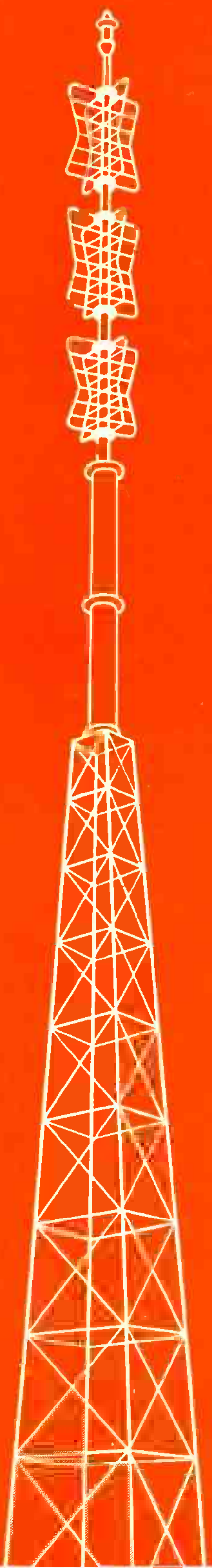


BROADCAST

FM • TELEVISION • AM

EQUIPMENT

RADIO CORPORATION OF AMERICA

ENGINEERING PRODUCTS DEPARTMENT, Camden, N. J., U. S. A.

GENERAL TECHNICAL INFORMATION AND DATA ON UHF TV ANTENNAS

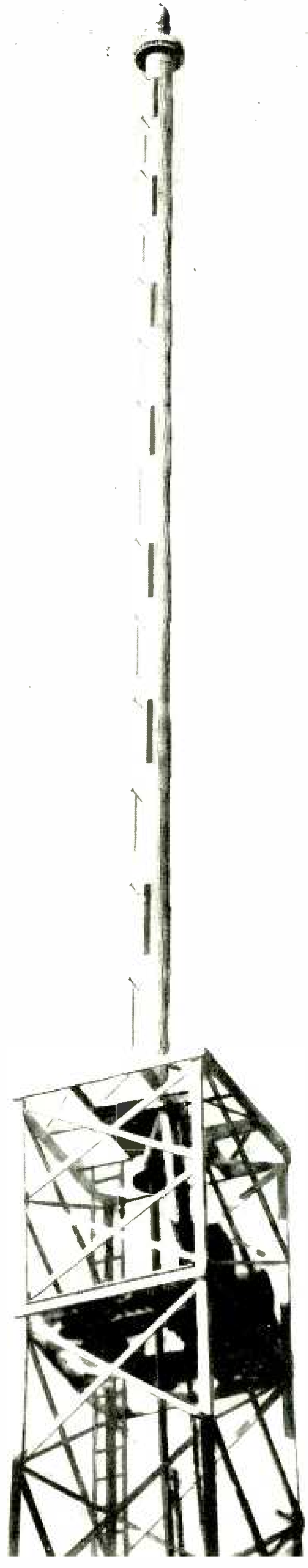
Contents

UHF TV PYLON ANTENNAS

2J8651

TMKS ®

PRINTED IN U.S.A.



Typical UHF Pylon Antenna Installation

GENERAL TECHNICAL DATA FOR RCA, UHF TELEVISION ANTENNAS

I. General Description of Non-Directional Type Antennas

A. THE "S" SERIES ANTENNAS USING ONE LAYER OFF-SET FEED

The physical characteristics of the "S" series antennas do not differ in any respect externally from the earlier center fed types. The salient difference is that the point of feed, instead of being at the center of the internal coaxial feeder, is displaced downward by one slot layer, or 3/2 wave lengths, from the geometrical center. At the UHF frequencies involved, this shift varies from approximately 37½ inches at Channel 14 to approximately 20 inches at Channel 83. Since this represents a small percentage of the overall length of the antenna, and since the radiation center has no specific definition for such an antenna of multiple sources of radiation and has been construed by implication to be the geometric center of the antenna, the geometric center is likewise considered the electrical or radiation center of an antenna employing this off-set feed.

B. "D" SERIES ANTENNAS HAVING TWO-LAYER OFF-SET FEED

The "D" series antennas similarly have no external physical differences from the earlier-center feed or the present "S" series antennas. The "D" antenna differs only in that they employ a point of feed off-set from the geometrical center downward by two layers of slots, or 3 wave lengths. This displacement ranges from approximately 75 inches at Channel 14 to approximately 40 inches at Channel 83. The radiation center, for the reasons outlined above, is considered to be the geometrical center.

II. Electrical Considerations in the Use of Off-Center Feed

To attain the desired high gain single lobe of suitable beam width directed at the horizontal and having minimum radiation in the minor lobes requires that the successive layers of slots be fed in phase. With such phase conditions the vertical radiation pattern will have minor lobes, however, accompanied by minima between the minor lobes which go to a theoretical zero value. In actual antennas where production tolerances are closely controlled, these nulls are minima which may in practice closely approach their theoretical value of zero. Thus the approach to a method of null fill-in becomes a matter of prime importance in obtaining signal distribution which will afford at least the minimum required field intensities over the desired service area. Ideally, the minima should be filled in to yield a smooth vertical pattern curve of proper shape, and having no lobes or points of minima, to achieve constant signal with varying distance over the area to be served. (See Fig. 1.) If the minima associated with the lower minor lobes are filled such that the average of these variations approaches such a curve, and the minima do not fall below the value required to attain minimum signal intensities, the minima fill-in requirements will have been obtained within the requirements of practice. Figs. 2, 3, and 4 show the ideal or cosecant field curve for three particular cases of antenna height and radii of service areas of constant field.

Feeding the various elements in phase but with an asymmetrical amplitude distribution is a practical method of approaching this minima fill-in requirement. This method is well adapted to series fed antennas where the radiated energy of a particular slot or layers of slots can be controlled by the degree of coupling to the feeder. Since the antenna consists of a discrete number of slot layers, the amplitude distribution must have a "stepped" power distribution rather than a smooth variation in distribution along the total aperture. The term "stepped" antenna arises from the plot of the radiated power per unit of distance along the aperture, as illustrated in Fig. 5. As indicated the coupling loops are set such that equal power is fed into the group or section of slot layers above the feed point and the group or section of slot layers below the feed point. The power radiated per element is then different in the top and bottom sections by the ratio of slot layers above and below the point of feed. In an eighteen-layer having two-layer off-center feed this results in an 11-7 division, thus the power density in the upper section has a ratio of 11/7 or 1.57 greater than the power density in the lower section.

Considering the upper and lower sections as two antennas, each having different patterns by reason of the different power densities, but fed with equal powers, as indicated in Figs. 5 and 6, it is evident that the minima and minor lobes will not occur at the same depression angles. Thus the resultant pattern will be one in which the minima cannot go to zero nor to values lower than the minima of either antenna, since the amplitudes are unequal at those depression angles and cannot produce complete cancellation even when in phase opposition.

Fig. 12 shows a calculated vertical pattern for a type TFU-24DM antenna, employing two-layer off-set feed and having no beam tilt, which evidences the benefits derived from such fill-in procedure. The use of beam tilt, to be discussed later, quite rapidly adds to the benefits of minima fill-in and does so to a much greater extent than with center-fed antennas. This is quite evident from the curve for the 24DM type with 1° of beam tilt, also shown on Fig. 12.

III. Use of Electrical Beam Tilt

The advantages of the use of beam tilt are well known and quite evident. Power directed in the horizontal plane at the antenna will serve no useful purpose in inducing voltages at receiving antenna located near the earth at or below the radio horizon. For this reason alone, it is then evident that electrical beam tilt, which depress the beam uniformly at all azimuth angles, should be used to at least the extent that the beam is tilted to the horizon or slightly below. Dependent upon the particular terrain conditions, the distribution of population, the extent of the population area from the transmitter and the vertical directivity pattern of the antenna considered greater values of beam tilt are in virtually every case useful. The solution for particular cases of course lies in the careful analysis of the above factors for a specific coverage problem.

The use of minima fill-in contributes a slight reduction in the power gain of the major lobe, by reason of the fill-in process at the minima. However, this reduction in gain is quite small, particularly in comparison of the penalties in the major lobe to the great benefits derived at angles below the major lobe. The use of beam tilt however does require the suffering of greater reduction in gain at the major lobe. However, for values of tilt commonly used the penalties are not at all in proportion to the decided benefits derived both for distant and close-in coverage. The reduction in maximum lobe and horizontal power may be read from Fig. 19. In addition to the apparent advantage of displacing the power distribution from the horizon or above, with the attendant waste of power contained in the major lobe at and above the horizontal plane to the areas where needed for receiver antennas, it is further apparent upon examination of the several vertical patterns that receivers at "medium" distances from the transmitter will receive radiation from well up on the major lobe curve rather than the area of lower relative field.

A further, and perhaps more important reason, for the use of some electrical beam tilt is the rate at which minima fill-in is accelerated. Fig. 13 shows the vertical pattern for a 24DM antenna having zero beam tilt and 1° beam tilt. The extent of fill-in for the same antenna when tilted is readily observed. This may likewise be seen in examining the zero and 1° tilt patterns for the TFU-21DL in Fig. 10 and the zero and 1° tilt patterns for the TFU-27DH in Fig. 18.

Similarly, a comparison of the present one layer offset types TFU-21BLS, TFU-24BMS, and TFU-27BHS for untilted and tilted conditions may be examined by reference to Figs. 7, 11, and 15.

It is apparent from an examination of the "D" type antennas for the respective groups of channels that considerable benefit is derived in the area of depression angles of common interest to every installation, down to about −6°. In Fig. 20 is shown the calculated pattern for a 24DM with the ideal or cosecant field curve from Fig. 3. The average of the calculated pattern is in close agreement with the ideal curve, thus a real improvement toward the condition of constant field versus distance for the close-in area is obtained.

Beam tilt is accomplished rather simply in these antennas by the simple expedient of displacing the entire harness upward by a small distance. The shift amounts to only a few inches and may be accomplished readily even after erection of the antenna upon the tower. When shifted, the upper section acquires a phase lead over the lower section. To determine the distance to be shifted for a given value of beam tilt the curves of Fig. 21 are used. From this curve is read the phase difference 2δ. This value may then be used in the equation:

$$d = \frac{\delta}{360} \times \frac{11802}{f}$$

$$\delta = \frac{2\delta}{2}$$

When d = Shift in inches
f = Frequency in mc

to determine the shift distance in inches. Suggested methods of mechanically accomplishing the harness shift are described in the instruction book for these antennas.

IV. Horizontal Radiation Pattern

Antennas of this type have a horizontal pattern circular within 0.5 db. The theoretical limit of circularity for 3-slot layers rotated 60° is 0.02 db maximum to minimum ratio.

The effect of operating two such antennas in close proximity, as on a common tower platform, has been studied to a limited extent. Further studies and measurements are in process with respect to this mode of operation as well as to investigate the effects of tower members on the horizontal pattern when mounting such antennas internally in a tower structure or closely adjacent to a tower as in side mounting, as might be done with several antennas on a common supporting tower. Figs. 22, 23, and 24 show the measured horizontal patterns for a model antenna having a cylinder of comparable dimensions in the presence of the antenna at different separations.

It may be concluded that separations on the order of 5 wave lengths will not cause variations in horizontal field pattern circularity in excess of about 2 db. Figs. 25 and 26 show the effect on the horizontal radiation pattern of a UHF antenna when mounted internally to a supporting tower.

V. Directional UHF Antennas

Figs. 27 and 28 show the horizontal field radiation patterns for two types of UHF directionals which readily lend themselves to manufacture and which will probably be useful for the majority of the conceivable installations which would benefit from a directional pattern.

Fig. 27 is the pattern for a single slot per layer antenna, the layers having the same slot dimensions and spacings as in the non-directional antennas but with the slots colinear. Calculated and measured model curves are shown.

Fig. 28 shows the calculated and a measured model pattern of a directional antenna having two slots per layer spaced diametrically opposite.

The application of directionals must be limited to within the requirements of the 10 db maximum variation limit. Shaping of patterns within this limit may be assisted by choice of the diameter of the radiating pipe, phasing of the slot layers, and small angular rotation of selected slot layers. Methods of null fill-in and beam tilt as applied to non-directional antennas may be similarly applied to directional types to obtain the desired effects of control of the vertical directivity pattern.

VI. Mechanical Specifications

Fig. 29 is a specification sheet for the various UHF antennas currently produced. Table I lists the appropriate mechanical parameters by channels associated with the dimensions on the specification sheet.

Figs. 30, 31 and 32 show the tower mounting plate requirements for the antenna flange furnished with each of the three pipe sizes used with the various types of antennas.

UHF TELEVISION PYLON ANTENNAS

Type	Sections	Channels	Relative Gain	Gain In DB
TFU-3BL	2	14-30	3	4.77
TFU-3BM	2	31-50	3	4.77
TFU-3BH	2	51-83	3	4.77
TFU-6BL	4	14-30	6	7.78
TFU-6BM	4	31-50	6	7.78
TFU-6BH	4	51-83	6	7.78
TFU-9BL	6	14-30	9	9.54
TFU-9BM	6	31-50	9	9.54
TFU-9BH	6	51-83	9	9.54
TFU-12BL	8	14-30	12	10.79
TFU-12BM	8	31-50	12	10.79
TFU-12BH	8	51-83	12	10.79
TFU-12BLS	14	14-30	21	13.22
TFU-21DL	14	14-30	21	13.22
TFU-24BLS	16	14-30	24	13.80
TFU-24DL	16	14-30	24	13.80
TFU-24BMS	16	31-50	24	13.80
TFU-24DM	16	31-50	24	13.80
TFU-27BHS	18	51-83	27	14.31
TFU-27DH	18	51-83	27	14.31

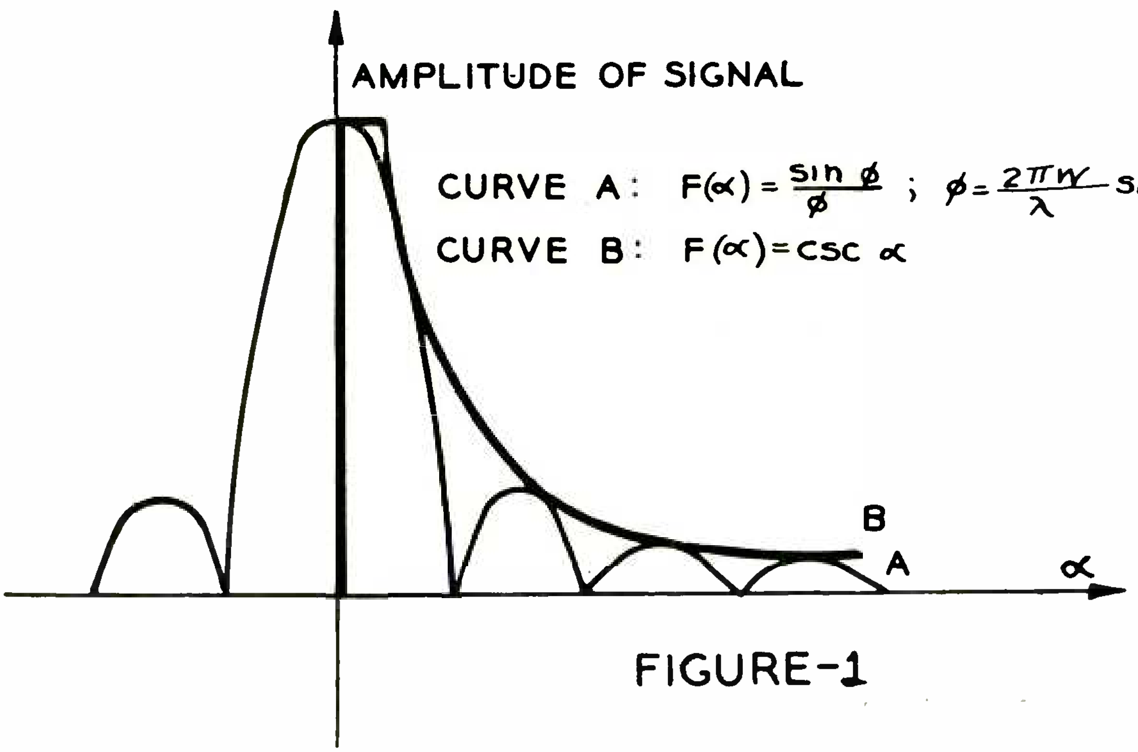


FIGURE-1

Ideal Curve to Yield Constant Field Strength versus Distance

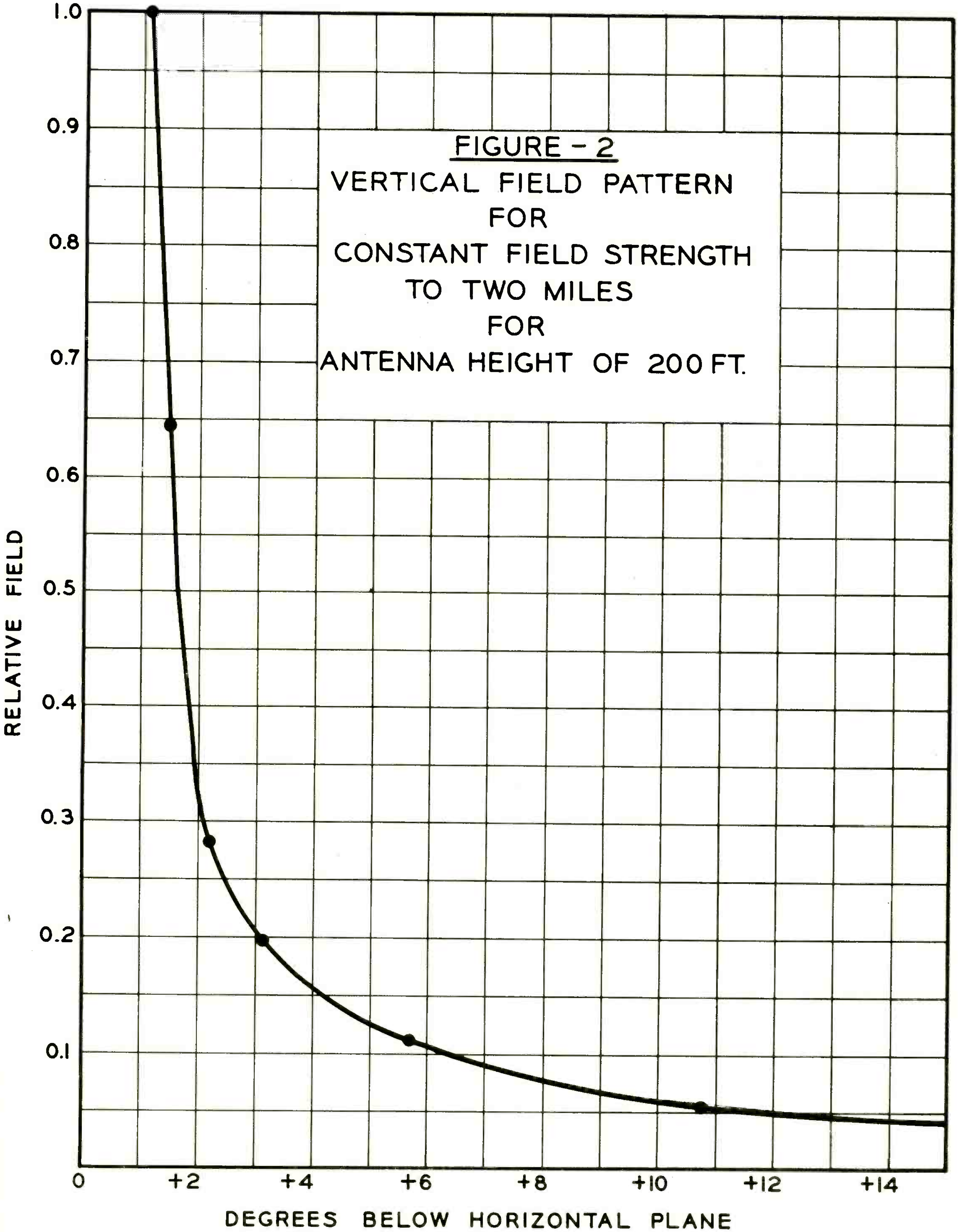


FIGURE - 2
VERTICAL FIELD PATTERN
FOR
CONSTANT FIELD STRENGTH
TO TWO MILES
FOR
ANTENNA HEIGHT OF 200 FT.
RELATIVE FIELD
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
+2
+4
+6
+8
+10
+12
+14
DEGREES BELOW HORIZONTAL PLANE

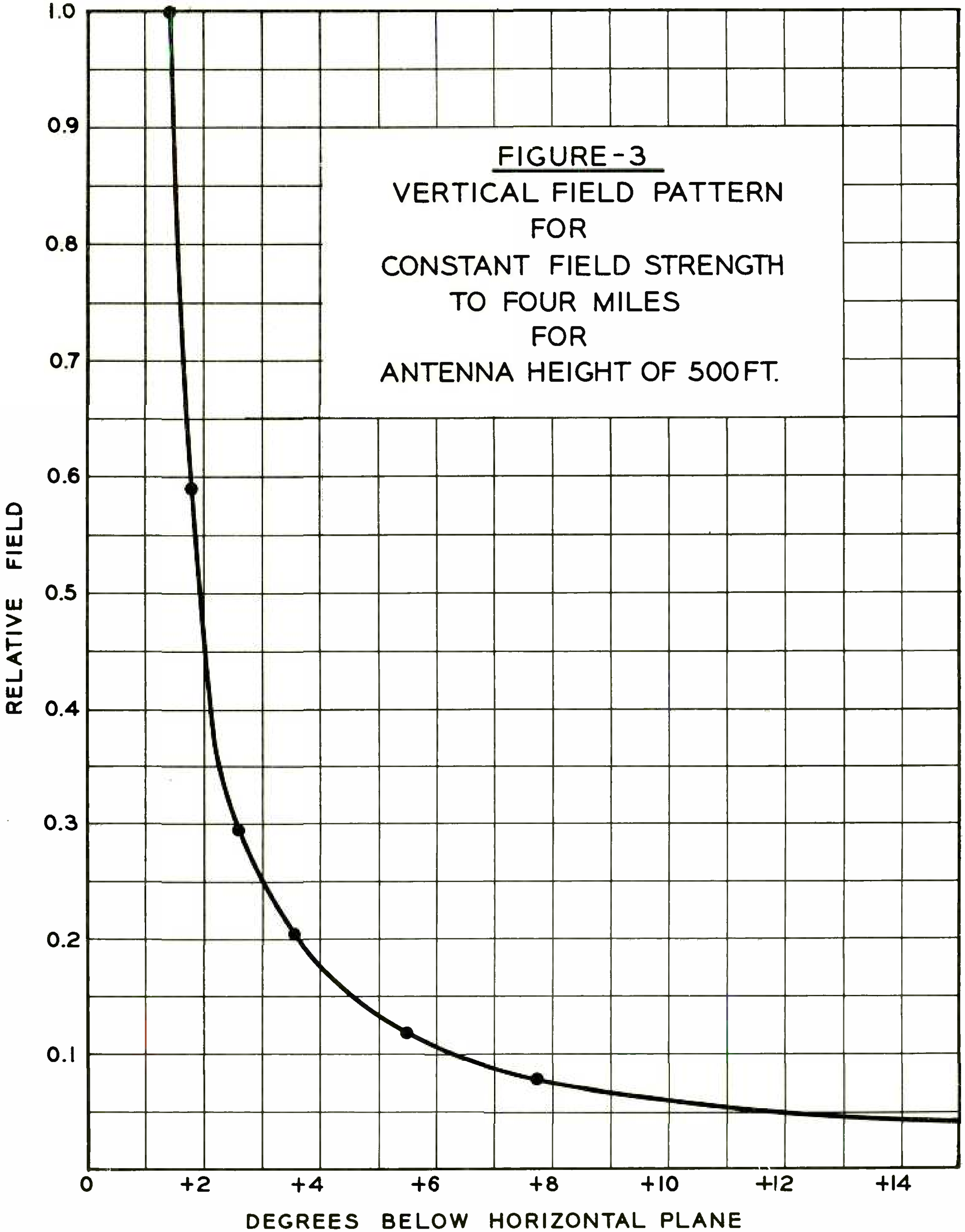


FIGURE-3
VERTICAL FIELD PATTERN
FOR
CONSTANT FIELD STRENGTH
TO FOUR MILES
FOR
ANTENNA HEIGHT OF 500 FT.
RELATIVE FIELD
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
+2
+4
+6
+8
+10
+12
+14
DEGREES BELOW HORIZONTAL PLANE

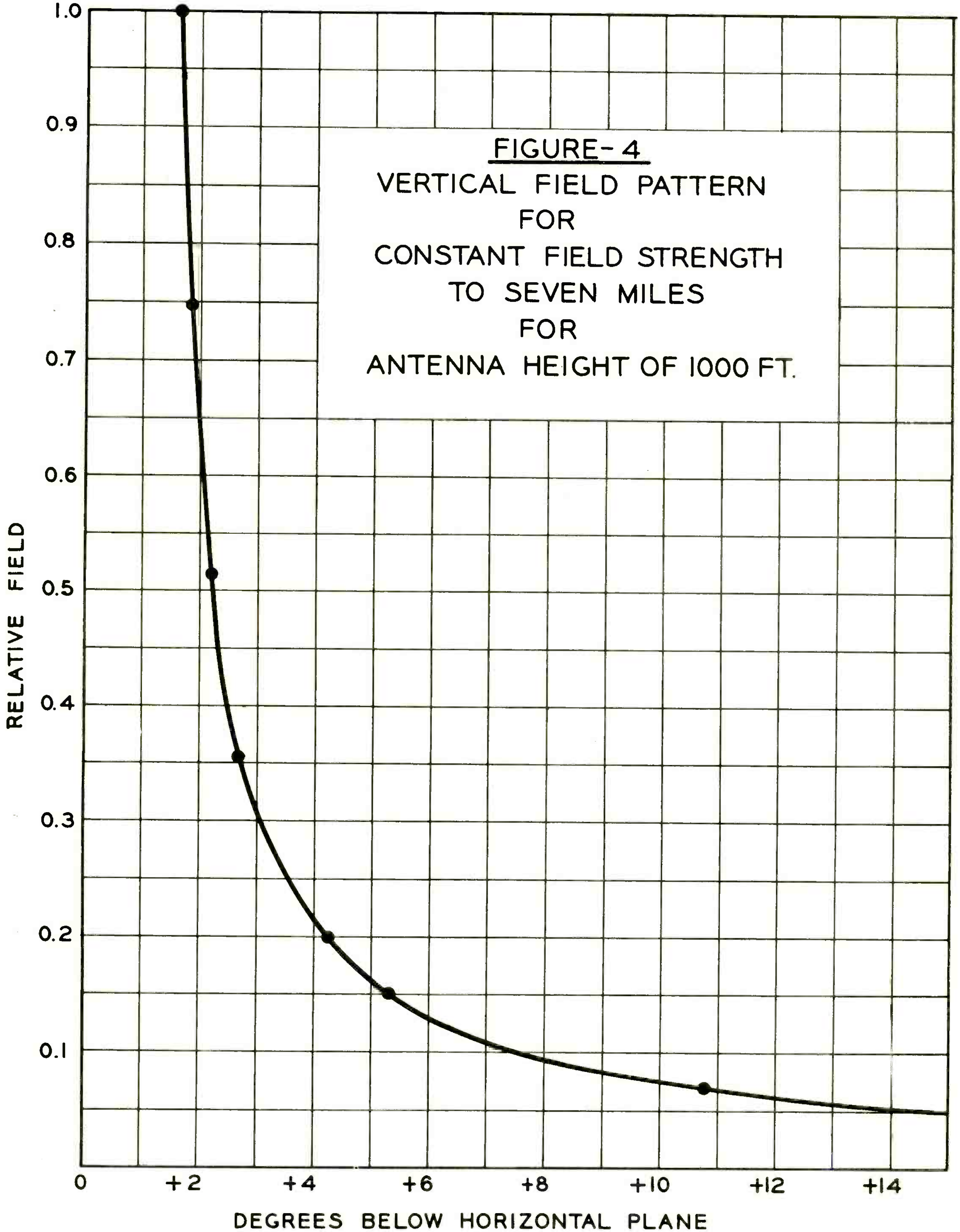


FIGURE-4
VERTICAL FIELD PATTERN
FOR
CONSTANT FIELD STRENGTH
TO SEVEN MILES
FOR
ANTENNA HEIGHT OF 1000 FT.
RELATIVE FIELD
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
+2
+4
+6
+8
+10
+12
+14
DEGREES BELOW HORIZONTAL PLANE

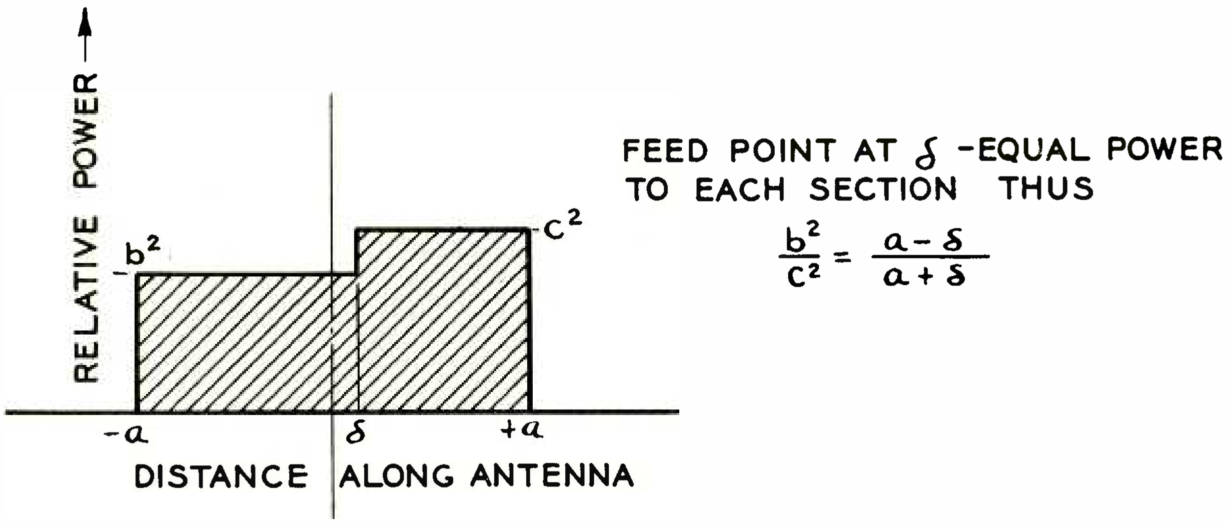


FIGURE-5

POWER DISTRIBUTION OF "STEPPED" ANTENNA

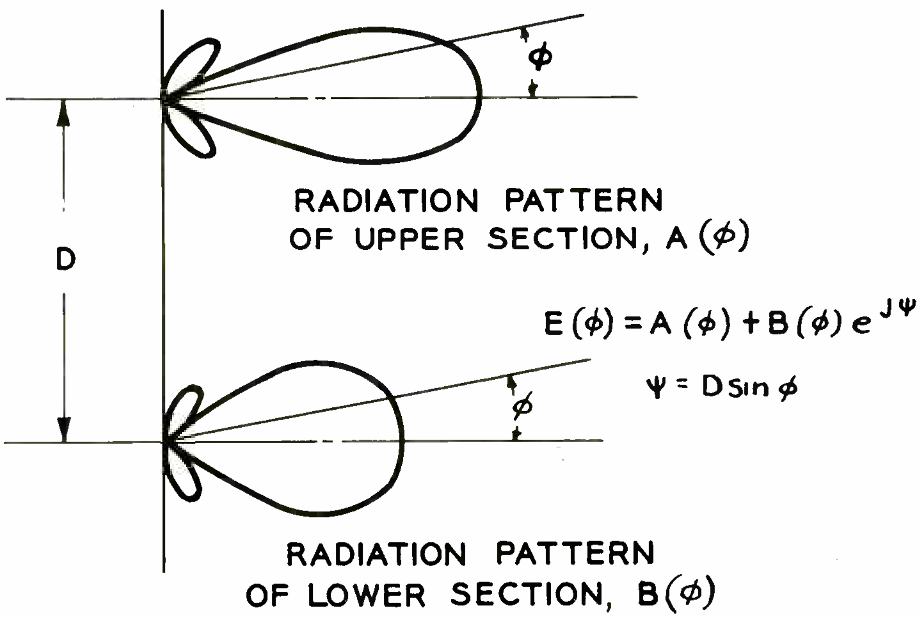


FIGURE-6

"STEPPED" ANTENNA CONSIDERED AS TWO ANTENNAS

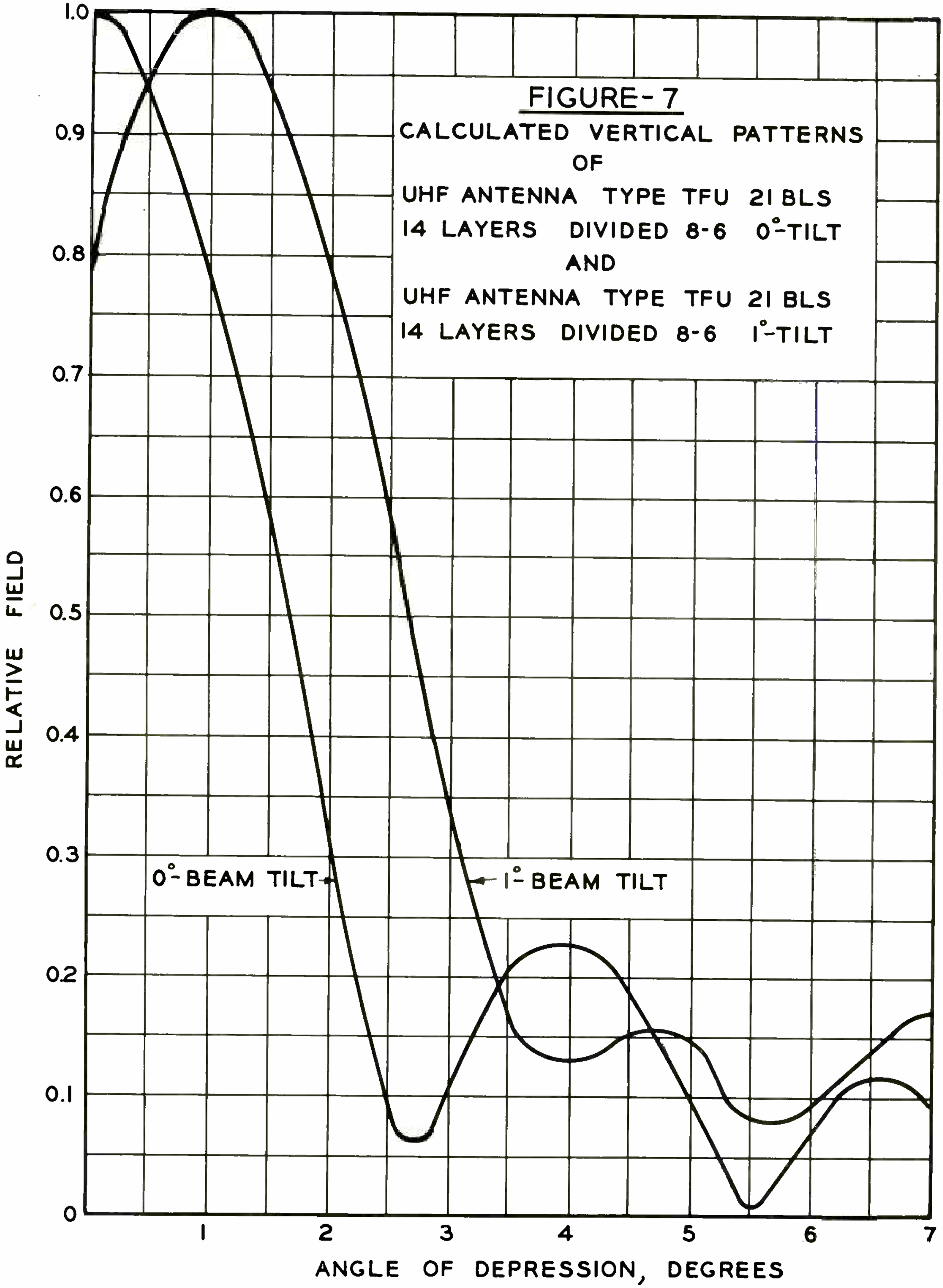


FIGURE-7
CALCULATED VERTICAL PATTERNS
OF
UHF ANTENNA TYPE TFU 21 BLS
14 LAYERS DIVIDED 8-6 0°-TILT
AND
UHF ANTENNA TYPE TFU 21 BLS
14 LAYERS DIVIDED 8-6 1°-TILT
0°-BEAM TILT
1°-BEAM TILT
RELATIVE FIELD
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
ANGLE OF DEPRESSION, DEGREES

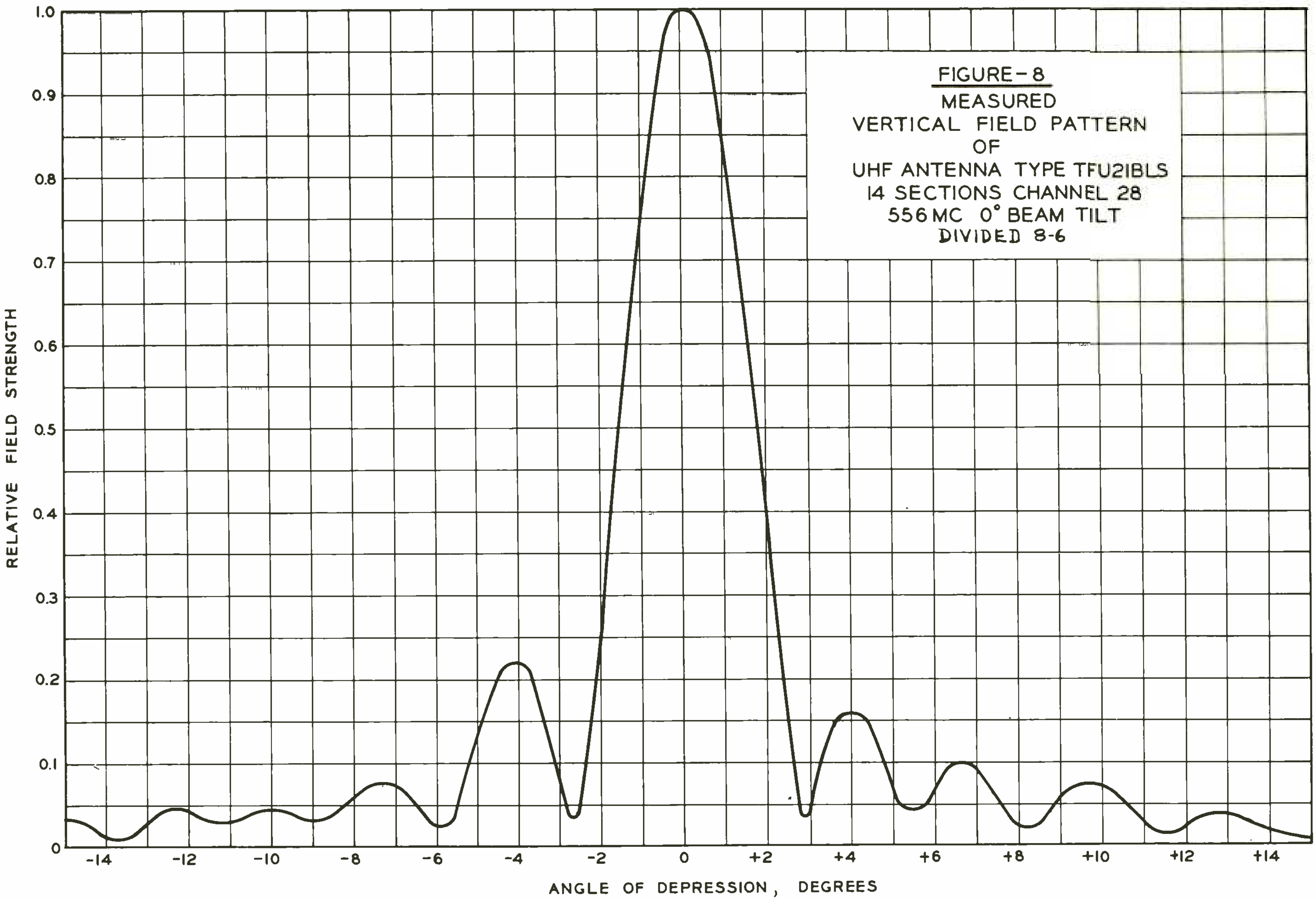


FIGURE - 8
MEASURED
VERTICAL FIELD PATTERN
OF
UHF ANTENNA TYPE TFU21BLS
14 SECTIONS CHANNEL 28
556 MC 0° BEAM TILT
DIVIDED 8-6
RELATIVE FIELD STRENGTH
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-14
-12
-10
-8
-6
-4
-2
0
+2
+4
+6
+8
+10
+12
+14
ANGLE OF DEPRESSION, DEGREES

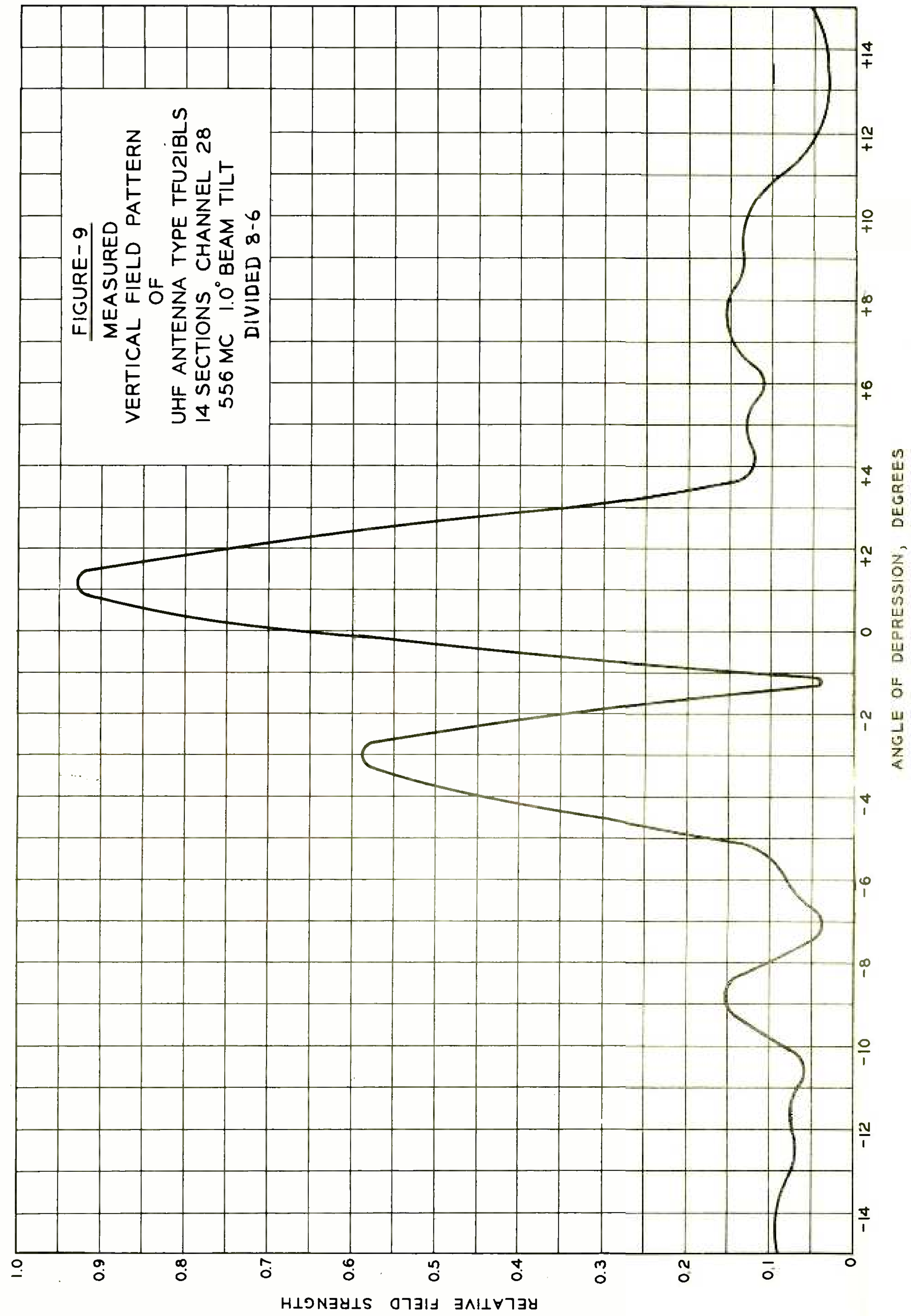


FIGURE-9
MEASURED
VERTICAL FIELD PATTERN
OF
UHF ANTENNA TYPE TFU21BLS
14 SECTIONS CHANNEL 28
556 MC 1.0° BEAM TILT
DIVIDED 8-6
RELATIVE FIELD STRENGTH
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-14
-12
-10
-8
-6
-4
-2
0
+2
+4
+6
+8
+10
+12
+14
ANGLE OF DEPRESSION, DEGREES

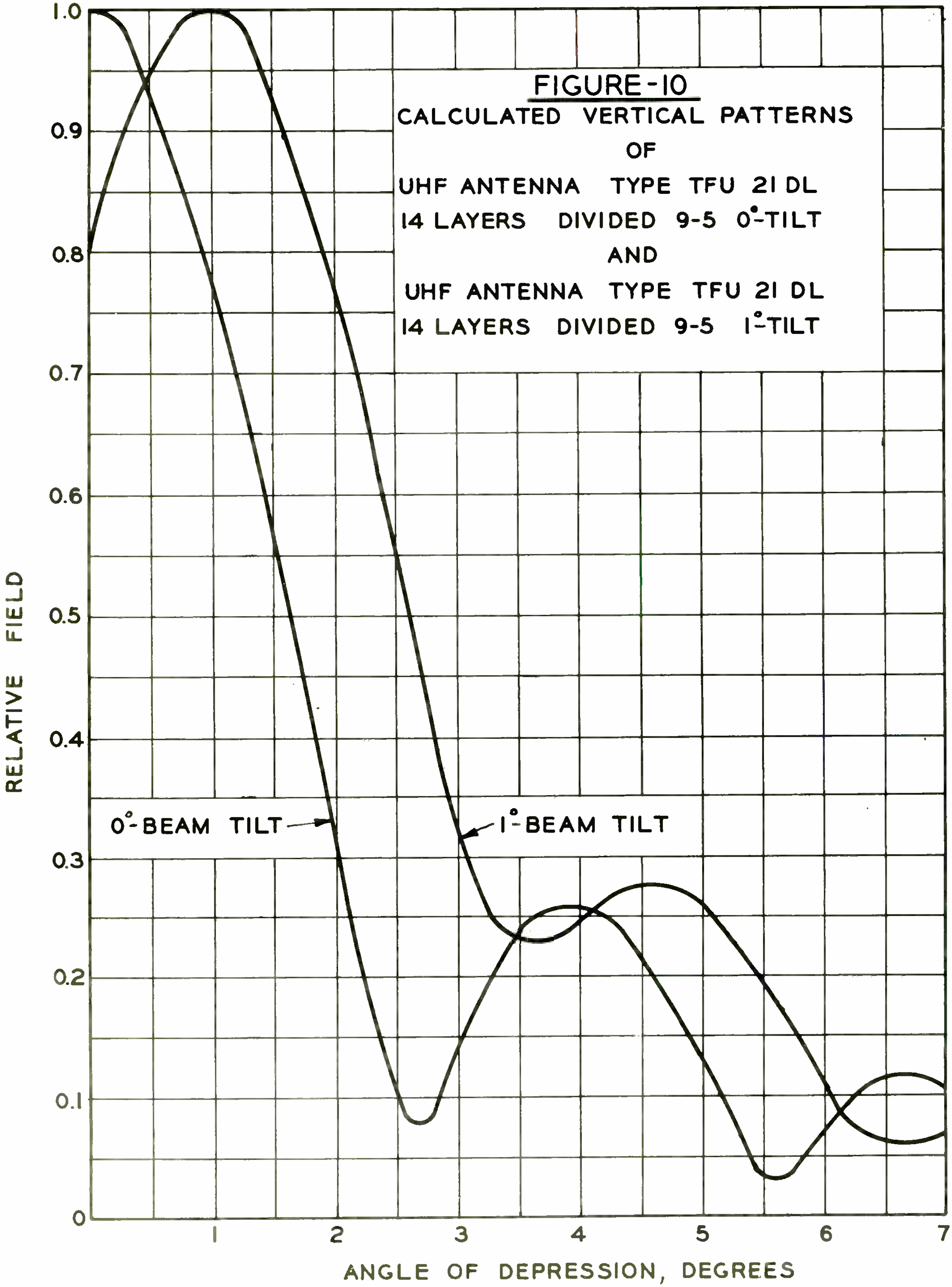


FIGURE-10
CALCULATED VERTICAL PATTERNS
OF
UHF ANTENNA TYPE TFU 21 DL
14 LAYERS DIVIDED 9-5 0°-TILT
AND
UHF ANTENNA TYPE TFU 21 DL
14 LAYERS DIVIDED 9-5 1°-TILT
0°-BEAM TILT
1°-BEAM TILT
RELATIVE FIELD
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
ANGLE OF DEPRESSION, DEGREES

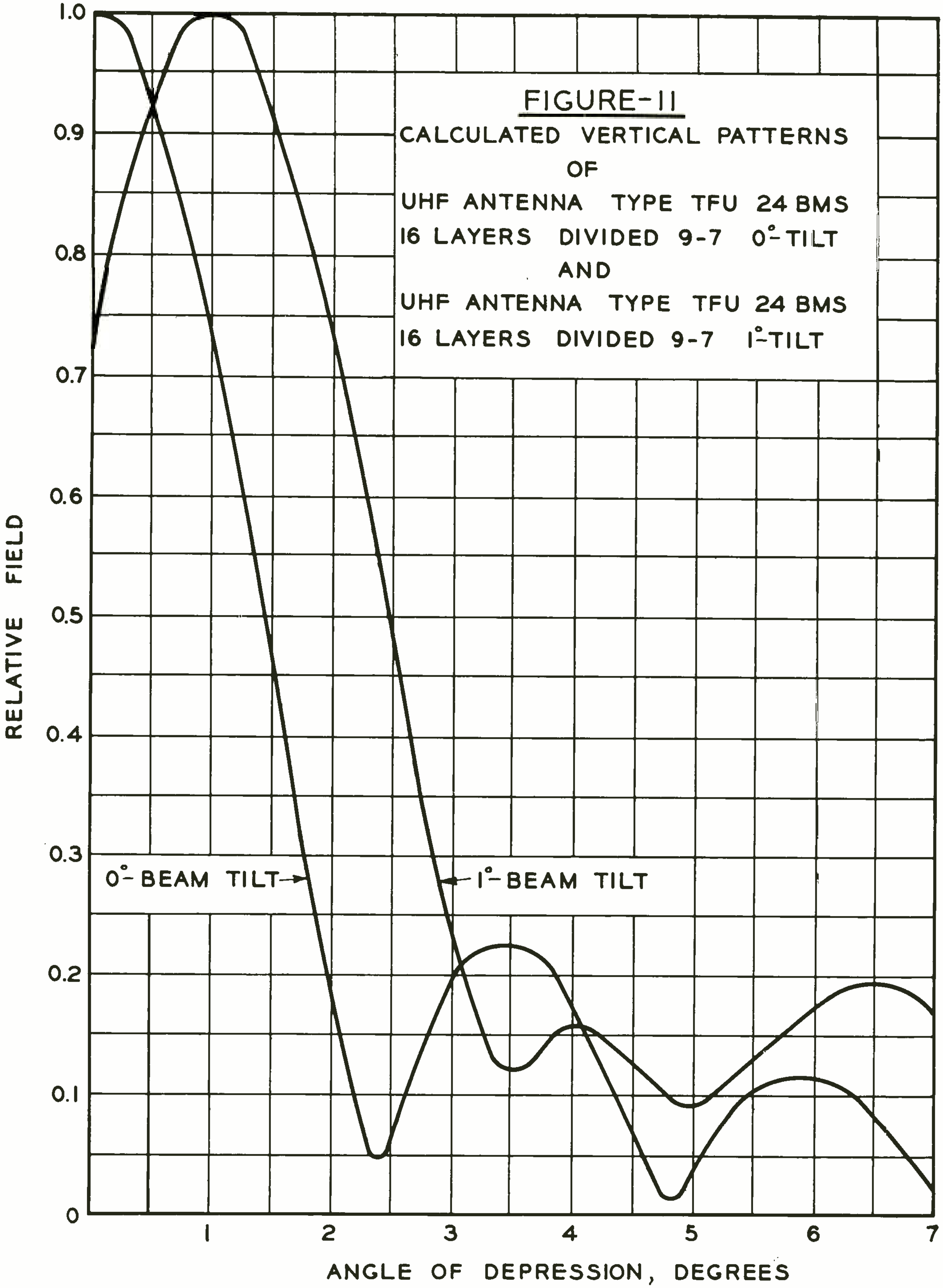


FIGURE-11
CALCULATED VERTICAL PATTERNS
OF
UHF ANTENNA TYPE TFU 24 BMS
16 LAYERS DIVIDED 9-7 0°-TILT
AND
UHF ANTENNA TYPE TFU 24 BMS
16 LAYERS DIVIDED 9-7 1°-TILT
0°-BEAM TILT
1°-BEAM TILT
RELATIVE FIELD
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
ANGLE OF DEPRESSION, DEGREES

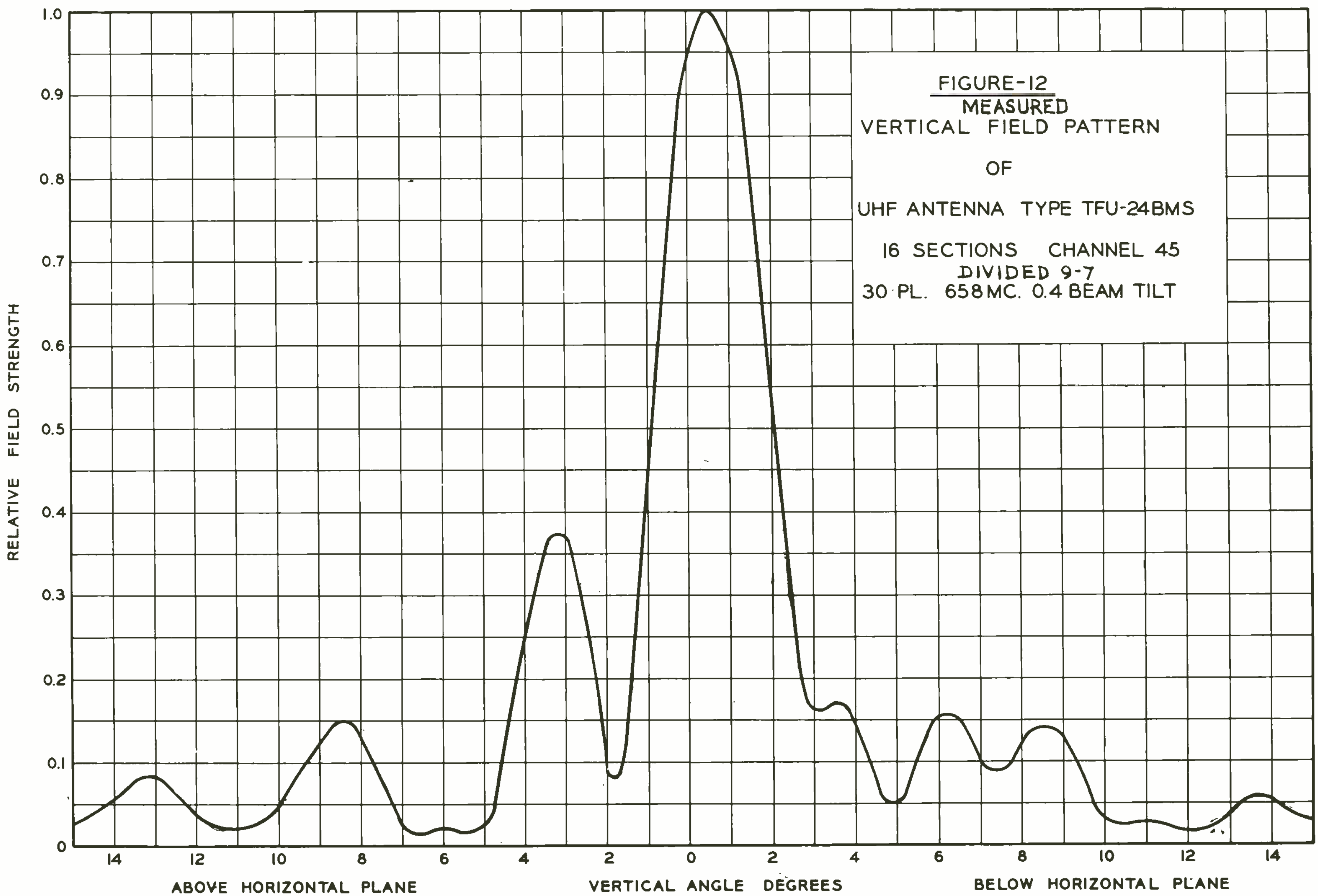


FIGURE-12
MEASURED
VERTICAL FIELD PATTERN
OF
UHF ANTENNA TYPE TFU-24BMS
16 SECTIONS CHANNEL 45
DIVIDED 9-7
30 PL. 658MC. 0.4 BEAM TILT
RELATIVE FIELD STRENGTH
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
14
12
10
8
6
4
2
0
2
4
6
8
10
12
14
ABOVE HORIZONTAL PLANE
VERTICAL ANGLE DEGREES
BELOW HORIZONTAL PLANE

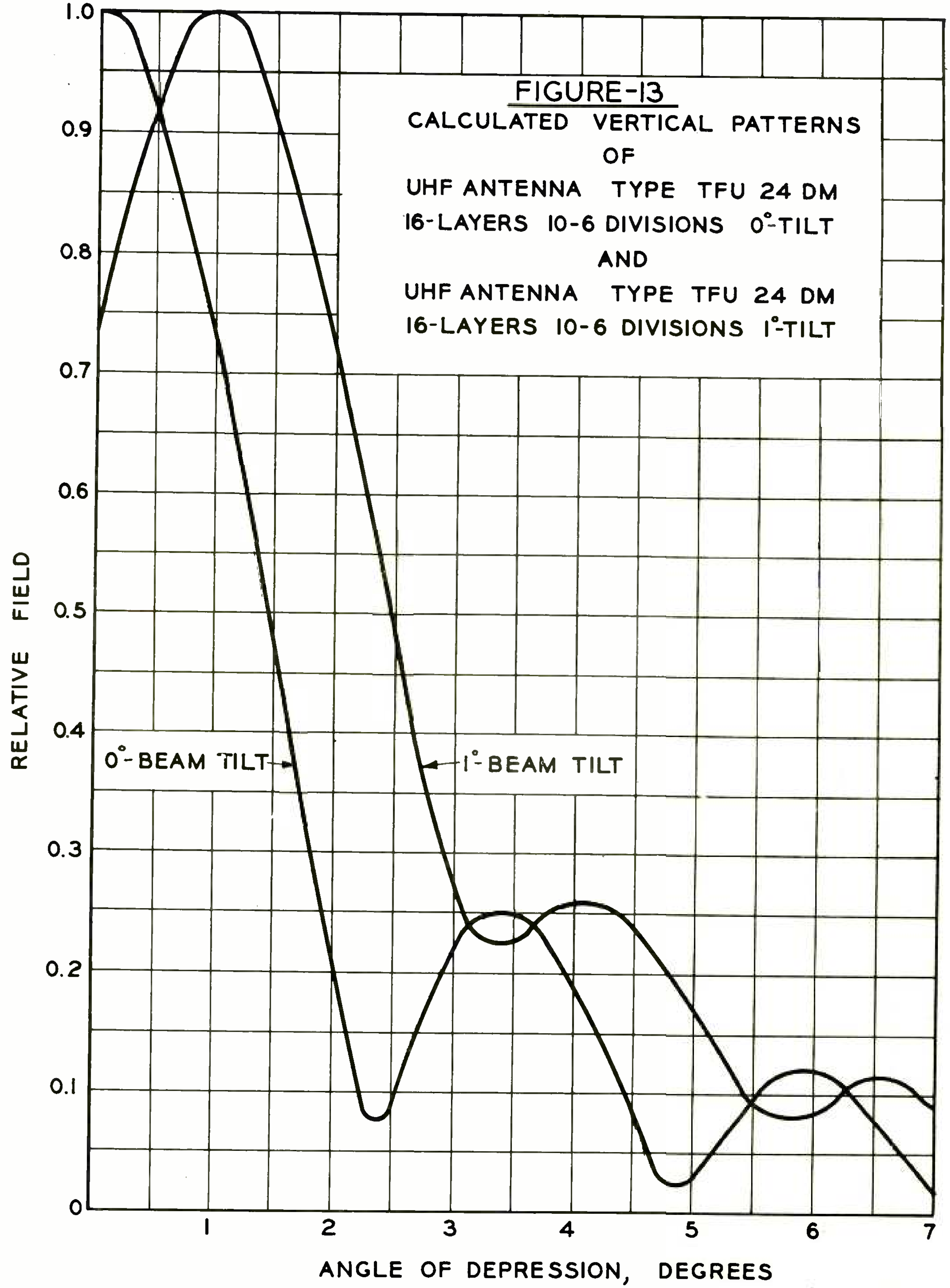


FIGURE-13
CALCULATED VERTICAL PATTERNS
OF
UHF ANTENNA TYPE TFU 24 DM
16-LAYERS 10-6 DIVISIONS 0°-TILT
AND
UHF ANTENNA TYPE TFU 24 DM
16-LAYERS 10-6 DIVISIONS 1°-TILT
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RELATIVE FIELD
0°-BEAM TILT
1°-BEAM TILT
1
2
3
4
5
6
7
ANGLE OF DEPRESSION, DEGREES

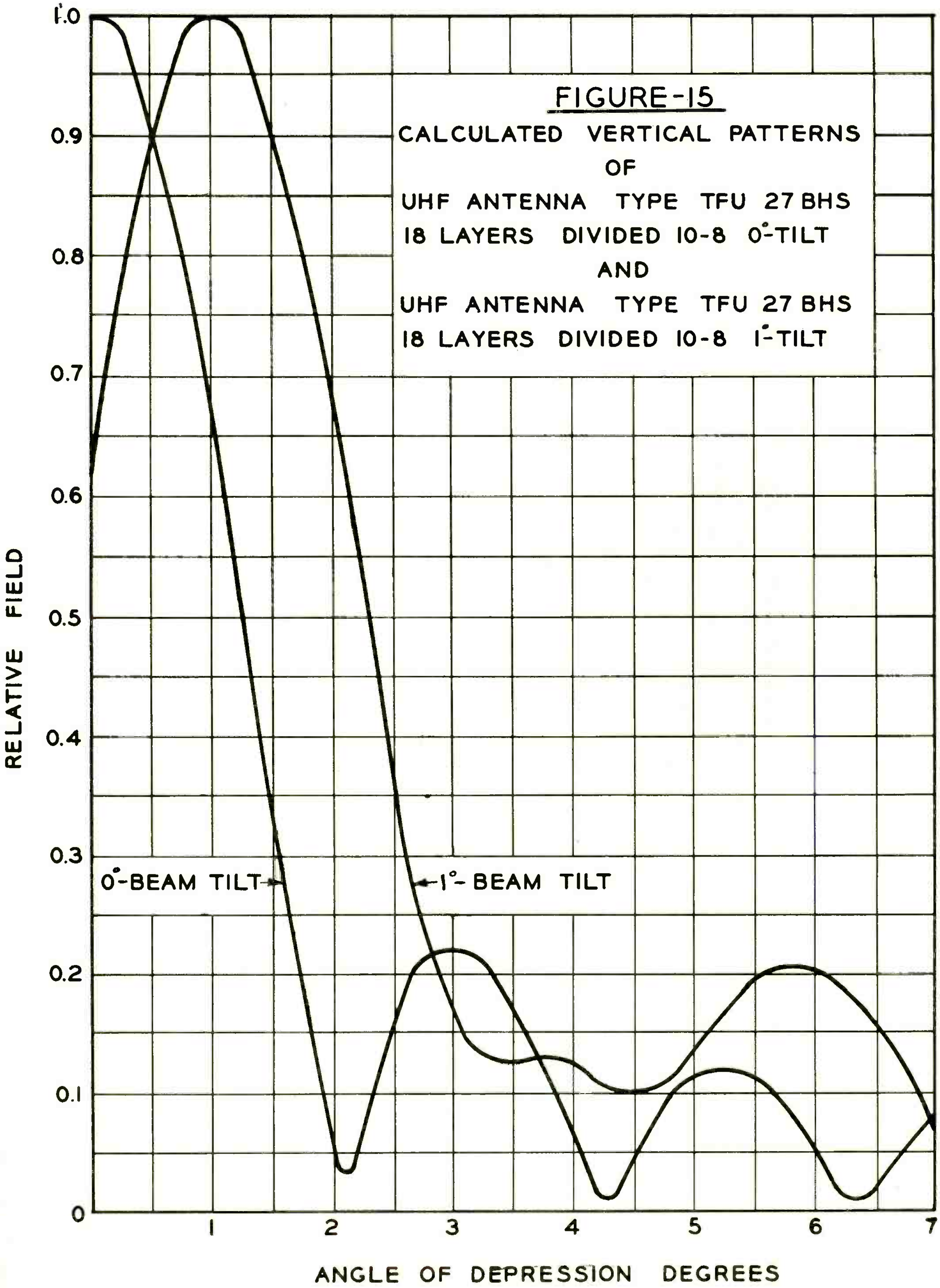


FIGURE-15
CALCULATED VERTICAL PATTERNS
OF
UHF ANTENNA TYPE TFU 27 BHS
18 LAYERS DIVIDED 10-8 0°-TILT
AND
UHF ANTENNA TYPE TFU 27 BHS
18 LAYERS DIVIDED 10-8 1°-TILT
0°-BEAM TILT
1°- BEAM TILT
RELATIVE FIELD
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
ANGLE OF DEPRESSION DEGREES

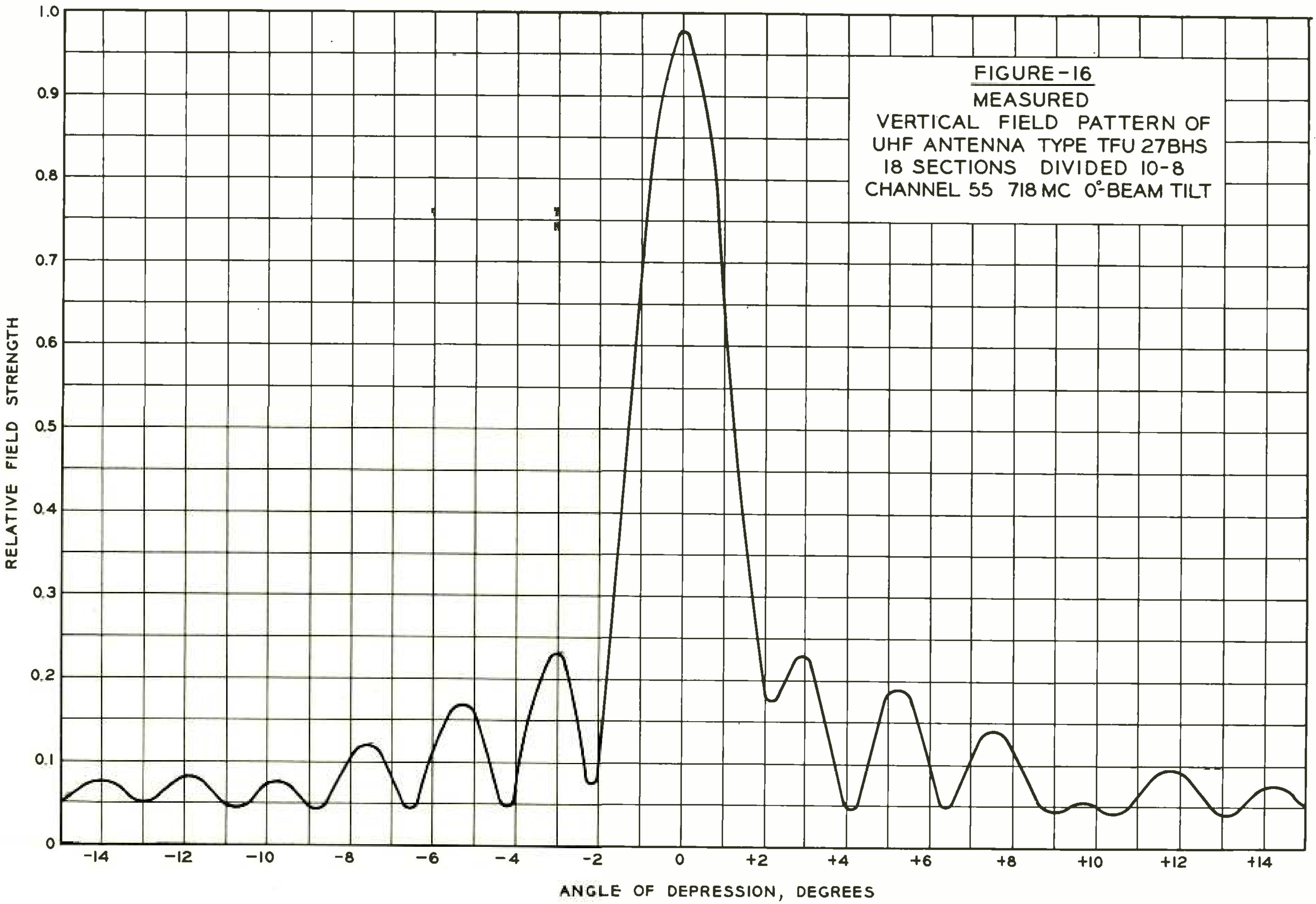


FIGURE-16
MEASURED
VERTICAL FIELD PATTERN OF
UHF ANTENNA TYPE TFU 27BHS
18 SECTIONS DIVIDED 10-8
CHANNEL 55 718 MC 0°-BEAM TILT

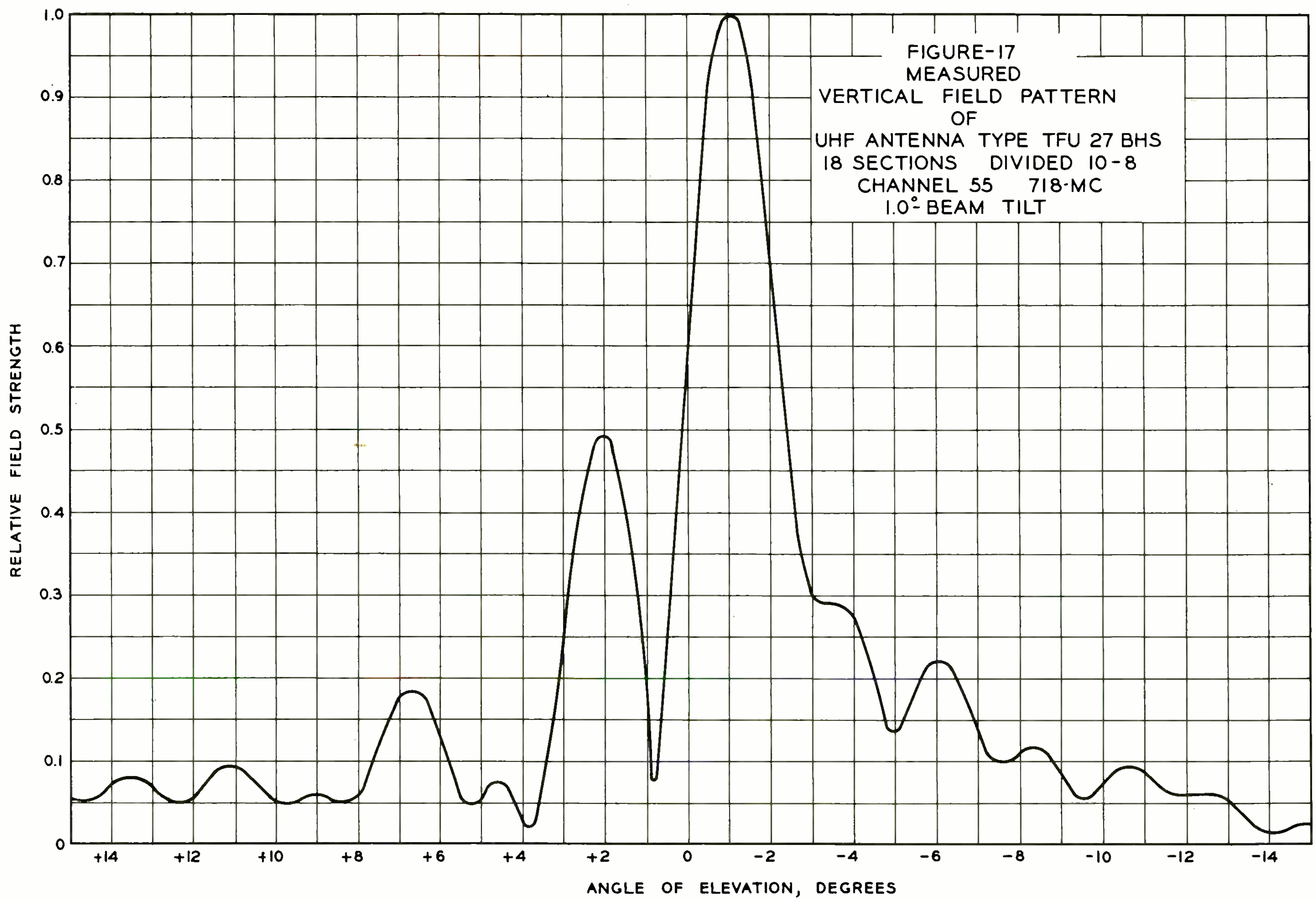


FIGURE-17
MEASURED
VERTICAL FIELD PATTERN
OF
UHF ANTENNA TYPE TFU 27 BHS
18 SECTIONS DIVIDED 10-8
CHANNEL 55 718-MC
1.0° BEAM TILT
RELATIVE FIELD STRENGTH
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
+14
+12
+10
+8
+6
+4
+2
0
-2
-4
-6
-8
-10
-12
-14
ANGLE OF ELEVATION, DEGREES

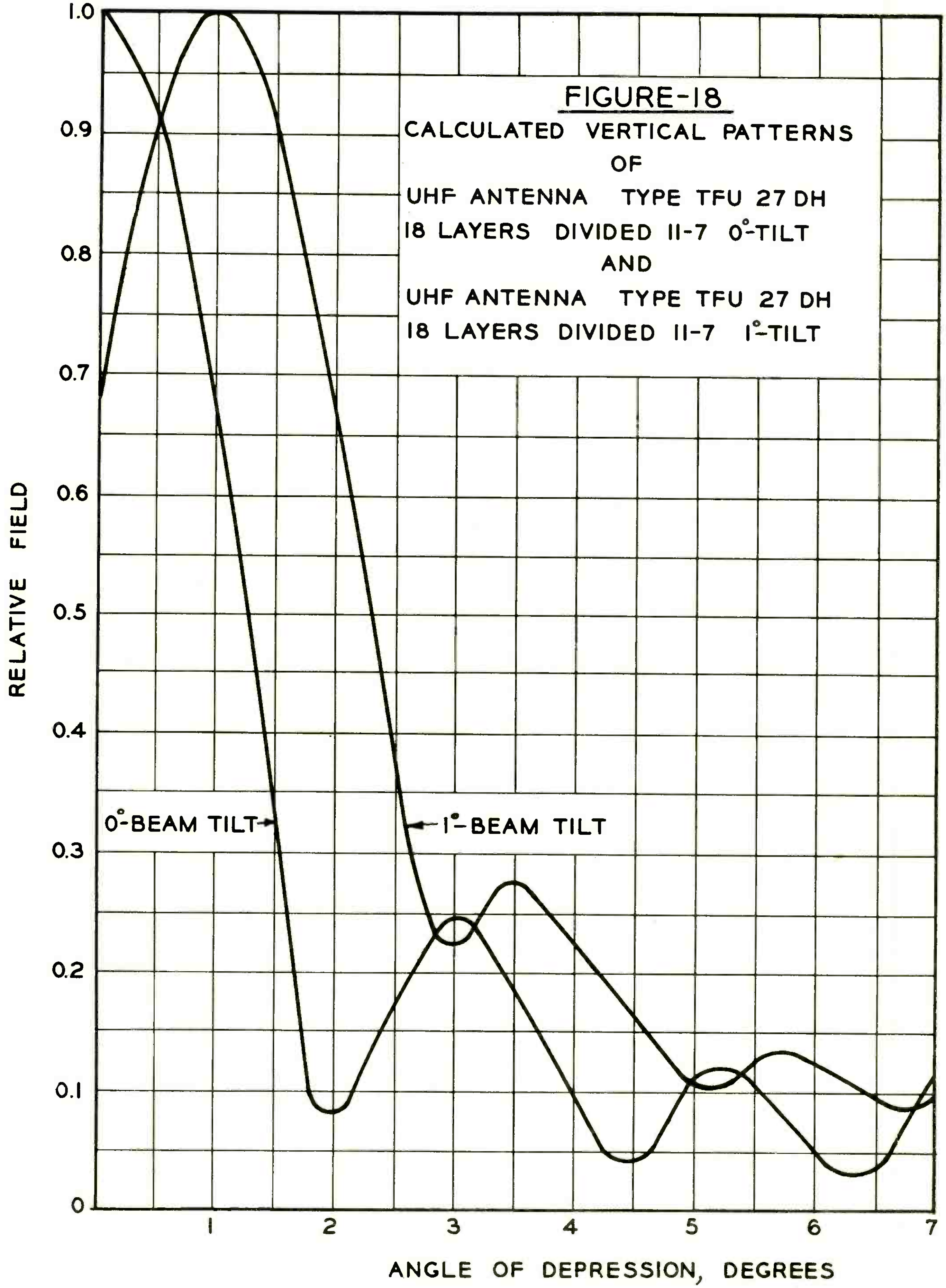
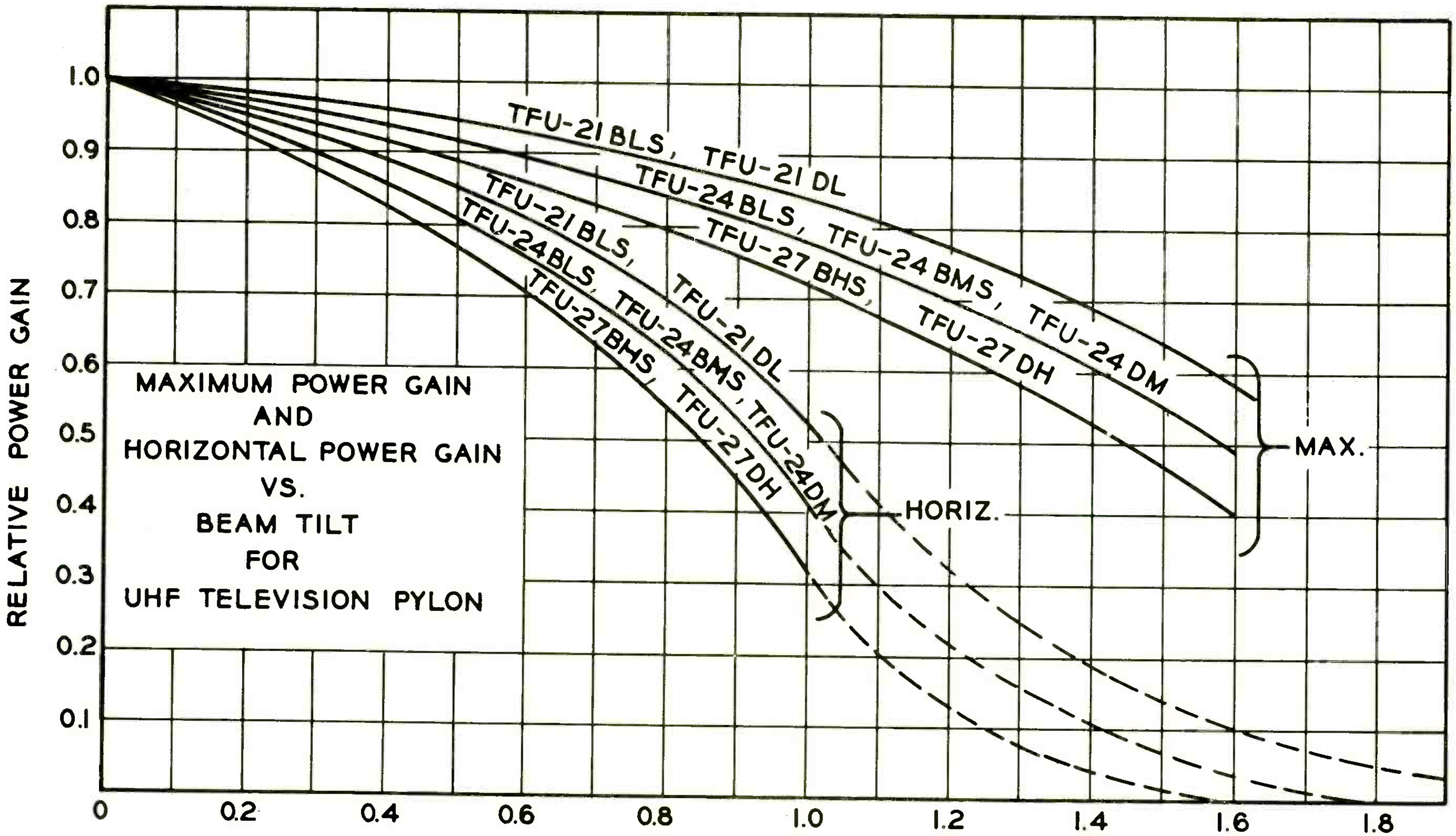


FIGURE-18
CALCULATED VERTICAL PATTERNS
OF
UHF ANTENNA TYPE TFU 27 DH
18 LAYERS DIVIDED 11-7 0°-TILT
AND
UHF ANTENNA TYPE TFU 27 DH
18 LAYERS DIVIDED 11-7 1°-TILT
RELATIVE FIELD
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0°-BEAM TILT
1°-BEAM TILT
1
2
3
4
5
6
7
ANGLE OF DEPRESSION, DEGREES


MAXIMUM POWER GAIN
AND
HORIZONTAL POWER GAIN
VS.
BEAM TILT
FOR
UHF TELEVISION PYLON
TFU-21BLS, TFU-21DL
TFU-24BLS, TFU-24BMS, TFU-24DM
TFU-27BHS, TFU-27DH
TFU-21BLS, TFU-21DL
TFU-24BLS, TFU-24BMS, TFU-24DM
TFU-27BHS, TFU-27DH
MAX.
HORIZ.
RELATIVE POWER GAIN
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
BEAM TILT, DEGREES
FIGURE-19

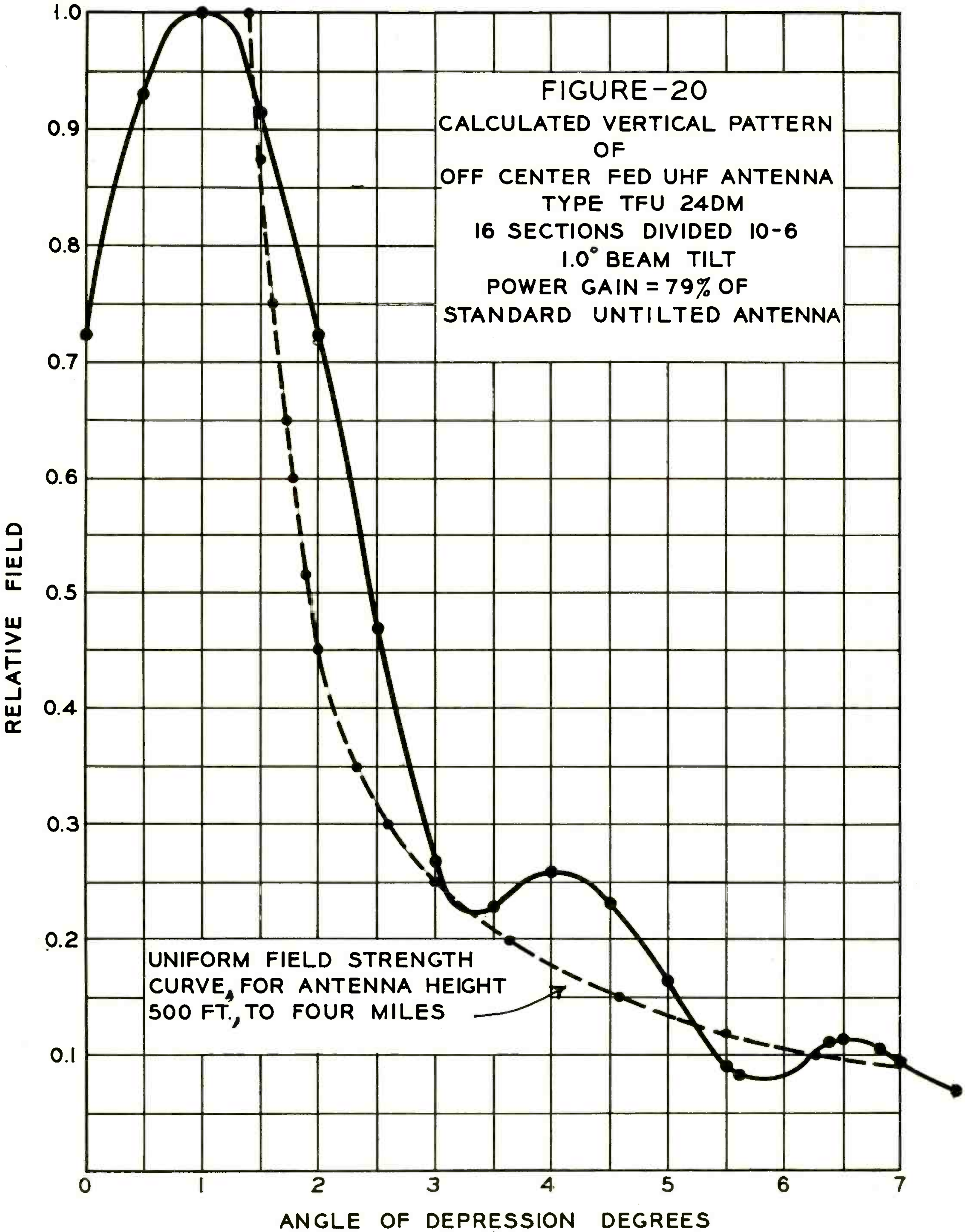


FIGURE-20
CALCULATED VERTICAL PATTERN
OF
OFF CENTER FED UHF ANTENNA
TYPE TFU 24DM
16 SECTIONS DIVIDED 10-6
1.0° BEAM TILT
POWER GAIN = 79% OF
STANDARD UNTILTED ANTENNA
UNIFORM FIELD STRENGTH
CURVE, FOR ANTENNA HEIGHT
500 FT., TO FOUR MILES
RELATIVE FIELD
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
ANGLE OF DEPRESSION DEGREES

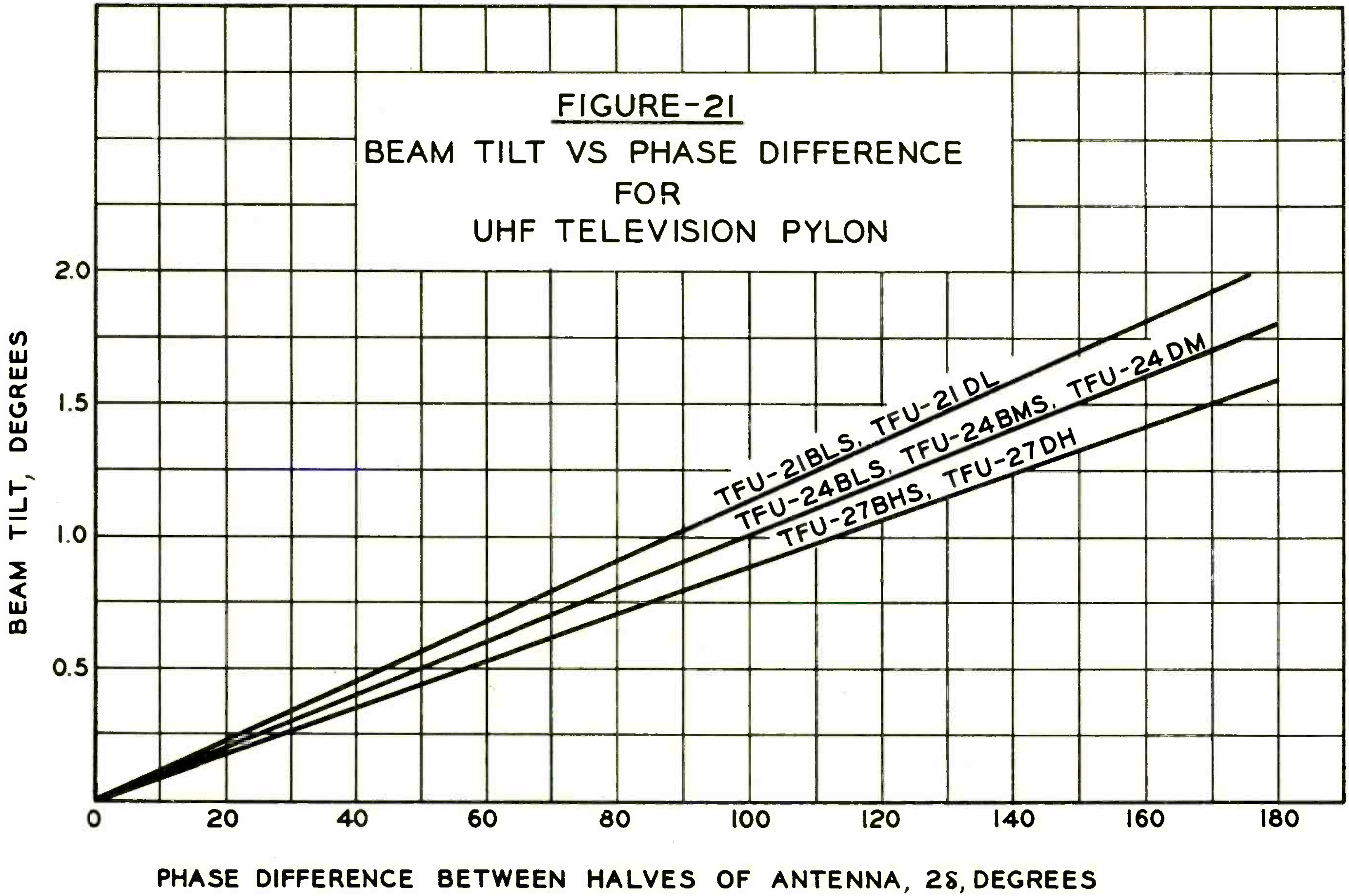


FIGURE-21
BEAM TILT VS PHASE DIFFERENCE
FOR
UHF TELEVISION PYLON
BEAM TILT, DEGREES
2.0
1.5
1.0
0.5
0
20
40
60
80
100
120
140
160
180
PHASE DIFFERENCE BETWEEN HALVES OF ANTENNA, 2δ, DEGREES
TFU-21BLS, TFU-21DL
TFU-24BLS, TFU-24BMS, TFU-24DM
TFU-27BHS, TFU-27DH

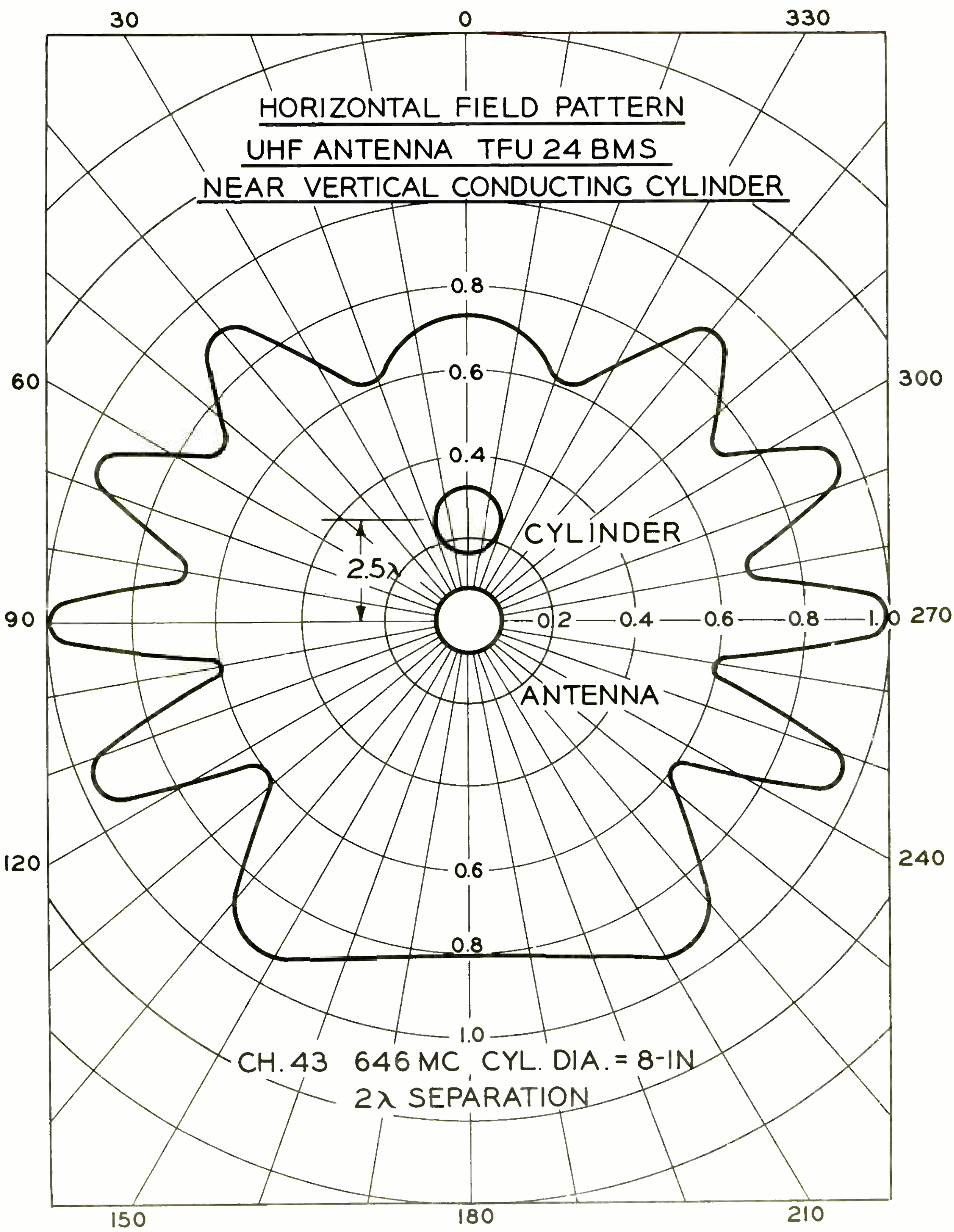

HORIZONTAL FIELD PATTERN
UHF ANTENNA TFU 24 BMS
NEAR VERTICAL CONDUCTING CYLINDER
30
0
330
60
300
90
270
120
240
150
180
210
0.8
0.6
0.4
0.2
1.0
CYLINDER
ANTENNA
2.5λ
CH. 43 646 MC CYL. DIA. = 8-IN
2λ SEPARATION

FIGURE-22

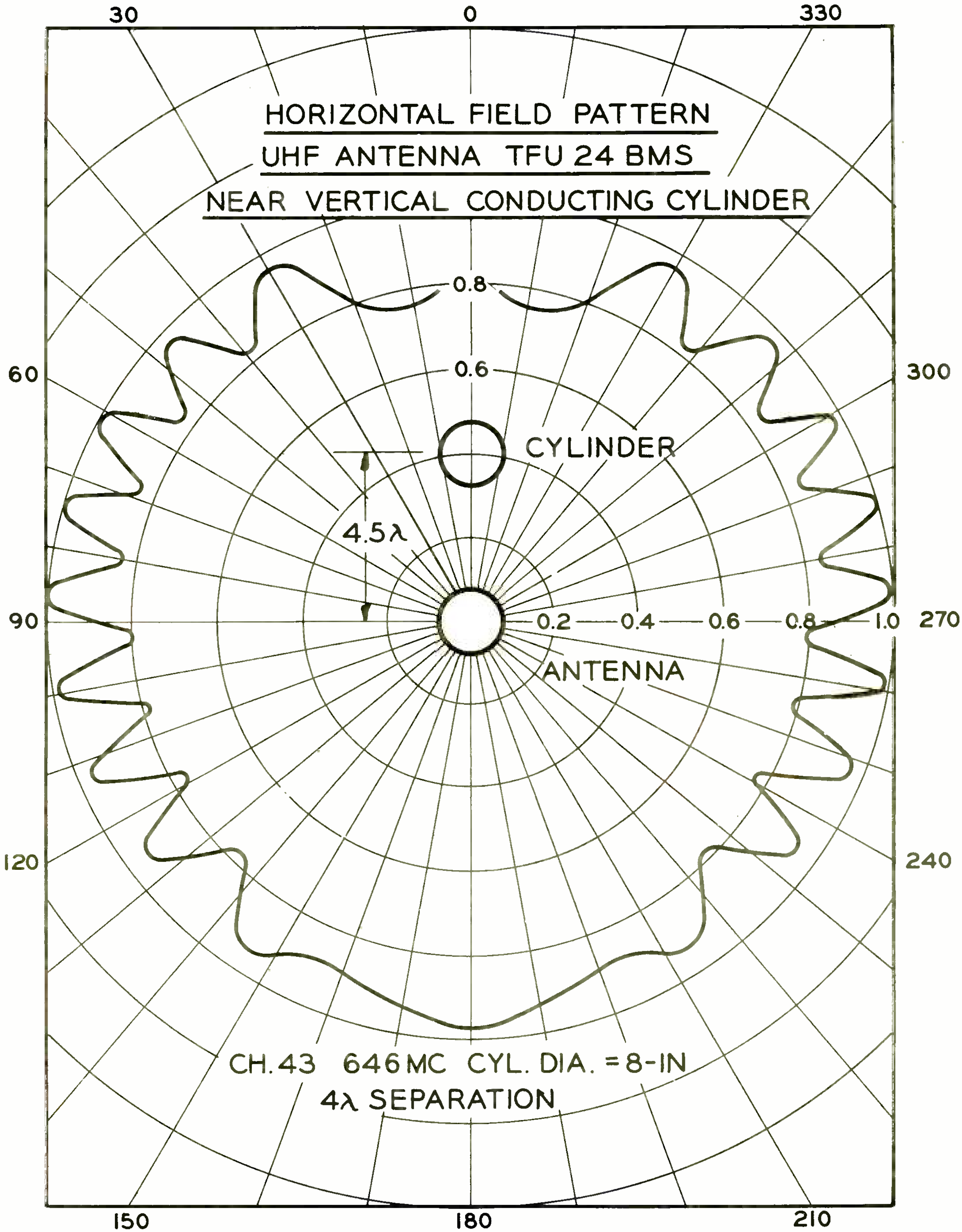

HORIZONTAL FIELD PATTERN
UHF ANTENNA TFU 24 BMS
NEAR VERTICAL CONDUCTING CYLINDER
30
0
330
60
300
90
270
120
240
150
180
210
0.8
0.6
0.2
0.4
0.6
0.8
1.0
CYLINDER
4.5λ
ANTENNA
CH. 43 646 MC CYL. DIA. = 8-IN
4λ SEPARATION

FIGURE-23

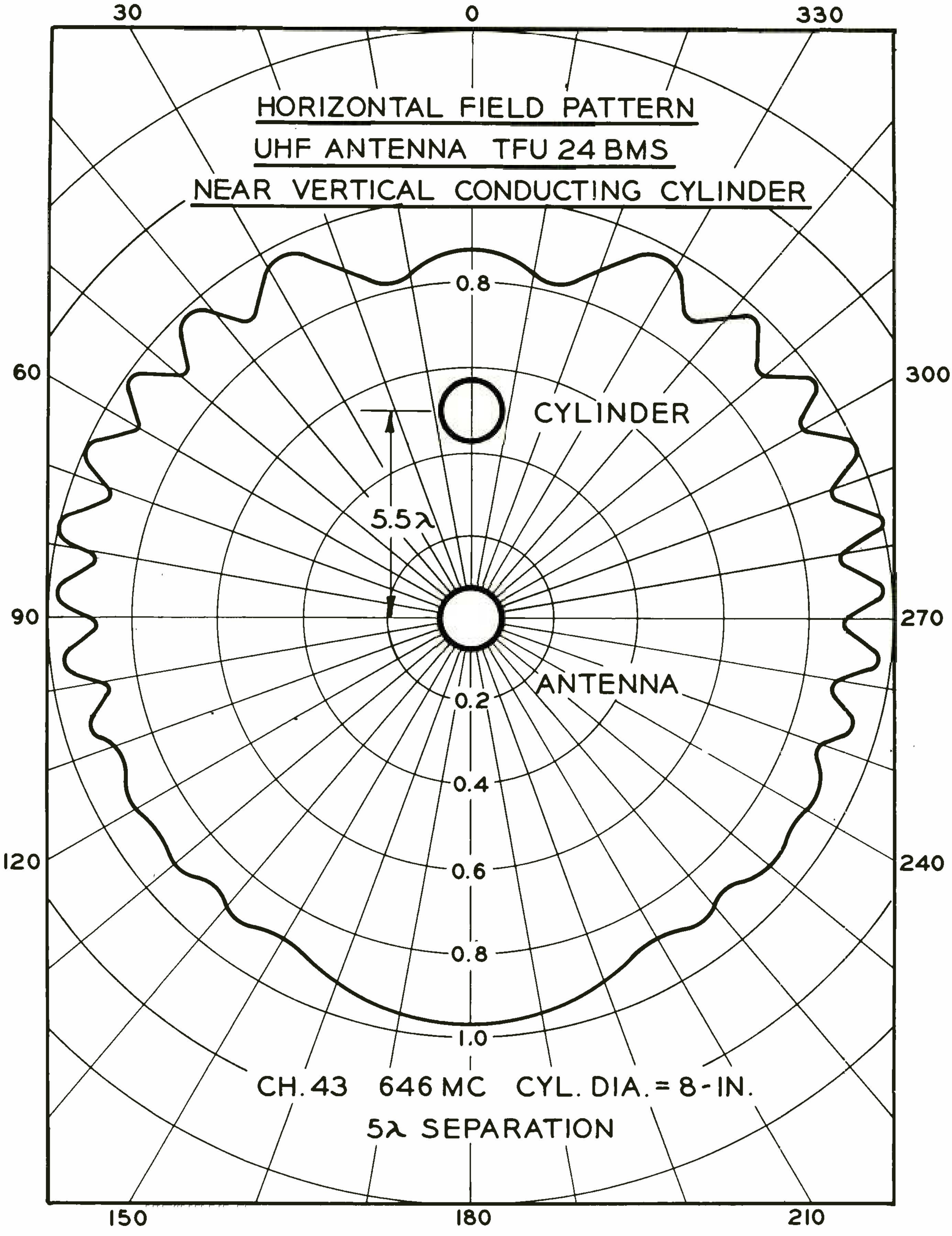
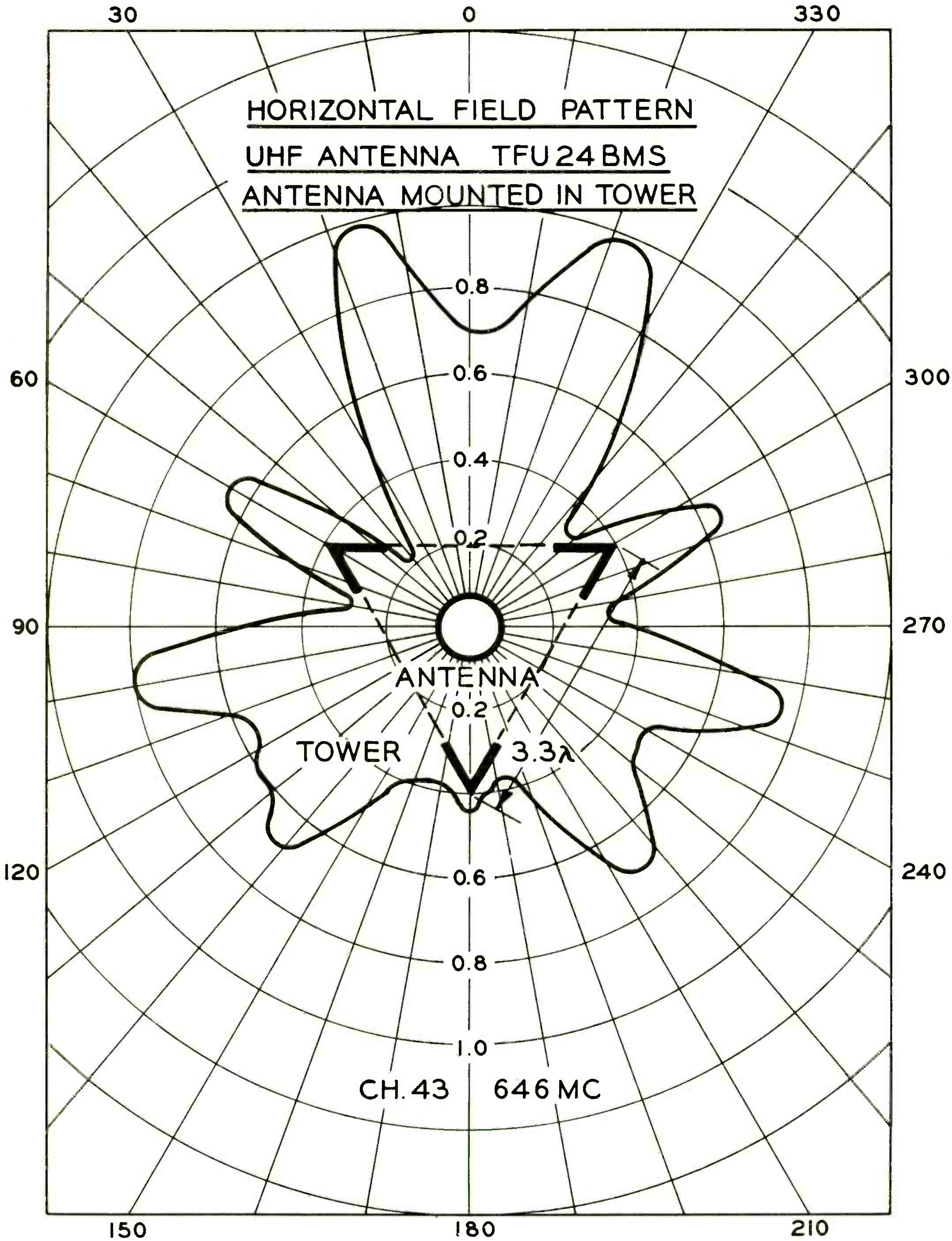
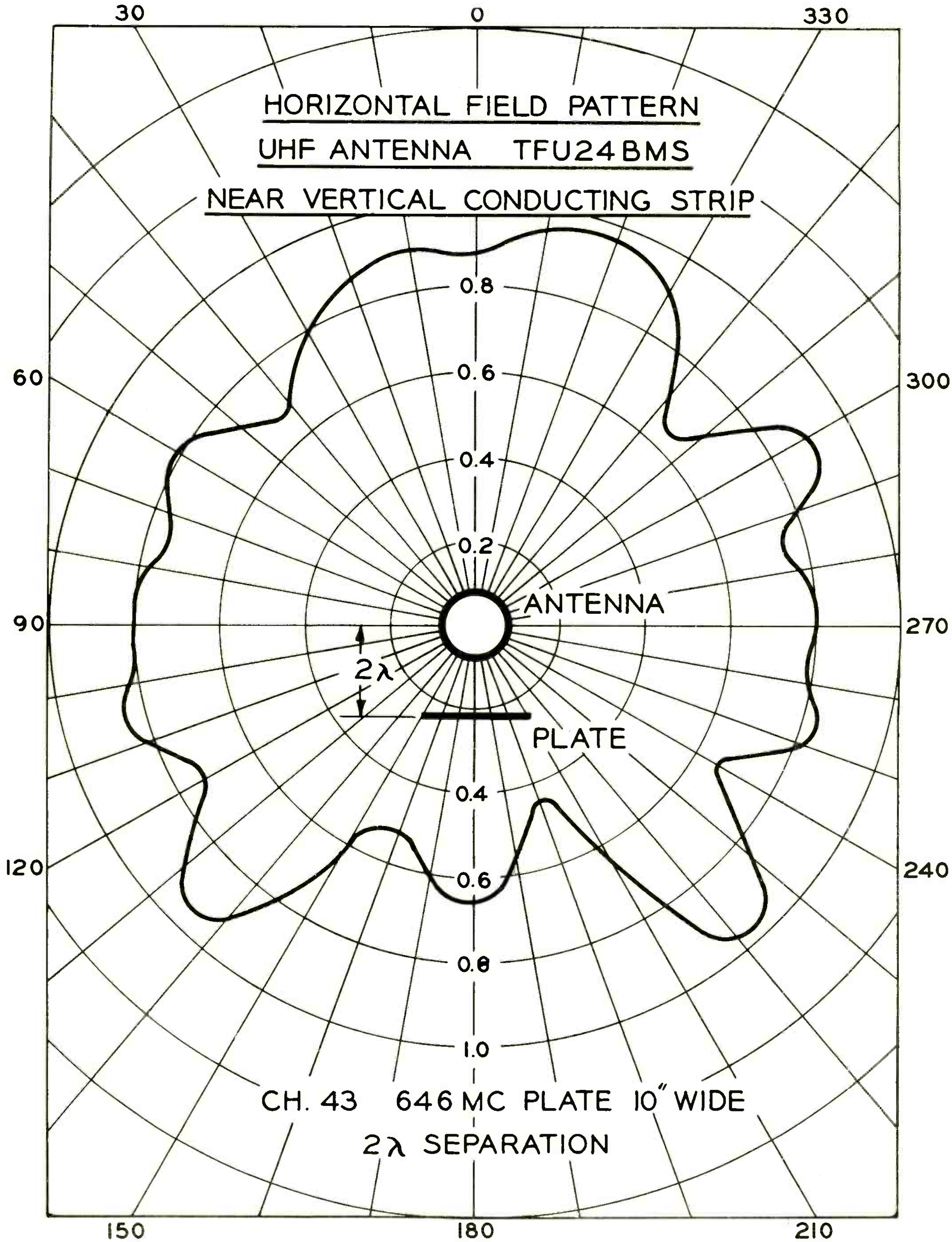

30
0
330
HORIZONTAL FIELD PATTERN
UHF ANTENNA TFU 24 BMS
NEAR VERTICAL CONDUCTING CYLINDER
0.8
CYLINDER
60
300
5.5λ
90
270
ANTENNA
0.2
0.4
120
240
0.6
0.8
1.0
CH. 43 646 MC CYL. DIA. = 8-IN.
5λ SEPARATION
150
180
210

FIGURE-24



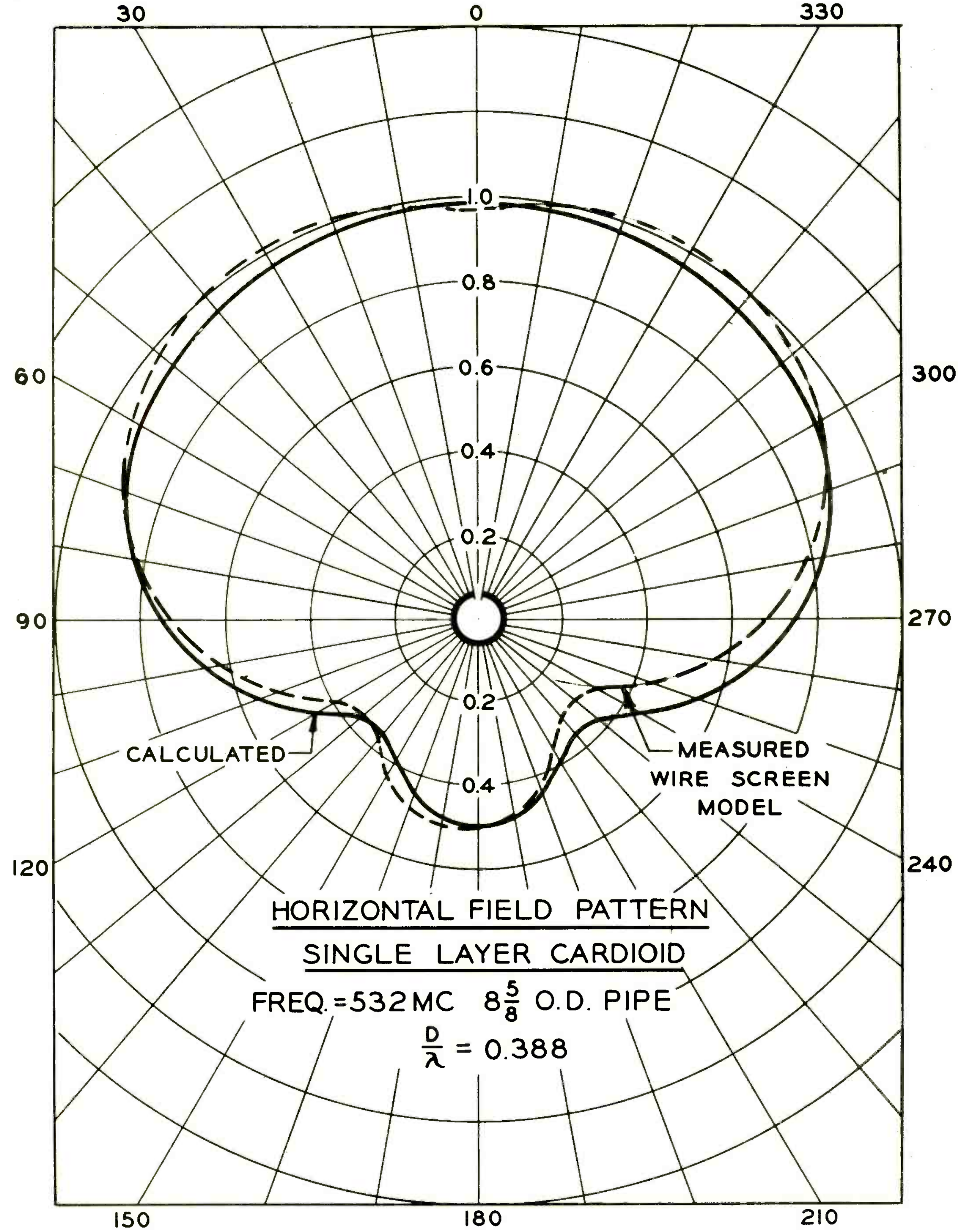
30
0
330
HORIZONTAL FIELD PATTERN
UHF ANTENNA TFU 24 BMS
ANTENNA MOUNTED IN TOWER
0.8
0.6
0.4
0.2
60
300
90
270
ANTENNA
0.2
TOWER
3.3λ
120
240
0.6
0.8
1.0
CH. 43
646 MC
150
180
210

FIGURE — 25

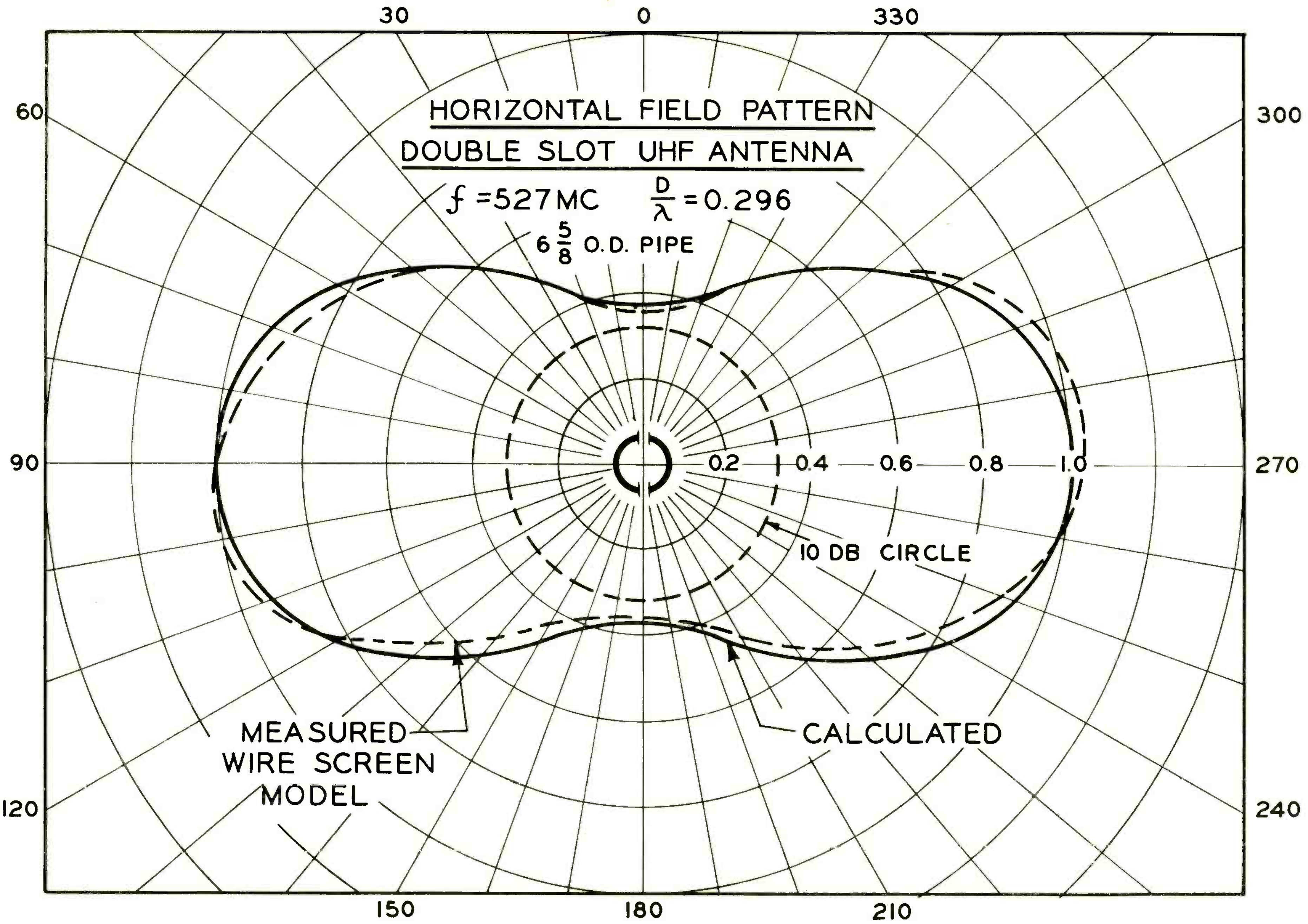


30
0
330
HORIZONTAL FIELD PATTERN
UHF ANTENNA TFU24BMS
NEAR VERTICAL CONDUCTING STRIP
0.8
0.6
0.4
0.2
60
300
90
270
ANTENNA
2λ
PLATE
0.4
0.6
0.8
1.0
120
240
CH. 43 646 MC PLATE 10" WIDE
2λ SEPARATION
150
180
210

FIGURE—26


30
0
330
60
300
90
270
120
240
150
180
210
1.0
0.8
0.6
0.4
0.2
0.2
0.4
CALCULATED
MEASURED
WIRE SCREEN
MODEL
HORIZONTAL FIELD PATTERN
SINGLE LAYER CARDIOID
FREQ.=532 MC 8 5/8 O.D. PIPE
D/λ = 0.388

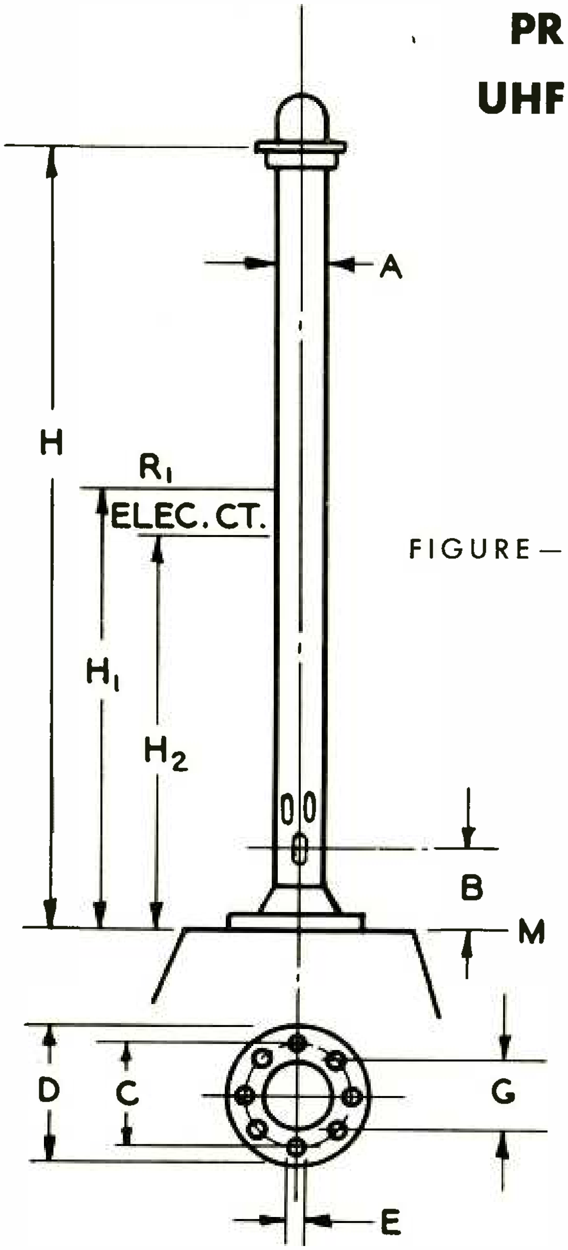
FIGURE—27



HORIZONTAL FIELD PATTERN
DOUBLE SLOT UHF ANTENNA
f =527MC
D/λ =0.296
6 5/8 O.D. PIPE
30
0
330
60
300
90
270
120
240
150
180
210
0.2
0.4
0.6
0.8
1.0
10 DB CIRCLE
MEASURED
WIRE SCREEN
MODEL
CALCULATED

FIGURE-28

PRELIMINARY ENGINEERING DATA
UHF SLOTTED TELEVISION ANTENNAS



FIGURE—29

ELECTRICAL SPECIFICATIONS

Power Handling..................................10 kw up to 10,000 ft.

Maximum Ambient Temperature, at Full Power........45° C.

Input Impedance............50 ohms, V.S.W.R. less than 1.1/1

Input Connection........Single 3⅛ UHF flanged coaxial line

Hor. Pattern Circularity..±0.5 db

MECHANICAL SPECIFICATIONS

Design Assumptions

- Max. wind velocity (½" rad. ice) 95 mph.
- Max. wind velocity (no ice) 110 mph. (50/30 p.s.f.). Tensile stress below 20,000 p.s.i.
- Actual wind velocity.
- Max stress on bolts 18,000 p.s.i.

Channels (approx.)	14 to 30 incl.	14 to 30 incl.	31 to 50 incl.	51 to 83 incl.
Type Number	TFU-21BLS	TFU-24BLS	TFU-24BMS	TFU-27BHS
MI Number	MI-19195 D-*	MI-19195 A-*	MI-19195 B-*	MI-19195 C-*
Weight, (Pounds)	Varies with channel—See Table I			
A, Inches (diam.)	10¾	10¾	8⅝	6⅝
B, Inches	37 to 32	37 to 32	32 to 28	30 to 25
C, Inches (bolt circle)	15¼	15¼	13	10⅝
D, Inches (diam.)	17⁹⁄₁₆	17⁹⁄₁₆	15	12½
E, Inches (bolt diam.)	1⅛	1⅛	1	⅞
F, Number of Holes	16	16	12	12
H, Feet	Varies with channel—See Table I			
H_1 All	H_2 + 1 ft.			
H_2 (elect. ctr.)	Varies with channel—See Table I			
R_1 (50/30 p.s.f.) No Ice	Varies with channel—See Table I			
M, Ft/Lbs (Moment) (30 p.s.f.)	Varies with channel—See Table I			
Relative Gain	21	24	24	27
G Top Cap Hole (diam.)	9¾"	9¾"	7⅝"	5¾"

* Note: Suffix number added to MI number indicates channel number.

TABLE I

PRELIMINARY UHF ANTENNA DATA WEIGHTS, HEIGHTS, AND MOMENTS FOR FILING

Channel No.	H_2(Ft.)	H (Ft.)	Weight	R_1(Ft./Lbs.)	M(Ft./Lbs.)	
14	23.85	47.70	2880	1595	39790	
15	23.65	47.30	2855	1585	39460	
16	23.50	46.90	2835	1575	38930	
17	23.10	46.20	2800	1550	37680	
18	22.80	45.60	2760	1530	36740	
19	22.55	45.10	2740	1515	36000	
20	22.35	44.70	2710	1500	35370	
21	22.15	44.30	2690	1490	34840	TFU-21BLS
22	21.80	43.60	2650	1485	33680	&
23	21.60	43.20	2630	1455	33160	TFU-21DL
24	21.40	42.80	2610	1440	32530	
25	21.20	42.40	2590	1425	31950	
26	20.95	41.90	2560	1415	31360	
27	20.75	41.50	2540	1400	30730	
28	20.55	41.10	2515	1485	30200	
29	20.30	40.60	2485	1370	29560	
30	20.15	40.30	2470	1360	29140	
14	27.023	54.167	3090	1820	51800	
15	26.668	53.334	3052	1795	50550	
16	26.417	52.834	3015	1775	49550	
17	26.083	52.167	2988	1755	49000	
18	25.750	51.500	2980	1735	48500	
19	25.417	50.835	2950	1720	47750	
20	25.167	50.334	2900	1695	44550	
21	24.917	49.834	2875	1680	43650	TFU-24BLS
22	24.584	49.167	2850	1665	42850	&
23	24.334	48.668	2820	1645	42000	TFU-24DL
24	24.000	48.000	2800	1625	41250	
25	23.750	47.500	2770	1615	40450	
26	23.500	47.000	2750	1600	40000	
27	23.250	46.500	2720	1590	39250	
28	23.000	46.000	2690	1570	38800	
29	22.750	45.500	2660	1550	38300	
30	22.500	45.000	2630	1540	37750	
31	22.250	44.500	2440	1275	30750	
32	22.000	44.000	2400	1265	30300	
33	21.834	43.668	2340	1255	29750	
34	21.584	43.167	2320	1245	29300	
35	21.417	42.834	2300	1235	28750	TFU-24BMS
36	21.167	42.334	2280	1225	28300	&
37	20.917	41.834	2260	1215	27800	TFU-24DM
38	20.750	41.500	2250	1205	27250	
39	20.584	41.167	2230	1195	26750	

TABLE I (Continued)

Channel No.	H_2(Ft.)	H (Ft.)	Weight	R_1(Ft./Lbs.)	M(Ft./Lbs.)	
40	20.334	40.668	2210	1185	26350	
41	20.167	40.334	2200	1175	25950	
42	20.000	40.000	2180	1165	25450	
43	19.834	39.668	2160	1155	25000	
44	19.584	39.167	2150	1145	24700	
45	19.417	38.834	2140	1135	24250	TFU-24BMS & TFU-24DM
46	19.250	38.500	2120	1125	23900	
47	19.000	38.000	2100	1110	23400	
48	18.751	37.584	2090	1095	23000	
49	18.584	37.250	2080	1085	22600	
50	18.414	36.828	2070	1075	22300	
51	20.584	41.167	1910	985	22600	
52	20.417	40.834	1895	980	22500	
53	20.250	40.500	1875	970	22000	
54	20.083	40.167	1860	965	21780	
55	19.917	39.834	1850	955	21350	
56	19.750	39.500	1840	950	21000	
57	19.584	39.167	1830	945	20800	
58	19.417	38.834	1820	940	20450	
59	19.250	38.500	1800	930	20100	
60	19.083	38.167	1785	925	19950	
61	18.917	37.834	1775	920	19650	
62	18.750	37.500	1760	915	19250	
63	18.584	37.167	1755	905	19000	
64	18.500	36.917	1750	900	18850	
65	18.334	36.668	1740	895	18550	
66	18.167	36.334	1730	890	18200	
67	18.000	36.000	1715	885	17990	TFU-27BHS & TFU-27DH
68	17.917	35.834	1700	880	17800	
69	17.834	35.584	1690	870	17500	
70	17.668	35.334	1675	865	17100	
71	17.500	35.000	1660	860	16990	
72	17.417	34.834	1655	855	16840	
73	17.250	34.500	1650	850	16460	
74	17.083	34.250	1640	845	16240	
75	17.000	34.000	1630	840	16000	
76	16.917	33.834	1620	835	15850	
77	16.751	33.584	1610	830	15600	
78	16.668	33.334	1600	825	15400	
79	16.584	33.167	1590	820	15100	
80	16.417	33.000	1580	815	14950	
81	16.334	32.584	1575	810	14750	
82	16.167	32.334	1570	805	14500	
83	16.083	32.167	1560	800	14350	

H_2—Height to Electrical Center.
H —Overall Height.
R_1—Wind Load at 50/30 p.s.f.
M—Overturning Moment at 50/30 p.s.f.

TOWER TOP INSTALLATION DRAWING FOR MOUNTING RCA TFU-27BH ANTENNA
(6⅝ DIA. POLE)

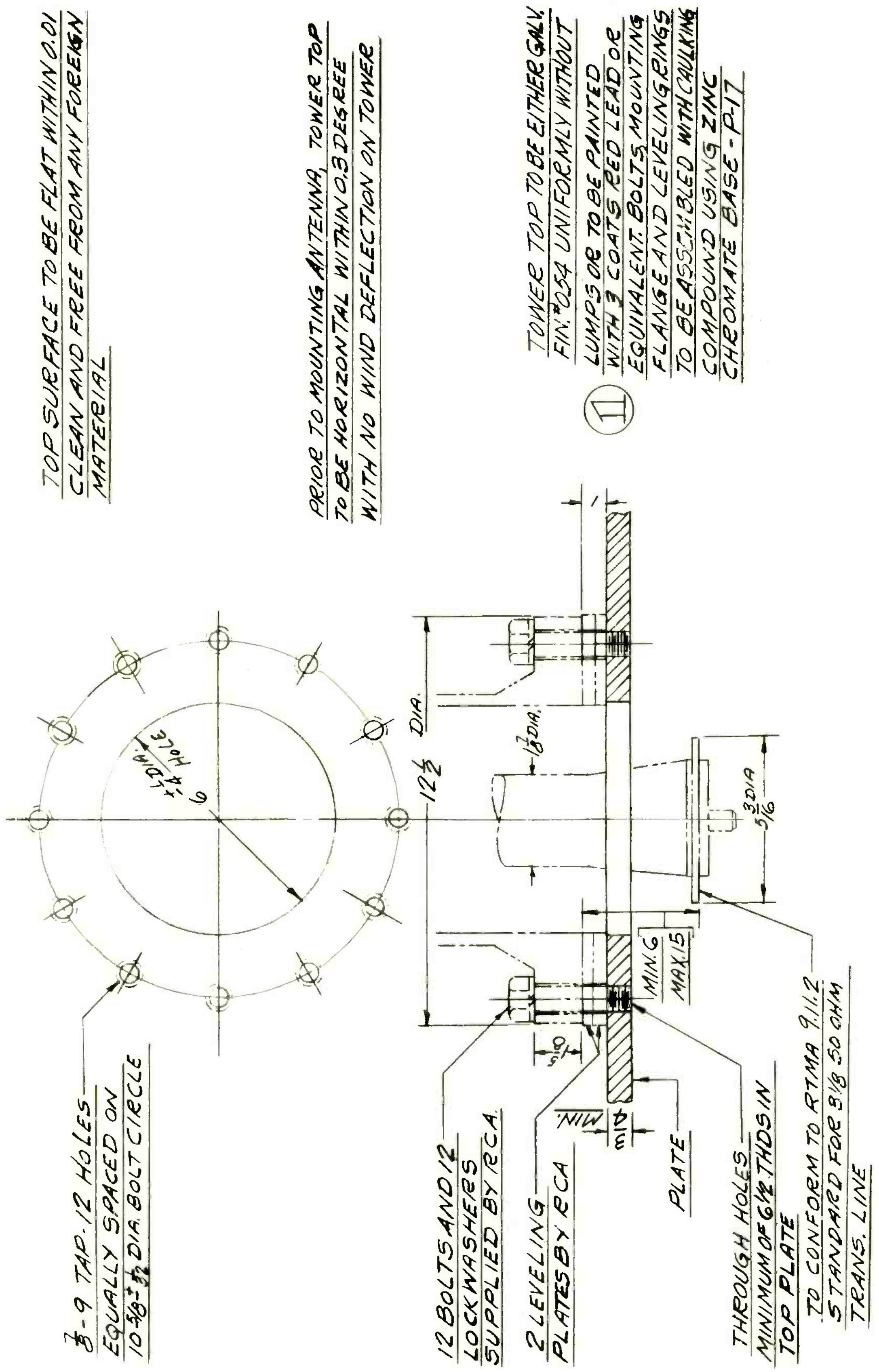


FIGURE — 30

TOWER TOP INSTALLATION DRAWING FOR MOUNTING RCA TFU-24BM ANTENNA

(8⅝ DIA. POLE)

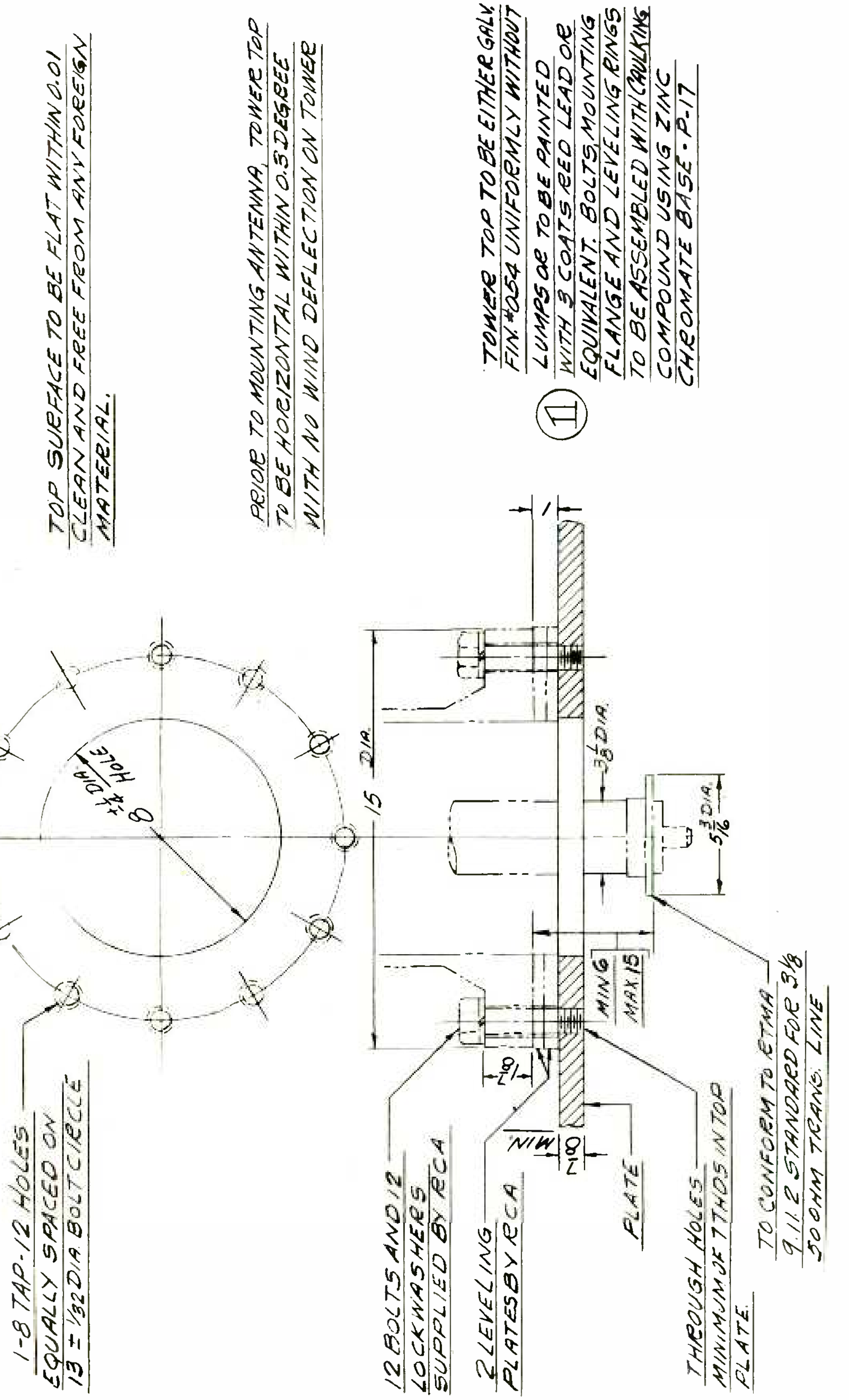


FIGURE — 31

TOWER TOP INSTALLATION DRAWING
FOR MOUNTING RCA TFU-21BL & TFU-24BL ANTENNA
(10¾ DIA. POLE)

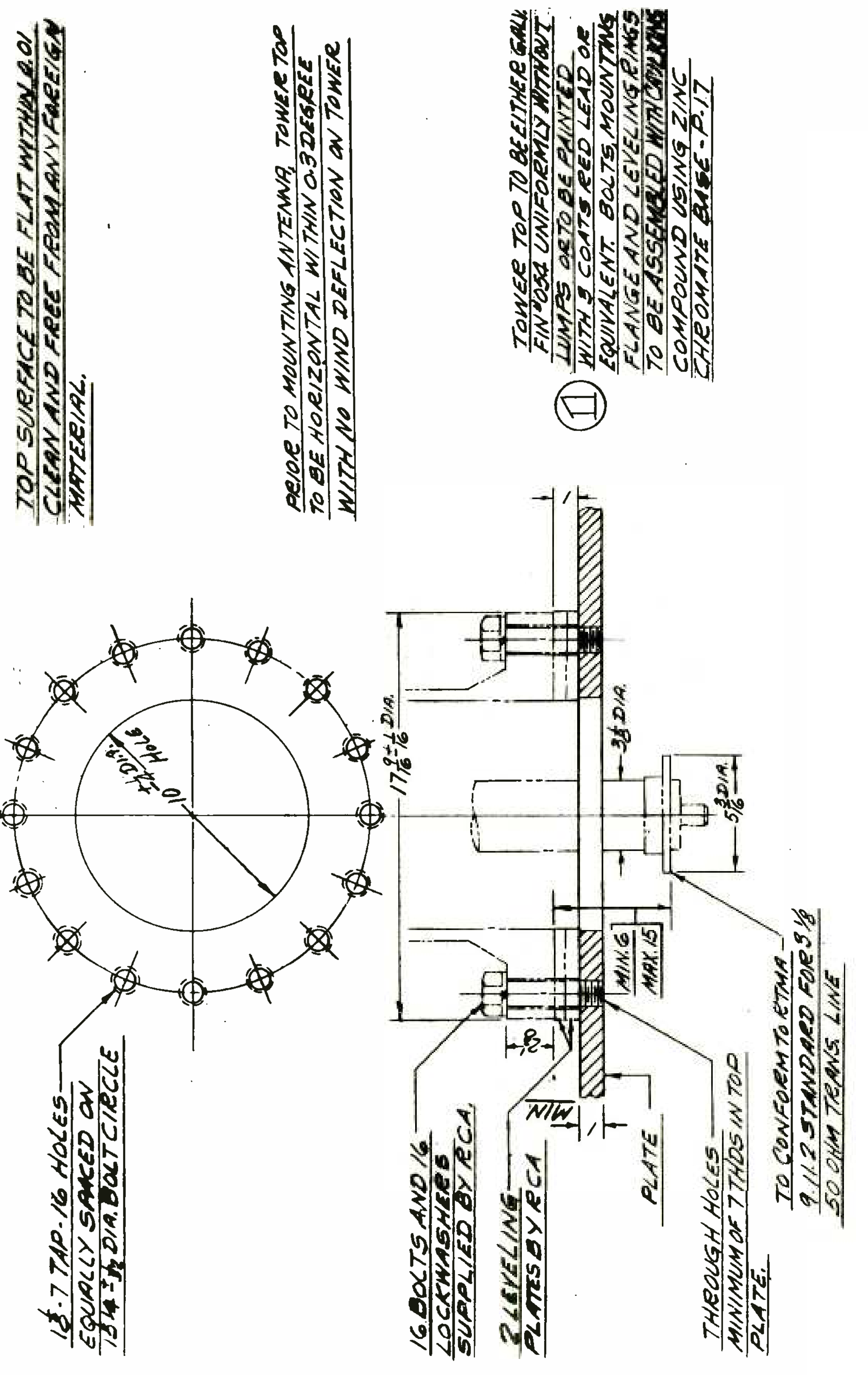


FIGURE — 32

Address all inquiries and orders to one of the field offices listed below. At each location you will find a broadcast equipment specialist who is anxious to help you with your problems.

522 Forsyth Building
Atlanta 3, Georgia

John Hancock Building
200 Berkley Street
Boston 16, Massachusetts

666 N. Lake Shore Drive
Chicago 11, Illinois

718 Keith Building
Cleveland 15, Ohio

1907-11 McKinney Avenue
Dallas 1, Texas

RCA Building
1560 Vine Street
Hollywood 28, Calif.

340 Dierks Building
Kansas City 6, Missouri

36 W. 49th Street
New York 20, New York

1355 Market Street
San Francisco 3, California

RADIO CORPORATION OF AMERICA
Engineering Products Department
Camden, N. J.

Form 1J3052 Rev.

Printed in U.S.A.