	KUVU	DA-N PRUVU
20	CFAC	DA-N CALGARY
21	KALE	DA-N RICHLAND
22	KABL	DA-1 OAKLAND
23	KNEZ	DA-N LOMPOC
24	KUOL	DA-N PHOENIX

100 0 100 200 300 400  
MILES

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300 mV/M @ 1 mile \* indicates pattern drawn at scale of 900 mV/M

# 970 KHZ REGIONAL



call	class	location
1	CBZ	DA-N FREDERICKTON
2	WCHS	DA-N PORTLAND
3	WWDJ	DA-2 MACKENSACK
4	WAMD	DA-2 ABERDEEN
5	WWSW	DA-2 PITTSBURGH
6	WANY	DA-2 WAYNESBORO
7	WJMX	DA-n FLORENCE
8	WAVE	DA-2 LOUISVILLE
9	WTBF	DA-N TROY
10	WFLA	DA-N TAMPA
11	CKGH	DA-1 HULL
12	WEBR	DA-1 BUFFALO
13	WREO	DA-2 ASHTABULA
14	WKHM	DA-2 JACKSON
15	KOQO	DA-2 AUSTIN
16	WMAV	DA-2 SPRINGFIELD
17	KAKC	DA-2 TULSA
18	KSYL	DA-N ALEXANDRIA
19	WDAY	DA-N FARGO
20	KOOK	DA-N BULLINGS
21	CJYR	DA-1 EDSON
22	KREM	DA-N SPOKANE
23	KOIN	DA-N PORTLAND
24	KBEE	DA-2 MODESTO
25	KBIS	DA-2 BAKERSFIELD
26	KCHV	DA-2 COACHELLA
27	KIAK	ND FAIRBANKS
28	XEJ	ND CO. JUAREZ

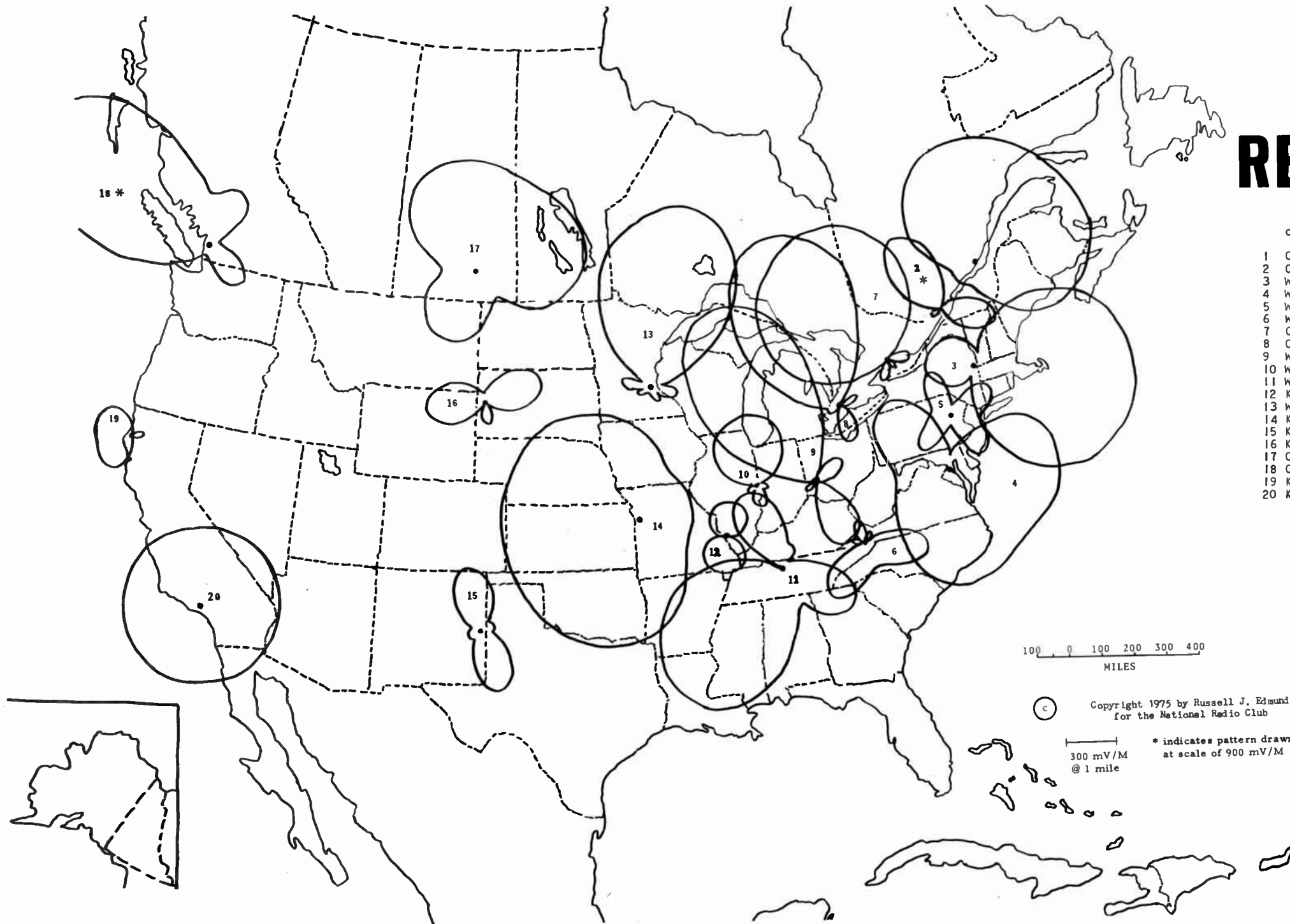
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MILES

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300 mV/M @ 1 mile \* indicates pattern drawn at scale of 900 mV/M

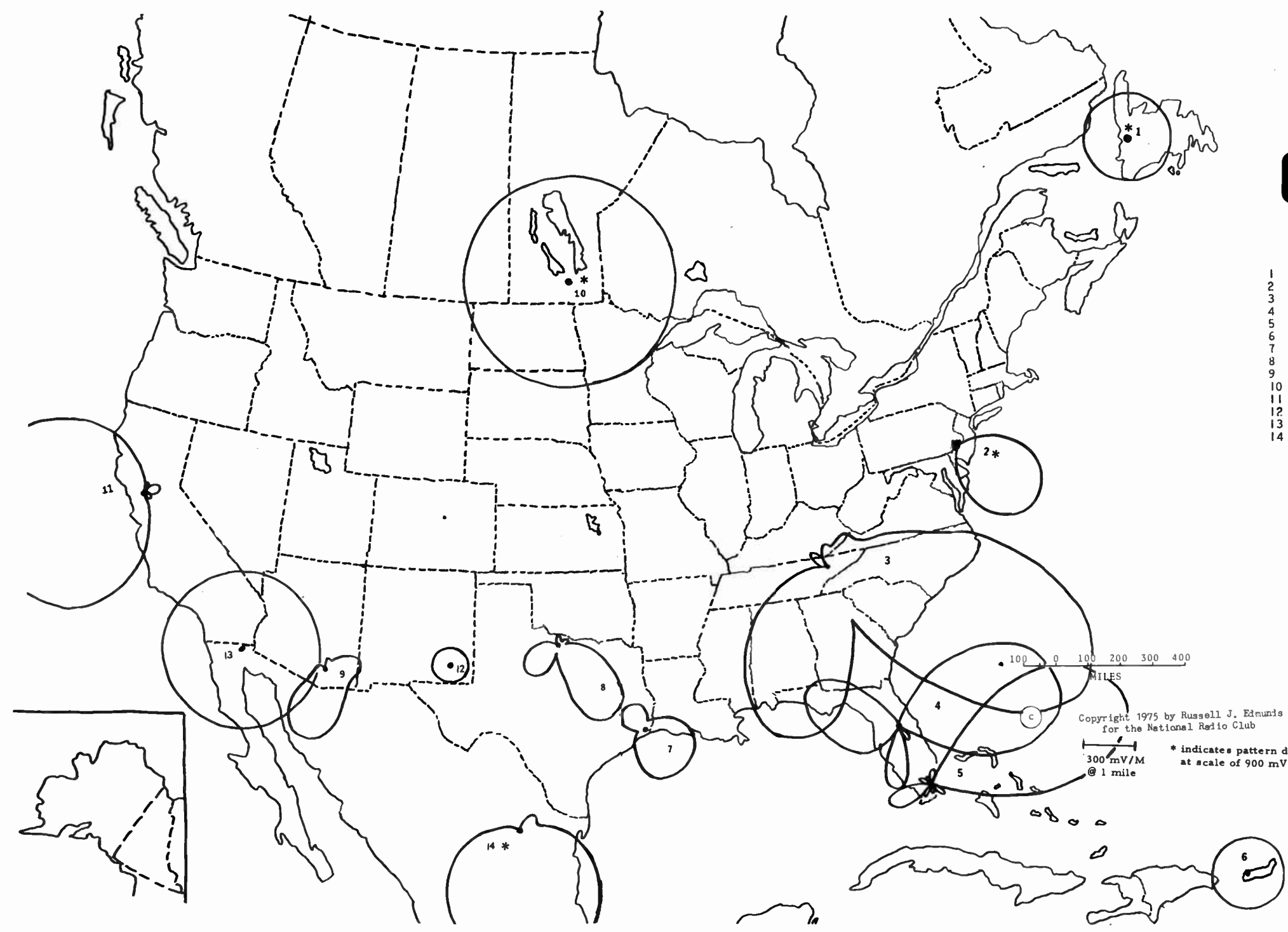
# 980 KHZ REGIONAL

call	class	location
1	DA-1	QUEBEC
2	DA-1	MONTREAL
3	DA-1	TROY
4	DA-N	WASHINGTON
5	DA-N	WILKES-BARRE
6	DA-N	BRISTOL
7	DA-2	PETERBOROUGH
8	DA-2	LONDON
9	DA-N	DAYTON
10	DA-2	DANVILLE
11	DA-N	NASHVILLE
12	DA-N	CHESTER
13	DA-1	RICHFIELD
14	DA-N	KANSAS CITY
15	DA-N	CLOVIS
16	DA-N	DEADWOOD
17	DA-2	REGINA
18	DA-1	NEW WESTMINSTER
19	DA-N	EUREKA
20	KFWB	ND LOS ANGELES



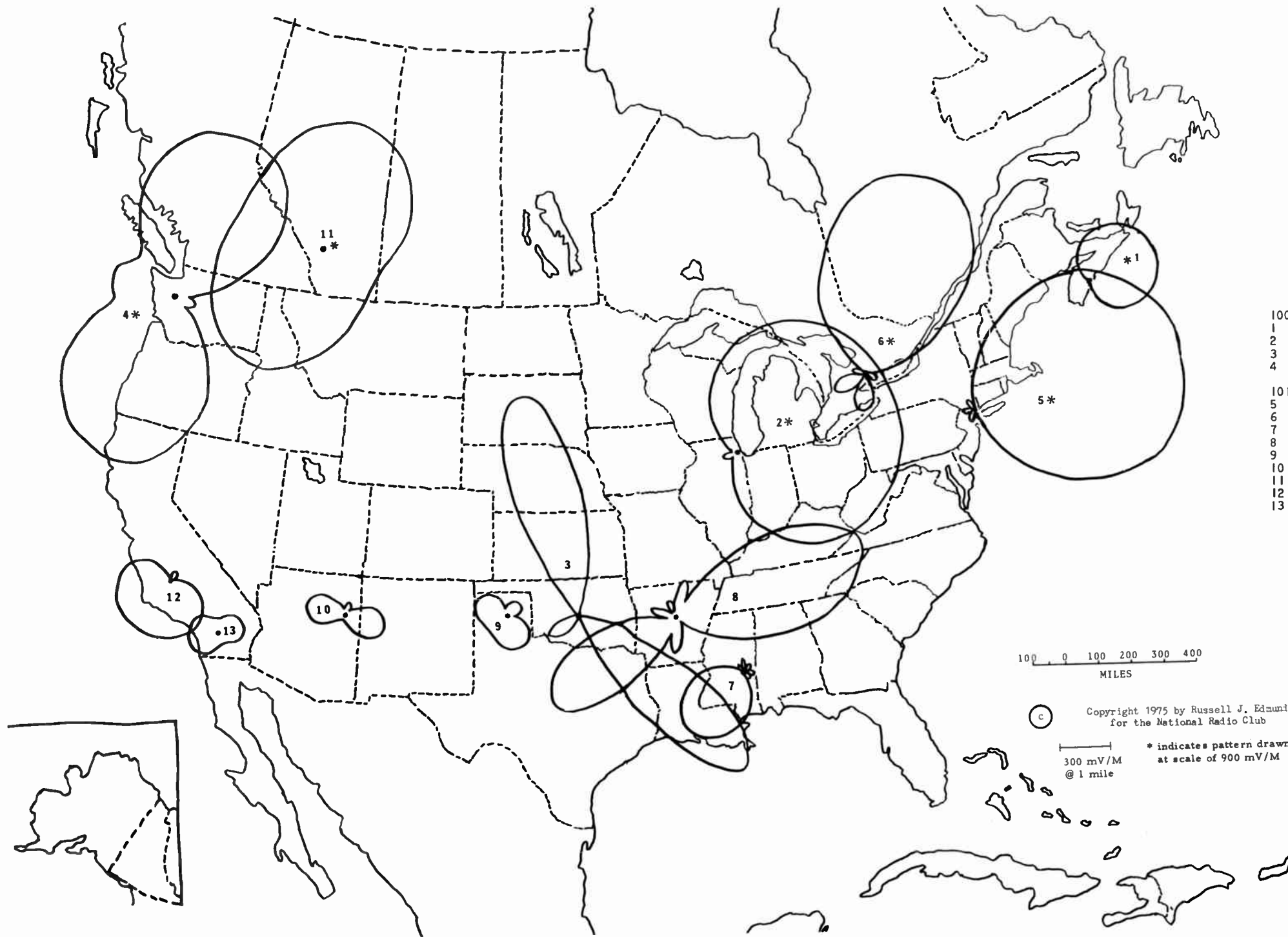
# 990 KHZ CLEAR

call	class	location
1	ND	CORNERBROOK
2	DA-2	PHILADELPHIA
3	DA-N	KNOXVILLE
4	DA-2	ORLANDO
5	DA-1	MIAMI
6	ND	MAYAGUEZ
7	DA-1	BEAUMONT
8	DA-2	WICHITA FALLS
9	DA-2	TUCSON
10	ND	WINNIPEG
11	DA-2	PITTSBURG
12	ND	ARTESIA
13	ND	MEXICALI
14	DA-N	MONTERREY



# 1000 1010 KHZ

# CLEAR



CALL	CLASS	LOCATION
1000:		
1 CKBW	DA-N	BRIDGEWATER
2 WCFL	DA-2	CHICAGO
3 KTOK	DA-2	OKLAHOMA CITY
4 KOMO	DA-N	SEATTLE

1010:		
5 WINS	DA-1	NEW YORK
6 CFRB	DA-2	TORONTO
7 WMOX	DA-2	MERIDIAN
8 KLRA	DA-N	LITTLE ROCK
9 KDJW	DA-1	AMARILLO
10 KVNC	DA-1	WINSLOW
11 CBR	DA-2	CALGARY
12 KCHJ	DA-2	DELANO
13 KCMJ	DA-2	PALM SPRINGS

100 0 100 200 300 400  
MILES

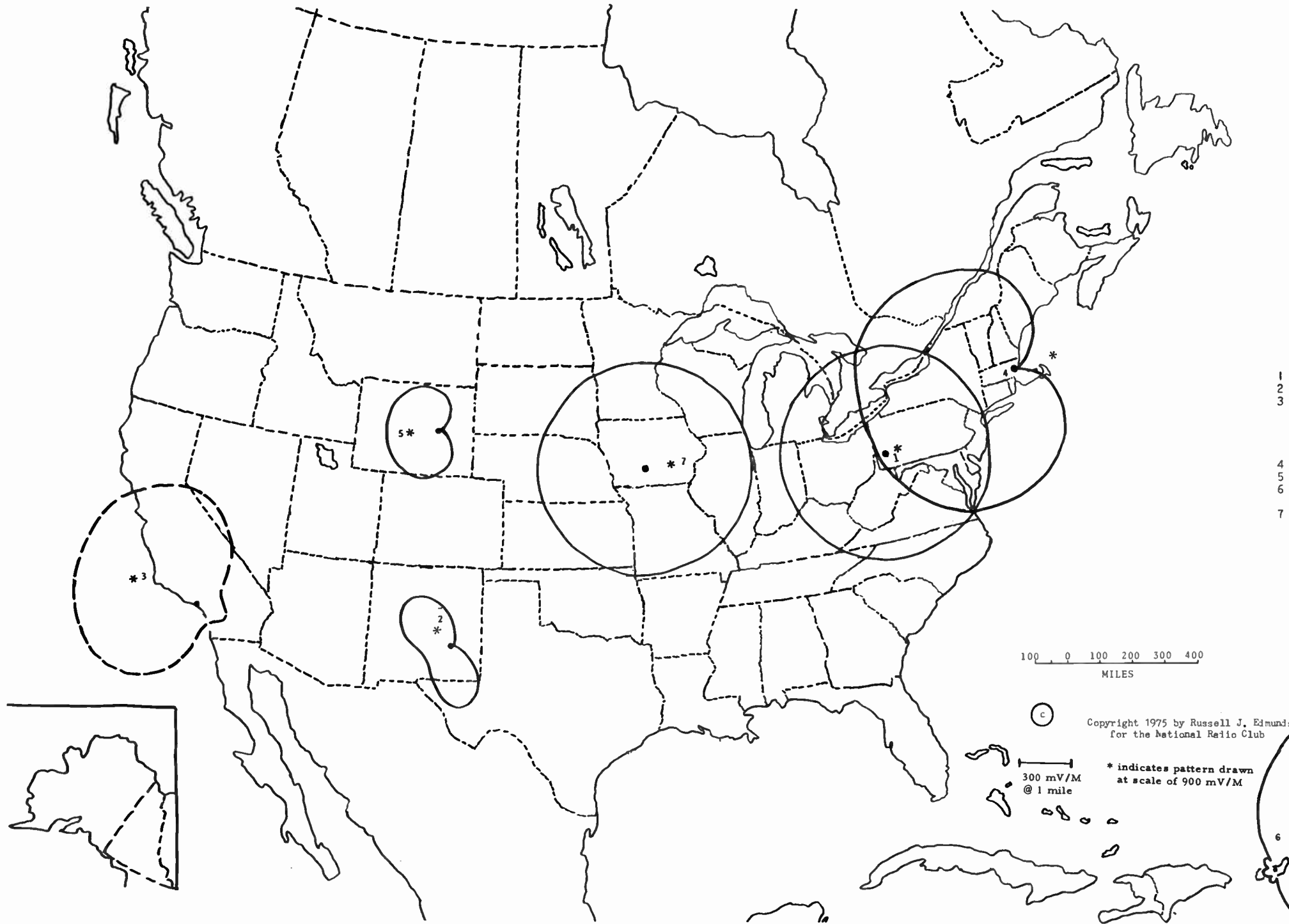
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300 mV/M @ 1 mile  
\* indicates pattern drawn  
at scale of 900 mV/M

1020  
1030 KHZ  
1040

**CLEAR**

call class location		
1020		
1	KDKA	ND PITTSBURGH
2	KBCQ	DA-2 ROSWELL
3	KGBS	DA-1 LOS ANGELES (L*)
*(KGBS granted full time when KBCQ changed night DA, present patterns shown)		
1030		
4	WBZ	DA-1 BOSTON
5	KTWO	DA-N CASPER
6	W	DA-1 SAN JUAN
1040		
7	WHO	ND DES MOINES



100 0 100 200 300 400  
MILES

(C)

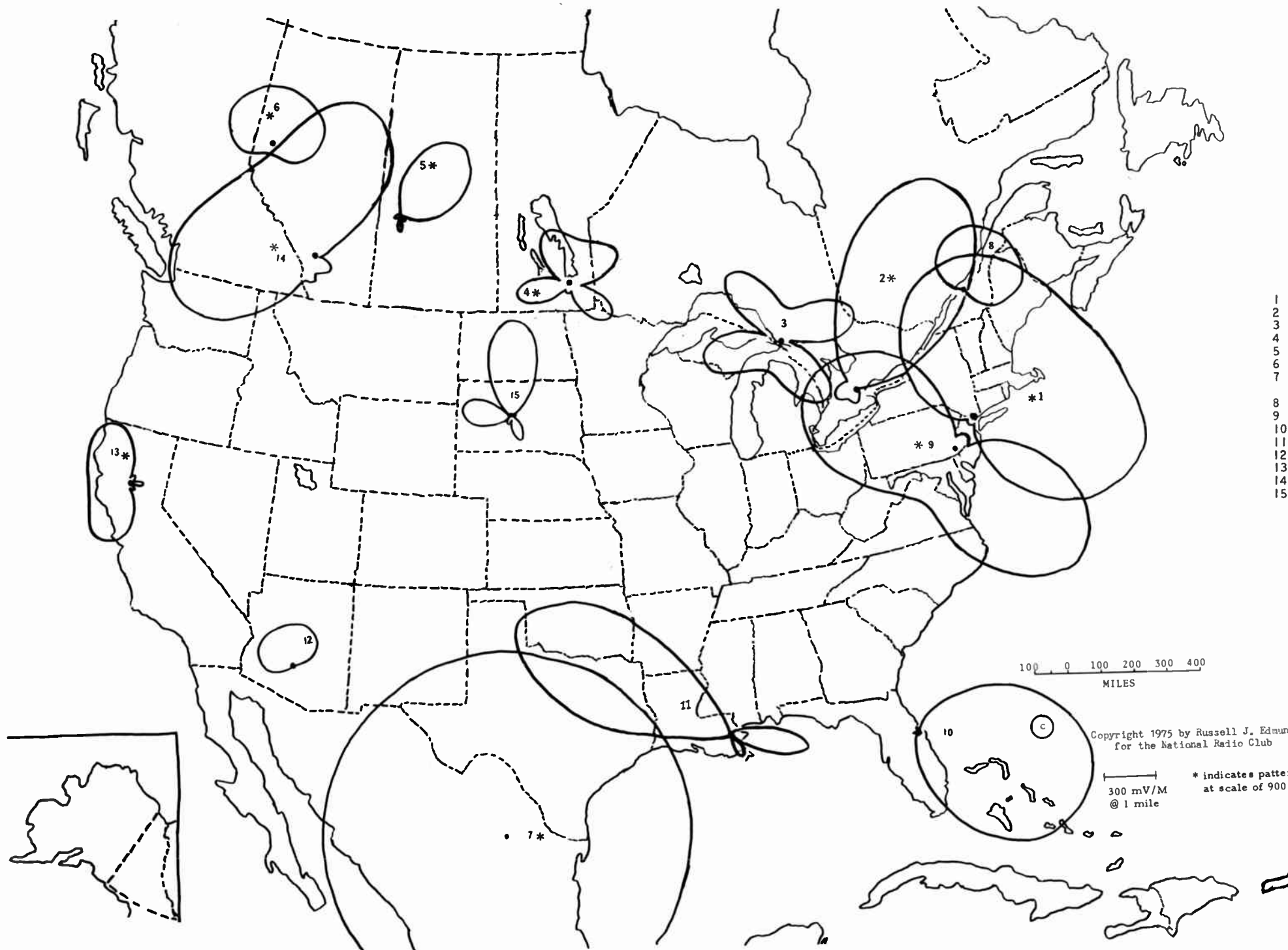
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300 mV/M  
@ 1 mile

\* indicates pattern drawn  
at scale of 900 mV/M



# 1050 KHZ 1060 KHZ CLEAR



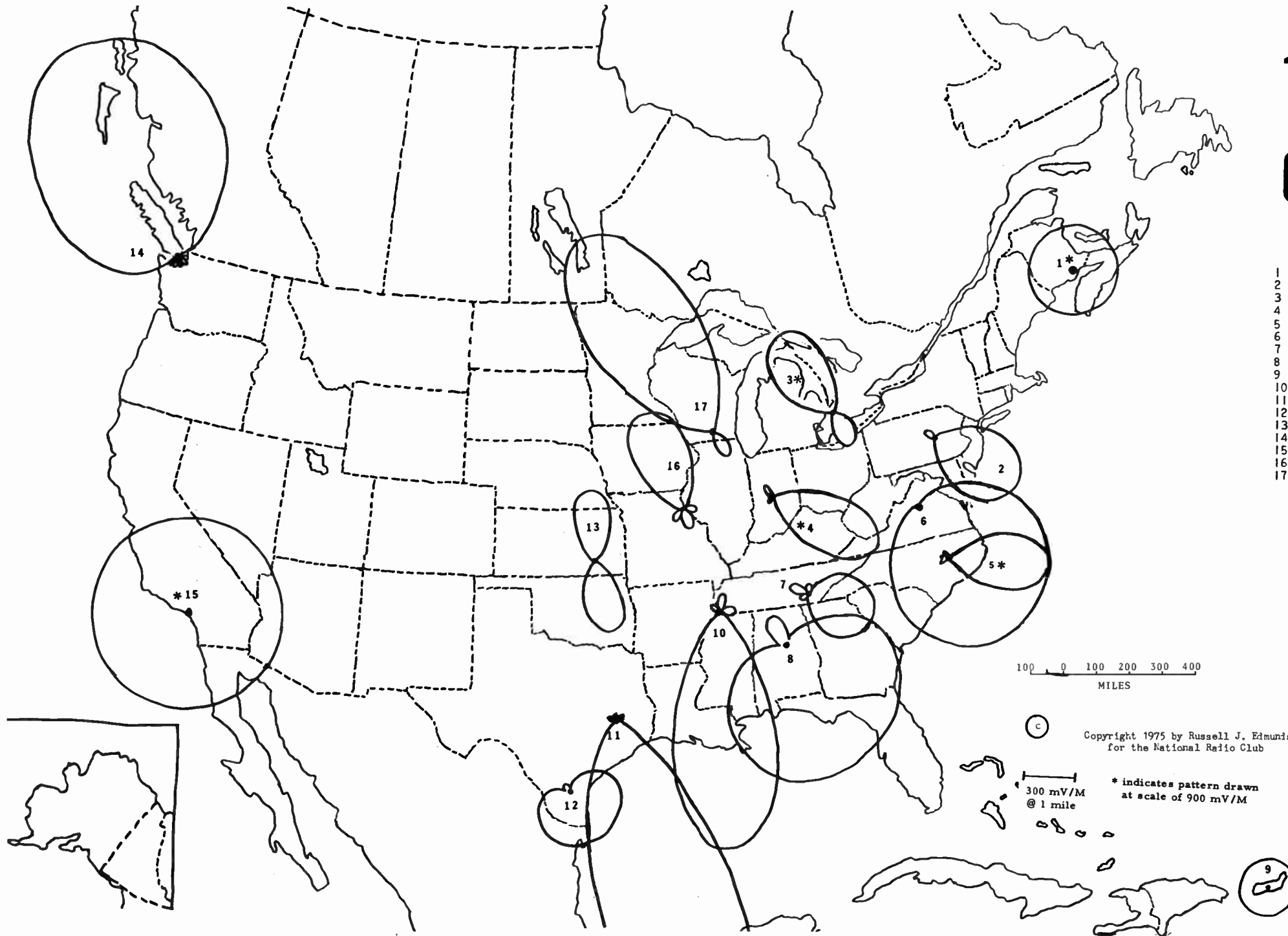
call	class	location
1050		
1 WHN	DA-1	NEW YORK
2 CHUM	DA-2	TORONTO
3 CJIC	DA-N	SAULT STE. MARIE
4 CKSB	DA-N	WINNIPEG
5 CJNB	DA-N	N. BATTLEFORD
6 CFGP	DA-1	GRANDE PRAIRIE
7 XEG	ND	MONTERREY
1060		
8 CJRP	DA-2	QUEBEC
9 KYW	DA-1	PHILADELPHIA
10 WRMF	DA-2	TITUSVILLE
11 WNOE	DA-2	NEW ORLEANS
12 KUPD	DA-1	TEMPE
13 KPAY	DA-N	CHICO
14 CFCN	DA-2	CALGARY
15 KGF X	DA-2	PIERRE

100 0 100 200 300 400  
MILES

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300 mV/M @ 1 mile  
\* indicates pattern drawn at scale of 900 mV/M

# 1070 KHZ CLEAR



call	class	location
1	CBA	ND MONCTON
2	WKOK	DA-N SUNBURY
3	CHOK	DA-2 SARNIA
4	WIBC	DA-2 INDIANAPOLIS
5	WNCT	DA-2 GREENVILLE
6	WINA	DA-N CHARLOTTESVILLE
7	WFLI	DA-2 LOOKOUT MOUNTAIN
8	WAPI	DA-N BIRMINGHAM
9	WMIA	ND ARECIBO
10	WDIA	DA-2 MEMPHIS
11	KENR	DA-2 HOUSTON
12	KOPY	DA-N ALICE
13	KFDI	DA-n WICHITA
14	CFAX	DA-1 VICTORIA
15	KNX	ND LOS ANGELES
16	KHMO	DA-2 HANNIBAL
17	WTSU	DA-2 MADISON

100 0 100 200 300 400  
MILES

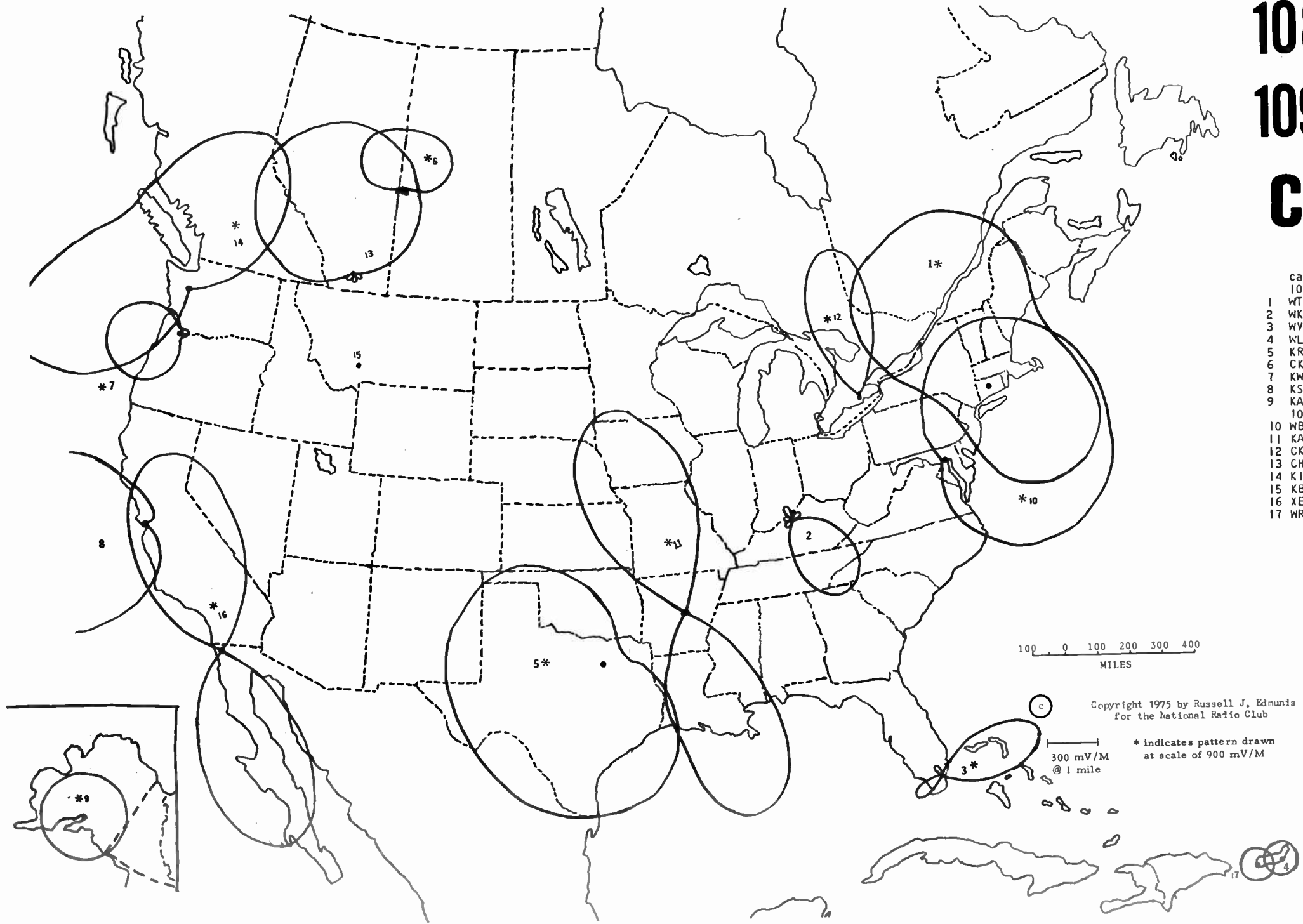
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300 mV/M  
@ 1 mile  
\* indicates pattern drawn  
at scale of 900 mV/M

# 1080 KHZ

# 1090

# CLEAR



call	class	location
1080		
1	DA-N	HARTFORD
2	DA-2	LOUISVILLE
3	DA-2	CORAL GABLES
4	ND	CAYEY
5	DA-N	DALLAS
6	DA-N	LLOYDMINSTER
7	DA-1	PORTLAND
8	DA-N	SANTA CRUZ
9	ND	ANCHORAGE
1090		
10	DA-N	BALTIMORE
11	DA-N	LITTLE ROCK
12	DA-2	KITCHENER
13	DA-2	LETHBRIDGE
14	DA-2	SEATTLE
15	DA-2	BOZEMAN
16	DA-N	ROSARITA BEACH
17	ND	SAN GERMAN

100 0 100 200 300 400  
MILES

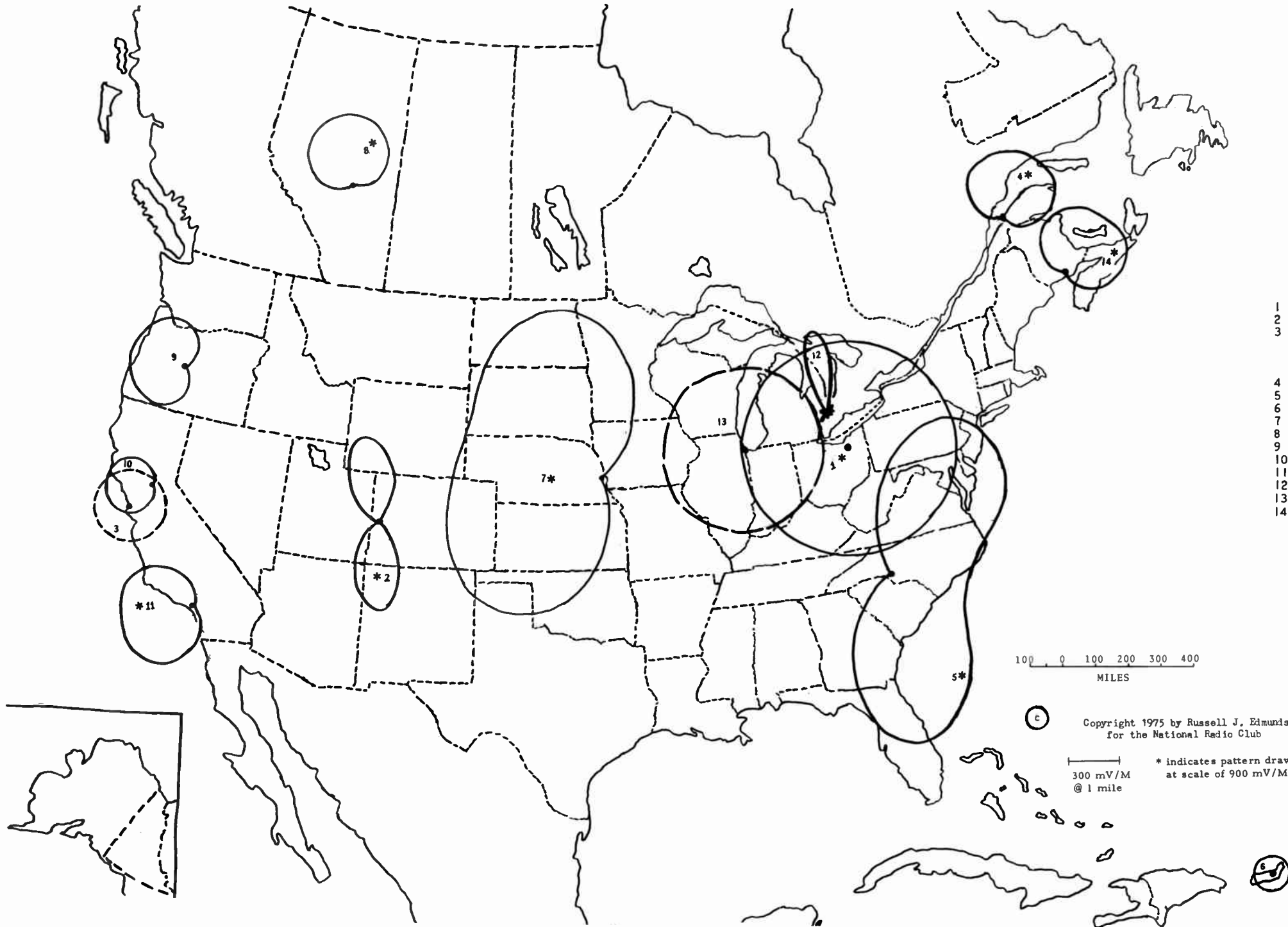
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300 mV/M @ 1 mile  
\* indicates pattern drawn at scale of 900 mV/M

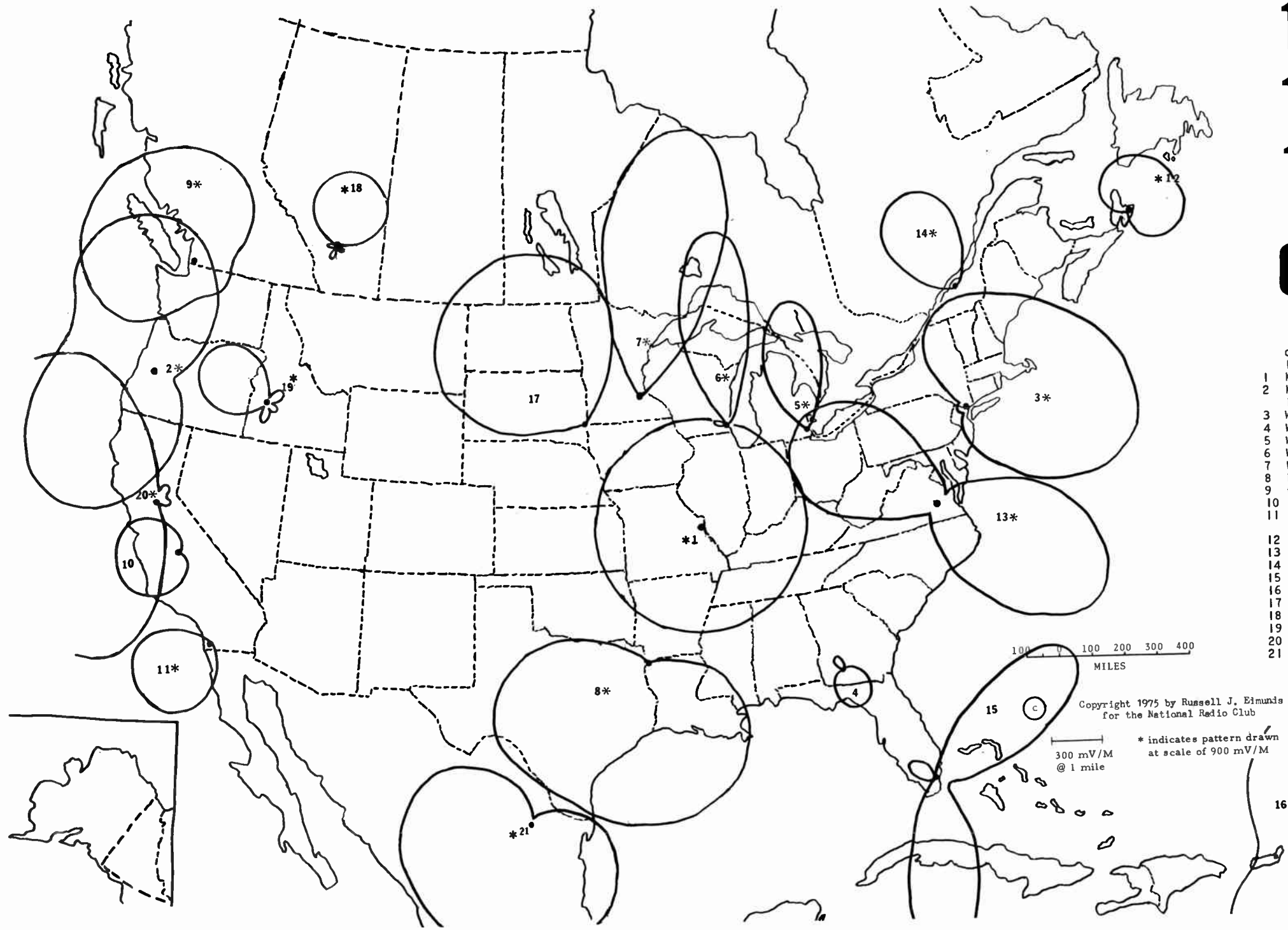
**1100  
1110 KHZ**

**CLEAR**

call	class	location
1100		
1	WWWE ND	CLEVELAND
2	KREX DA-N	GRAND JUNCTION
3	KFAX ND	SAN FRANCISCO (L)
(KFAX operated 1000 watts ND during WWWE silent period)		
1110		
4	C DA-2	RIMOUSKI
5	WBT DA-N	CHARLOTTE
6	WVJP ND	CAGUAS
7	KFAB DA-N	OMAHA
8	CHOT DA-N	EDMONTON
9	KBND DA-2	BEND
10	KPOP DA-N	ROSEVILLE
11	KRLA DA-2	PASADENA
12	CKJD DA-2	SARNIA (po 1250)
13	WMBI ND	CHICAGO (L)
14	CBD DA-2	ST. JOHN'S

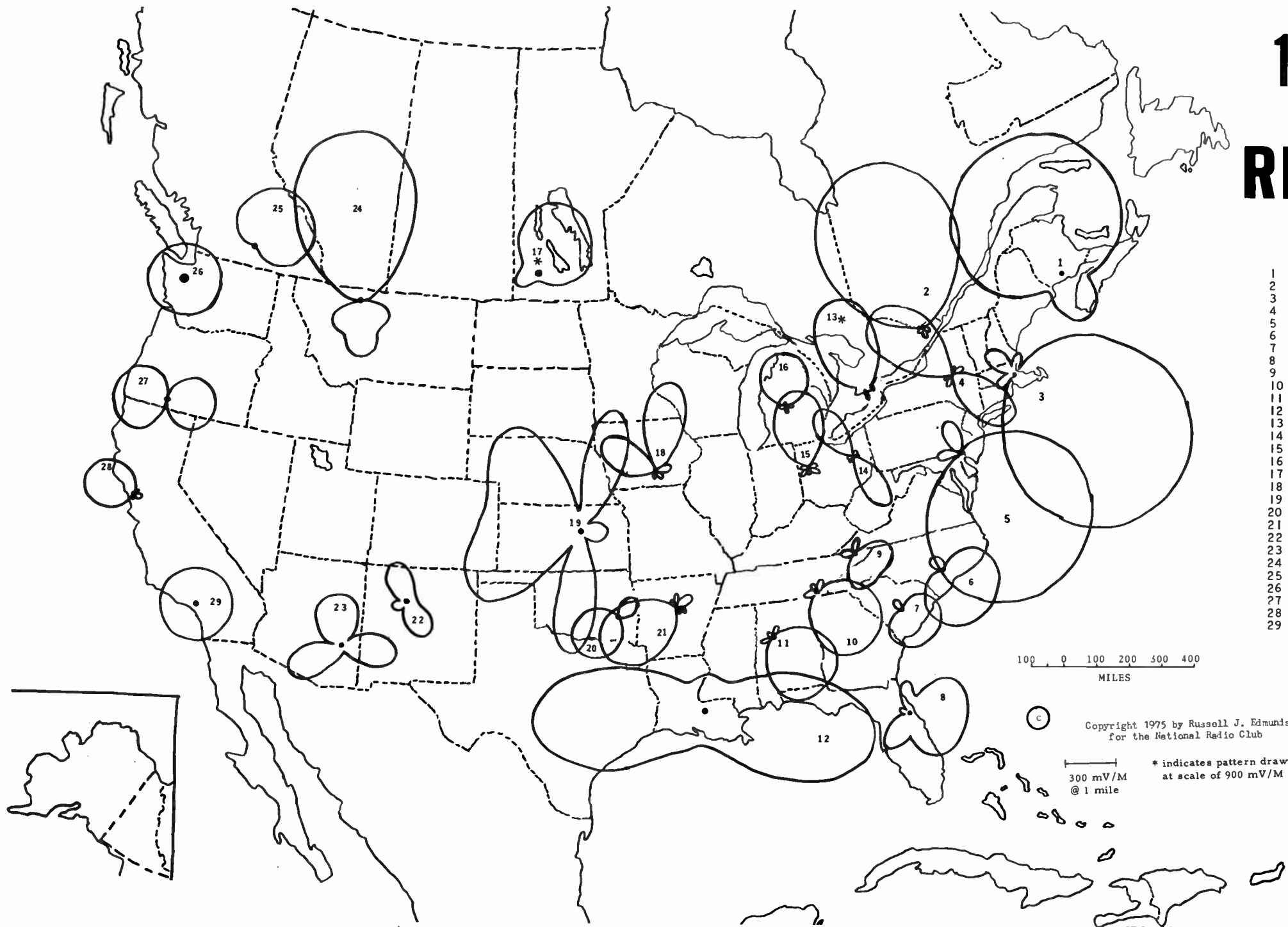


# 1120 1130 KHZ 1140 CLEAR



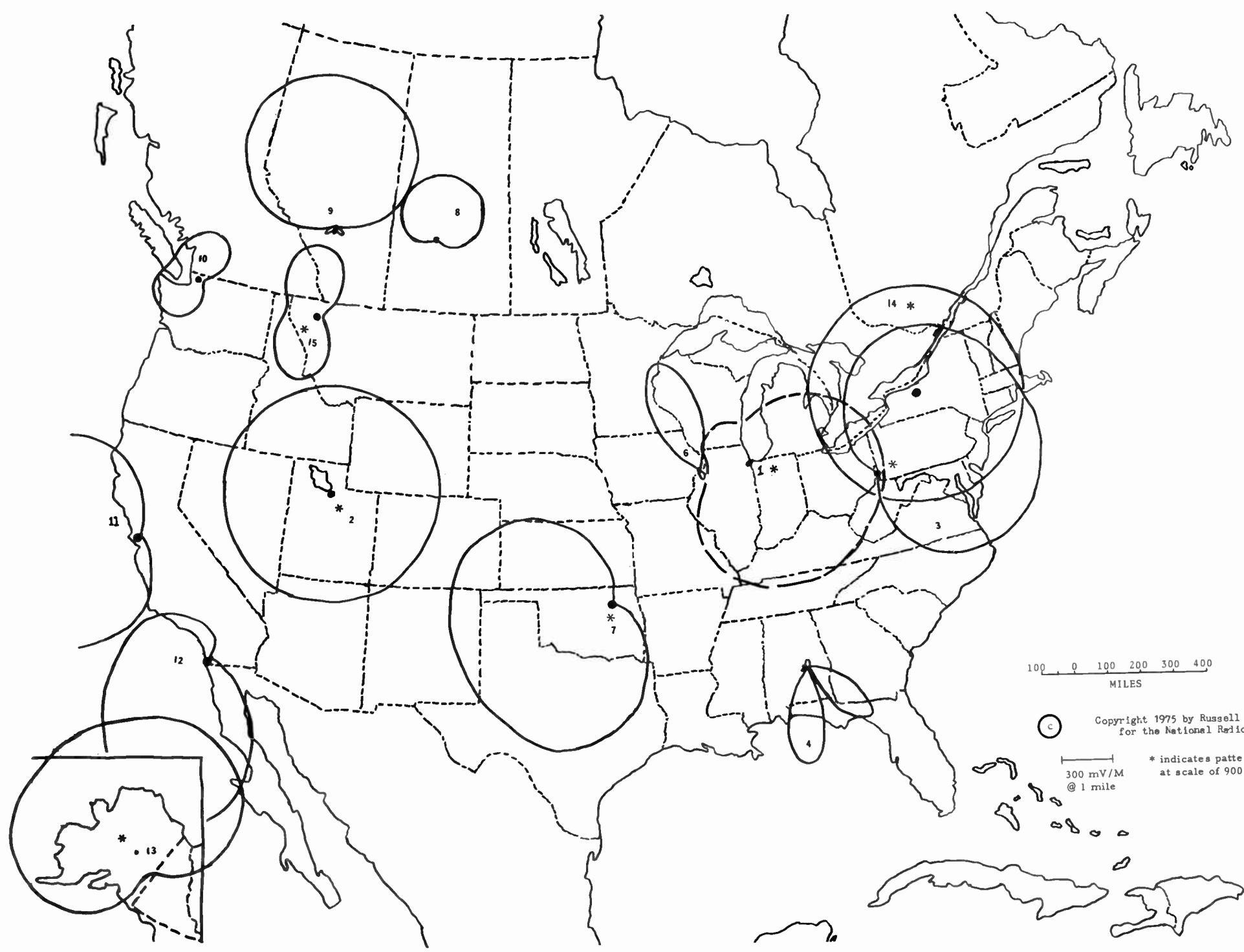
call	class	location
1120		
1 KMOX	ND	ST. LOUIS
2 KPNW	DA-2	EUGENE
1130		
3 WNEW	DA-N	NEW YORK
4 WMGA	DA-N	MOULTRIE
5 WCAR	DA-2	DETROIT
6 WISN	DA-2	MILWAUKEE
7 WDGY	DA-2	MINNEAPOLIS
8 KWKH	DA-N	SHREVEPORT
9 CKWX	DA-N	VANCOUVER
10 KRDU	DA-1	DINUBA
11 KSDO	DA-2	SAN DIEGO
1140		
12 CBI	DA-N	SIDNEY
13 WRVA	DA-1	RICHMOND
14 CJTR	DA-2	THREE RIVERS
15 WQBA	DA-2	MIAMI
16 WQ11	DA-1	SAN JUAN
17 KSOU	DA-N	SIOUX FALLS
18 CKXL	DA-2	CALGARY
19 KGEM	DA-1	BOISE
20 KRAK	DA-1	SACRAMENTO
21 XEMR	DA-N	MONTERREY

# 1150 KHZ REGIONAL



call	class	location
1	CHSJ	DA-2 ST. JOHN
2	CJRC	DA-2 OTTAWA
3	WCOP	DA-2 BOSTON
4	WRUN	DA-2 UTICA
5	WDEL	DA-2 WILMINGTON
6	WGBR	DA-2 GOLDSBORO
7	WDIX	DA-2 URANBURG
8	WNDB	DA-N JAYTONA BEACH
9	WCRK	DA-N MURRISTOWN
10	WGOW	DA-N CHATTANOOGA
11	WJRD	DA-N TUSCALOOSA
12	WJBU	DA-1 BATON ROUGE
13	CKUC	DA-2 HAMILTON
14	WCUE	DA-2 CUYAHOGA FALLS
15	WIMA	DA-N LIMA
16	WCEN	DA-N MOUNT PLEASANT
17	CKX	DA-N BRANDON
18	KWKY	DA-2 DES MOINES
19	KSAL	DA-N SALINA
20	KNED	DA-N MCALESTER
21	KXLR	DA-N N. LITTLE ROCK
22	KDEF	DA-N ALBUQUERQUE
23	KCKY	DA-N COOLIDGE
24	KSEN	DA-? SHELBY
25	CKIQ	DA-1 KELOWNA
26	KAYO	ND SEATTLE
27	KAGO	DA-N KLA MATH FALLS
28	KPLS	DA-2 SANTA RUSA
29	KIIS	ND LOS ANGELES

# 1160 1170 KHZ 1180 CLEAR



call	class	location
1160		
1 WJJD	DA-1	CHICAGO (L)
2 KSL	ND	SALT LAKE CITY
1170		
3 WWVA	DA-N	WHEELING
4 WCOV	DA-2	MONTGOMERY
5 WLEO	ND	PONCE
6 KSTT	DA-2	DAVENPORT
7 KV00	DA-N	TULSA
8 CFNS	DA-1	SASKATOON
9 CKGY	DA-N	RED DEER
10 KPUG	DA-2	BELLINGHAM
11 KLOK	DA-2	SAN JOSE
12 KCBO	DA-2	SAN DIEGO
13 KRKM	DA-N	NORTH POLE
1180		
14 WHAM	ND	ROCHESTER
15 KOFI	DA-N	KALISPELL



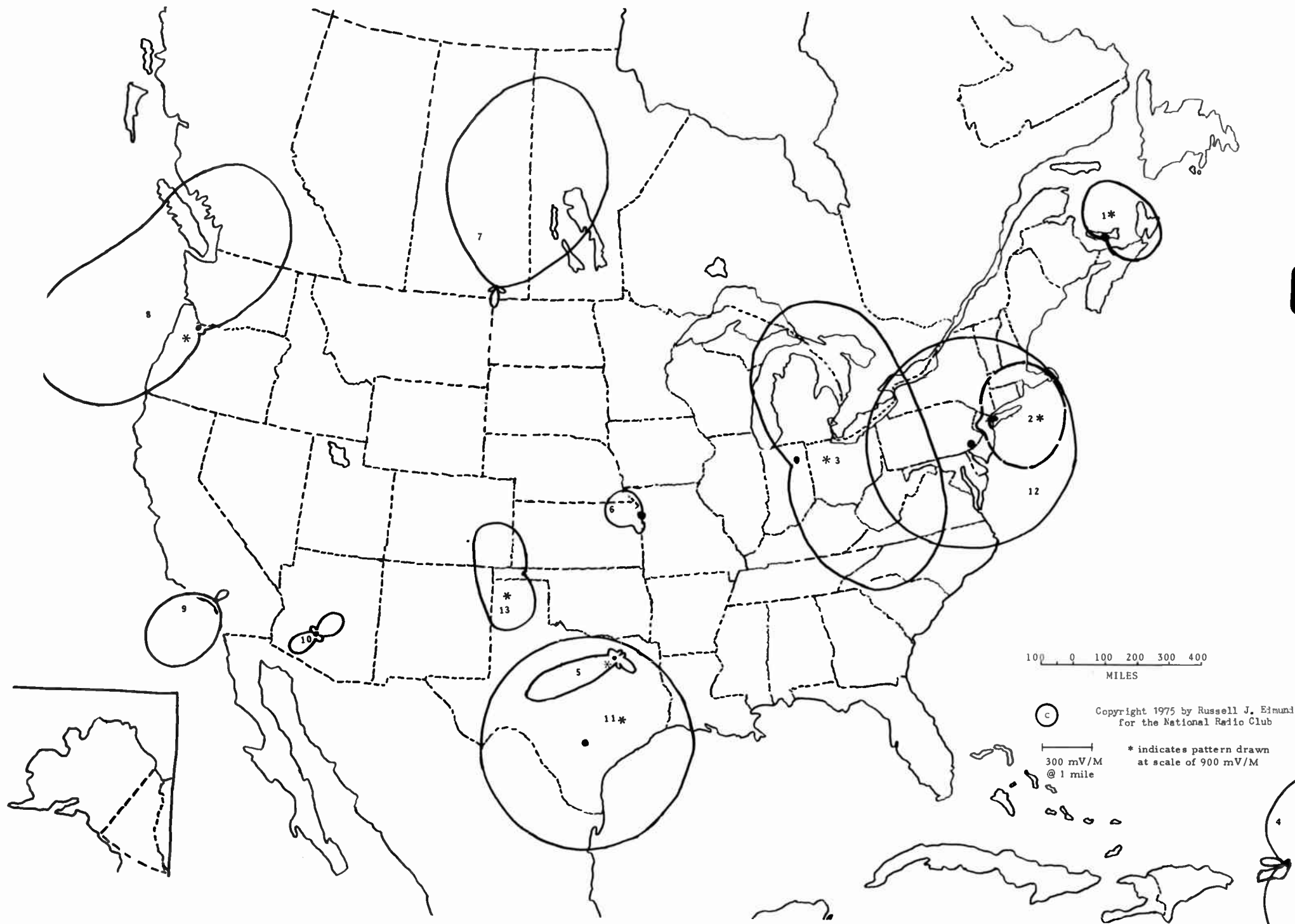
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300 mV/M @ 1 mile \* indicates pattern drawn at scale of 900 mV/M



1190  
1200 KHZ  
1210

**CLEAR**



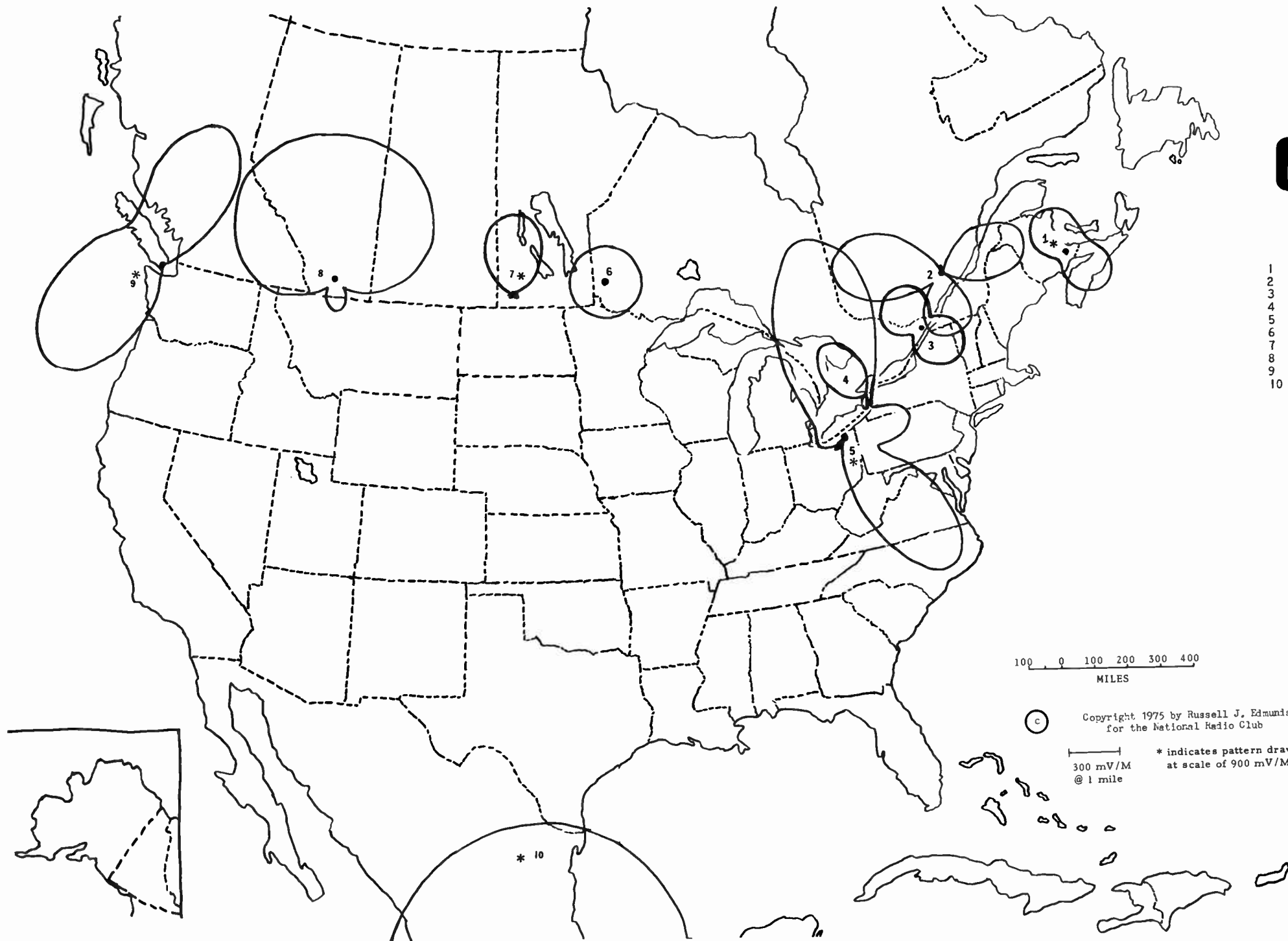
call	class	location
1190		
1 CHTN	DA-N	CHARLOTTOWN
2 WLIB	DA-1	NEW YORK (L)
3 WWOV	DA-N	FORT WAYNE
4 WBMJ	DA-1	SAN JUAN
5 KLIF	DA-2	DALLAS
6 KAYO	DA-N	KANSAS CITY
7 CFSL	DA-N	WEYBURN
8 KEX	DA-1	PORTLAND
9 KEZY	DA-N	ANAHEIM
10 KRDS	DA-1	TOLLESON
1200		
11 WOAI	ND	SAN ANTONIO
1210		
12 WCAU	ND	PHILADELPHIA
13 KBYN	DA-N	GUYMON



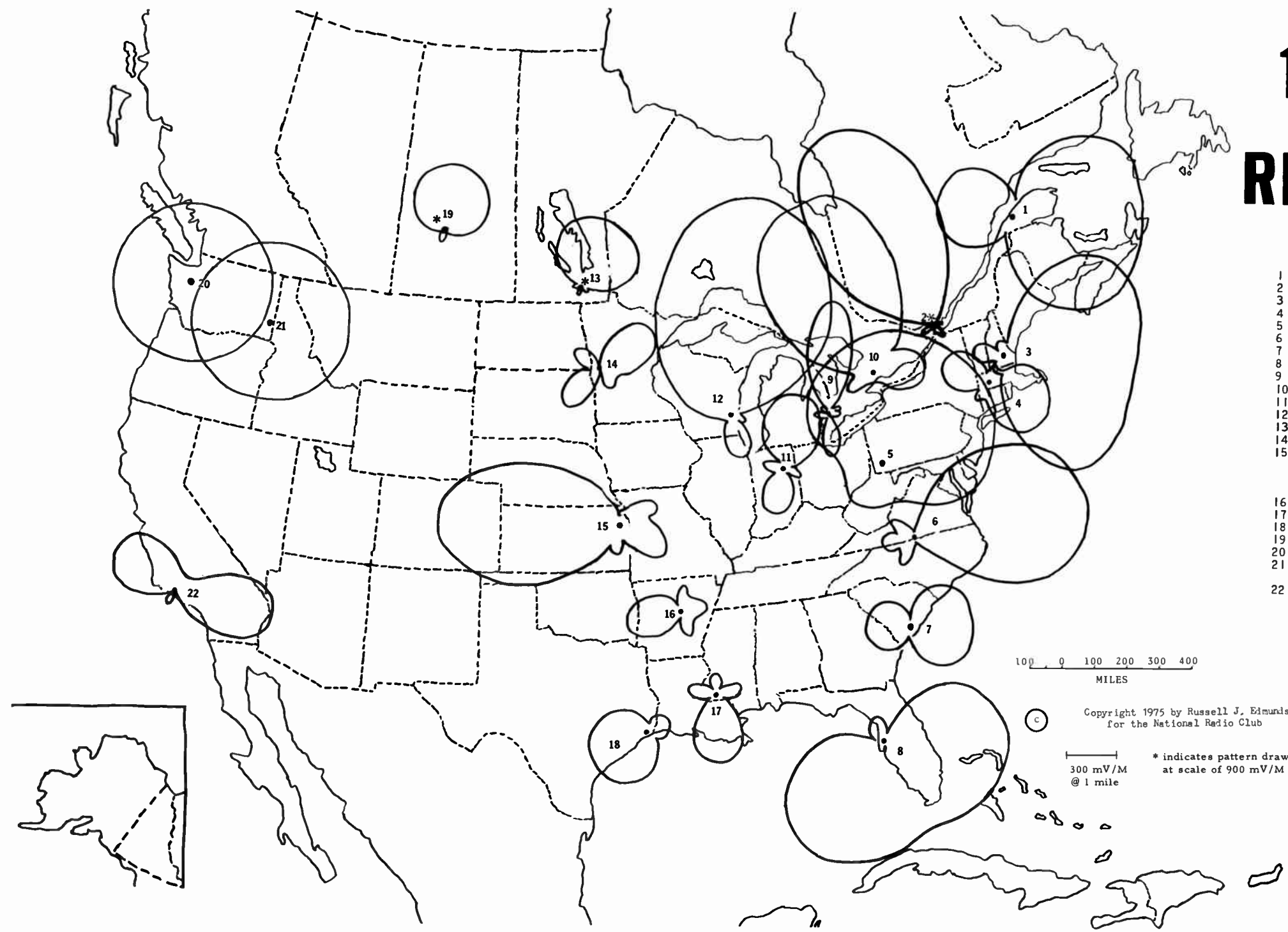
# 1220 KHZ

# CLEAR

call	class	location
1	CKCW	DA-N MONCTON
2	CKSM	DA-2 SHAWINIGAN FALLS
3	CJSS	DA-2 CORNWALL
4	CHSC	DA-1 ST. CATHARINES
5	WGAR	DA-1 CLEVELAND
6	CJRL	ND KENORA
7	CJRB	DA-2 BOUISSEVAIN
8	CJUC	DA-N LETHBRIDGE
9	CKDA	DA-1 VICTORIA
10	XEB	ND MEXICO, DF



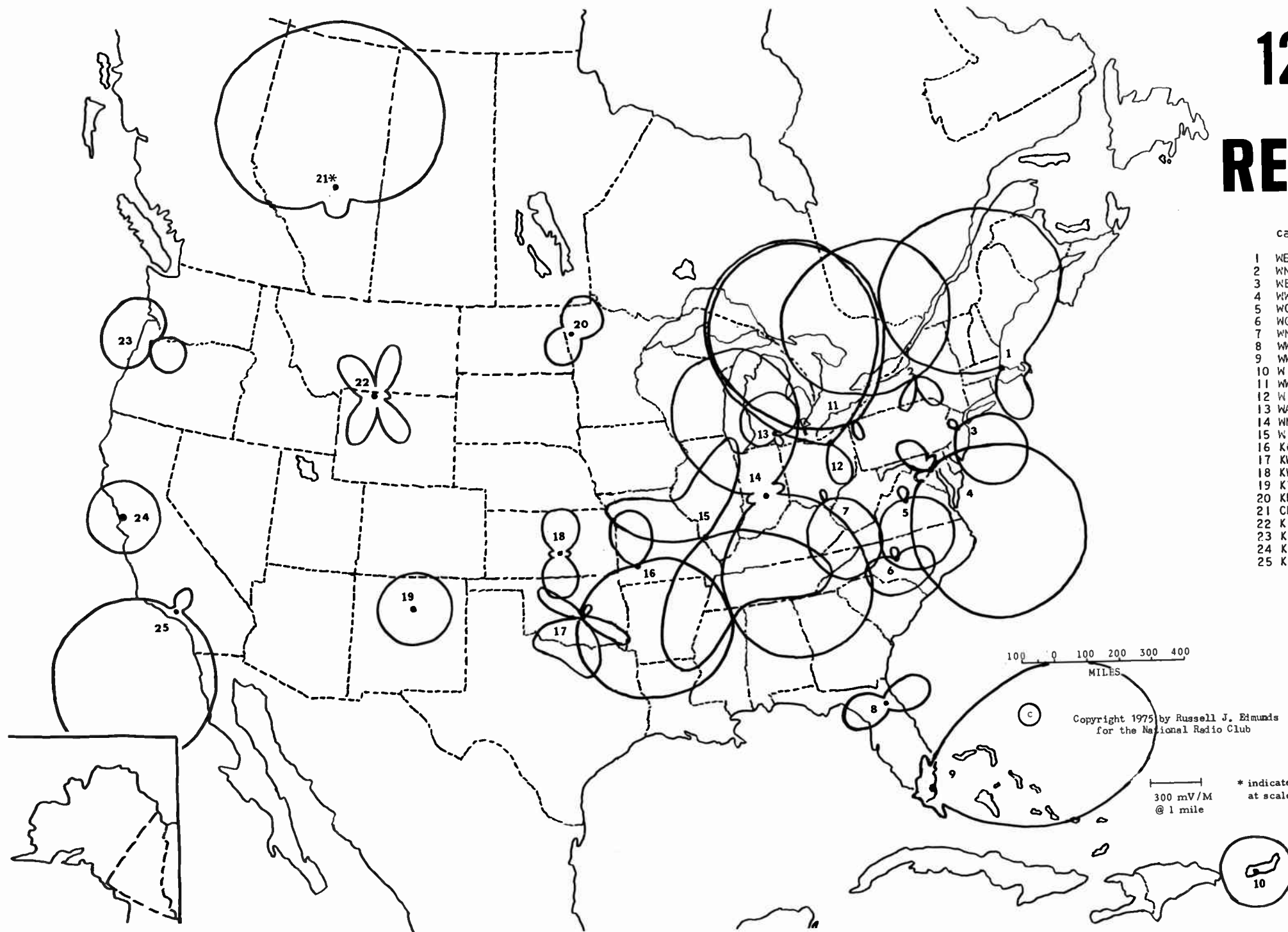
# 1250 KHZ REGIONAL



call	class	location
1	CKBL	DA-N MATANE
2	CBOF	DA-1 UTTAWA
3	WKBR	DA-2 MANCHESTER
4	WARE	DA-N WARE
5	WTAE	DA-N PITTSBURGH
6	WDVA	DA-N DANVILLE
7	WTMA	DA-N CHARLESTON
8	WDAE	DA-1 TAMPA
9	CKJD	DA-2 SARNIA (CP:1110)
10	CHWO	DA-2 OAKVILLE
11	WGL	DA-2 FORT WAYNE
12	WEMP	DA-2 MILWAUKEE
13	CHSM	DA-2 STEINBACH
14	KBRF	DA-N FERGUS FALLS
15	WREN	DA-N TOPEKA
	KFKU	DA-N LAWRENCE
(WREN & KFKU share time and use same transmitter & ant)		
16	KALO	DA-N LITTLE ROCK
17	WHNY	DA-N MCCOMB
18	KPAC	DA-N PORT ARTHUR
19	CKOM	DA-N SASKATOON
20	KYAC	ND SEATTLE
21	KWSU	ND PULLMAN
(KYAC & KWSU share time)		
22	KTMS	DA-1 SANTA BARBARA

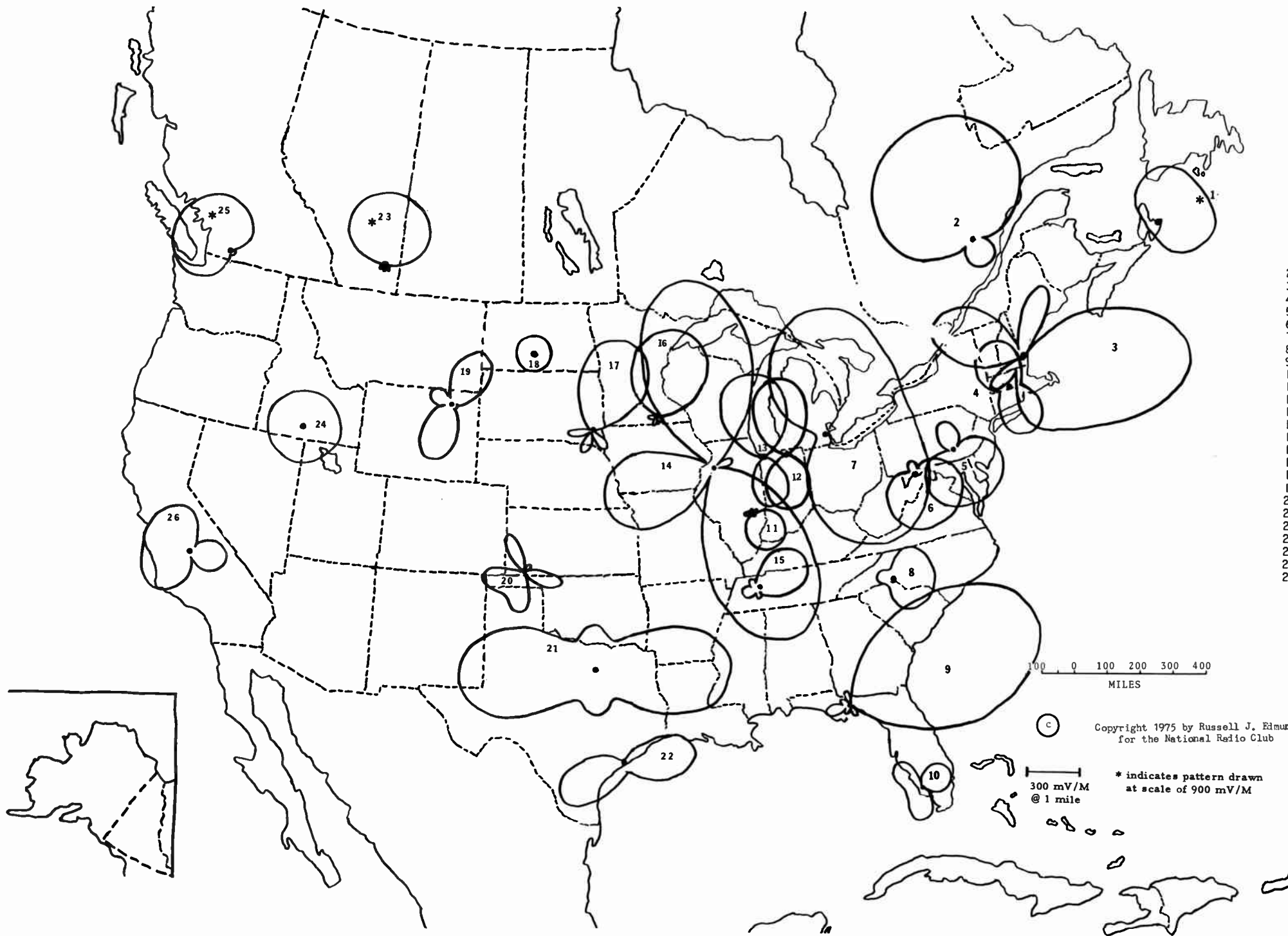
# 1260 KHZ REGIONAL

call	class	location
1	WEZE	DA-N BOSTON
2	WNDR	DA-N SYRACUSE
3	WBUD	DA-2 TRENTON
4	WADC	DA-2 WASHINGTON
5	WCHV	DA-2 CHARLOTTESVILLE
6	WGWR	DA-2 ASHEBORO
7	WNXT	DA-2 PORTSMOUTH
8	WPPF	DA-N PALATKA
9	WWOK	DA-2 MIAMI
10	WISO	ND PONCE
11	WWYN	DA-2 ERIE
12	WIXY	DA-2 CLEVELAND
13	WALM	DA-N ALBION
14	WNDE	DA-N INDIANAPOLIS
15	WIBV	DA-2 BELLEVILLE
16	KGBX	DA-N SPRINGFIELD
17	KWSH	DA-N WEWOKA
18	KVHK	DA-2 HUTCHINSON
19	KVSF	ND SANTE FE
20	KRUX	DA-N CROOKSTON
21	CFRN	DA-N EDMONTON
22	KPOW	DA-N POWELL
23	KMCM	DA-N McMINNVILLE
24	KYA	ND SAN FRANCISCO
25	KGIL	DA-2 SAN FERNANDO



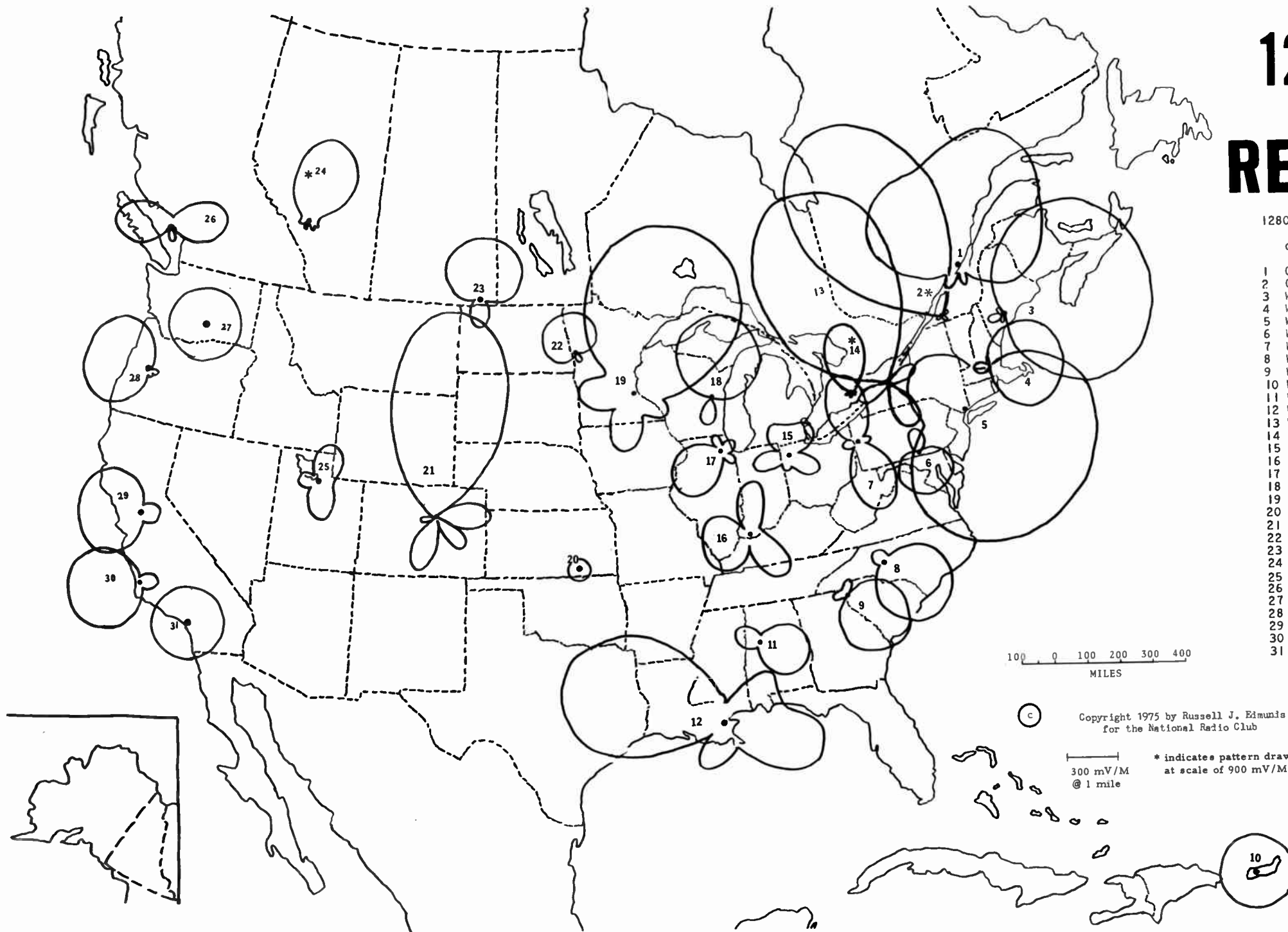
# 1270 KHZ

## REGIONAL



call	class	location
1	CJCB	DA-N SYDNEY
2	CFGT	DA-N ALMA
3	WTSN	DA-2 DOVER
4	WSPR	DA-1 SPRINGFIELD
5	WLBR	DA-2 LEBANON
6	WUOK	DA-2 CUMBERLAND
7	WXYZ	DA-N DETROIT
8	WCGC	DA-N BELMONT
9	WTNT	DA-N TALLAHASSEE
10	WNUG	DA-N NAPLES
11	WEIC	DA-2 CHARLESTON
12	WCMR	DA-2 ELKHART
13	WVCA	DA-1 GARY
14	WHBF	DA-N ROCK ISLAND
15	WLK	DA-N NEWPORT
16	KWEB	DA-2 ROCHESTER
17	KNWC	DA-N SIOUX FALLS
18	KBOU	ND BISMARCK-MANDAN
19	KIML	DA-N GILLETTE
20	KSCB	DA-N LIBERAL
21	KFJZ	DA-1 FORT WORTH
22	KIOX	DA-N BAY CITY
23	CHAT	DA-N MEDICINE HAT
24	KTFI	ND TWIN FALLS
25	CHWK	DA-N CHILLIWACK
26	KCOK	DA-N TULARE

# 1280 KHZ REGIONAL



1280

call	class	location
1 CKCV	DA-2	QUEBEC
2 CJMS	DA-2	MONTREAL
3 WABK	DA-N	GARDINER
4 WEIM	DA-N	FITCHBURG
5 WADO	DA-1	NEW YORK
6 WHVR	DA-2	HANOVER
7 WKST	DA-N	NEW CASTLE
8 WSAT	DA-N	SALISBURY
9 WANS	DA-N	ANDERSON
10 WCMN	ND	ARECIBO
11 WNPT	DA-N	TUSCALOUSA
12 WSGO	DA-1	NEW ORLEANS
13 WRUC	DA-N	ROCHESTER
14 CHAM	DA-2	HAMILTON
15 WONW	DA-N	DEFIANCE
16 WGBF	DA-N	EVANSVILLE
17 WMRO	DA-2	AURORA
18 WNAM	DA-2	NEENAH-MENASHA
19 WUTC	DA-N	MINNEAPOLIS
20 KSOK	ND	ARKANSAS CITY
21 KTLK	DA-2	DENVER
22 KVQX	DA-N	MOORHEAD
23 CJSL	DA-1	ESTEVAN
24 C	DA-1	CALGARY
25 KNAK	DA-1	SALT LAKE CITY
26 CHQB	DA-1	POWELL RIVER
27 KIT	ND	YAKIMA
28 KBDF	DA-N	EUGENE
29 KJOY	DA-N	STOCKTON
30 KFYN	DA-N	ARROYO GRANDE
31 KFOX	ND	LONG BEACH

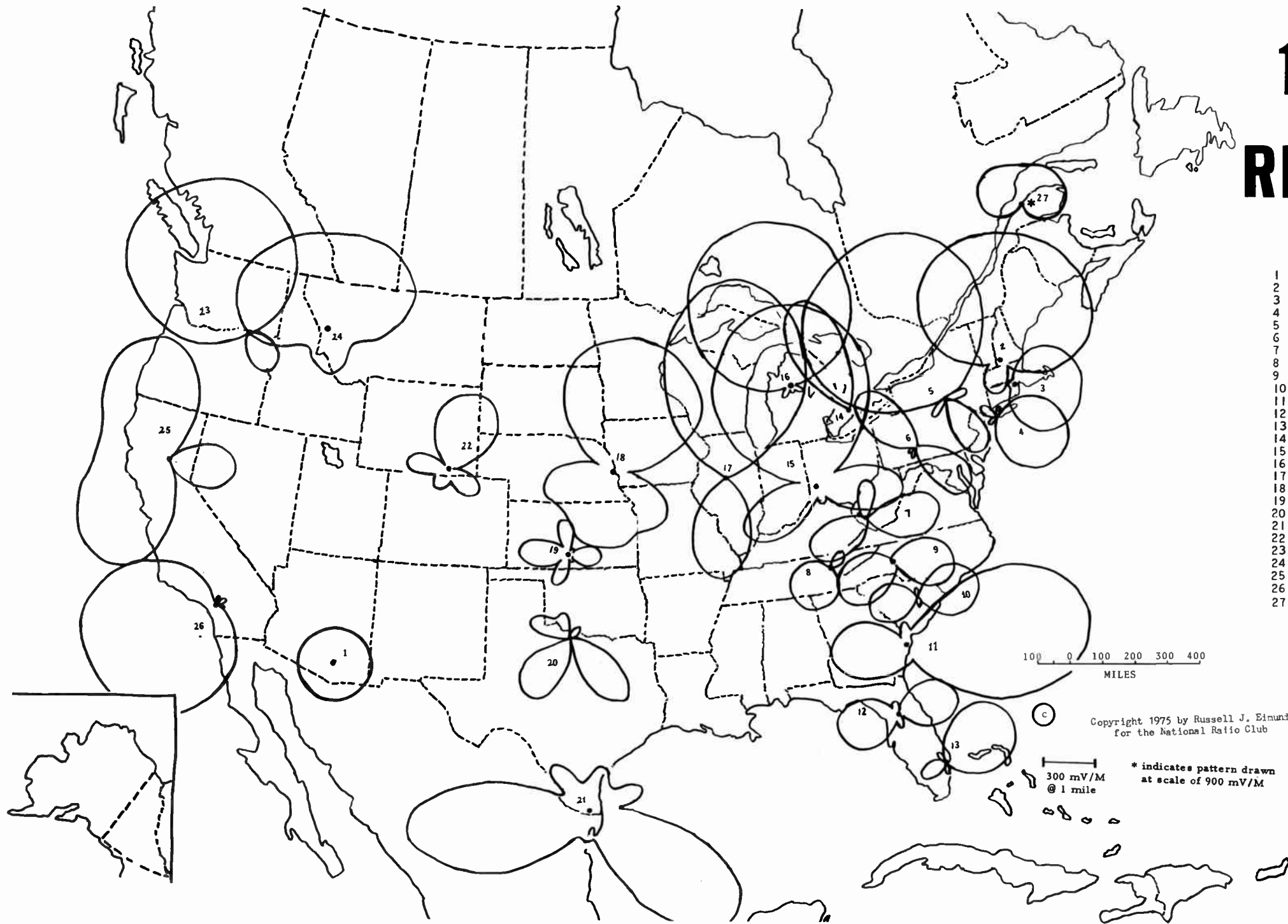
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MILES

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300 mV/M  
@ 1 mile

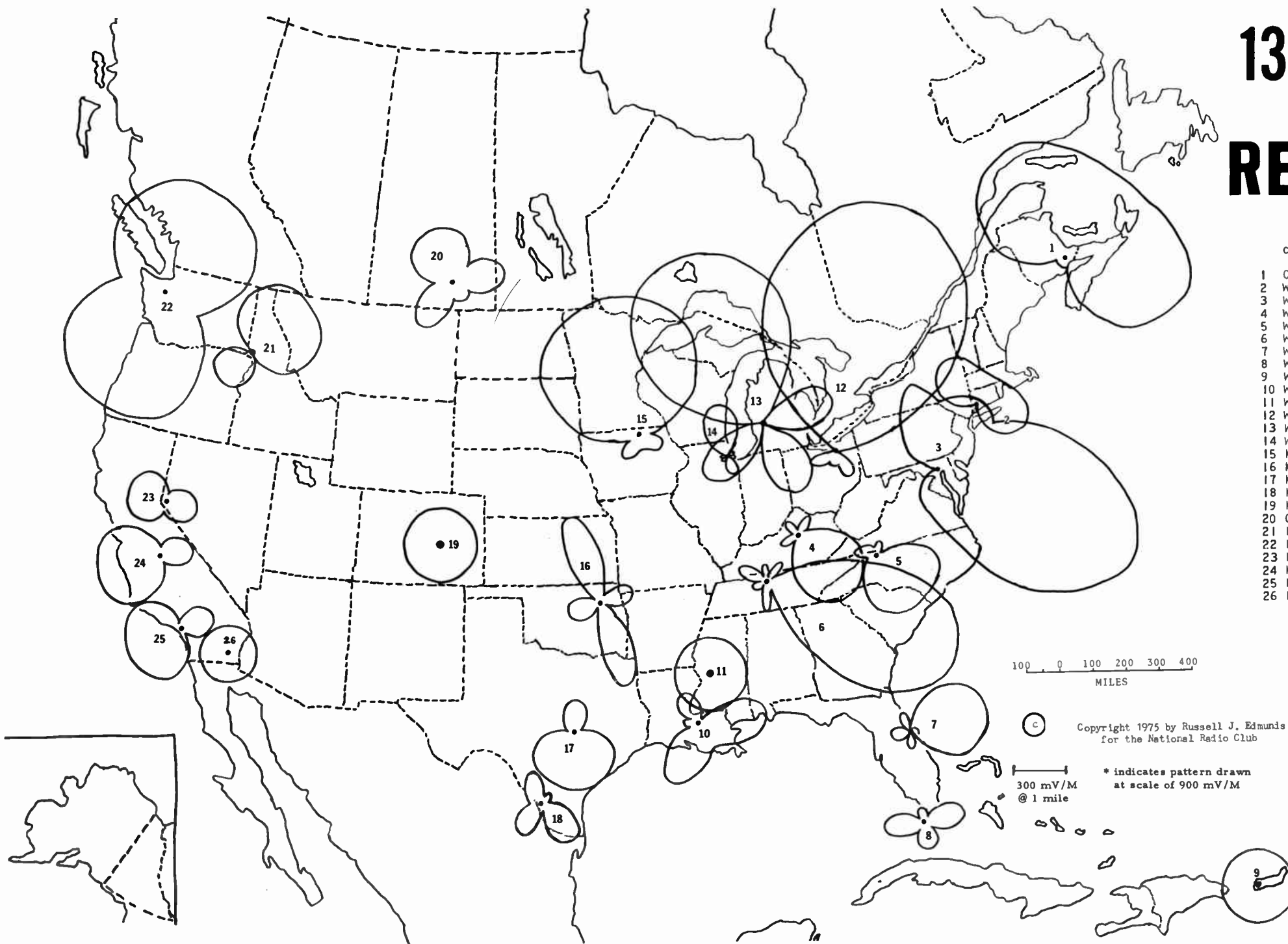
\* indicates pattern drawn  
at scale of 900 mV/M

# 1290 KHZ REGIONAL



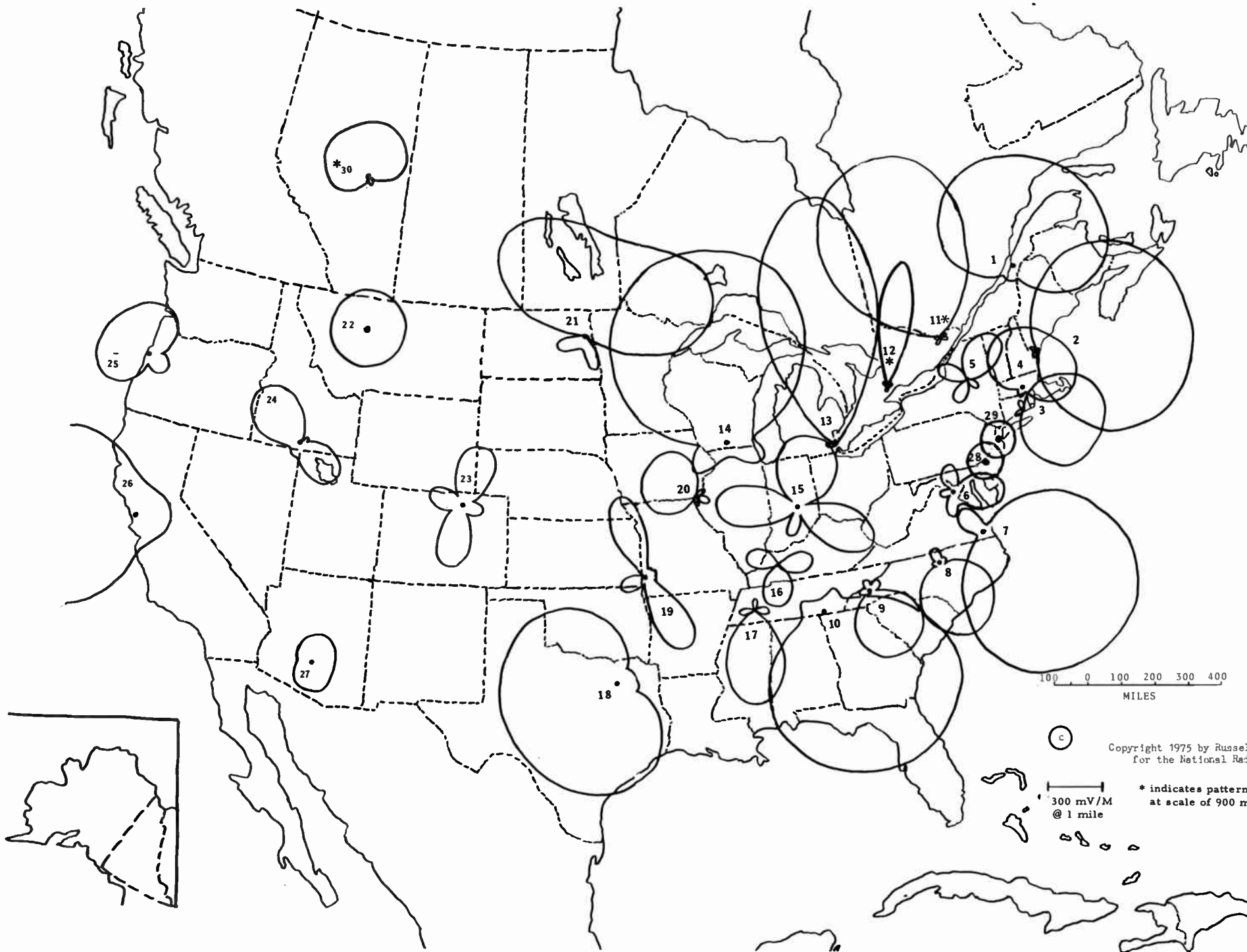
call	class	location
1	KCUB	ND TUCSON
2	WKNE	DA-1 KEENE
3	WICE	DA-2 PROVIDENCE
4	WGLI	DA-2 BABYLON
5	WNBF	DA-N BINGHAMTON
6	WFBG	DA-N ALTOONA
7	WVOW	DA-N LOGAN
8	WATO	DA-2 OAK RIDGE
9	WHKY	DA-N HICKORY
10	WFIG	DA-N SUMTER
11	WTOC	DA-N SAVANNAH
12	WTMC	DA-N OCALA
13	WIRK	DA-N WEST PALM BEACH
14	CJOE	DA-1 LONDON
15	WHIO	DA-N DAYTON
16	WHGR	DA-N HOUGHTON LAKE
17	WIRL	DA-2 PEURIA
18	KOIL	DA-N UMAHA
19	KVNS	DA-2 PRATT
20	KTRN	DA-N WICHITA FALLS
21	KRGV	DA-N WESLACO
22	KUWB	DA-2 LARAMIE
23	KUMA	DA-N PORTLAND
24	KVGO	DA-1 MISSOULA
25	KHSL	DA-N CHICO
26	KMEM	DA-2 SAN BERNARDIN
27	C	DA-2 MATANE

# 1300 KHZ REGIONAL



call	class	location
1 CBAF	DA-1	MUNCTON
2 WAVZ	DA-N	NEW HAVEN
3 WFBR	DA-2	BALTIMORE
4 WBLG	DA-N	LEXINGTON
5 WSYD	DA-N	MOUNT AIRY
6 WMAK	DA-N	NASHVILLE
7 WRKT	DA-2	COCOA BEACH
8 WFFG	DA-2	MARATHON
9 WTIL	ND	MAYAGUEZ
10 WIBR	DA-2	BATON ROUGE
11 WRBC	ND	JACKSON
12 WERE	DA-1	CLEVELAND
13 WOOD	DA-N	GRAND RAPIDS
14 WTAQ	DA-2	LA GRANGE
15 KGLU	DA-N	MASON CITY
16 KXXO	DA-2	TULSA
17 KVET	DA-2	AUSTIN
18 KLAR	DA-N	LAREDO
19 KVOR	ND	COLORADO SPRINGS
20 CJME	DA-1	REGINA
21 KOZE	DA-N	LEWISTON
22 KMPS	DA-N	SEATTLE
23 KPTL	DA-N	CARSON CITY
24 KYNO	DA-N	FRESNO
25 KWKW	DA-2	PASADENA
26 KROP	ND	BRAWLEY

# 1310 KHZ REGIONAL



call	class	location
1	UA-N	LA POCAHONTE
2	DA-2	PORTLAND
3	DA-2	NORWICH
4	DA-2	WORCESTER
5	DA-N	UTICA
6	DA-2	FAIRFAX
7	DA-N	NEWPORT NEWS
8	DA-2	DURHAM
9	DA-N	ASHEVILLE
10	DA-N	CHATTAHOOGA
11	DA-2	OTTAWA
12	DA-2	RICHMOND HILL
13	DA-2	DEARBORN
14	DA-N	MADISON
15	DA-N	INDIANAPOLIS
16	DA-N	MADISONVILLE
17	DA-N	JACKSON
18	DA-N	DALLAS
19	DA-2	JUPLIN
20	DA-N	KEOKUK
21	DA-N	GRAND FORK
22	ND	GREAT FALLS
23	DA-N	GREENLEYS
24	DA-N	TWIN FALLS
25	DA-N	NEWPORT
26	DA-1	OAKLAND
27	DA-N	MESA
28	ND	CAMDEN
29	ND	ASBURY PARK
30	DA-N	ST. PAUL

100 0 100 200 300 400  
MILES

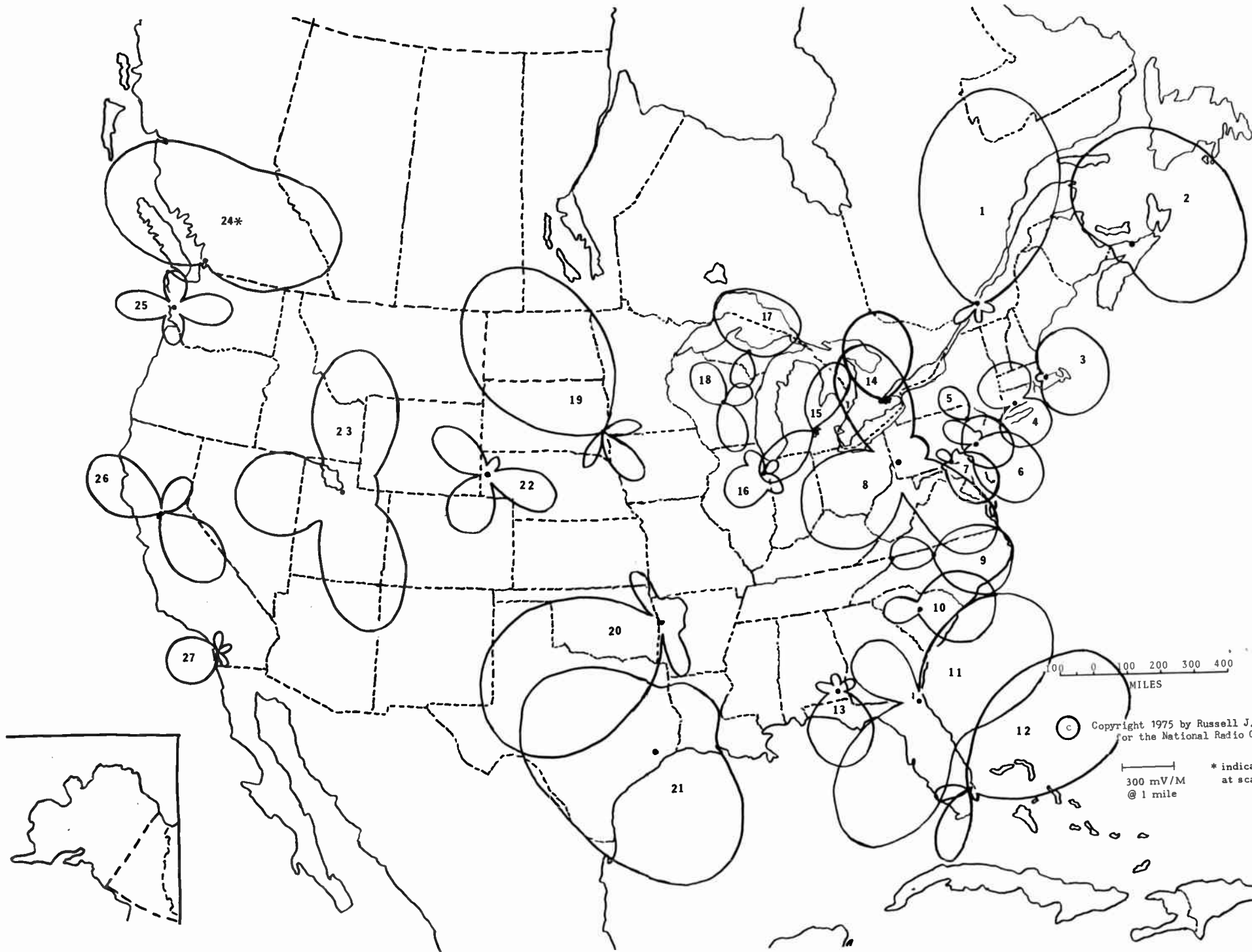
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\* indicates pattern drawn  
at scale of 900 mV/M

300 mV/M  
@ 1 mile



# 1320 KHZ REGIONAL



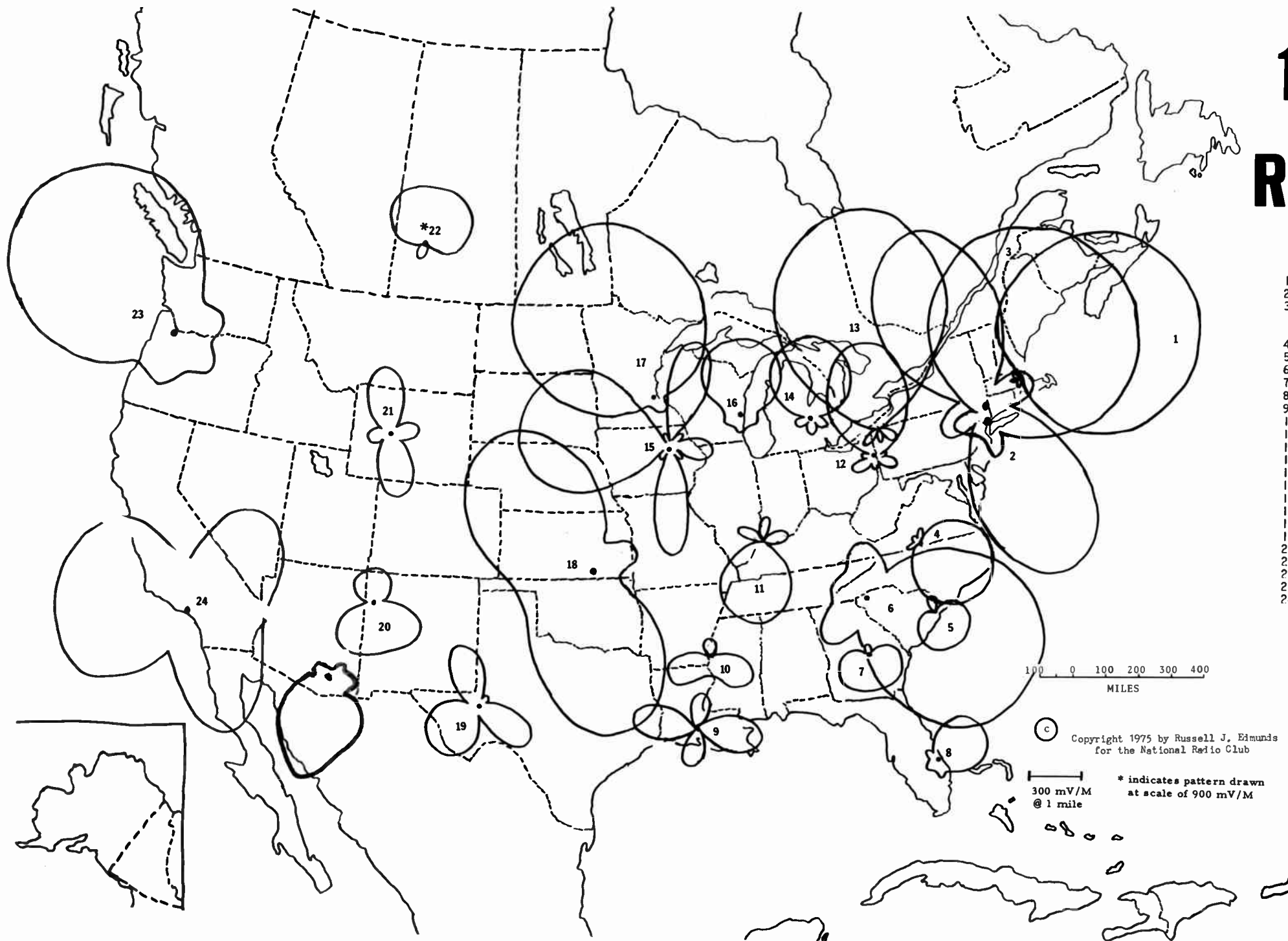
call	class	location
1	CJSO	DA-2 SOREL
2	CKEC	DA-N NEW GLASGOW
3	WARA	DA-2 ATTLEBORO
4	WATR	DA-2 WATERBURY
5	WSCR	DA-N SCRANTON
6	WKAP	DA-2 ALLENTOWN
7	WGET	DA-2 GETTYSBURG
8	WKTQ	DA-N PITTSBURGH
9	WCOG	DA-2 GREENSBORO
10	WUIC	DA-N COLUMBIA
11	WVOJ	DA-N JACKSONVILLE
12	WGMA	DA-2 HOLLYWOOD
13	WAGF	DA-N DOTHAN
14	CFTJ	DA-2 CAMBRIDGE
15	WILS	DA-2 LANSING
16	WKAN	DA-N KANKAKEE
17	WDMJ	DA-N MARQUETTE
18	WFHR	DA-N WISCONSIN RAPIDS
19	KELO	DA-N SIOUX FALLS
20	KWHN	DA-N FORT SMITH
21	KXYZ	DA-N HOUSTON
22	KOLT	DA-N SCOTT SBLUFF
23	KCPX	DA-1 SALT LAKE CITY
24	CHQM	DA-2 VANCOUVER
25	KXRO	DA-N ABERDEEN
26	KCRA	DA-2 SACRAMENTO
27	KUDE	DA-1 OCEANSIDE
28	WUNO	ND RIO PIEDRAS

0 100 200 300 400  
MILES

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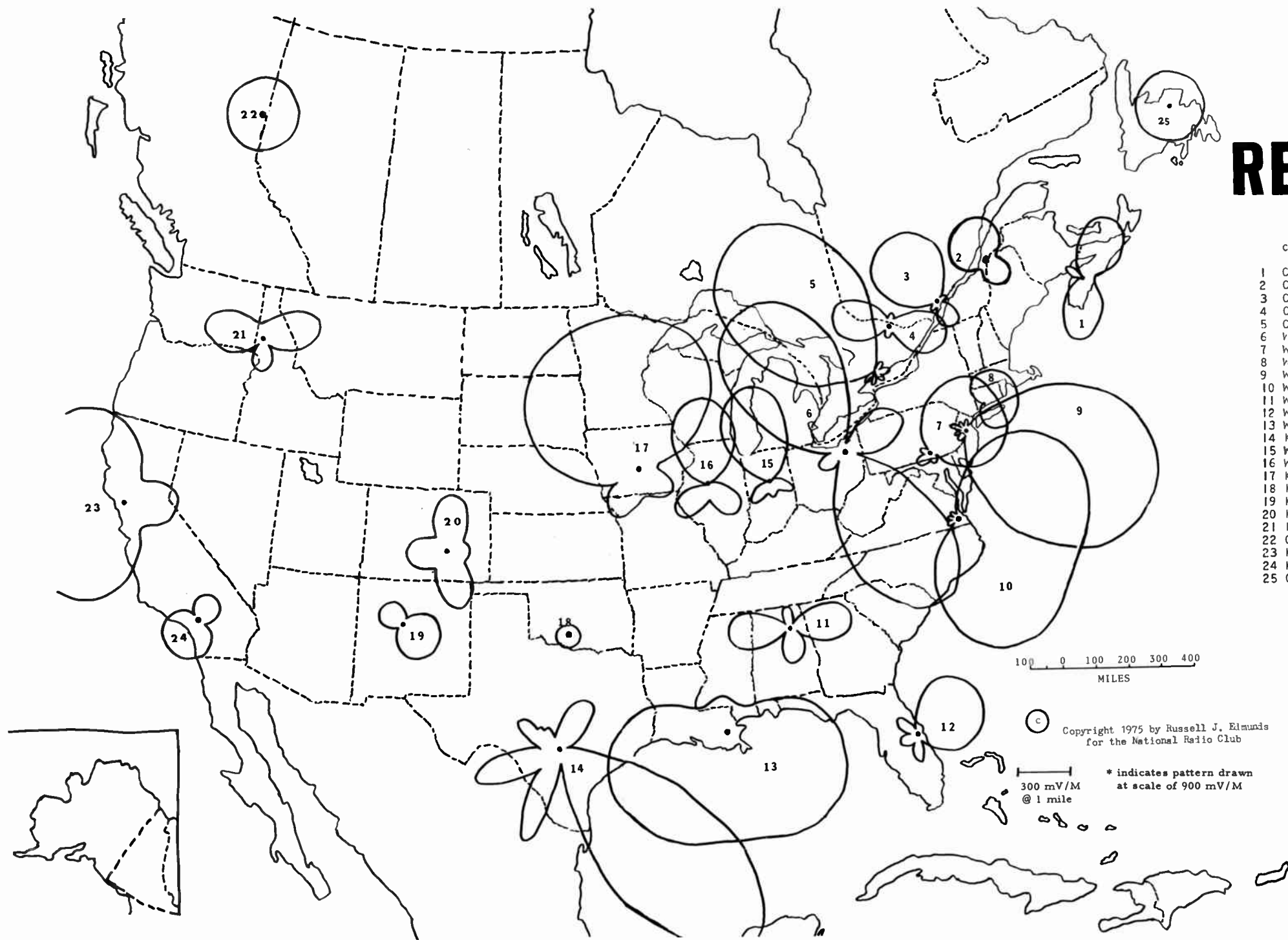
300 mV/M @ 1 mile  
\* indicates pattern drawn at scale of 900 mV/M

# 1330 KHZ REGIONAL



call	class	location
1	DA-2	WALTHAM
2	DA-2	NEW YORK
3	DA-1	NEW YORK
(WEVD & WPOW share time, WEVD has requested to use WPOW DA)		
4	DA-N	LANVILLE
5	DA-N	CONWAY
6	DA-N	GREENVILLE
7	DA-N	DUBLIN
8	DA-N	FORT PIERCE
9	DA-N	LAFAYETTE
10	DA-N	GREENVILLE
11	DA-N	EVANSVILLE
12	DA-2	CAMPBELL
13	DA-2	ERIE
14	DA-2	FLINT
15	DA-2	WATERLOO
16	DA-2	SHEBOYGAN
17	DA-2	MINNEAPOLIS
18	DA-N	WICHITA
19	DA-N	MONAHANS
20	DA-N	GALLUP
21	DA-N	LANDER
22	DA-1	KOSETOWN
23	DA-1	PORTLAND
24	DA-N	LOS ANGELES

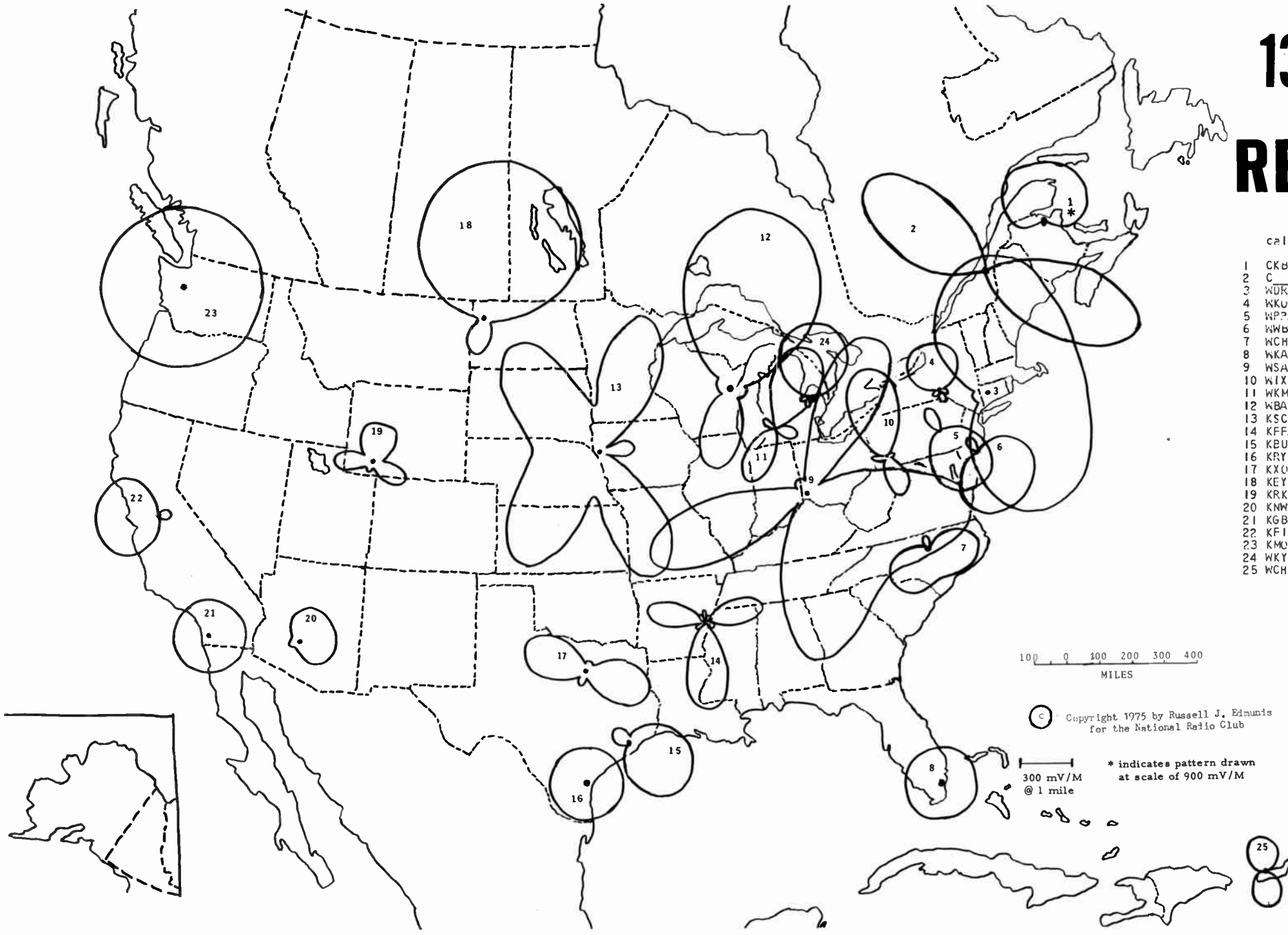
# 1350 KHZ REGIONAL



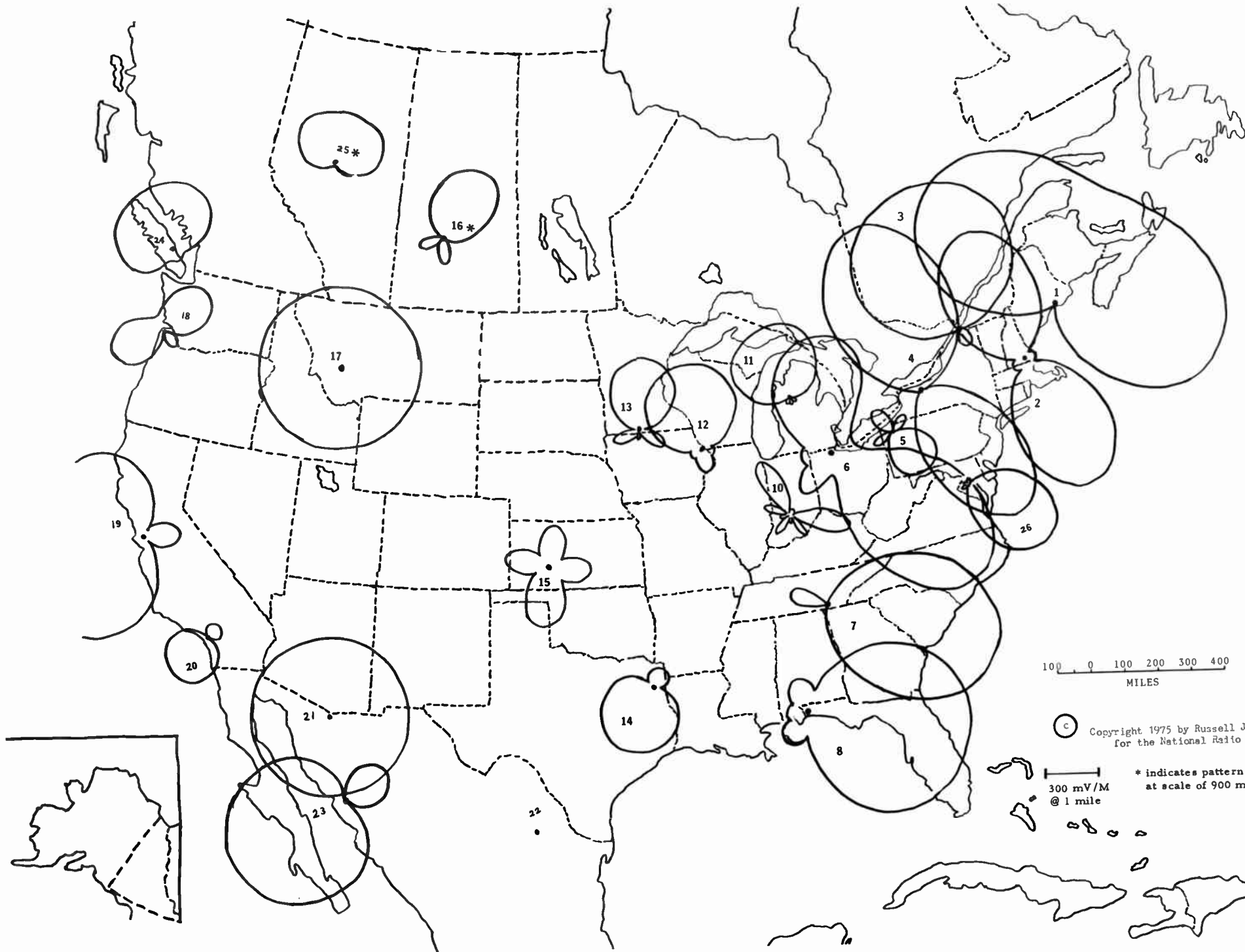
call	class	location
1	DA-1	MIDDLETON
2	DA-1	ST. PAMPHILE
3	DA-2	JOLIETTE
4	DA-1	PEMBROKE
5	DA-1	OSHAWA
6	DA-1	AKRON
7	DA-N	YORK
8	DA-N	NORWALK
9	DA-2	PR. INCETON
10	DA-2	PORTSMOUTH
11	DA-N	GADSDEN
12	DA-N	CUCOA
13	DA-N	NEW ORLEANS
14	DA-N	SAN ANTONIO
15	DA-2	KOKOMO
16	DA-2	PEUKIA
17	DA-N	DES MOINES
18	ND	DUNGAN
19	DA-N	ALBUQUERQUE
20	DA-N	PUEBLO
21	DA-N	LEWISTON
22	ND	DAWSON CREEK
23	DA-N	SANTA ROSA
24	DA-2	SAN BERNARDINO
25	ND	GANDER

# 1360 KHZ REGIONAL

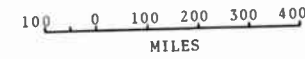
call	class	location
1 CKBC	DA-N	BATHURST
2 C	UA-2	STE-MARIE DE BEAUCE
3 WDRG	DA-N	HARTFORD
4 WKUP	DA-2	BINGHAMTON
5 WPPA	DA-2	POTTSVILLE
6 WWBZ	DA-N	VINELAND
7 WCHL	DA-N	CHAPEL HILL
8 WKAT	ND	MIAMI BEACH
9 WSAI	DA-N	CINCINNATI
10 WIXZ	DA-N	McKEESPORT
11 WKMI	DA-N	KALAMAZOO
12 WBAY	DA-N	GREEN BAY
13 KSCJ	DA-N	SIOUX CITY
14 KFFA	DA-N	HELENA
15 KBUK	DA-2	BAYTOWN
16 KRYS	ND	CORPUS CHRISTI
17 KXOL	DA-N	FORT WORTH
18 KEYZ	DA-N	WILLISTON
19 KRKK	DA-N	ROCK SPRINGS
20 KNWZ	DA-N	GLENDALE
21 KGB	ND	SAN DIEGO
22 KFIV	DA-2	MODESTO
23 KMO	ND	TACOMA
24 WKYU	DA-N	CARO
25 WCHC	DA-2	CAMUY



# 1370 KHZ REGIONAL



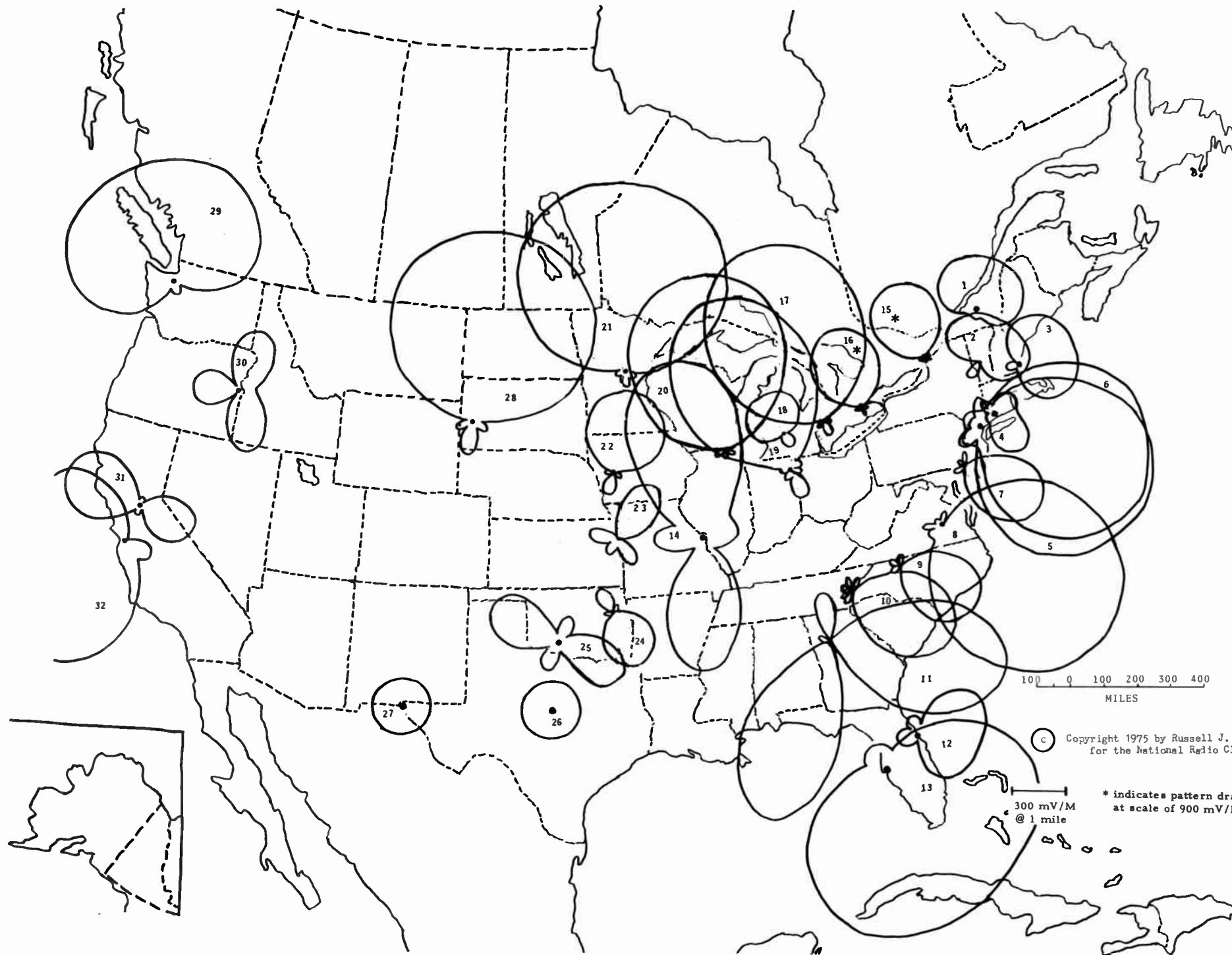
call	class	location
1 WDEA	DA-2	ELLSWORTH
2 VFEA	DA-1	MANCHESTER
3 CFLV	DA-1	VALLEYFIELD
4 WSAY	DA-N	ROCHESTER
5 WNCB	DA-N	CORRY
6 WSPD	DA-N	TOLEDO
7 WDEF	DA-N	CHATTANOUGA
8 WCOA	DA-N	PENSACOLA
9 WIVV	ND	VIEQUES
10 WTTS	DA-2	BLOOMINGTON
11 WWAM	DA-2	CADILLAC
12 KDTH	CA-N	DUBUQUE
13 KSUM	DA-2	FAIRMONT
14 KFRU	DA-N	LONGVIEW
15 KGNU	DA-N	DODGE CITY
16 CJWN	DA-2	SASKATOON
17 KXLF	ND	BUTTE
18 KAST	DA-N	ASTORIA
19 KEEN	DA-2	SAN JOSE
20 KREL	DA-2	CORONA
21 XEHF	ND	NOGALES
22 XEMON	DA-N	MONTERREY
	(pattern not available)	
23 XEHX	DA-N	CD. OBREGON
24 CHPO	DA-1	PARKSVILLE
25 CFOX	DA-N	WESTLOCK
26 WKIK	DA-N	LEONARDTOWN



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300 mV/M @ 1 mile  
\* indicates pattern drawn at scale of 900 mV/M

# 1380 KHZ REGIONAL



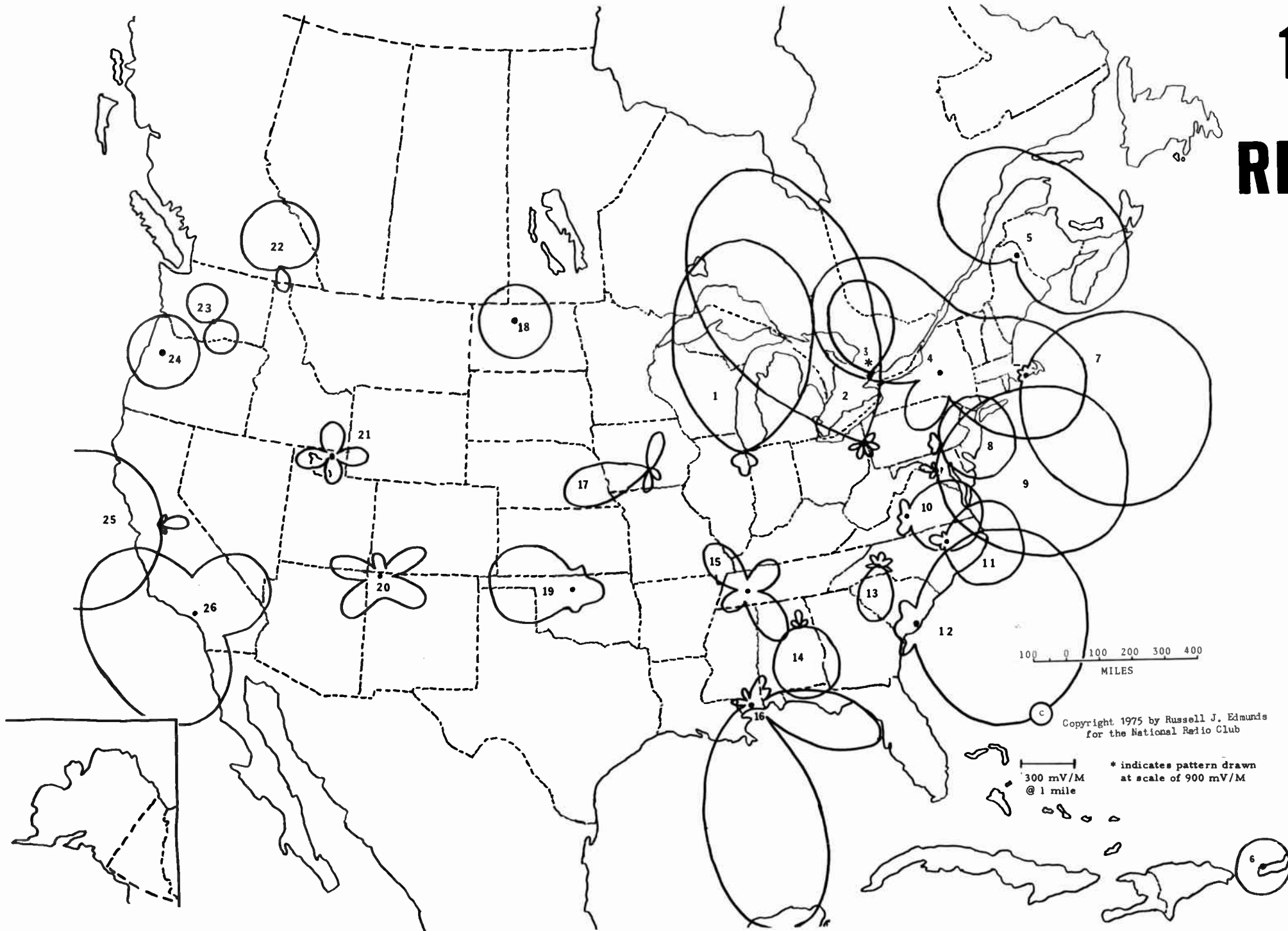
call	class	location
1	CFDA	DA-N VICTORIAVILLE
2	WSYB	DA-N RUTLAND
3	WBBX	DA-N PORTSMOUTH
4	WUWH	DA-2 NAUGATUCK
5	WBNX	DA-1 NEW YORK
6	WAWZ	DA-2 ZARAPHATH
7	WAMS	DA-3 WILMINGTON (WBNX & WAWZ share time) (uses two daytime patterns)
8	WTVR	DA-N RICHMOND
9	WTUB	DA-N WINSTON-SALEM
10	WKKE	DA-N ASHEVILLE
11	WAOK	DA-N ATLANTA
12	WDAT	DA-N ORMOND BEACH
13	WLCY	DA-N ST. PETERSBURG
14	KWK	DA-N ST. LOUIS
15	CKLC	DA-2 KINGSTON
16	CKPC	DA-2 BRANTFORD
17	WPHM	DA-2 PORT HURON
18	WPLB	DA-N GREENVILLE
19	WMEE	DA-2 FORT WAYNE
20	WBEL	DA-N BELOIT
21	KLIZ	DA-N BRAINERD
22	KCIM	DA-2 CARROLL
23	KUDL	DA-2 FAIRWAY
24	KMUS	DA-N MUSKOGEE
25	KSWO	DA-2 LAWTON
26	KBWD	ND BROWNWOOD
27	KTSM	ND EL PASO
28	KUTA	DA-N RAPID CITY
29	KRKO	DA-N EVERETT
30	KSRV	DA-N UNTARIO
31	KuMS	DA-2 SACRAMENTO
32	KTOM	DA-2 SALINAS

100 0 100 200 300 400  
MILES

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\* indicates pattern drawn  
at scale of 900 mV/M  
300 mV/M  
@ 1 mile

# 1390 KHZ REGIONAL

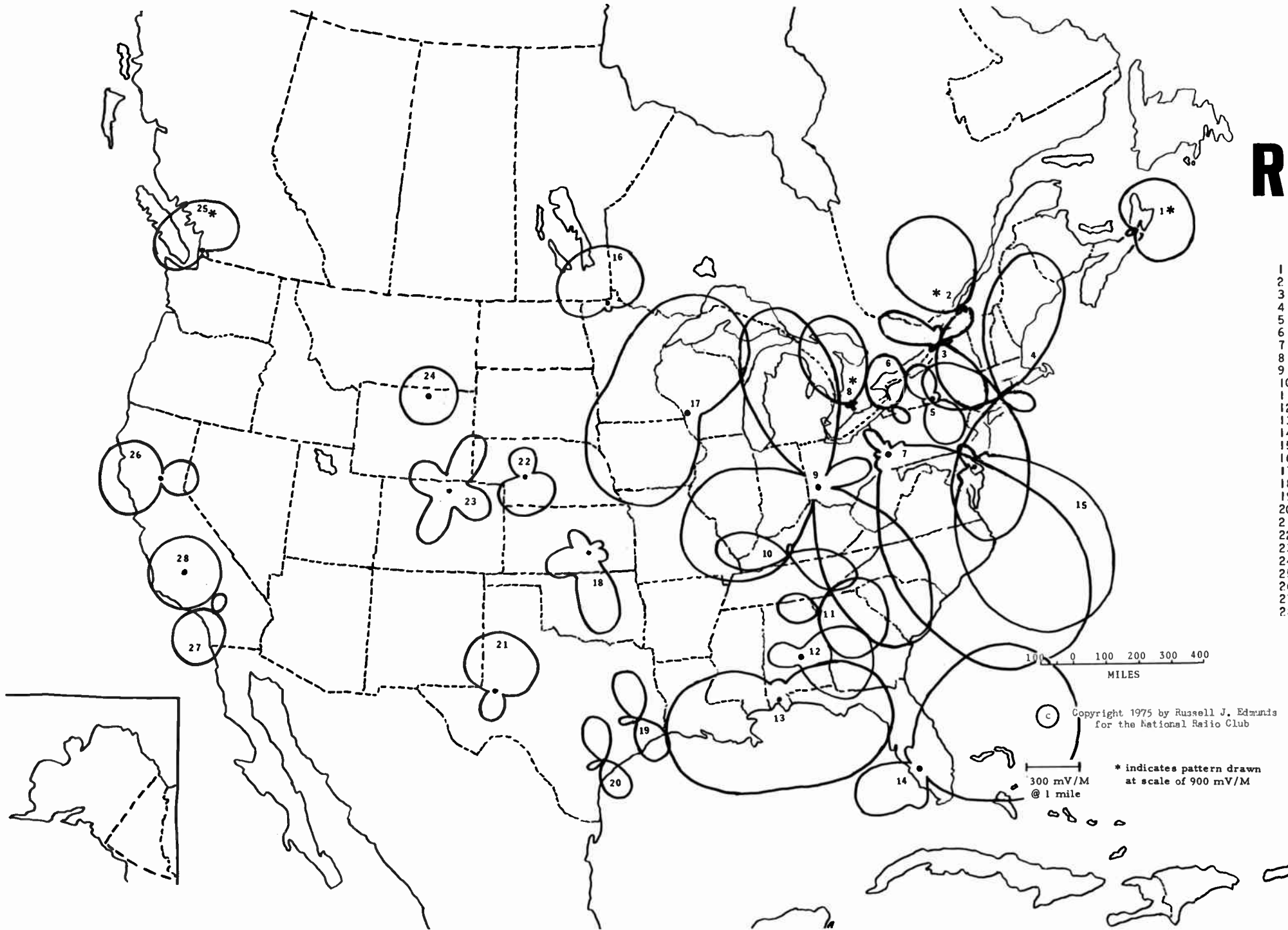


call	class	location
1	WVON	DA-2 CHICAGO
2	WFMJ	DA-N YOUNGSTOWN
3	CHOO	DA-1 AJAX
4	WFBL	DA-N SYRACUSE
5	WEGP	DA-N PRESQUE ISLE
6	WISA	ND ISABELA
7	WPLM	DA-2 PLYMOUTH
8	WLAN	DA-2 LANCASTER
9	WEAM	DA-2 ARLINGTON
10	WVOD	DA-N LYNCHBURG
11	WEED	DA-N ROCKY MOUNT
12	WCSC	DA-N CHARLESTON
13	WADA	DA-N SHELBY
14	WHMA	DA-N ANNISTON
15	WTJS	DA-N JACKSON
16	WROA	DA-2 GULDPURT
17	KCBC	DA-1 DES MOINES
18	KLPM	ND MINOT
19	KCRC	DA-1 ENID
20	KENN	DA-N FARMINGTON
21	KBLW	DA-N LOGAN
22	CKKC	DA-1 NELSON
23	KBBO	DA-N YAKIMA
24	KSML	ND SALEM
25	KCEY	DA-2 TURLOCK
26	KGER	DA-N LONG BEACH

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300 mV/M @ 1 mile \* indicates pattern drawn at scale of 900 mV/M

# 1410 KHZ REGIONAL



call	class	location
1 C	DA-2	PORT HAWESBURY
2 CFMB	DA-1	MONTREAL
3 WOTT	DA-N	WATERTOWN
4 WPOP	DA-2	HARTFORD
5 WELM	DA-N	ELMIRA
6 WDOE	DA-N	DUNKIRK
7 KOV	DA-2	PITTSBURGH
8 CKSL	DA-2	LONDON
9 WING	DA-N	DAYTON
10 W'LBJ	DA-N	BOWLING GREEN
11 WLAQ	DA-N	ROME
12 WPXC	DA-2	PRATTVILLE
13 WUNI	DA-N	MOBILE
14 WHYK	DA-N	FORT MYERS
15 WDUV	DA-N	DUVER
16 KRWB	DA-N	ROSEAU
17 WIZM	DA-N	LA CRUSSE
18 KWBB	DA-2	WICHITA
19 KJCH	DA-2	CLEVELAND
20 KNAL	DA-N	VICTORIA
21 KRIG	DA-N	ODESSA
22 KNOP	DA-N	NORTH PLATTE
23 KCOL	DA-N	FORT COLLINS
24 KWYO	ND	SHERIDAN
25 CFUN	DA-2	VANCOUVER
26 KMYC	DA-2	MARYSVILLE
27 KCAL	DA-N	REDLANDS
28 KERN	ND	BAKERSFIELD

100 0 100 200 300 400  
MILES

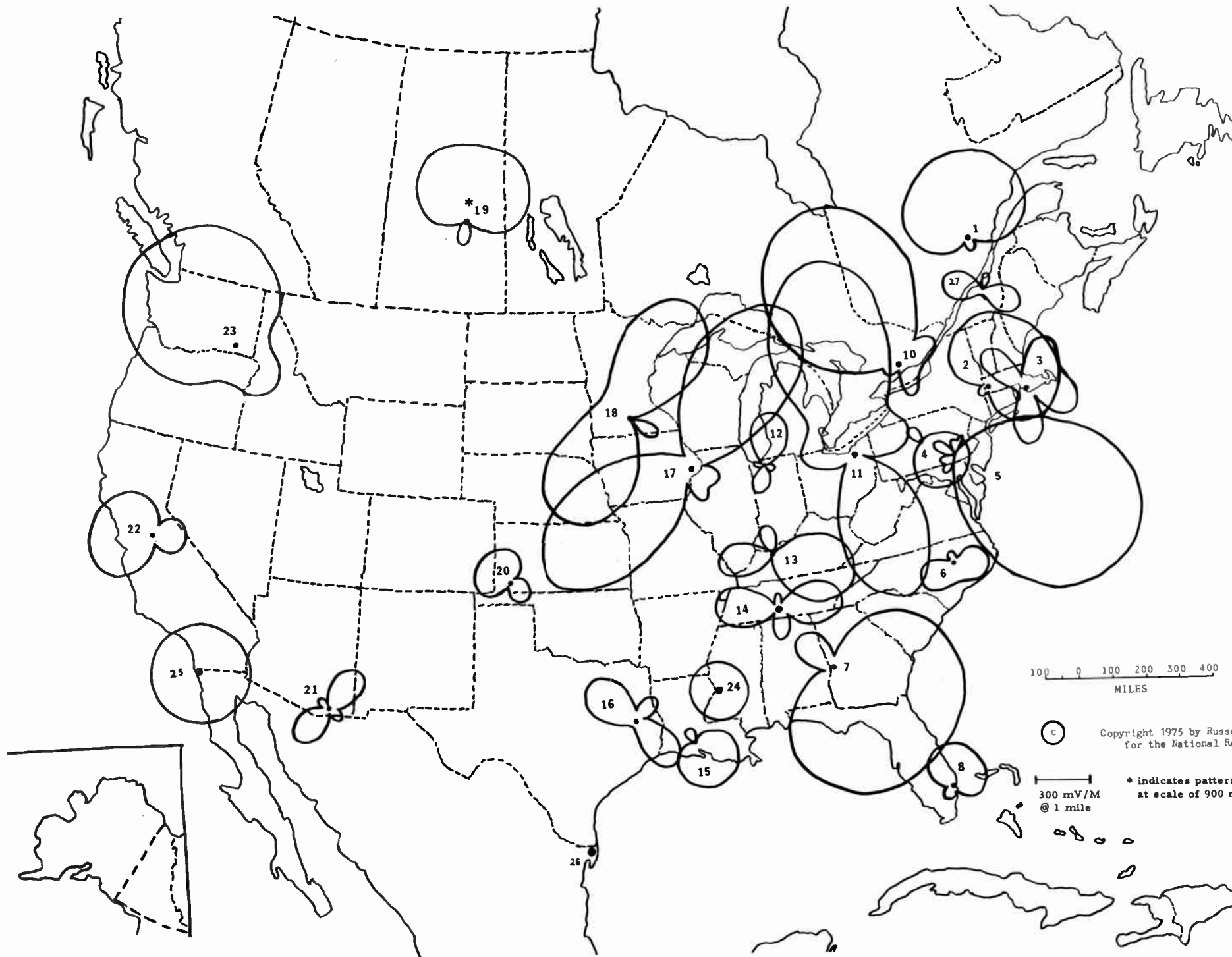
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\* indicates pattern drawn  
at scale of 900 mV/M

300 mV/M  
@ 1 mile



# 1420 KHZ REGIONAL



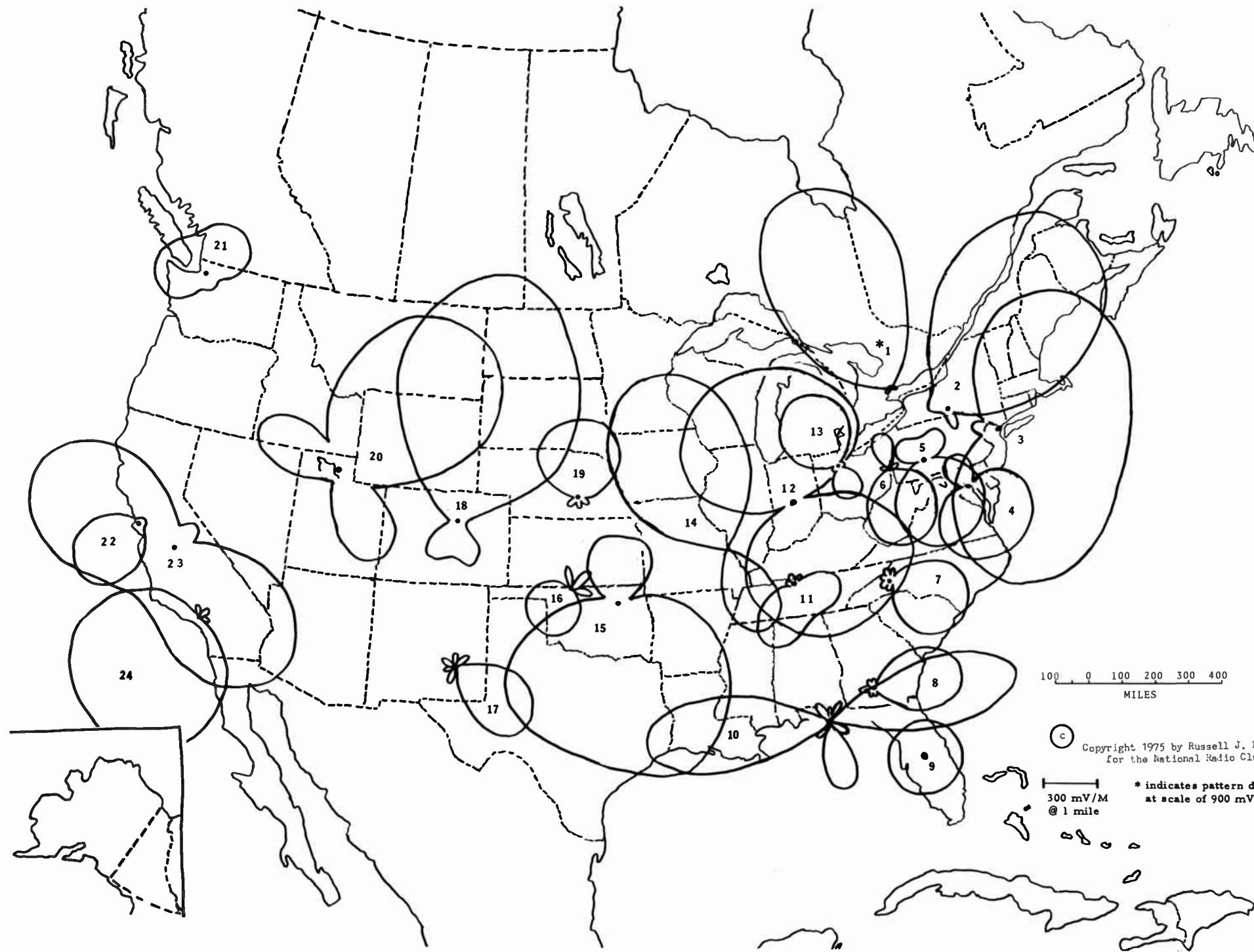
call	class	location
1	CJMT	DA-N CHICOUTIMI
2	WBEC	DA-N PITTSFIELD
3	WBSM	DA-1 NEW BEDFORD
4	WCED	DA-N DU BOISE
5	WCOJ	DA-N COATESVILLE
6	WVOT	DA-N WILSON
7	WRBL	DA-N COLUMBUS
8	WDBF	DA-2 DELRAY BEACH
9	WEUC	ND PONCE
10	CKPT	DA-2 PETERBOROUGH
11	WHK	DA-N CLEVELAND
12	WIMS	DA-2 MICHIGAN CITY
13	WVJS	DA-2 OWENSBORO
14	WKSR	DA-N PULASKI
15	KPEL	DA-N LAFAYETTE
16	KLUF	DA-N LUFKIN
17	WOC	DA-2 DAVENPORT
18	KTOE	DA-N MANKATO
19	CJVR	DA-N MELFORT
20	KULY	DA-2 ULYSSES
21	KTAN	DA-N SIERRA VISTA
22	KSTN	DA-2 STOCKTON
23	KUJ	DA-N WALLA WALLA
24	WQBC	ND VICKSBURG
25	XEXX	ND TIJUANA
26	XEEW	DA-2 MATAMOROS
27	CKTL	DA-N PLEISSISVILLE



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300 mV/M @ 1 mile  
\* indicates pattern drawn at scale of 900 mV/M

# 1430 KHZ REGIONAL



call	class	location
1	CKFH	DA-2 TORONTO
2	WENE	DA-N ENDICOTT
3	WNJR	DA-N NEWARK
4	WNAV	DA-N ANNAPOLIS
5	WYAM	DA-N ALTOONA
6	WEIR	DA-2 WEIRTON
7	WMNC	DA-N MORGANTON
8	WVGS	DA-N TIFTON
9	WOPD	ND LAKELAND
10	WPFC	DA-2 PANAMA CITY
11	WENO	DA-N MADISON
12	WIRE	DA-N INDIANAPOLIS
13	WFUB	DA-2 FOSTORIA
14	WIL	DA-2 ST. LOUIS
15	KELI	DA-N TULSA
16	KALV	DA-1 ALVA
17	KMGW	DA-N ROSWELL
18	KUSI	DA-N AURORA
19	KRGI	DA-N GRAND ISLAND
20	KLU	DA-N OGDEN
21	KBRC	DA-N MOUNT VERNON
22	KEGL	DA-1 SANTA CLARA
23	KARM	DA-2 FRESNO
24	KALI	DA-2 SAN GABRIEL
25	WNEL	ND CAGUAS

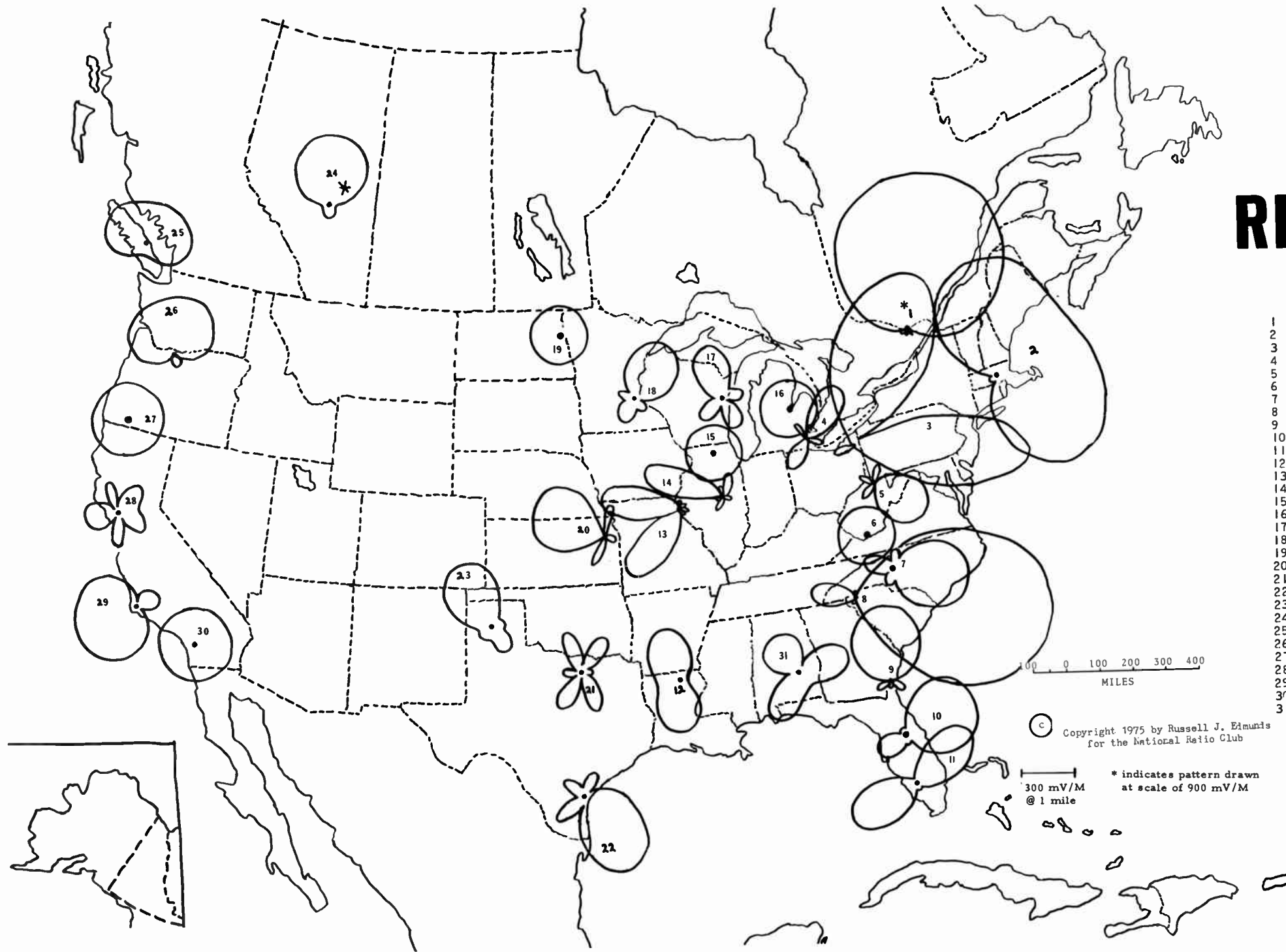
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MILES

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300 mV/M @ 1 mile  
\* indicates pattern drawn  
at scale of 900 mV/M

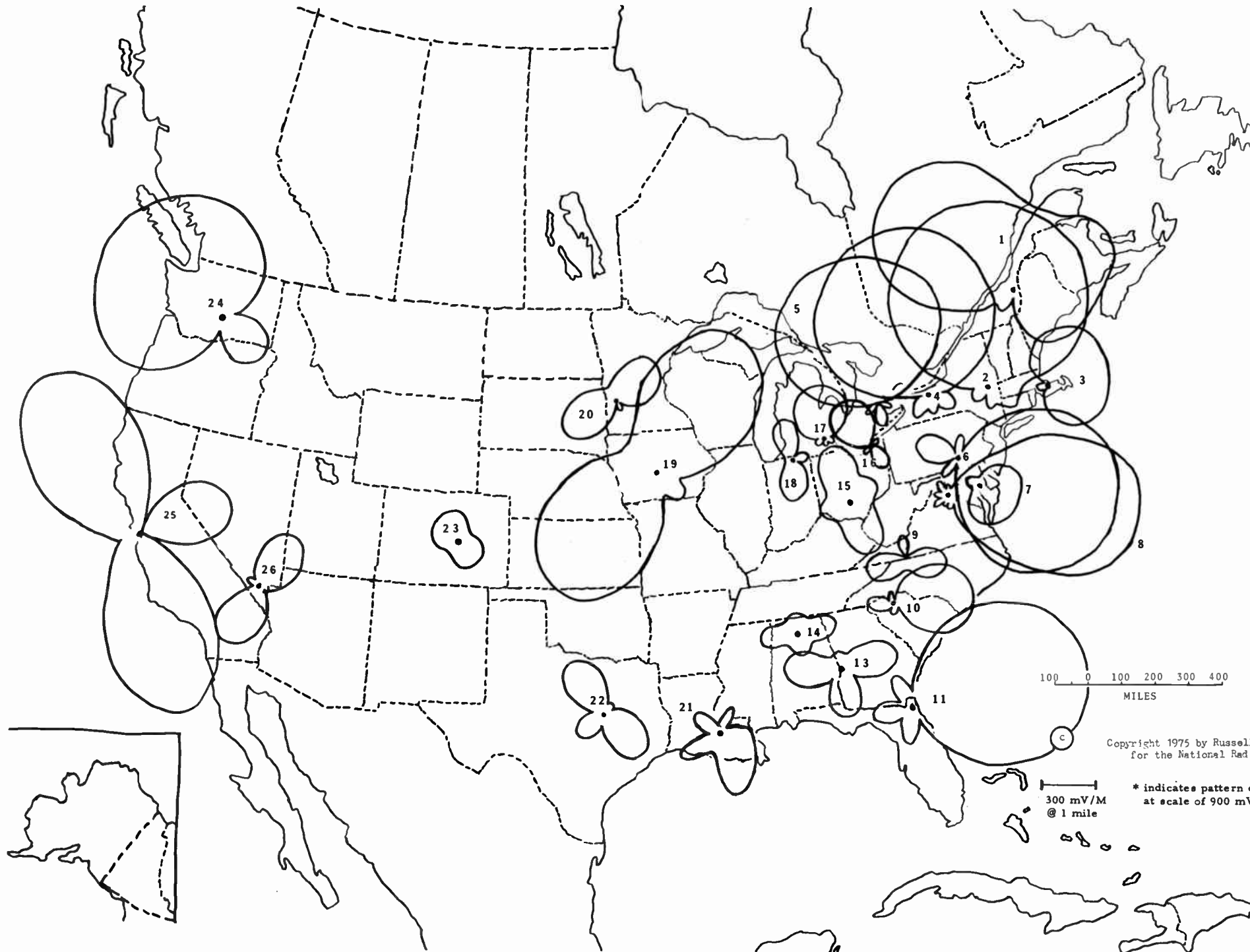
# 1440

## REGIONAL



call	class	location
1	CKPM	DA-1 OTTAWA
2	WAAB	DA-2 WORCESTER
3	WHHH	DA-2 WARREN
4	WCHB	DA-2 INKSTER
5	WAJR	DA-2 MORGANTOWN
6	WHIS	ND BLUFFIELD
7	WBUY	DA-N LEXINGTON
8	WQOK	DA-N GREENVILLE
9	WGIG	DA-N BRUNSWICK
10	WNBE	DA-N WINTER PARK
11	WAYK	DA-2 LEHIGH ACRES
12	KMLB	DA-N MUNKIE
13	WIGEM	DA-2 QUINCY
14	WAKC	DA-2 NORMAL
15	WKOK	ND ROCKFORD
16	WBCM	ND BAY CITY
17	WNFL	DA-2 GREEN BAY
18	KORS	DA-N GOLDEN VALLEY
19	KXXL	ND GRAND FURKS
20	KEWI	DA-1 TOPEKA
21	KUNT	DA-N DENTON
22	KEYS	DA-N CORPUS CHRISTI
23	KPUR	DA-N AMARILLO
24	CJOI	DA-N WETASKIWIN
25	CFCP	DA-N COURTENAY-COMOX
26	KOOL	DA-N THE DALIES
27	KMED	ND MEDFORD
28	KVON	DA-2 NAPA
29	KUHL	DA-N SANTA MARIA
30	KPRO	ND RIVERSIDE
31	WHHY	DA-N MONTGOMERY

# 1460 KHZ REGIONAL



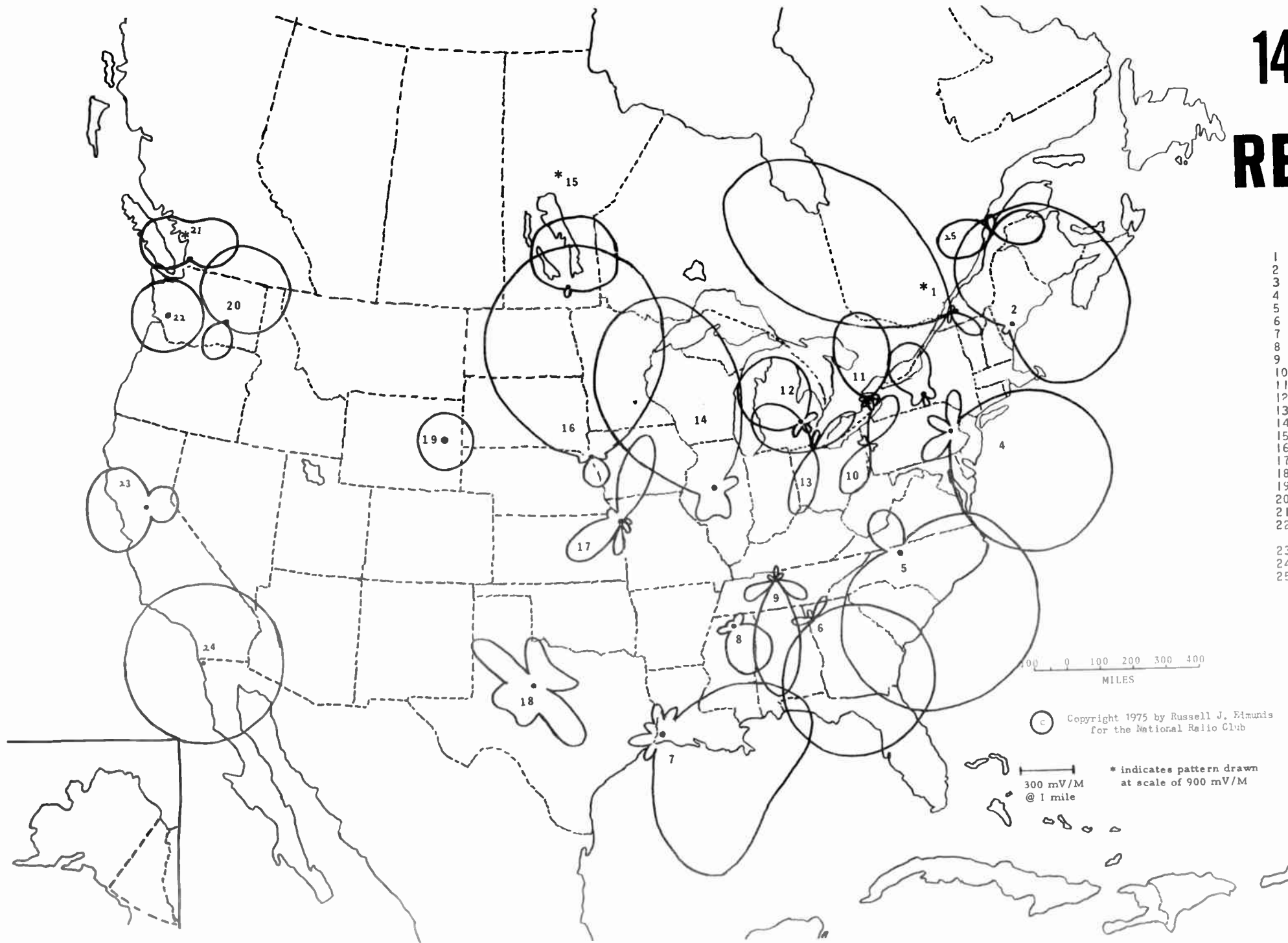
call	class	location
1	CKRB	DA-N ST. GEORGES DE BEAUCE
2	WOKO	DA-N ALBANY
3	WBET	DA-N BROCKTON
4	WAXC	DA-N ROCHESTER
5	CJOY	DA-2 GUELPH
6	WCMB	DA-N HARRISBURG
7	WEMD	DA-2 EASTON
8	WPRW	DA-2 MANASSAS
9	WRAD	DA-N KAUFORD
10	WBCU	DA-N UNION
11	WPDO	DA-N JACKSONVILLE
12	WFOA	NU SAN SEBASTIAN
13	WPNX	DA-N PHENIX CITY
14	WFMH	DA-N CULLMAN
15	WBNS	DA-1 COLUMBUS
16	WPVL	DA-2 PATNESVILLE
17	WPUN	DA-N PONTIAC
18	WKAM	DA-N GOSHEN
19	KSO	DA-N DES MOINES
20	KDMA	DA-N MONTEVIDEO
21	WXOK	DA-N BATON ROUGE
22	WACO	DA-N WACO
23	KYSN	DA-N COLORADO SPRING
24	KIMX	DA-N YAKIMA
25	KDON	DA-1 SALINAS
26	KENO	DA-N LAS VEGAS

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MILES

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300 mV/M  
@ 1 mile  
\* indicates pattern drawn  
at scale of 900 mV/M

# 1470 KHZ REGIONAL



call	class	location
1 CFOX	DA-1	POINTE CLAIRE
2 WLAM	DA-1	LEWISTON
3 WTKO	DA-N	ITHICA
4 WSN	DA-N	ALLENTOWN
5 WBIG	DA-N	GREENSBORO
6 WRGA	DA-N	ROME
7 KLCL	DA-N	LAKE CHARLES
8 WNAU	DA-N	NEW ALBANY
9 WVOL	DA-2	BERRY HILL
10 WFAP	DA-N	FARRELL
11 CHOW	DA-2	WELLAND
12 WFMF	DA-2	FLINT
13 WOHO	DA-2	TULEDO
14 WMBD	DA-2	PEURIA
15 CFRW	DA-1	WINNIPEG
16 KWSL	DA-2	SIOUX CITY
17 KAKE	DA-1	ATCHISON
18 KKBC	UA-N	ABILENE
19 KWIV	ND	DOUGLAS
20 KSEM	DA-2	MOSES LAKE
21 CJVB	DA-2	VANCOUVER
22 KELA	ND	CENTRALIA- CHEHALIS
23 KNDE	DA-2	SACRAMENTO
24 XEABC	ND	TIJUANA
25 C___	DA-1	BAGOTVILLE

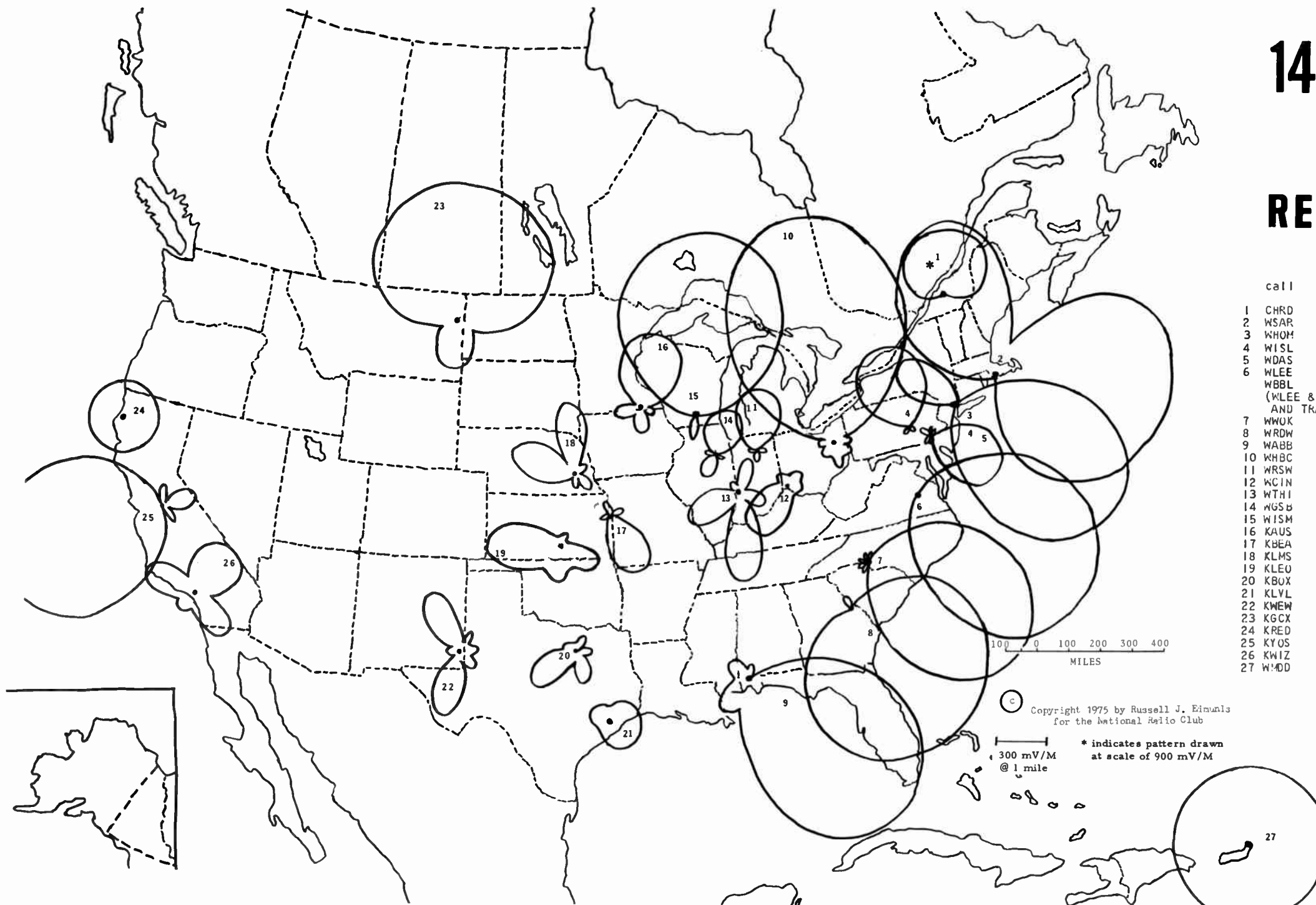
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MILES

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300 mV/M  
@ 1 mile  
\* indicates pattern drawn  
at scale of 900 mV/M

# 1480

## REGIONAL



call	class	location
1 CHR	DA-2	DRUMMONDVILLE
2 WSAR	DA-2	FALL RIVER
3 WHOM	DA-2	NEW YORK
4 WISL	DA-N	SHAMOKIN
5 WDAS	DA-2	PHILADELPHIA
6 WLEE	DA-2	RICHMOND
WBBL	DA-2	RICHMOND
(WLEE & WBBL SHARE TIME AND TRANSMITTER)		
7 WWOK	DA-2	CHARLOTTE
8 WRDW	DA-N	AUGUSTA
9 WABB	DA-N	MOBILE
10 KHBC	DA-N	CANTON
11 WRSW	DA-2	WARSAW
12 WCIN	DA-2	CINCINNATI
13 WTHI	DA-2	TERRE HAUTE
14 WGSB	DA-2	GENEVA
15 WISM	JA-2	MADISON
16 KAUS	DA-2	AUSTIN
17 KBEA	JA-2	MISSION
18 KLMS	DA-2	LINCOLN
19 KLEO	DA-2	WICHITA
20 KBOX	DA-2	DALLAS
21 KLVL	DA-N	PASADENA
22 KWEW	DA-N	HOBBS
23 KGCX	DA-1	SIDNEY
24 KRED	ND	EUREKA
25 KYOS	DA-N	MERCED
26 KWIZ	DA-2	SANTA ANA
27 WJDD	ND	FAJARDO

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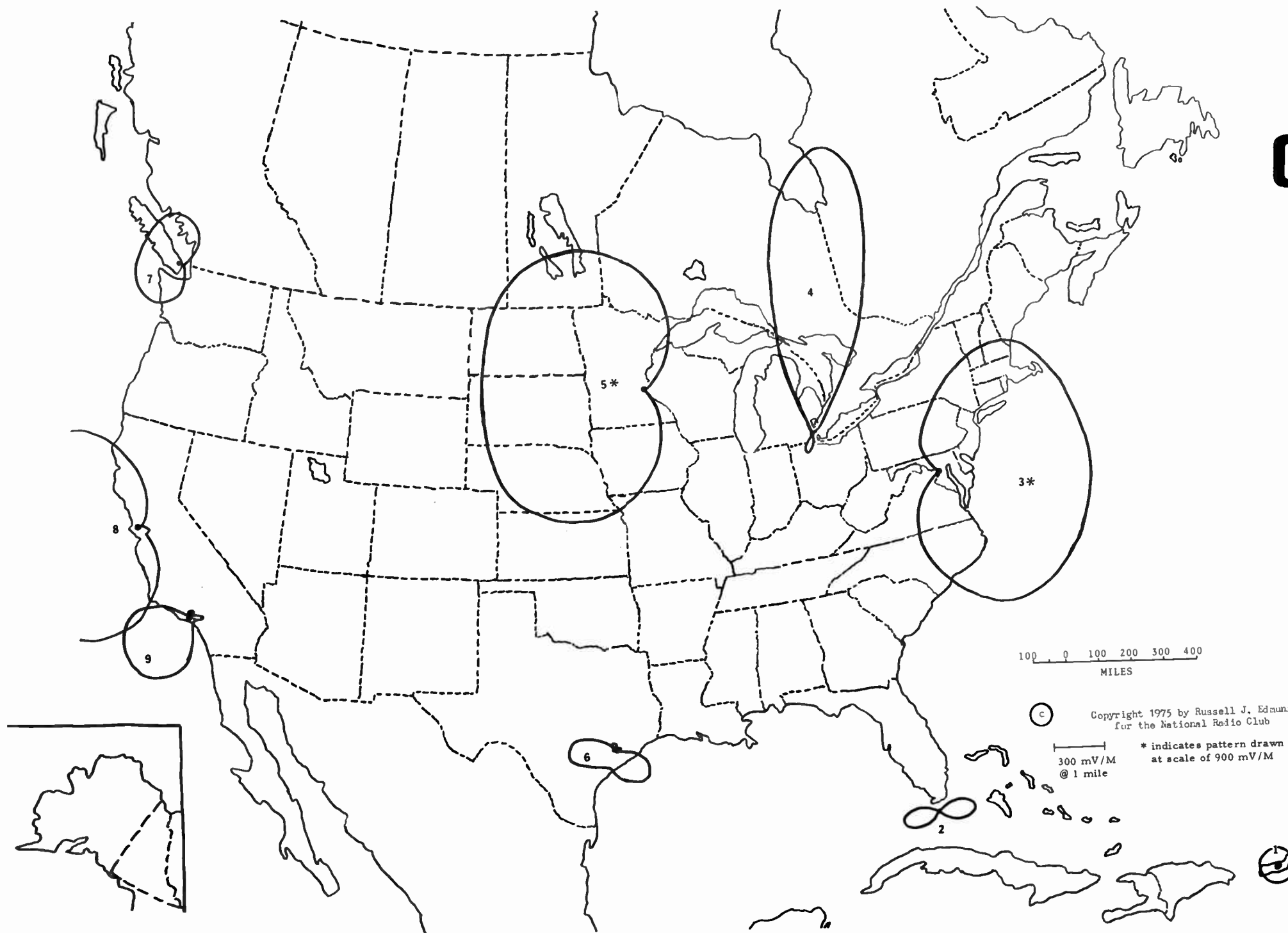
\* indicates pattern drawn  
at scale of 900 mV/M

300 mV/M  
@ 1 mile

# 1500 KHZ CLEAR

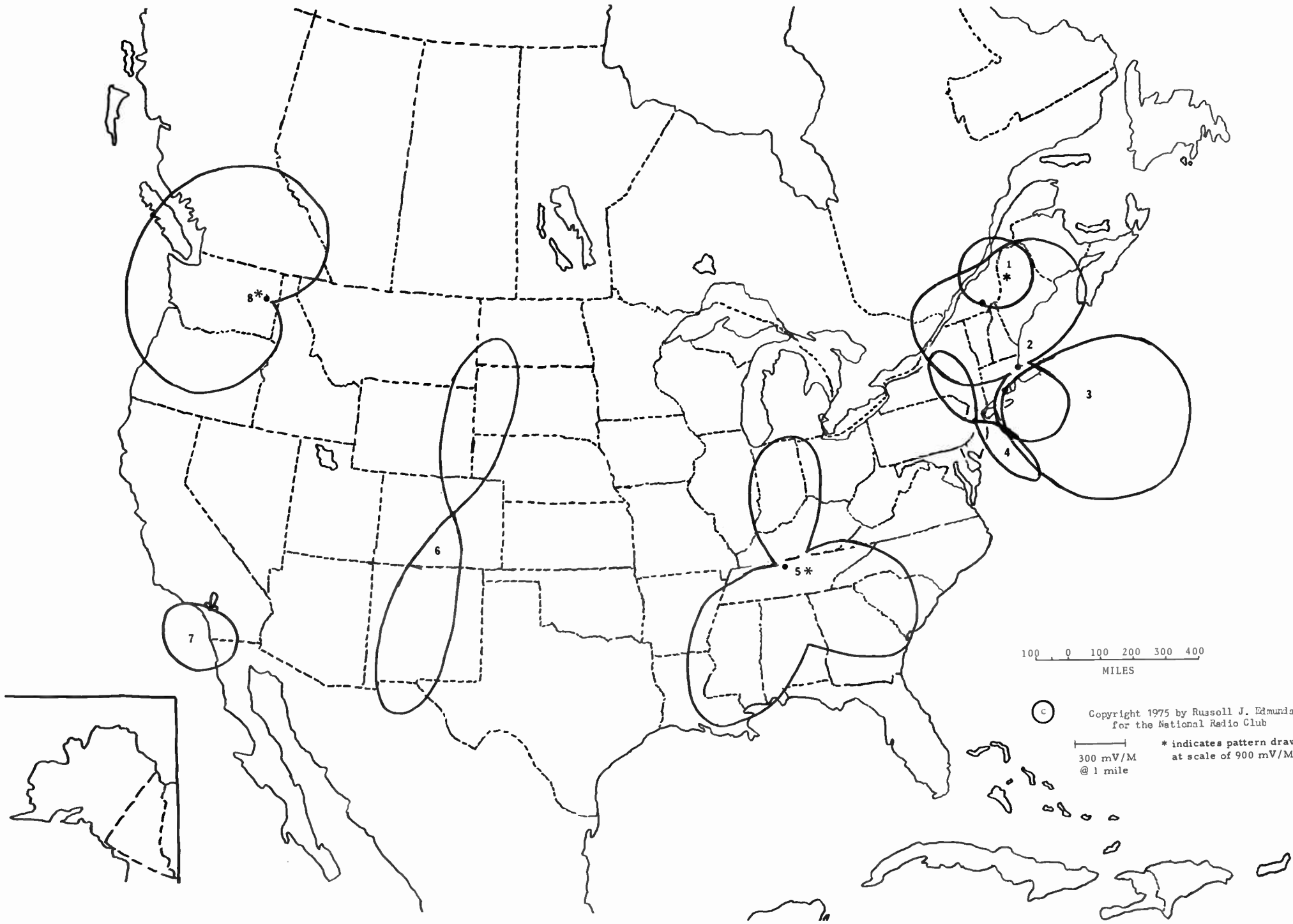
call class location

1	WMNT	ND	MANATI
2	WKIZ	DA-1	KEY WEST
3	WTOP	DA-2	WASHINGTON
4	WDEE	DA-2	DETROIT
5	KSTP	DA-N	ST. PAUL
6	KANI	DA-1	WHARTON
7	CKAY	DA-2	DUNCAN
8	KXRK	DA-2	SAN JOSE
9	KROQ	DA-2	BURBANK



# 1510 KHZ CLEAR

call	class	location
1	CJRS DA-2	SHERBROOKE
2	WMEX DA-2	BOSTON
3	WNLC DA-2	NEW LONDON
4	WRAN DA-2	DOVER
5	WLAC DA-N	NASHVILLE
6	KDKU DA-2	LITTLETON
7	KSOM DA-2	ONTARIO
8	KGA DA-N	SPOKANE



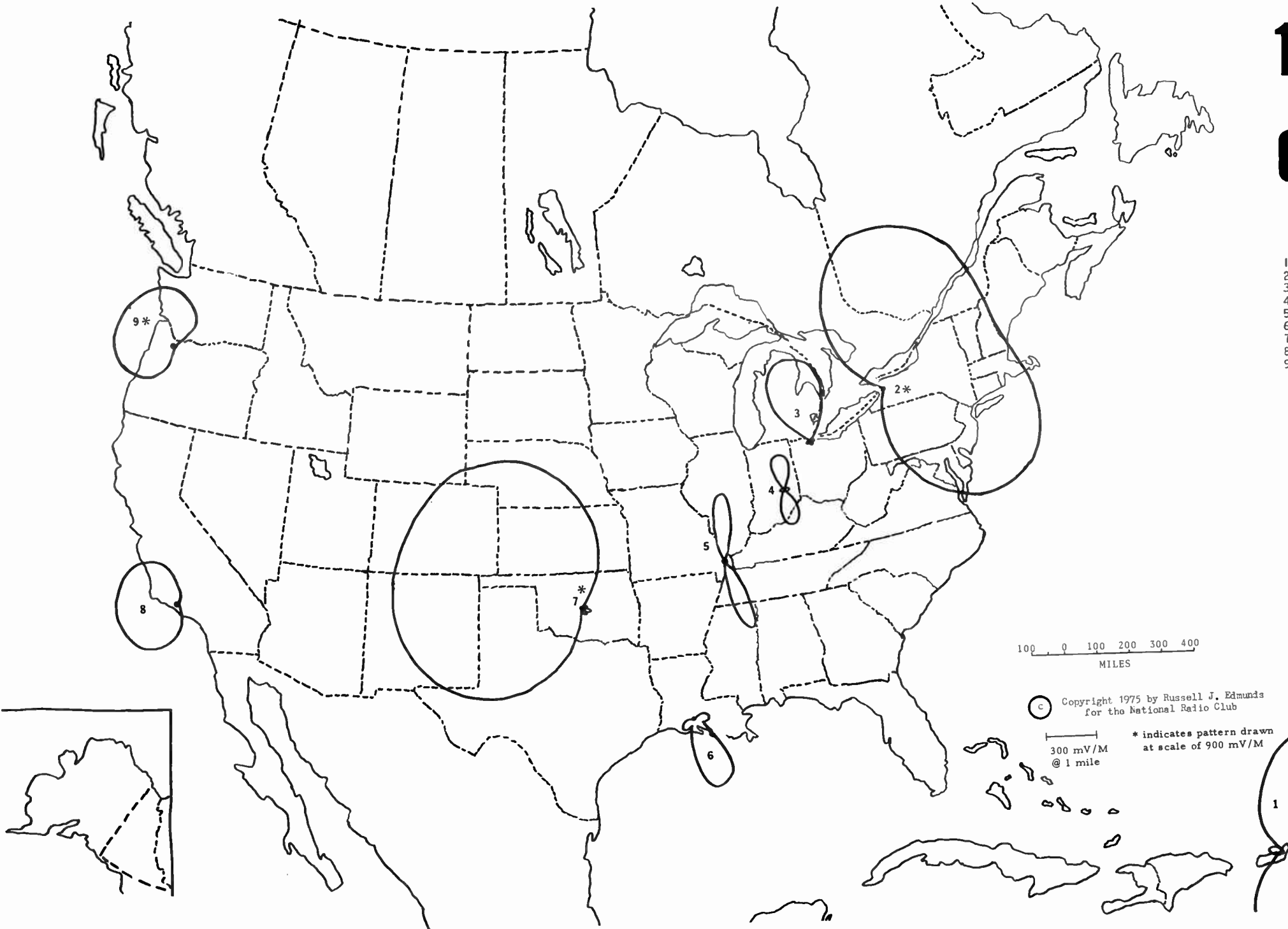
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MILES

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300 mV/M @ 1 mile \* indicates pattern drawn  
at scale of 900 mV/M



# 1520 KHZ CLEAR

call	class	location
1	WRAI	DA-1 SAN JUAN
2	WKBW	DA-1 BUFFALO
3	WTUU	DA-2 TOLEDO
4	WSVL	DA-2 SHELBYVILLE
5	KMPL	DA-2 SIKESTON
6	KXKW	DA-1 LAFAYETTE
7	KOMA	DA-N OKLAHOMA CITY
8	KACY	DA-2 PORT HUENEME
9	KYXI	DA-2 OREGON CITY

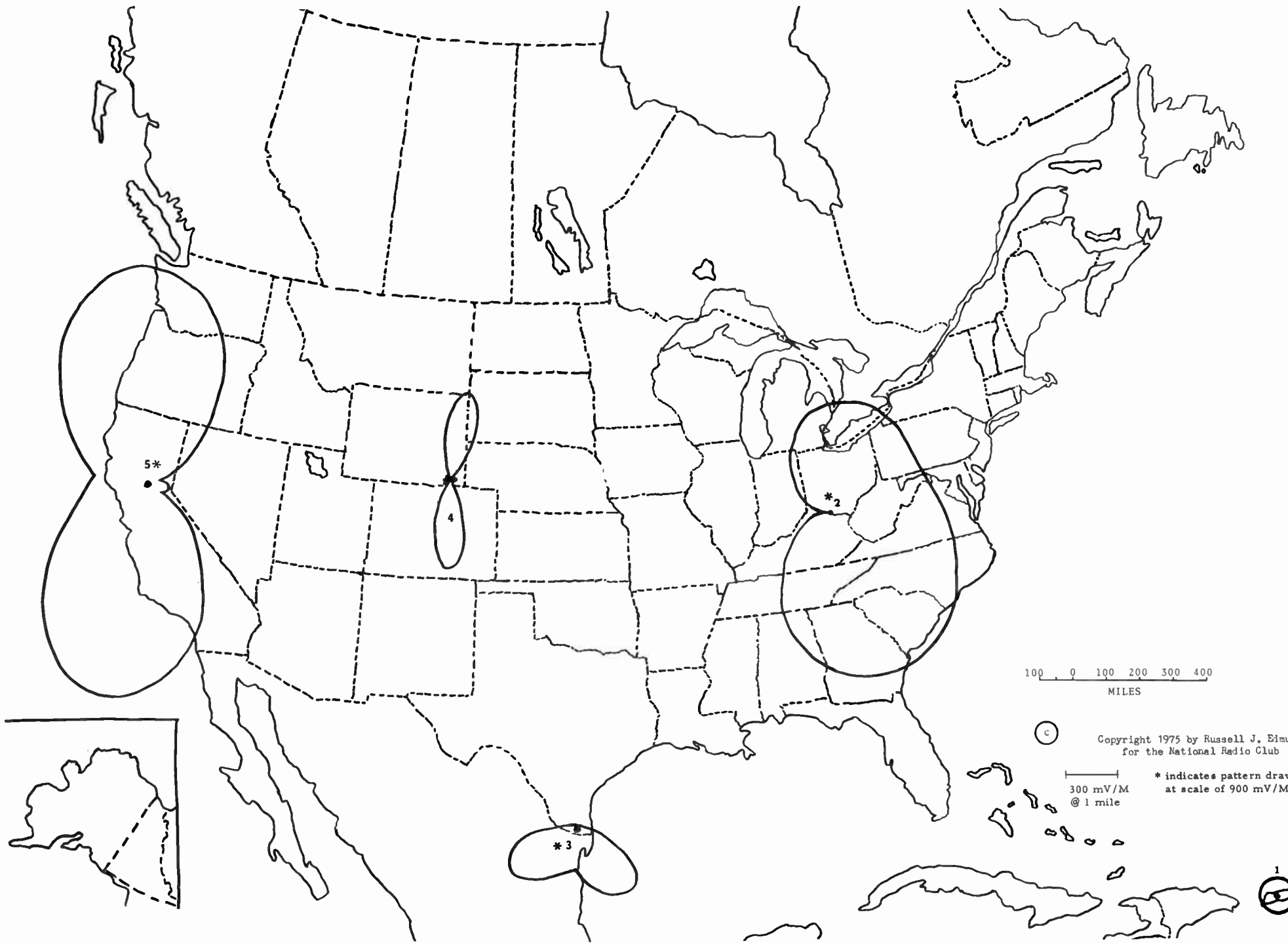


# 1530 KHZ

# CLEAR

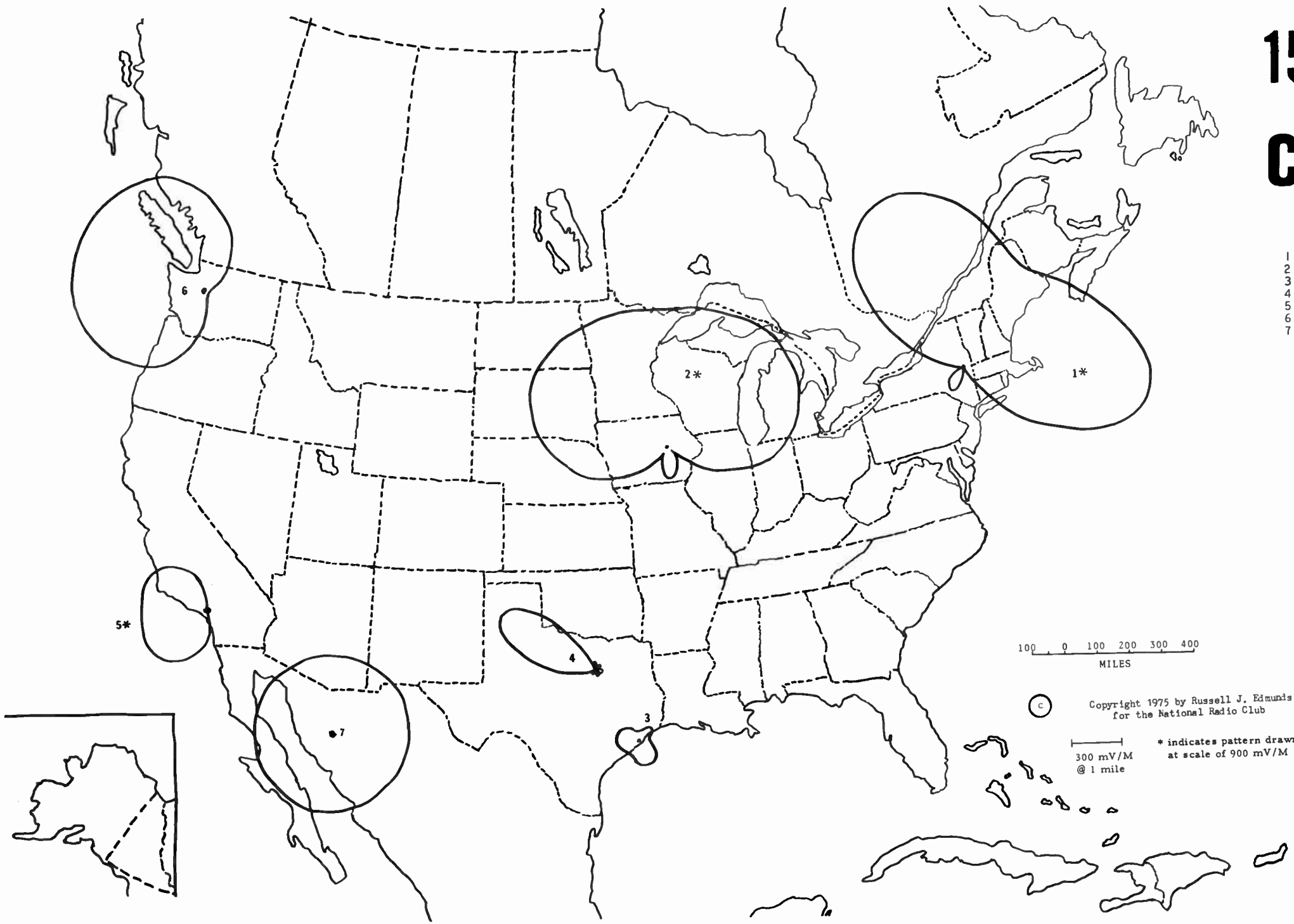
call class location

- |   |      |      |                              |
|---|------|------|------------------------------|
| 1 | WUPR | ND   | UTUADO                       |
| 2 | WCKY | DA-N | CINCINNATI                   |
|   |      |      | (DA after Sacramento sunset) |
| 3 | KGBT | DA-N | HARLINGEN                    |
| 4 | KNIE | DA-2 | CHEYENNE                     |
| 5 | KFBK | DA-1 | SACRAMENTO                   |



# 1540 KHZ CLEAR

call	class	location
1	WPTR	DA-1 ALBANY
2	KXEL	DA-N WATERLOO
3	KGBC	DA-N GALVESTON
4	KIXV	DA-2 FORT WORTH
5	KPOL	DA-2 LOS ANGELES
6	KZAM	DA-2 BELLVUE
7	XEQN	ND HERMOSILLO



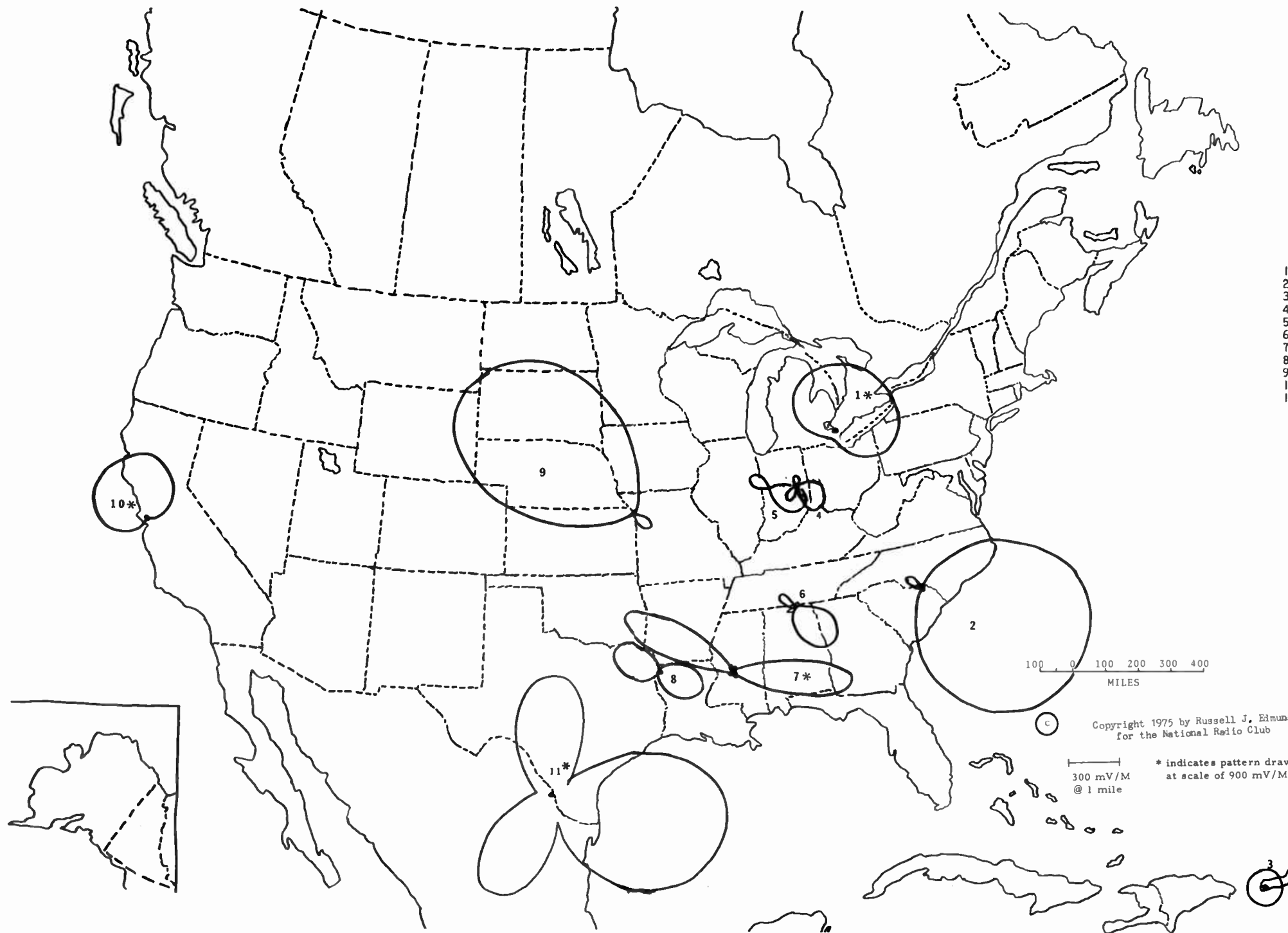
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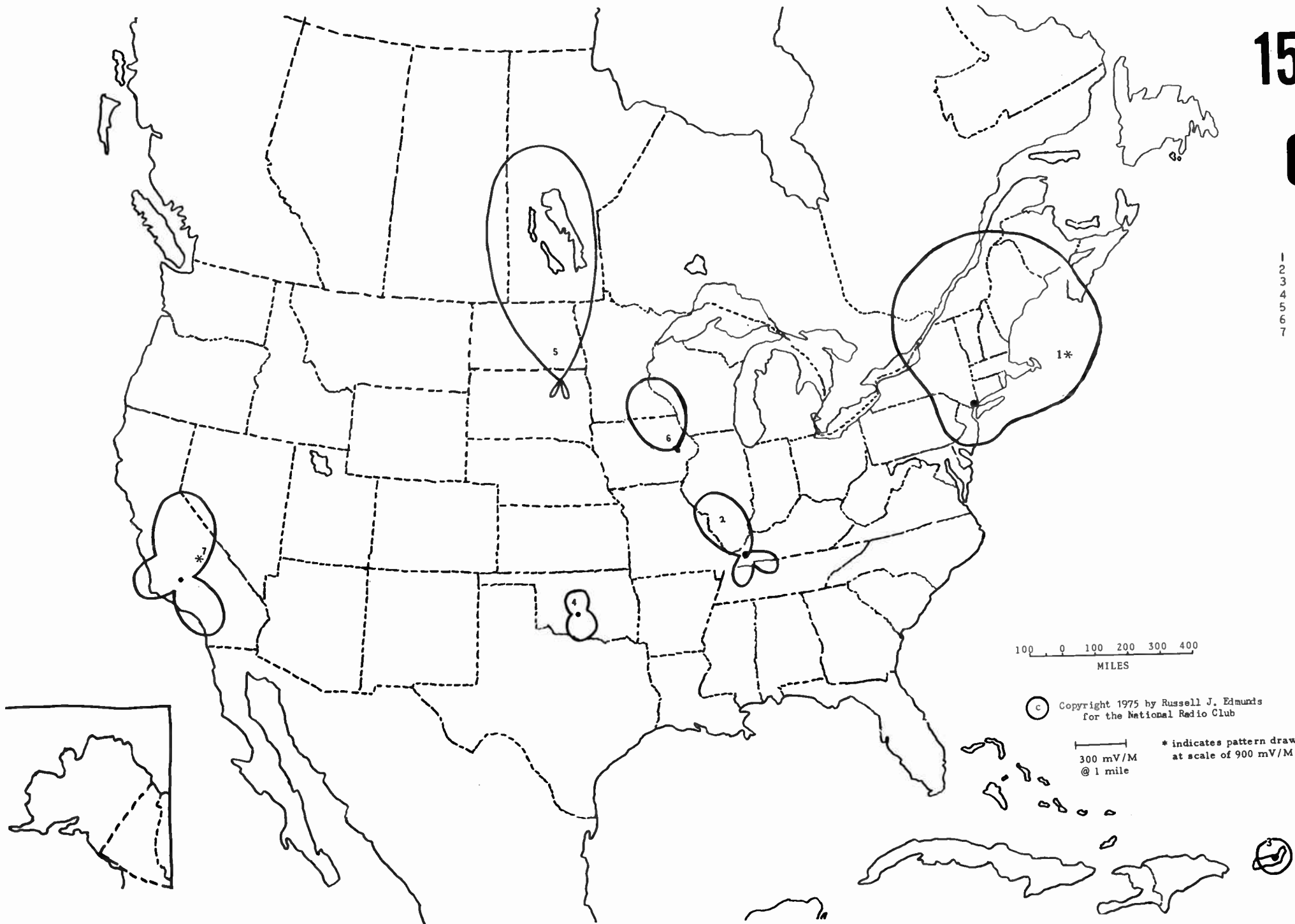
# 1550 KHZ CLEAR

call	class	location
1	DA-1	WINDSOR
2	DA-N	BENNETTSVILLE
3	ND	YAUCO
4	DA-?	NEW CASTLE
5	DA-N	CRAWFORDSVILLE
6	DA-N	HUNTSVILLE
7	DA-2	JACKSON
8	DA-N	SHREVEPORT
9	DA-N	ST. JOSEPH
10	DA-2	SAN FRANCISCO
11	DA-N	NUEVO LAREDO



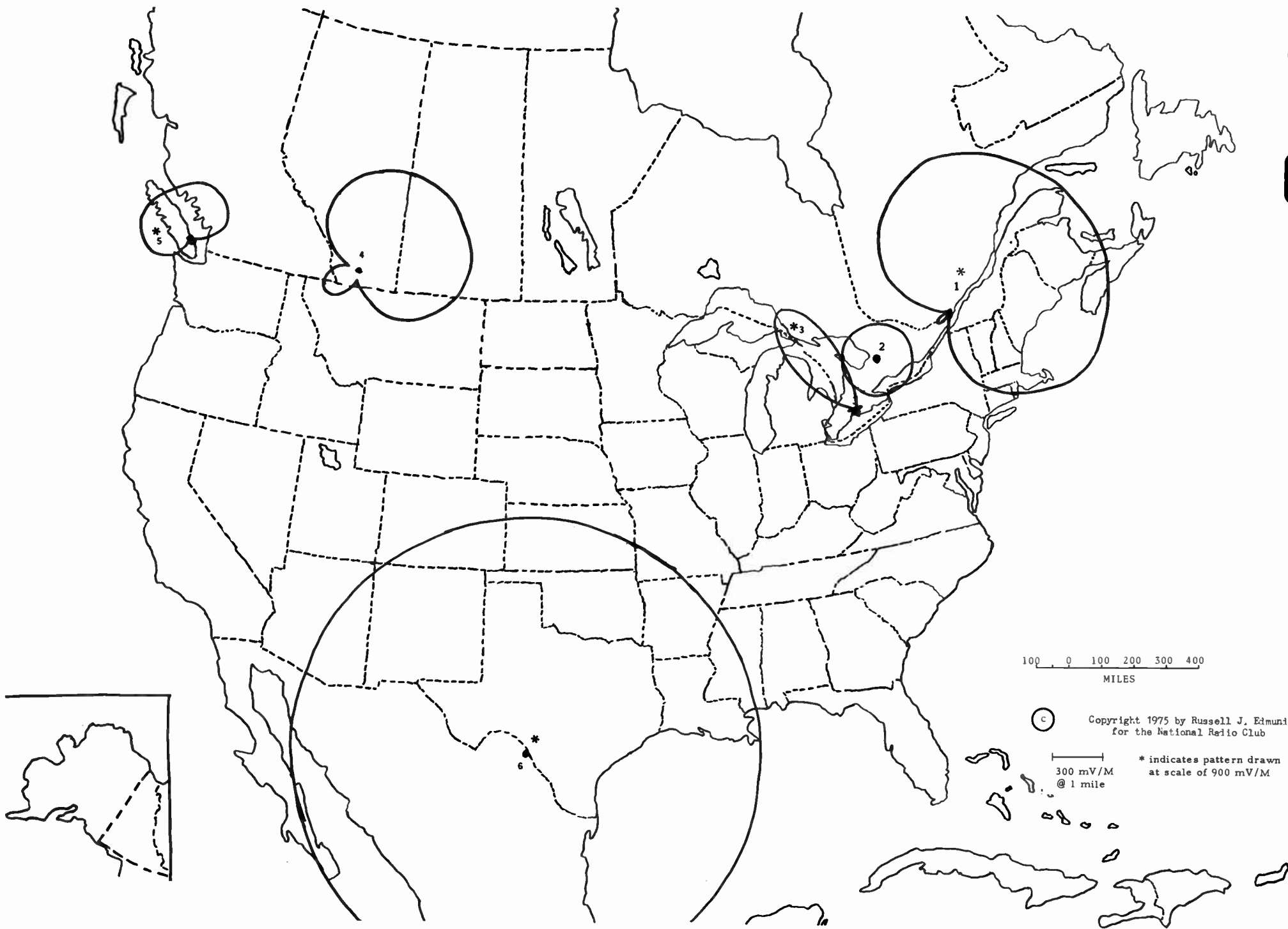
# 1560 KHZ CLEAR

call	class	location
1	WQXR	DA-2 NEW YORK
2	WDXR	DA-2 PADUCAH
3	WRSJ	ND BAYAMON
4	KWCU	DA-N CHICKASHA
5	KKAA	DA-2 ABERDEEN
6	K	DA-2 IOWA CITY
7	KPMC	DA-1 BAKERSFIELD



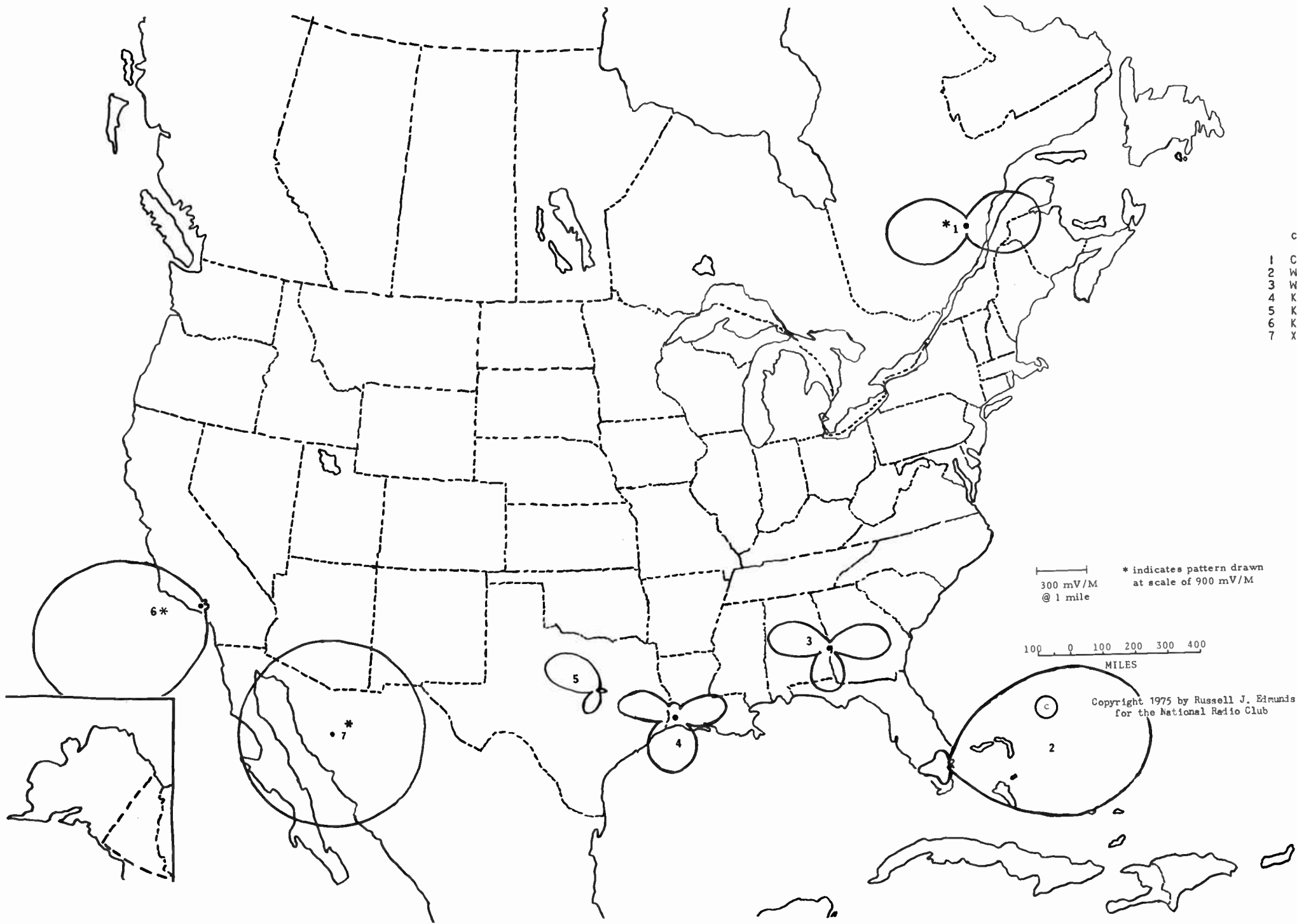
# 1570 KHZ CLEAR

call	class	location
1 CKLM	DA-2	MONTREAL
2 CFOR	NU	ORILLIA
3 CHLU	DA-2	ST. THOMAS
4 CKTA	DA-N	TABER
5 CHUB	DA-2	NANAIMO
6 XERF	NU	CU. ACUNA



# 1580 KHZ CLEAR

call	class	location
1	CBJ	DA-1 CHICOUTIMI
2	WSFR	DA-2 FORT LAUDERDALE
3	WCLS	DA-N COLUMBUS
4	KLOU	DA-N LAKE CHARLES
5	KRZI	DA-2 WACO
6	KDAY	DA-2 SANTA MONICA
7	XEDM	ND HERMOSILLO



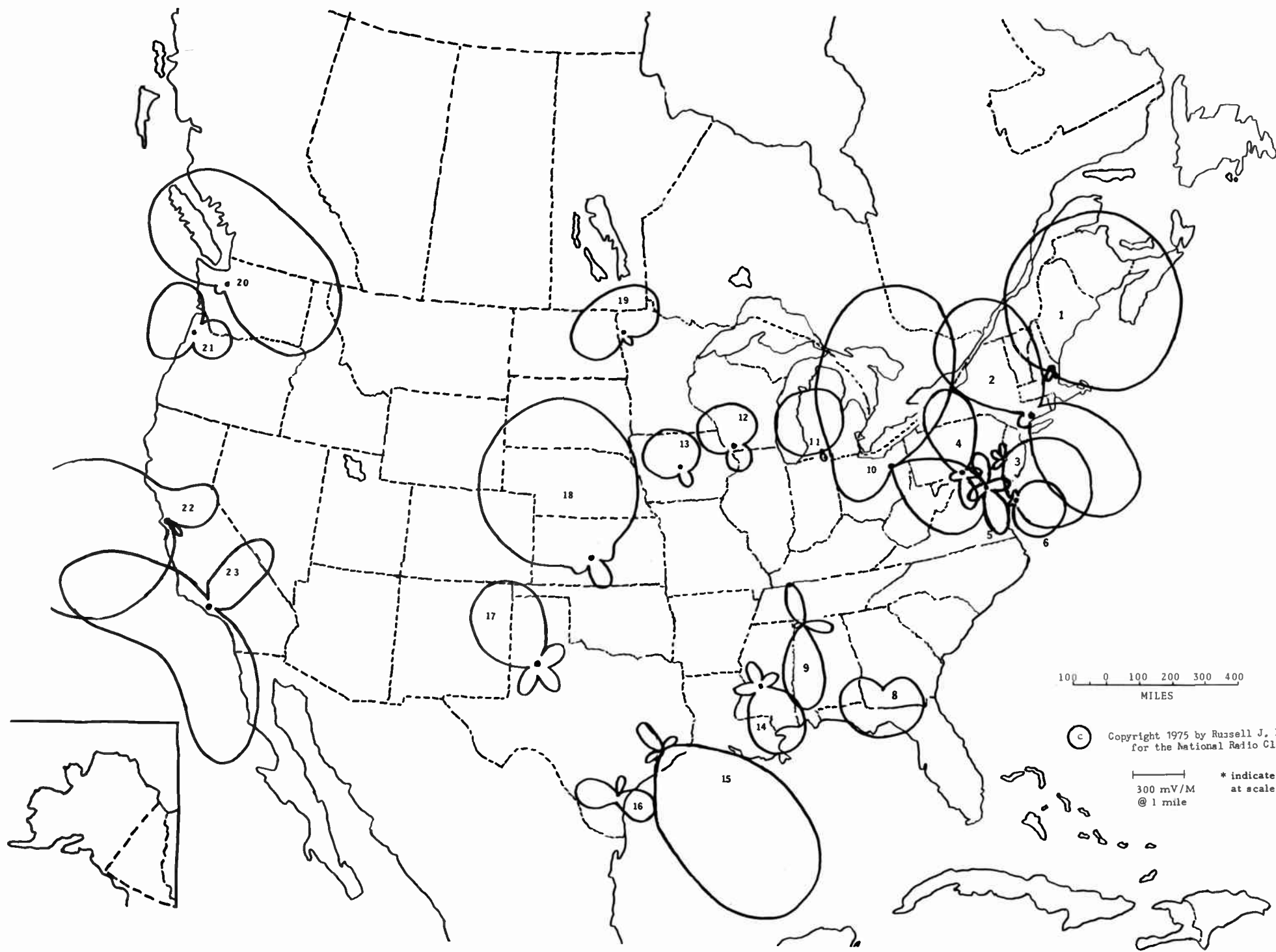
300 mV/M  
@ 1 mile

\* indicates pattern drawn  
at scale of 900 mV/M

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# 1590 KHZ REGIONAL

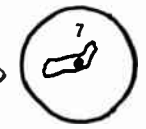


call	class	location
1 WSMN	DA-1	NASHUA
2 WQOW	DA-1	WATERBURY
3 WEEZ	DA-N	CHESTER
4 WCBG	DA-N	CHAMBERSBURG
5 WISZ	DA-2	GLEN BURNIE
6 WETT	DA-2	OCEAN CITY
7 WXRf	ND	GUAYAMA
8 WALG	DA-2	ALBANY
9 WYNA	DA-N	TUSCUMBIA
10 WAKR	DA-N	AKRON
11 WTVB	DA-N	COLDWATER
12 WSWW	DA-N	PLATTEVILLE
13 KWBG	DA-N	BOONE
14 WWUN	DA-N	JACKSON
15 KYOK	DA-N	HOUSTON
16 KIKN	DA-2	SINTON
17 KCBQ	DA-2	LUBBOCK
18 KVGB	DA-N	GREAT BEND
19 KRAD	DA-N	E. GRAND FORK
20 KTW	DA-N	SEATTLE
21 KTIL	DA-N	TILLAMOOK
22 KLIV	DA-N	SAN JOSE
23 KBuQ	DA-1	VENTURA-UXNARD

100 0 100 200 300 400  
MILES

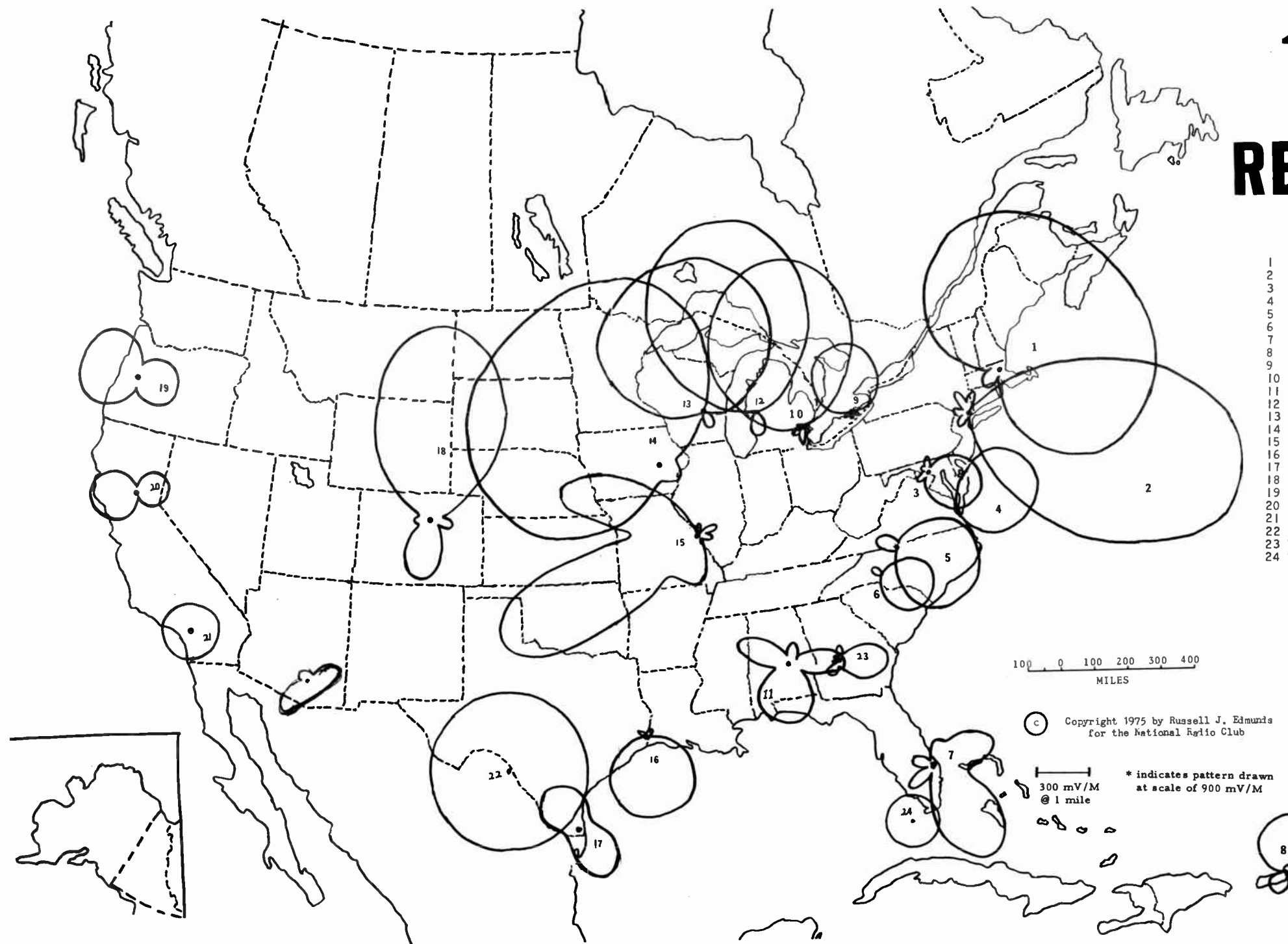
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# 1600 KHZ REGIONAL



call	class	location
1	DA-1	BROOKLINE
2	DA-2	NEW YORK
3	DA-N	ROCKVILLE
4	DA-N	DOVER
5	DA-N	REIDSVILLE
6	DA-N	CHARLOTTE
7	DA-1	RIVIERA BEACH
8	DA-1	BAYAMON
9	DA-2	SIMCOE
10	DA-2	ANN ARBOR
11	DA-N	MONTGOMERY
12	DA-N	MUSKEGON
13	DA-2	RIPON
14	DA-N	CEDAR RAPIDS
15	DA-N	ST. LOUIS
16	DA-N	ORANGE
17	DA-2	BROWNSVILLE
18	DA-N	LAKEWOOD
19	DA-N	EUGENE
20	DA-N	YUBA CITY
21	ND	POMONA
22	ND	CU. ACUNA
23	DA-N	WARNER ROBINS
24	ND	KEY WEST

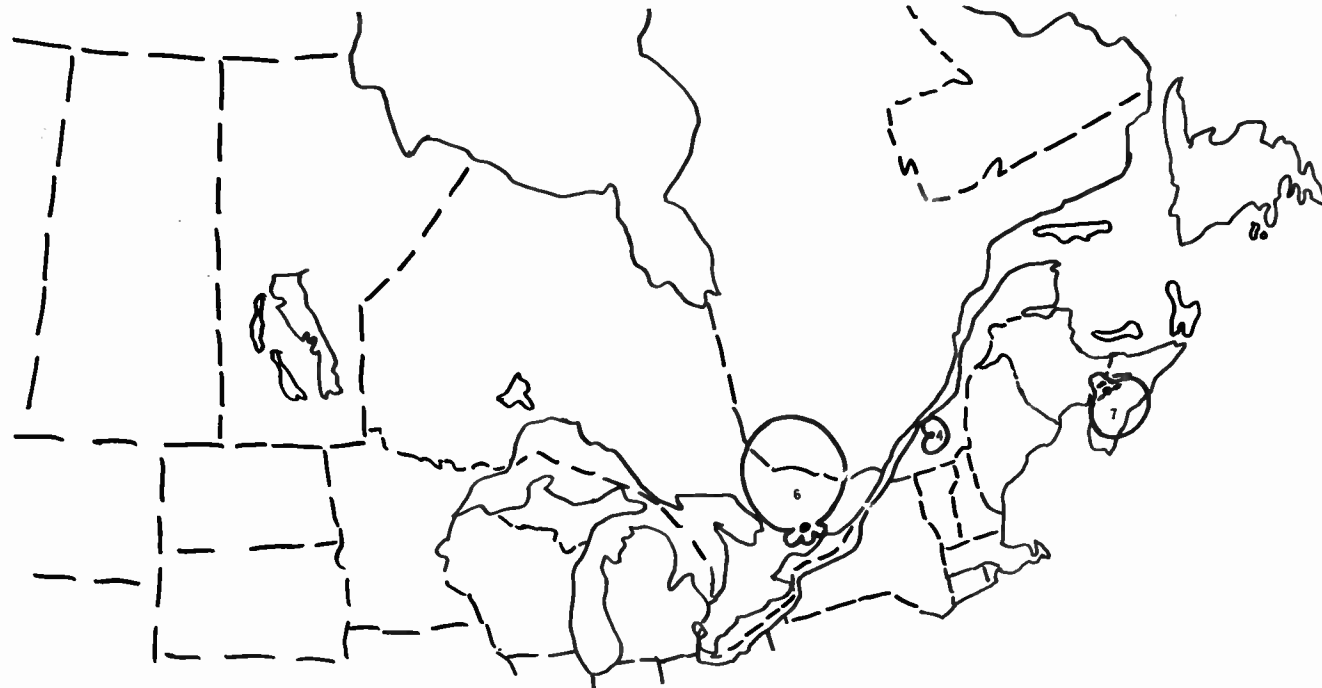
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MILES

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@ 1 mile

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at scale of 900 mV/M

# CANADIAN LOCAL



call	class	location
1240		
1 CFEK	DA-1	FERNIE
1340		
2 CJLS	DA-2	YARMOUTH
1400		
3 CJRP	DA-N	RIVIERE du LOUP
4 CKRV	DA-1	DRUMMONDVILLE
1450		
5 CHEF	DA-2	GRANBY
6 CHUC	DA-2	PORT HOPE
1490		
7 CKEN	DA-1	KENTVILLE
8 CHYM	DA-2	KITCHENER

300 mV/M  
@ 1 mile

\* indicates pattern drawn  
at scale of 900 mV/M

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