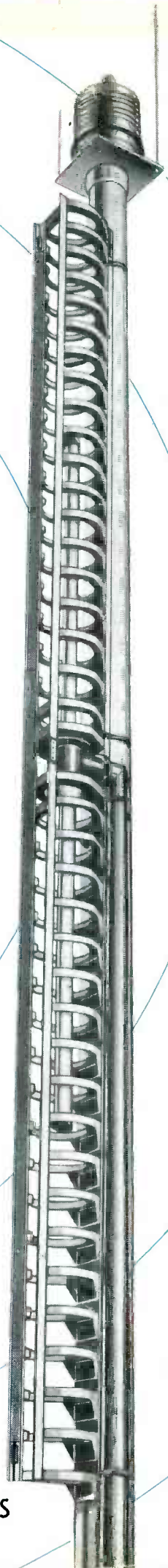
TELEVISION BROADCAST TRANSMITTING EQUIPMENT



AMCI

ALFORD

MANUFACTURING COMPANY

ANTENNA SYSTEMS – COMPONENTS – AIR NAVIGATION AIDS and INSTRUMENTS

PRICE LIST FOR TELEVISION BROADCAST EQUIPMENT

PRICES EFFECTIVE JULY 15, 1957

AMCI®

ALFORD Manufacturing Company
299 ATLANTIC AVE., BOSTON, MASS.

INDEX

PRICE LIST FOR TELEVISION BROADCAST EQUIPMENT

TYPE	DESCRIPTION	PRICE
	OMNIDIRECTIONAL ANTENNAS, CHANNELS 7 THROUGH 13	
1046 (5-bay)	A 5-bay Type 1046 Antenna Array, Channels 7 through 13, including the interconnecting transmission line but excluding de-icers and the supporting mast	$42,000.00
	Normal Complement of De-icers supplied as an integral part of the 5-bay array and internally wired to junction boxes on each bay	3,000.00
	Standard Mast for 5-bay Type 1046-P Arrays, less mast beacon	8,181.00
	Standard Mast for 5-bay Type 1046-Q Arrays, less mast beacon	7,285.00
	Standard Mast for 5-bay Type 1046-R Arrays, less mast beacon	6,159.00
1046 (4½-bay)	A 4½-bay Type 1046 Antenna Array, Channels 7 through 13, including the interconnecting transmission line but excluding de-icers and the supporting mast	37,800.00
	Normal Complement of De-icers supplied as an integral part of the 4½-bay array and internally wired to junction boxes on each bay	2,700.00
	Standard Mast for 4½-bay Type 1046-P Arrays, less mast beacon	6,950.00
	Standard Mast for 4½-bay Type 1046-Q Arrays, less mast beacon	6,260.00
	Standard Mast for 4½-bay Type 1046-R Arrays, less mast beacon	5,444.00
1046 (4-bay)	A 4-bay Type 1046 Antenna Array, Channels 7 through 13, including the interconnecting transmission line but excluding de-icers and the supporting mast	33,600.00
	Normal Complement of De-icers supplied as an integral part of the 4-bay array and internally wired to junction boxes on each bay	2,400.00
	Standard Mast for 4-bay Type 1046-P Arrays, less mast beacon	5,486.00
	Standard Mast for 4-bay Type 1046-Q Arrays, less mast beacon	4,793.00
	Standard Mast for 4-bay Type 1046-R Arrays, less mast beacon	4,418.00
1046 (3-bay)	A 3-bay Type 1046 Antenna Array, Channels 7 through 13, including the interconnecting transmission line but excluding de-icers and the supporting mast	25,200.00
	Normal Complement of De-icers supplied as an integral part of the 3-bay array and internally wired to junction boxes on each bay	1,800.00
	Standard Mast for 3-bay Type 1046-P Arrays, less mast beacon	3,555.00
	Standard Mast for 3-bay Type 1046-Q Arrays, less mast beacon	3,042.00
	Standard Mast for 3-bay Type 1046-R Arrays, less mast beacon	2,895.00
1046 (2-bay)	A 2-bay Type 1046 Antenna Array, Channels 7 through 13, including the interconnecting transmission line but excluding de-icers and the supporting mast	16,800.00
	Normal Complement of De-icers supplied as an integral part of the 2-bay array and internally wired to junction boxes on each bay	1,200.00
	Standard Mast for 2-bay Type 1046-P Arrays, less mast beacon	2,022.00
	Standard Mast for 2-bay Type 1046-Q Arrays, less mast beacon	1,862.00
	Standard Mast for 2-bay Type 1046-R Arrays, less mast beacon	1,598.00

TYPE	DESCRIPTION	PRICE

OMNIDIRECTIONAL ANTENNAS, CHANNELS 7 THROUGH 13 *(continued)*

1046 (1-bay)	A 1-bay Type 1046 Antenna Array, Channels 7 through 13, including the interconnecting transmission line but excluding de-icers and the supporting mast	$ 7,000.00
	Normal Complement of De-icers supplied as an integral part of the 1-bay array and internally wired to junction boxes on the bay	600.00
	Standard Mast for 1-bay Type 1046 Array, less mast beacon	815.00
1046 (1-bay)	A 1-bay Type 1046 Antenna Array, Channels 7 through 13, excluding the interconnecting transmission line, de-icers and the supporting mast and excluding engineering service at installation	5,100.00
	Normal Complement of De-icers supplied as an integral part of the 1-bay array and internally wired to junction boxes on the bay	600.00
	Standard Mast for 1-bay Type 1046 Array, less mast beacon	815.00

OMNIDIRECTIONAL ANTENNAS, CHANNEL 6

1046-N (3-bay)	A 3-bay Type 1046-N Antenna Array for Channel 6, including the interconnecting transmission line but excluding de-icers and the supporting mast	37,800.00
	Normal Complement of De-icers supplied as an integral part of the 3-bay array and internally wired to junction boxes on each bay	2,700.00
	Standard Mast for 3-bay Type 1046-N Arrays, less mast beacon	16,020.00
1046-N (1½-bay)	A 1½-bay Type 1046 Antenna Array for Channel 6, including the interconnecting transmission line but excluding de-icers and the supporting mast	On application
	Normal Complement of De-icers supplied as an integral part of the 1½-bay array and internally wired to junction boxes on each bay	1,350.00
	Standard Mast for 1½-bay Type 1046-N Arrays, less mast beacon	4,050.00
1046-N (1¼-bay)	A 1¼-bay Type 1046 Antenna Array for Channel 6, including the interconnecting transmission line but excluding de-icers and the supporting mast	On application
	Normal Complement of De-icers supplied as an integral part of the 1¼-bay array and internally wired to junction boxes on each bay	1,125.00
	Standard Mast for 1¼-bay Type 1046-N Arrays, less mast beacon	3,160.00
1046-N (1-bay)	A 1-bay Type 1046-N Antenna Array for Channel 6, including the interconnecting transmission line but excluding de-icers and the supporting mast	On application
	Normal Complement of De-icers supplied as an integral part of the 1-bay array and internally wired to junction boxes on the bay	900.00
	Standard Mast for 1-bay Type 1046-N Array, less mast beacon	2,680.00

TYPE	DESCRIPTION	PRICE

OMNIDIRECTIONAL ANTENNAS, CHANNELS 4 AND 5

1046	All Type 1046 Antenna Arrays for Channels 4 and 5	On application

DIRECTIONAL ANTENNAS, CHANNELS 7 THROUGH 13

1030 (5-bay)	A 5-bay Type 1030 Directional Antenna Array, Channels 7 through 13, including the interconnecting transmission line but excluding de-icers and the supporting mast	$52,000.00
	Normal Complement of De-icers supplied as an integral part of the 5-bay array and internally wired to junction boxes on each bay	3,000.00
	Standard Mast for 5-bay Type 1030-P Arrays, less mast beacon	On application
	Standard Mast for 5-bay Type 1030-Q Arrays, less mast beacon	On application
	Standard Mast for 5-bay Type 1030-R Arrays, less mast beacon	On application
1030 (4-bay)	A 4-bay Type 1030 Directional Antenna Array, Channels 7 through 13, including the interconnecting transmission line but excluding de-icers and the supporting mast	41,600.00
	Normal Complement of De-icers supplied as an integral part of the 4-bay array and internally wired to junction boxes on each bay	2,400.00
	Standard Mast for 4-bay Type 1030-P Arrays, less mast beacon	On application
	Standard Mast for 4-bay Type 1030-Q Arrays, less mast beacon	On application
	Standard Mast for 4-bay Type 1030-R Arrays, less mast beacon	On application
1030 (3-bay)	A 3-bay Type 1030 Directional Antenna Array, Channels 7 through 13, including the interconnecting transmission line but excluding de-icers and the supporting mast	31,200.00
	Normal Complement of De-icers supplied as an integral part of the 3-bay array and internally wired to junction boxes on each bay	1,800.00
	Standard Mast for 3-bay Type 1030-P Arrays, less mast beacon	On application
	Standard Mast for 3-bay Type 1030-Q Arrays, less mast beacon	On application
	Standard Mast for 3-bay Type 1030-R Arrays, less mast beacon	On application
1030 (2-bay)	A 2-bay Type 1030 Directional Antenna Array, Channels 7 through 13, including the interconnecting transmission line but excluding de-icers and the supporting mast	20,800.00
	Normal Complement of De-icers supplied as an integral part of the 2-bay array and internally wired to junction boxes on each bay	1,200.00
	Standard Mast for 2-bay Type 1030-P Arrays, less mast beacon	On application
	Standard Mast for 2-bay Type 1030-Q Arrays, less mast beacon	On application
	Standard Mast for 2-bay Type 1030-R Arrays, less mast beacon	On application
1030 (1-bay)	A 1-bay Type 1030 Directional Antenna Array, Channels 7 through 13, including the interconnecting transmission line but excluding de-icers and the supporting mast	9,500.00
	Normal Complement of De-icers supplied as an integral part of the 1-bay array and internally wired to junction boxes on the bay	600.00
	Standard Mast for 1-bay Type 1030 Array, less mast beacon	On application

TYPE	DESCRIPTION	PRICE

DIRECTIONAL ANTENNAS, CHANNELS 4 THROUGH 6

1030	All Type 1030 Directional Antenna Arrays for Channels 4 through 6	On application

STANDBY ANTENNAS, CHANNELS 7 THROUGH 13

1020 (Two 2-bays)	Two 2-bay Type 1020 Antenna Arrays, Channels 7 through 13, with one 2-bay array for visual and one 2-bay array for aural, excluding de-icers and the supporting mast and excluding engineering service at installation	$10,200.00
	Normal Complement of De-icers supplied as an integral part of the two 2-bay arrays and internally wired to junction boxes on each bay	1,200.00
	Standard Mast for two 2-bay Type 1020-P Arrays, less mast beacon	2,022.00
	Standard Mast for two 2-bay Type 1020-Q Arrays, less mast beacon	1,862.00
	Standard Mast for two 2-bay Type 1020-R Arrays, less mast beacon	1,598.00
1020 (2-bay)	A 2-bay Type 1020 Antenna Array, Channels 7 through 13, with one bay for visual and one for aural, excluding de-icers and the supporting mast and excluding engineering service at installation	4,600.00
	Normal Complement of De-icers supplied as an integral part of the 2-bay array and internally wired to junction boxes on each bay	600.00
	Standard Mast for 2-bay Type 1020 Array, less mast beacon	815.00
1020 (1-bay)	A 1-bay Type 1020 Antenna Array, Channels 7 through 13, excluding de-icers and without the supporting mast and excluding engineering service at installation	2,500.00
	Normal Complement of De-icers supplied as an integral part of the 1-bay array and internally wired to a junction box on the bay	300.00

DIPLEXING FILTERS, CHANNELS 2 THROUGH 13

1051	A Type 1051 10-kilowatt Diplexing Filter	
	Channels 2 through 6	14,000.00
	Channels 7 through 13	9,400.00
1052	A Type 1052 25-kilowatt Diplexing Filter	
	Channels 2 through 6	14,500.00
	Channels 7 through 13	9,850.00
1053	A Type 1053 50-kilowatt Diplexing Filter	
	Channels 7 through 13	14,500.00

TYPE	DESCRIPTION	PRICE

OMNIDIRECTIONAL UHF ANTENNAS, CHANNELS 14 THROUGH 83

11,410 (2-bay)	A 2-bay Type 11,410 UHF Antenna Array, Channels 14 through 83, with one bay for visual and one for aural, including the supporting mast but excluding de-icers and excluding engineering service at installation	$ 4,100.00
	Normal Complement of De-icers supplied as an integral part of the 2-bay array and internally wired to junction boxes on each bay	300.00
UHF	Other UHF Antenna Arrays for Channels 14 through 83	On application

HYBRIDS, CHANNELS 2 THROUGH 13

1024-3	A Type 1024-3 10-kilowatt Hybrid	
	Channels 2 through 6	1,450.00
	Channels 7 through 13	900.00
1024-5	A Type 1024-5 25-kilowatt Hybrid	
	Channels 2 through 6	1,840.00
	Channels 7 through 13	1,140.00
1024-6	A Type 1024-6 50-kilowatt Hybrid	
	Channels 2 through 6	2,040.00
	Channels 7 through 13	1,340.00

COAXIAL SWITCHES

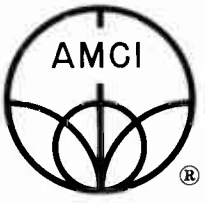
1038-H	A Type 1038-H Hand Operated Coaxial Switch for use with 6⅛" coaxial transmission line, Channels 2 through 13 (Specify channel)	2,500.00
1038-R	A Type 1038-R Motor Driven Coaxial Switch for use with 6⅛" coaxial transmission line, Channels 2 through 13 (Specify channel)	3,300.00

SPECIAL COAXIAL TRANSMISSION LINE COMPONENTS

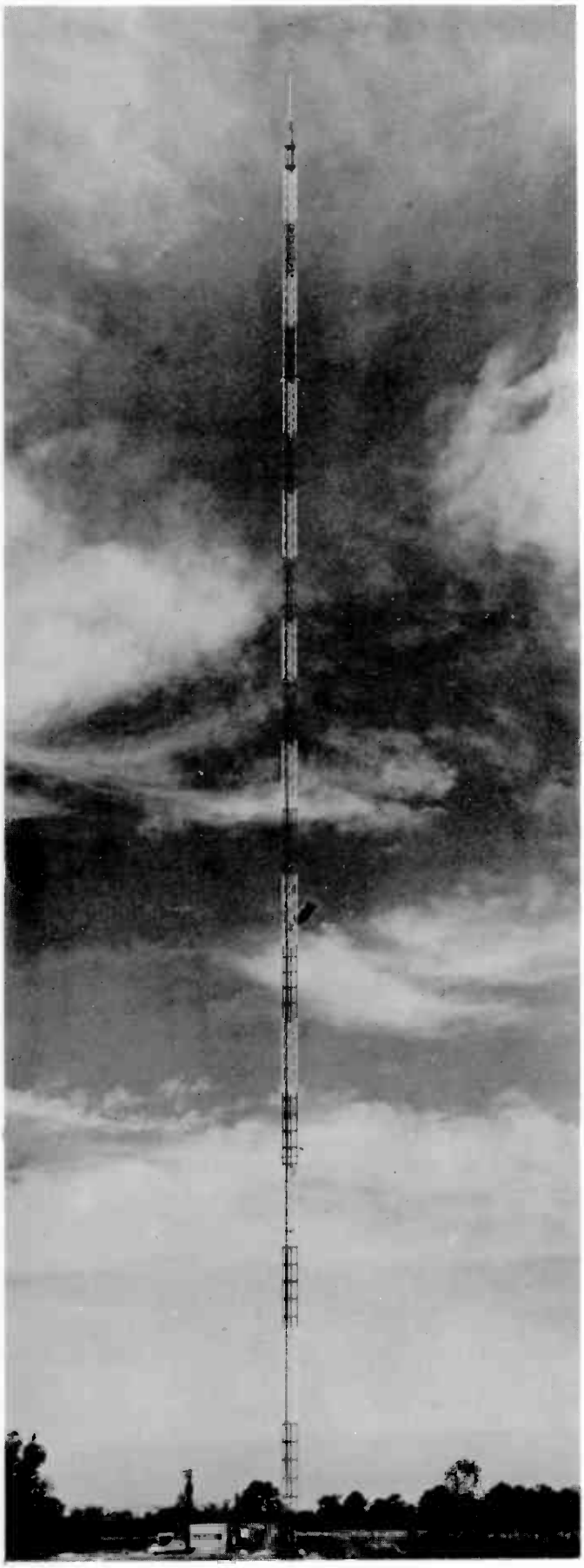
Inquiries are invited for special coaxial transmission line components such as Power Dividing Tees, Expansion Joints, Precision Tapered Reducers, Heavy-wall or cast 90° Mitre Elbows, etc. Prices are available on application.

The above prices are subject to the terms of our standard contract and do not include any local, State and Federal sales and excise taxes. All prices are F.O.B. factory, Boston Mass., with the exception of the standard masts. The masts are F.O.B. suppliers' factory, which may be Syracuse or Brooklyn, New York or Camden, New Jersey. Delivery can usually be made in 50 to 75 days. We request that you contact us for more specific delivery dates for individual installations. All prices are subject to change without notice.

VHF TELEVISION BROADCAST TRANSMITTING EQUIPMENT



ALFORD *Manufacturing Co.*
299 ATLANTIC AVE., BOSTON, MASS.



STATION: WITN

CHANNEL: 7

LOCATION: Washington, North Carolina

ANTENNA TYPE: AMCI Five-Bay Type 1046 with Type I Null Fill-in

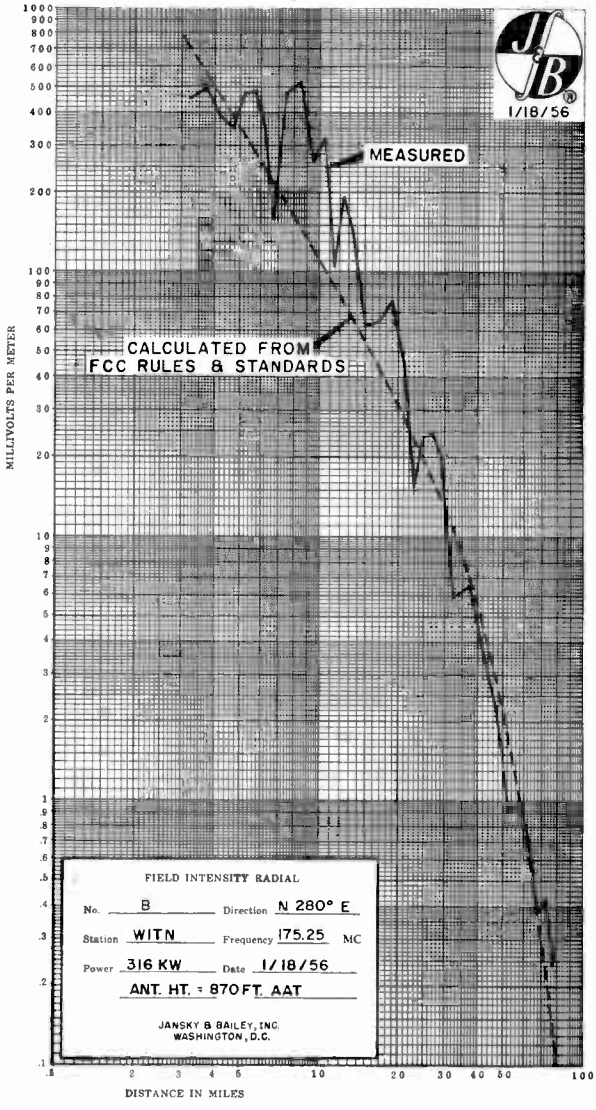
ANTENNA GAIN: 19.4

DIPLEXER TYPE: AMCI Type 1042

TRANSMITTER POWER: 20 kilowatts

ERP: 316 kilowatts

HEIGHT ABOVE GROUND: Approximately 920 feet to the top of the antenna



With the proper null fill-in, a relatively high gain antenna array with a relatively low power transmitter is in general the most economical combination for achieving an ERP of 316 kw from the point of view of both the initial investment and subsequent operating costs.

The Type 1046 and the Type 1030 Antennas described on the following pages were specifically designed to provide antennas which could be stacked vertically to achieve relatively high gains; for example, as high as 20 for omnidirectional arrays and as high as 36 for certain directional arrays, without resulting in too large a shear and overturning moment at the base of the supporting mast.

Because there is only one feed point per bay (with an omnidirectional gain of 4), the interconnecting transmission line is relatively simple even with high gain arrays; for example, an array with an omnidirectional gain of 20 has only five feed points and an array with an omnidirectional gain of 16 has only four.

A four bay Type 1046 array and a 25 Kw transmitter or a five bay Type 1046 array and a 20 Kw transmitter therefore in general provide two economical ways for the TV broadcaster to achieve an omnidirectional ERP of 316 kilowatts.

With directional arrays, the maximum gain may be as high as 7.2 per bay. Here an ERP of 316 kilowatts may be achieved with a three bay Type 1030 directional array and a 20 or 25 kilowatt transmitter.

You are invited to investigate the values of shear and overturning moment for the high gain arrays at various channels in the engineering data sheets which are part of this brochure.

TELEVISION BROADCAST TRANSMITTING ANTENNA

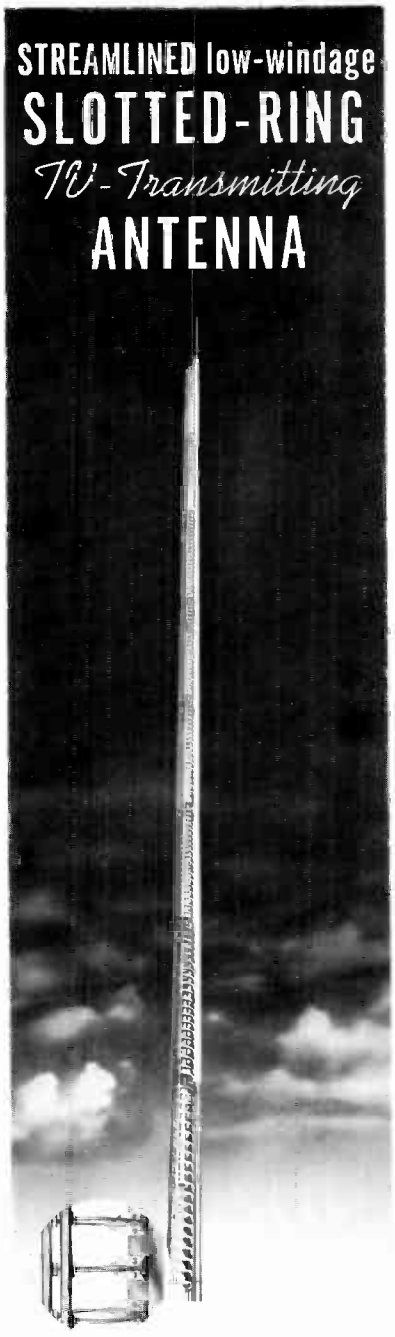
TYPE 1046

FOR CHANNELS 7 THROUGH 13

AMCI®

ALFORD *Manufacturing Co.*

299 ATLANTIC AVE., BOSTON, MASS.



AMCI TYPE 1046
CHANNELS 7 THROUGH 13

This streamlined design allows one to achieve 316 kw ERP with a four-bay array with a gain of 16 and a 25 kw transmitter or a five-bay array with a gain of 20 and a 20 kw transmitter, without resulting in an excessive overturning moment at the top of the tower.

DESCRIPTION

The Type 1046 Antenna is designed for omni-directional television transmitting service. It consists of a series of slotted rings mounted on a channel. These rings are energized as a group, and act almost like a current sheet. The antenna is ordinarily mounted on a tubular mast although in certain instances it may be mounted on the side of a tower.

Each bay consists of two radiating elements (half bays) arranged one above the other and fed with a single 3-1/8 inch diameter rigid coaxial transmission line.

The antenna is provided with a feeding arrangement of a type which enables each bay to handle high power and allows the entire exposed feeder along with every other active part to be deiced. When called for, tubular sealed heaters are supplied as a part of the antenna for deicing purposes.

Each bay is approximately 3.4 wavelengths long and has an average power gain of approximately 4. Several bays can be stacked one above the other to give additional gain, the gain being proportional to the number of bays used. A half bay may also be used if desired; for example, for standby purposes.

When several bays are stacked to give a higher gain, the bays are joined through the use of a rigid coaxial transmission line harness into a single feed line for the entire array. This type of feed provides an important economic advantage, particularly in the case of high towers, in that it requires only a single transmission line to be installed from the transmitter up the tower to the array.

When desired, arrays can be supplied with null fill-in and/or beam tilt to provide substantially uniform coverage even in close to the tower. The null fill-in and/or beam tilt is achieved through the proper selection of line transformers and transmission line lengths in the coaxial feed lines between the bays.

Since each bay is capable of handling an average power of 31 kw, the power rating of a multi-bay array is determined by the rating of the interconnecting feed lines. If 3-1/8 inch diameter coaxial transmission line is used as the main feed line, the average power rating of the array will be 31 kilowatts. In those cases where the array is to be operated with a 50 kilowatt transmitter, a 4-1/8 inch diameter line, with the proper adapters to match 6-1/8 inch diameter line at the input, is used as the main feed line. The 4-1/8 inch diameter line is a

special line manufactured by the Alford Manufacturing Company for use where a higher power line is desired but where the bulk of a 6-1/8 inch diameter line is not necessary. For special installations requiring even higher power, a 6-1/8 inch diameter feed line could be used but this would result in a somewhat larger overturning moment at the bottom of the mast than shown in the enclosed engineering data sheets.

The engineering data sheets which follow are based on our standard masts which have been designed for a maximum loading of 50 pounds per square foot of wind pressure on projected flat surfaces, not covered with ice, which corresponds to an actual wind velocity of 110 miles per hour. (To convert to any other pressure, the values given should be multiplied by the ratio of the pressure desired to 50.) The horizontal radiation pattern of the antenna does not vary greatly with the diameter of the mast on which the antenna is mounted. The antenna may be, therefore, mounted on other than our standard masts. For example, an earlier version of the Type 1046 antenna is mounted on a mast designed for 225 pounds per square foot (232 miles per hour). (See page 4 showing antenna on Mount Washington.) Inquiries are invited for mast designs based on higher wind pressures than the 50 pounds per square foot standard mast.

CONSTRUCTION

The antenna itself is mechanically rugged. It is designed to withstand wind velocities exceeding 200 miles per hour and presents an unusually small surface area to the wind.

Corrosion resistant aluminum alloys, both wrought and cast, are the primary materials of construction. Stainless steel screws and bolts are used throughout the antenna.

The total weight of a bay is approximately 350 pounds when designed to operate at Channels 7 and 8 with the higher channel bays weighing slightly less.

There are two teflon seals per bay. The diameters of the inner conductors which pass through these seals are approximately 1-3/4 inches. The outer conductor diameters are approximately 3 inches.

SUMMARY OF FEATURES

(1) Simple yet rugged interconnecting harness even with high gain arrays

(2) Low shear and low overturning moment at the base of the mast

(3) Single transmission line feed

(4) Small number of coaxial transmission line seals

(5) Mechanically rugged

(6) Capable of handling high power

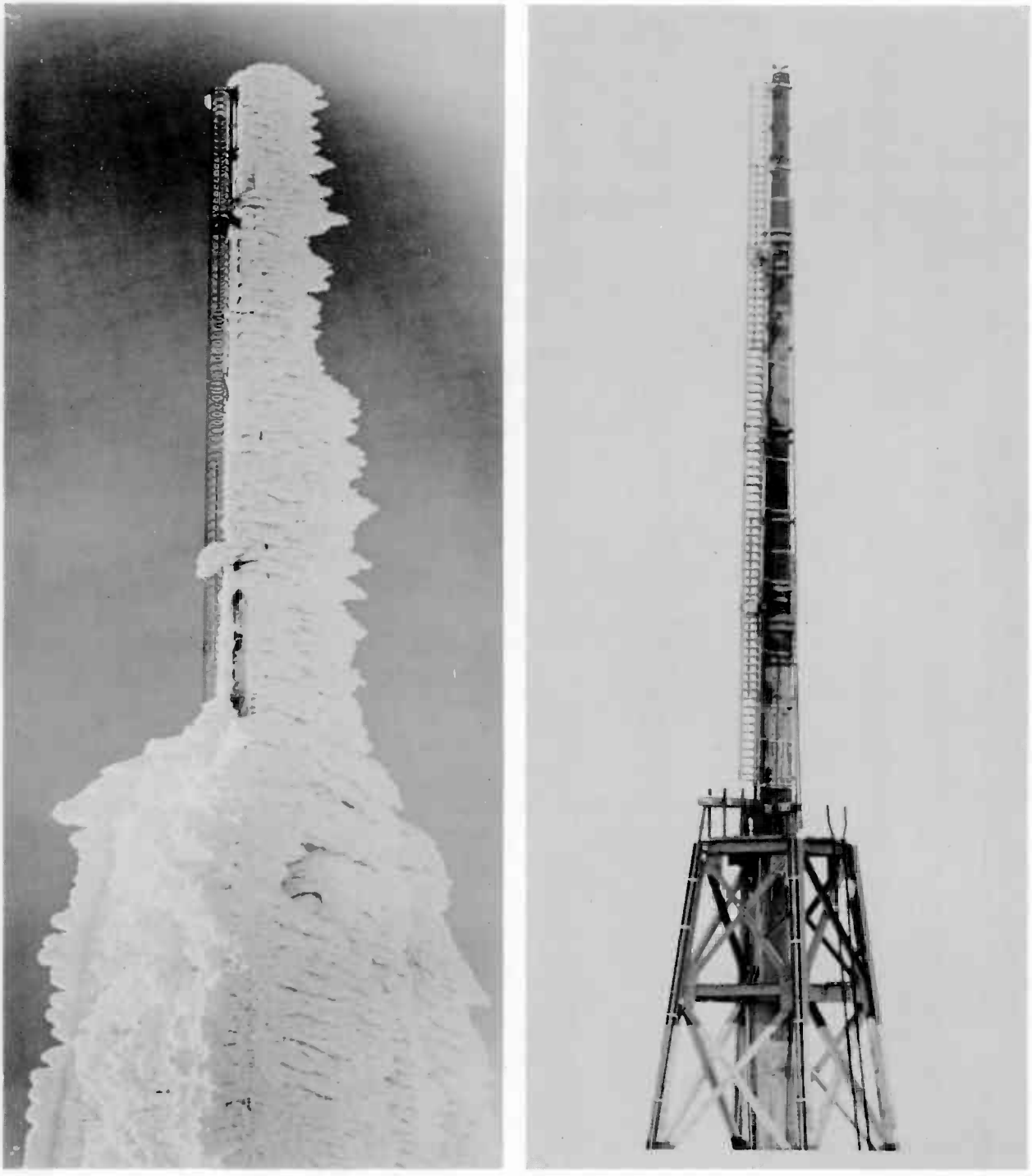
(7) Can be readily installed on an existing mast or tower

(8) Suitable for use under extreme weather conditions

CHARACTERISTICS

See Engineering Data Sheets

A Portion of a Type 1046-R Antenna Bay Mounted on its Supporting Mast



Two views of the AMCI Two-Bay Type 9900 (a special type with extra deicing capacity) Antenna Array at Station WMTW (TV) Channel 8, on Mount Washington, New Hampshire. Picture at left was taken after a typical sleet storm and shows the antenna itself completely deiced. (The mast and tower are not intended to be deiced.) The quality of the televised picture remained normal.

FOREWORD TO ENGINEERING DATA

The Type 1046 Omnidirectional Television Transmitting Antenna is made in three sizes to cover the VHF Upper Band from Channel 7 through 13.

Type 1046-P is used for Channels 7 and 8

Type 1046-Q is used for Channels 9 and 10

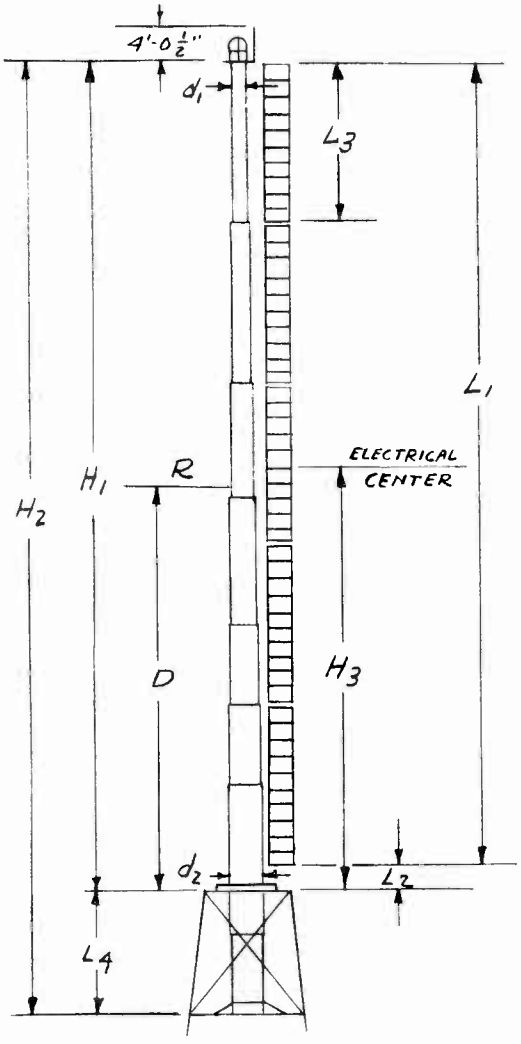
Type 1046-R is used for Channels 11, 12 and 13

The Type 1046 Antennas are streamlined versions of our original Type 1040 Slotted Ring Antennas. Because of the streamlining, the overturning moment and the shear at the base of the mast caused by various wind pressures are lower per bay than previously resulted with the Type 1040 Antenna.

Any one of the arrays listed on the following pages can be supplied with various degrees of null fill-in. There are three standard types of null fill-in which are known as Types I, II and III with Type III having the most complete null fill-in. As with all antenna arrays in general, the more the nulls are filled, the larger is the decrease in gain from that gain which the array has when there is no null fill-in. The gains and the locations of the corresponding centers of radiation of particular arrays for a particular channel are available on request.

Four calculated vertical patterns, based on measured half-bay patterns, are included (following the engineering data sheets) showing the effect of the three types of null fill-in on the vertical pattern as well as the vertical pattern with no null fill-in for a four bay Type 1046 Antenna Array as an illustration. The relative gains as a function of these four patterns are tabulated below:

Type of Null Fill-In	Drawing Number	Relative Gain
None	A1090-5002A	100 %
I	A1090-5004A	96.2%
II	A1090-5003A	92.5%
III	A1090-5005A	88.7%



ENGINEERING DATA FOR FIVE-BAY TYPE 1046-P ANTENNA ARRAY FOR TELEVISION CHANNELS 7 AND 8

MECHANICAL DATA WITH STANDARD MAST

H_1:	97 ft. 8 in.	L_4:	15 ft. 0 in.
H_2:	112 ft. 8 in	d_1:	4-1/2 in.
H_3:	50 ft. 1-3/16 in. (no null fill-in)	d_2:	18 in.
L_1:	94 ft. 2-3/8 in.	D:	42 ft. 10 in.
L_2:	3 ft. 0 in.	Weight per bay:	350 lbs.
L_3:	18 ft. 8-7/8 in.	Total weight:	15,600 lbs.

Transmission Line Connection is 3 ft. 0 in. above the top of the tower. Specify flange desired.

Standard Mast Dwg.: A1046-60,100

REACTIONS WITH STANDARD MAST WITH NO ICE

	50/33.3 psf	30/20 psf
Shear (R):	6,720 lbs.	4,030 lbs.
Overturning Moment (RxD):	288,000 lb-ft.	172,800 lb-ft.
Twisting Moment:	2,100 lb-ft.	1,260 lb-ft.

Maximum Design Loading of Standard Mast: 50/33.3 pounds per square foot

ELECTRICAL DATA

Average Power Rating: 31 kw or 55 kw (specify choice)

Horizontal Circularity: ± 2 Db

Input Impedance: 51.5 ohms

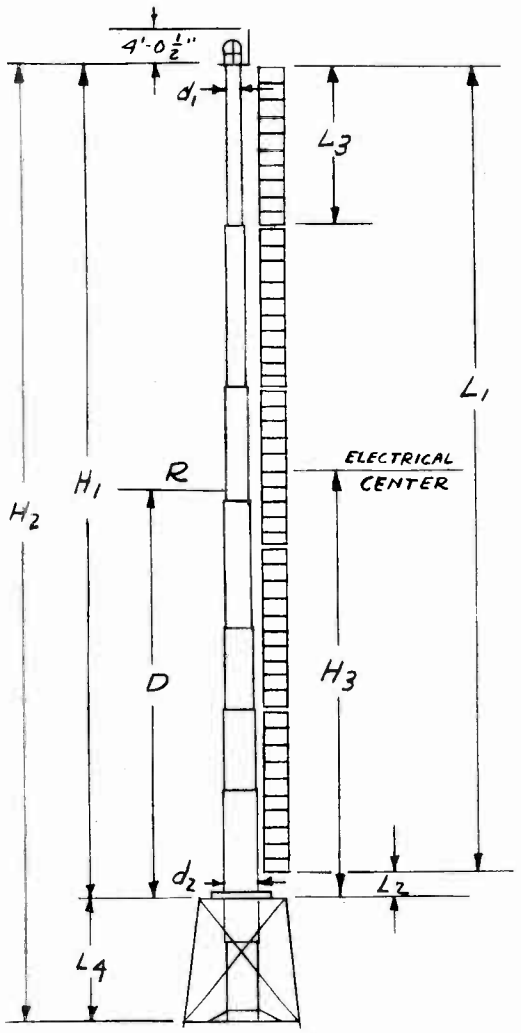
VSWR: 1.1 or better

Gain (with no null fill-in) at Visual Carrier

Channel 7: 20.0

Channel 8: 20.1

Vertical Patterns: Dwg. A1090-5008, -5009, -5010, -5011. Specify null fill-in and/or beam tilt desired.



ENGINEERING DATA FOR 4½-BAY TYPE 1046-P ANTENNA ARRAY FOR TELEVISION CHANNELS 7 AND 8

MECHANICAL DATA WITH STANDARD MAST

H_1:	88 ft. 1 in.	L_4:	13 ft. 0 in.
H_2:	101 ft. 1 in.	d_1:	4-1/2 in.
H_3:	45 ft. 2-3/4 in. (no null fill-in)	d_2:	16 in.
L_1:	84 ft. 7 in.	D:	38 ft. 11 in.
L_2:	3 ft. 0 in.	Weight per bay:	350 lbs.
L_3:	18 ft. 8-7/8 in.	Total weight:	12,700 lbs.

Transmission Line Connection is 3 ft. 0 in. above the top of the tower. Specify flange desired.

Standard Mast Dwg.: A1046-60,120

REACTIONS WITH STANDARD MAST WITH NO ICE

	50/33.3 psf	30/20 psf
Shear (R):	5,820 lbs.	3,490 lbs.
Overturning Moment (RxD):	227,000 lb-ft.	136,000 lb-ft.
Twisting Moment:	1,860 lb-ft.	1,120 lb-ft.

Maximum Design Loading of Standard Mast: 50/33.3 pounds per square foot

ELECTRICAL DATA

Average Power Rating: 31 kw or 55 kw (specify choice)

Horizontal Circularity: ± 2 Db

Input Impedance: 51.5 ohms

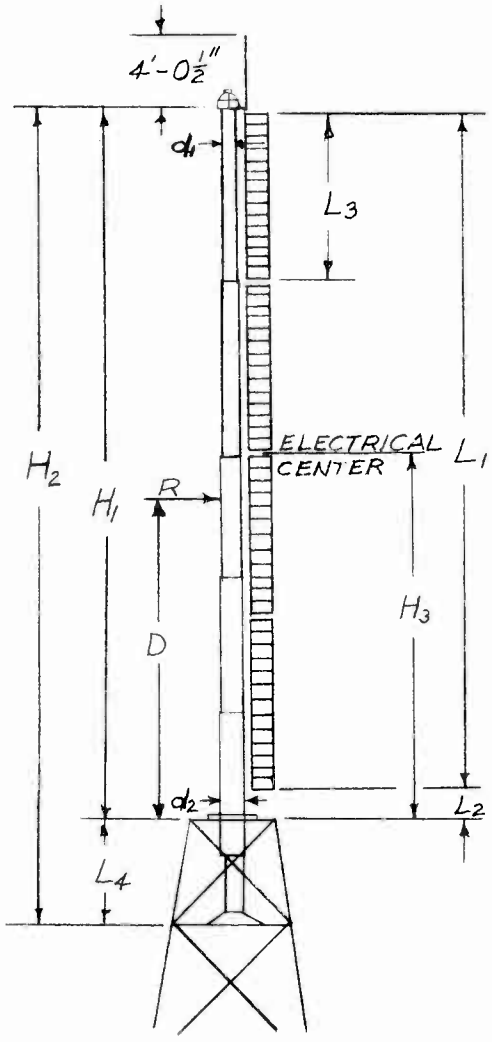
VSWR: 1.1 or better

Gain (with no null fill-in) at Visual Carrier

Channel 7: 18.0

Channel 8: 18.1

Vertical Patterns: Dwg. A1090-5020, -5021, -5022, and -5023. Specify null fill-in and/or beam tilt desired.



ENGINEERING DATA FOR FOUR-BAY TYPE 1046-P ANTENNA ARRAY FOR TELEVISION CHANNELS 7 AND 8

MECHANICAL DATA WITH STANDARD MAST

H_1:	78 ft. 10 in.	L_4:	11 ft. 6 in.
H_2:	90 ft. 4 in.	d_1:	4-1/2 in.
H_3:	40 ft. 8 in. (no null fill-in)	d_2:	14 in.
L_1:	75 ft. 4 in.	D:	35 ft. 2 in.
L_2:	3 ft. 0 in.	Weight per bay:	350 lbs.
L_3:	18 ft. 8-7/8 in.	Total weight:	10,800 lbs.

Transmission Line Connection is 3 ft. 0 in. above the top of the tower. Specify flange desired.

Standard Mast Dwg.: A1046-60,101

REACTIONS WITH STANDARD MAST WITH NO ICE

	50/33.3 psf	30/20 psf
Shear (R):	5,000 lbs.	3,000 lbs.
Overturning Moment (RxD):	175,900 lb-ft.	105,500 lb-ft.
Twisting Moment:	1,620 lb-ft.	970 lb-ft.

Maximum Design Loading of Standard Mast: 50/33.3 pounds per square foot

ELECTRICAL DATA

Average Power Rating: 31 kw or 55 kw (specify choice)

Horizontal Circularity: ± 2 Db

Input Impedance: 51.5 ohms

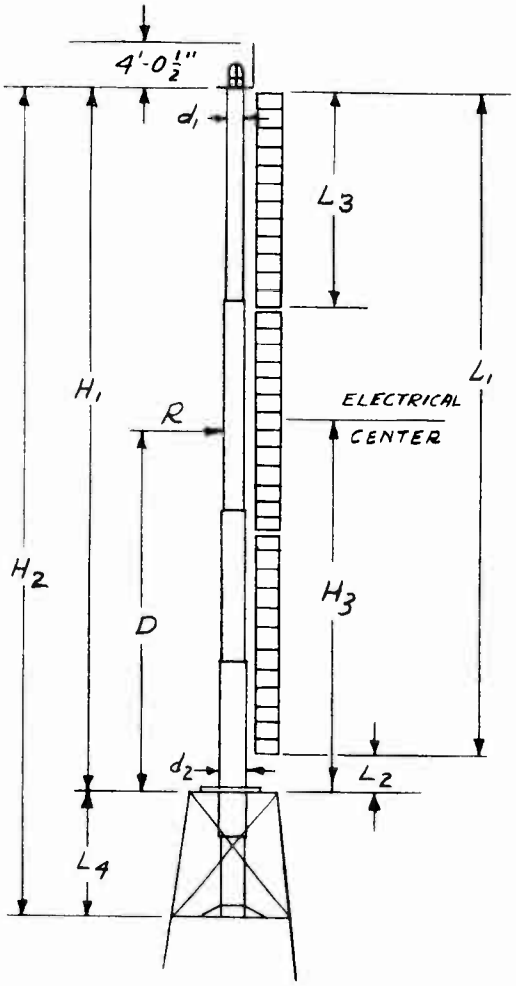
VSWR: 1.1 or better

Gain (with no null fill-in) at Visual Carrier

Channel 7: 16.0

Channel 8: 16.1

Vertical Patterns: Dwg. A1090-5002, -5003, -5004, -5005. Specify null fill-in and/or beam tilt desired.



ENGINEERING DATA FOR THREE-BAY TYPE 1046-P ANTENNA ARRAY FOR TELEVISION CHANNELS 7 AND 8

MECHANICAL DATA WITH STANDARD MAST

H_1:	60 ft. 0 in.	L_4:	11 ft. 6 in.
H_2:	71 ft. 6 in.	d_1:	4-1/2 in.
H_3:	31 ft. 2-13/16 in. (no null fill-in)	d_2:	10-3/4 in.
L_1:	56 ft. 5-5/8 in.	D:	27 ft. 5 in.
L_2:	3 ft. 0 in.	Weight per bay:	350 lbs.
L_3:	18 ft. 8-7/8 in.	Total weight:	7,100 lbs.

Transmission Line Connection is 3 ft. 0 in. above the top of the tower. Specify flange desired.

Standard Mast Dwg.: A1046-60,102

REACTIONS WITH STANDARD MAST WITH NO ICE

	50/33.3 psf	30/20 psf
Shear (R):	3,450 lbs.	2,070 lbs.
Overturning Moment (RxD):	94,400 lb-ft.	56,700 lb-ft.
Twisting Moment:	1,160 lb-ft.	700 lb-ft.

Maximum Design Loading of Standard Mast: 50/33.3 pounds per square foot

ELECTRICAL DATA

Average Power Rating: 31 kw or 55 kw (specify choice)

Horizontal Circularity: ± 2 Db

Input Impedance: 51.5 ohms

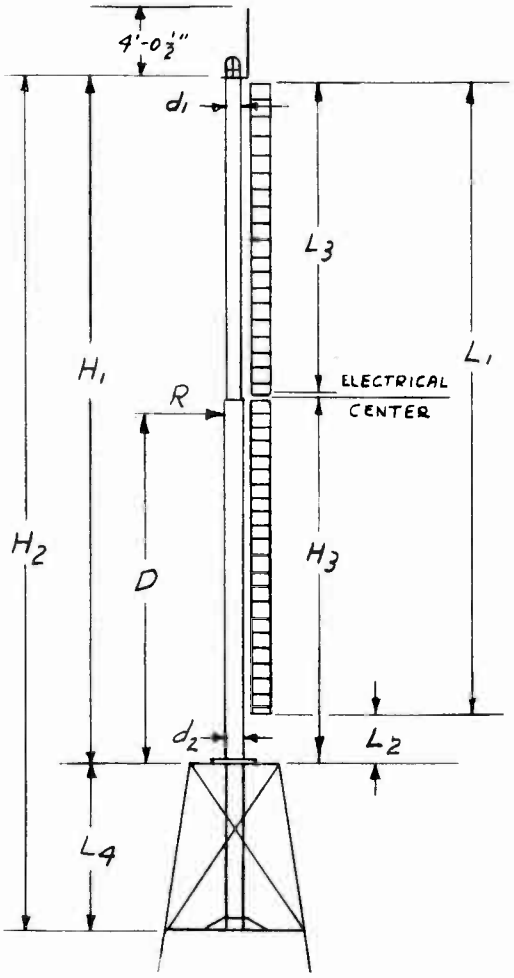
VSWR: 1.1 or better

Gain (with no null fill-in) at Visual Carrier

Channel 7: 12.0

Channel 8: 12.1

Vertical Patterns: Dwg. A1090-5001, -5006 and -5007. Specify null fill-in and/or beam tilt desired.



ENGINEERING DATA FOR TWO-BAY TYPE 1046-P ANTENNA ARRAY FOR TELEVISION CHANNELS 7 AND 8

MECHANICAL DATA WITH STANDARD MAST

H_1:	41 ft. 1 in.	L_4:	10 ft. 0 in.
H_2:	51 ft. 1 in.	d_1:	4-1/2 in.
H_3:	21 ft. 9-5/8 in. (no null fill-in)	d_2:	8-5/8 in.
L_1:	37 ft. 7-1/4 in.	D:	20 ft. 1 in.
L_2:	3 ft. 0 in.	Weight per bay:	350 lbs.
L_3:	18 ft. 8-7/8 in.	Total weight:	4,100 lbs.

Transmission Line Connection is 3 ft. 0 in. above the top of the tower. Specify flange desired.

Standard Mast Dwg.: A1046-60,103

REACTIONS WITH STANDARD MAST WITH NO ICE

	50/33.3 psf	30/20 psf
Shear (R):	1,930 lbs.	1,150 lbs.
Overturning Moment (RxD):	38,700 lb-ft.	23,200 lb-ft.
Twisting Moment:	760 lb-ft.	460 lb-ft.

Maximum Design Loading of Standard Mast: 50/33.3 pounds per square foot

ELECTRICAL DATA

Average Power Rating: 31 kw or 55 kw (specify choice)

Horizontal Circularity: ± 2 Db

Input Impedance: 51.5 ohms

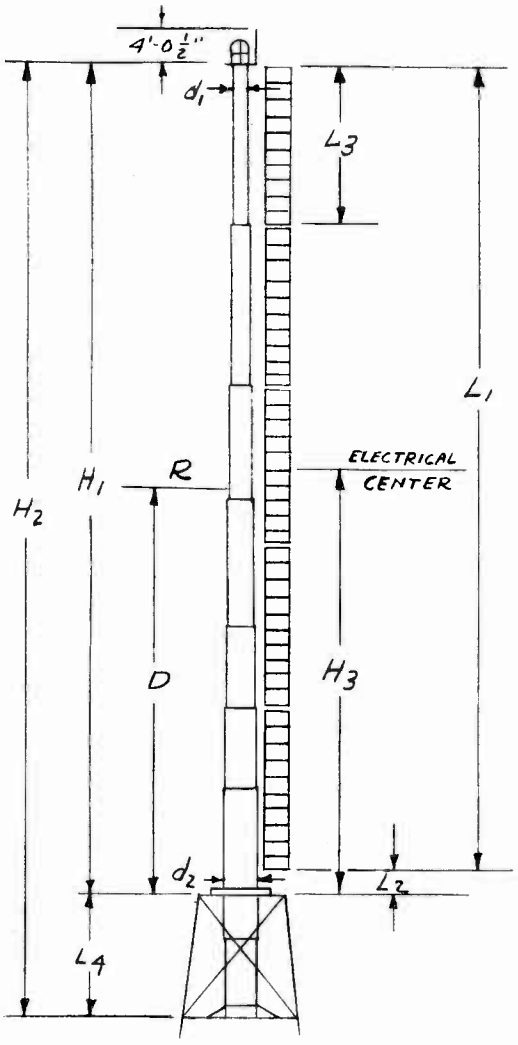
VSWR: 1.1 or better

Gain (with no null fill-in) at Visual Carrier

Channel 7: 8.0

Channel 8: 8.0

Vertical Patterns: Dwg. A1090-5012, -5013 and -5014. Specify null fill-in and/or beam tilt desired.



ENGINEERING DATA FOR FIVE-BAY TYPE 1046-Q ANTENNA ARRAY FOR TELEVISION CHANNELS 9 AND 10

MECHANICAL DATA WITH STANDARD MAST

H_1: 92 ft. 3 in.

H_2: 106 ft. 3 in.

H_3: 47 ft. 4-11/16 in. (no null fill-in)

L_1: 88 ft. 9-3/8 in.

L_2: 3 ft. 0 in.

L_3: 17 ft. 7-7/8 in.

L_4: 14 ft. 0 in.

d_1: 4-1/2 in.

d_2: 16 in.

D: 41 ft. 0 in.

Weight per bay: 340 lbs.

Total weight: 14,100 lbs.

Transmission Line Connection is 3 ft. 0 in. above the top of the tower. Specify flange desired.

Standard Mast Dwg.: A1046-60,104

REACTIONS WITH STANDARD MAST WITH NO ICE

	50/33.3 psf	30/20 psf
Shear (R):	6,050 lbs.	3,630 lbs.
Overturning Moment (RxD):	248,000 lb-ft.	148,300 lb-ft.
Twisting Moment:	1,750 lb-ft.	1,050 lb-ft.

Maximum Design Loading of Standard Mast: 50/33.3 pounds per square foot

ELECTRICAL DATA

Average Power Rating: 31 kw or 55 kw (specify choice)

Horizontal Circularity: ± 2 Db

Input Impedance: 51.5 ohms

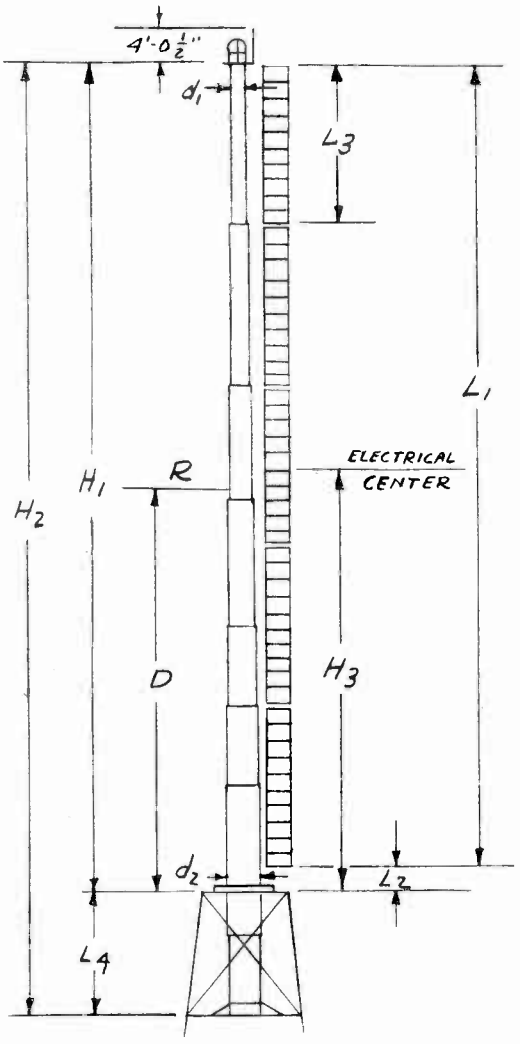
VSWR: 1.1 or better

Gain (with no null fill-in) at Visual Carrier

Channel 9: 20.0

Channel 10: 20.1

Vertical Patterns: Dwg. A1090-5008, -5009, -5010 and -5011. Specify null fill-in and/or beam tilt desired.



ENGINEERING DATA FOR 4½-BAY TYPE 1046-Q ANTENNA ARRAY FOR TELEVISION CHANNELS 9 AND 10

MECHANICAL DATA WITH STANDARD MAST

H_1:	83 ft. 3 in.	L_4:	13 ft. 0 in.
H_2:	96 ft. 3 in.	d_1:	4-1/2 in.
H_3:	42 ft. 10 in. (no null fill-in)	d_2:	16 in.
L_1:	79 ft. 9 in.	D:	37 ft. 0 in.
L_2:	3 ft. 0 in.	Weight per bay:	340 lbs.
L_3:	17 ft. 7-7/8 in.	Total weight:	12,300 lbs.

Transmission Line Connection is 3 ft. 0 in. above the top of the tower. Specify flange desired.

Standard Mast Dwg.: A1046-60,121

REACTIONS WITH STANDARD MAST WITH NO ICE

	50/33.3 psf	30/20 psf
Shear (R):	5,280 lbs.	3,170 lbs.
Overturning Moment (RxD):	195,400 lb-ft.	117,300 lb-ft.
Twisting Moment:	1,560 lb-ft.	940 lb-ft.

Maximum Design Loading of Standard Mast: 50/33.3 pounds per square foot

ELECTRICAL DATA

Average Power Rating: 31 kw or 55 kw (specify choice)

Horizontal Circularity: ± 2 Db

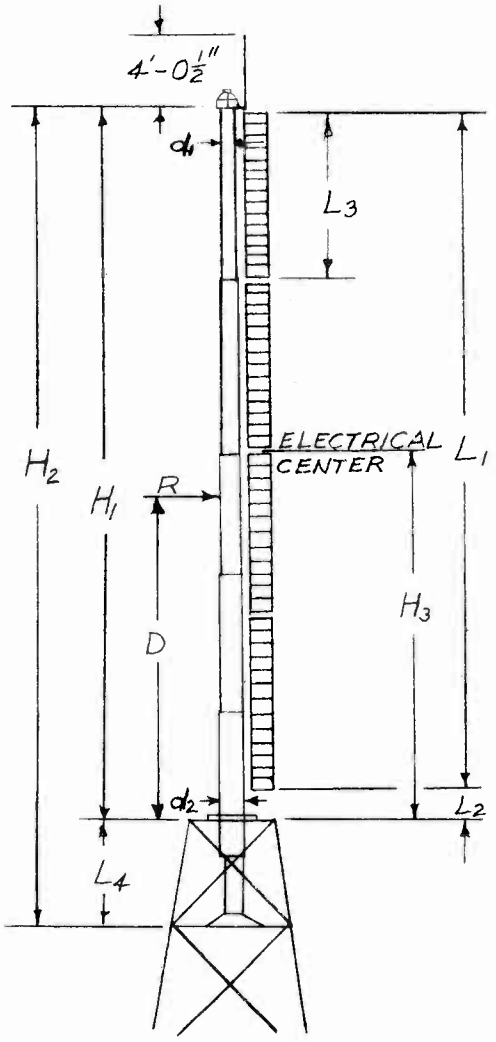
Input Impedance: 51.5 ohms

VSWR: 1.1 or better

Gain (with no null fill-in) at Visual Carrier

Channel 9	18.0
Channel 10	18.1

Vertical Patterns: Dwg. A1090-5020, -5021, -5022, and -5023. Specify null fill-in and/or beam tilt desired.



ENGINEERING DATA FOR FOUR-BAY TYPE 1046-Q ANTENNA ARRAY FOR TELEVISION CHANNELS 9 AND 10

MECHANICAL DATA WITH STANDARD MAST

H_1:	74 ft. 6 in.	L_4:	11 ft. 6 in.
H_2:	86 ft. 0 in.	d_1:	4-1/2 in.
H_3:	38 ft. 6 in. (no null fill-in)	d_2:	12-3/4 in.
L_1:	71 ft. 0 in.	D:	33 ft. 5-1/2 in.
L_2:	3 ft. 0 in.	Weight per bay:	340 lbs.
L_3:	17 ft. 7-7/8 in.	Total weight:	9,400 lbs.

Transmission Line Connection is 3 ft. 0 in. above the top of the tower. Specify flange desired.

Standard Mast Dwg.: A1046-60,105

REACTIONS WITH STANDARD MAST WITH NO ICE

	50/33.3 psf	30/20 psf
Shear (R):	4,540 lbs.	2,720 lbs.
Overturning Moment (RxD):	152,000 lb-ft.	91,100 lb-ft.
Twisting Moment:	1,360 lb-ft.	820 lb-ft.

Maximum Design Loading of Standard Mast: 50/33.3 pounds per square foot

ELECTRICAL DATA

Average Power Rating: 31 kw or 55 kw (specify choice)

Horizontal Circularity: ± 2 Db

Input Impedance: 51.5 ohms

VSWR: 1.1 or better

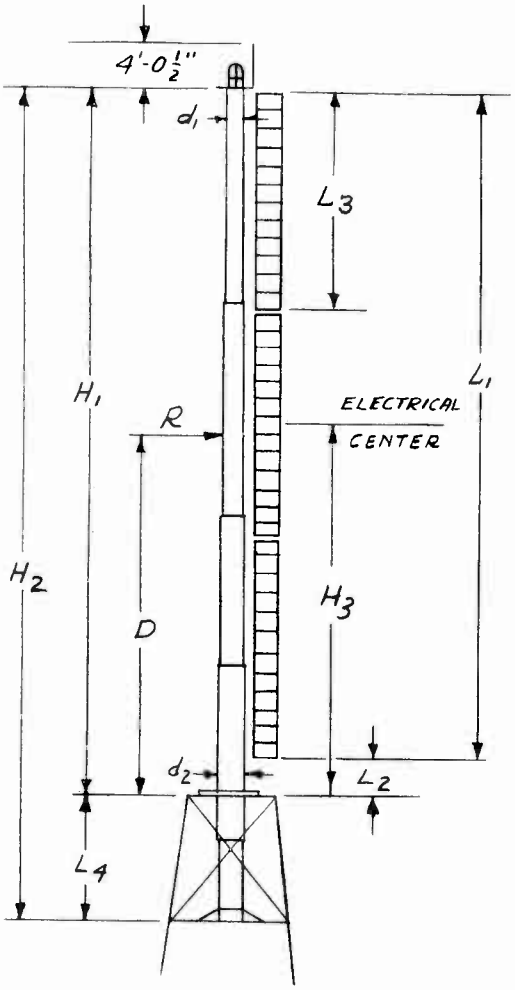
Gain (with no null fill-in) at Visual Carrier

Channel 9: 16.0

Channel 10: 16.1

Vertical Patterns: Dwg. A1090-5002, -5003, -5004 and -5005. Specify null fill-in and/or beam tilt desired.

ENGINEERING DATA FOR THREE-BAY TYPE 1046-Q ANTENNA ARRAY FOR TELEVISION CHANNELS 9 AND 10



MECHANICAL DATA WITH STANDARD MAST

H_1:	56 ft. 9 in.	L_4:	11 ft. 6 in.
H_2:	68 ft. 3 in.	d_1:	4-1/2 in.
H_3:	29 ft. 7-5/16 in. (no null fill-in)	d_2:	10-3/4 in.
L_1:	53 ft. 2-5/8 in.	D:	26 ft. 0 in.
L_2:	3 ft. 0 in.	Weight per bay:	340 lbs.
L_3:	17 ft. 7-7/8 in.	Total weight:	6,200 lbs.

Transmission Line Connection is 3 ft. 0 in. above the top of the tower. Specify flange desired.

Standard Mast Dwg.: A1046-60,106

REACTIONS WITH STANDARD MAST WITH NO ICE

	50/33.3 psf	30/20 psf
Shear (R):	3,160 lbs.	1,890 lbs.
Overturning Moment (RxD):	82,200 lb-ft.	49,300 lb-ft.
Twisting Moment:	980 lb-ft.	590 lb-ft.

Maximum Design Loading of Standard Mast: 50/33.3 pounds per square foot

ELECTRICAL DATA

Average Power Rating: 31 kw or 55 kw (specify choice)

Horizontal Circularity: ± 2 Db

Input Impedance: 51.5 ohms

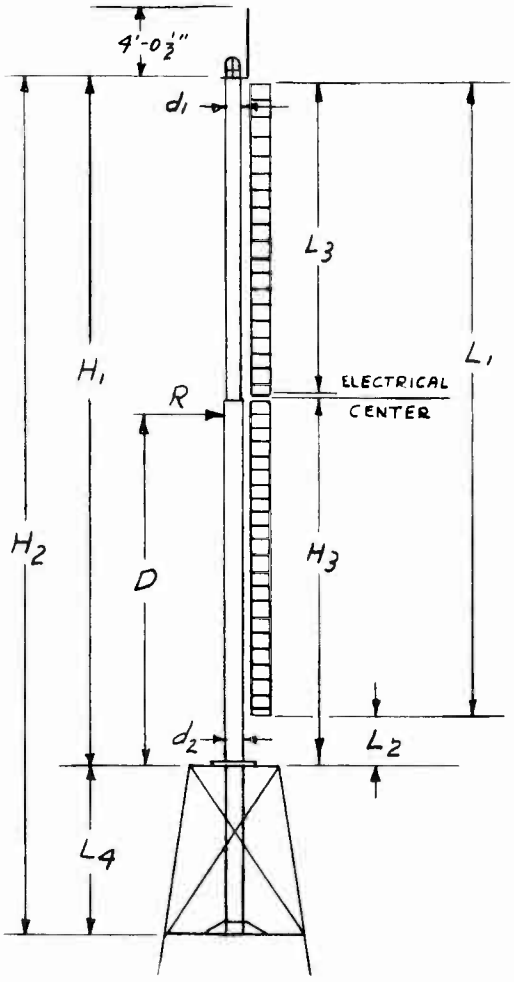
VSWR: 1.1 or better

Gain (with no null fill-in) at Visual Carrier

Channel 9: 12.0

Channel 10: 12.1

Vertical Patterns: Dwg. A1090-5001, -5006 and -5007. Specify null fill-in and/or beam tilt desired.



ENGINEERING DATA FOR TWO-BAY TYPE 1046-Q ANTENNA ARRAY FOR TELEVISION CHANNELS 9 AND 10

MECHANICAL DATA WITH STANDARD MAST

H_1:	38 ft. 11 in.	L_4:	10 ft. 0 in.
H_2:	48 ft. 11 in.	d_1:	4-1/2 in.
H_3:	20 ft. 8-5/8 in. (no null fill-in)	d_2:	8-5/8 in.
L_1:	35 ft. 5-1/4 in.	D:	19 ft. 6 in.
L_2:	3 ft. 0 in.	Weight per bay:	340 lbs.
L_3:	17 ft. 7-7/8 in.	Total weight:	3,800 lbs.

Transmission Line Connection is 3 ft. 0 in. above the top of the tower. Specify flange desired.

Standard Mast Dwg.: A1046-60,107

REACTIONS WITH STANDARD MAST WITH NO ICE

	50/33.3 psf	30/20 psf
Shear (R):	1,750 lbs.	1,050 lbs.
Overturning Moment (RxD):	34,100 lb-ft.	20,500 lb-ft.
Twisting Moment:	630 lb-ft.	380 lb-ft.

Maximum Design Loading of Standard Mast: 50/33.3 pounds per square foot

ELECTRICAL DATA

Average Power Rating: 31 kw or 55 kw (specify choice)

Horizontal Circularity: ± 2 Db

Input Impedance: 51.5 ohms

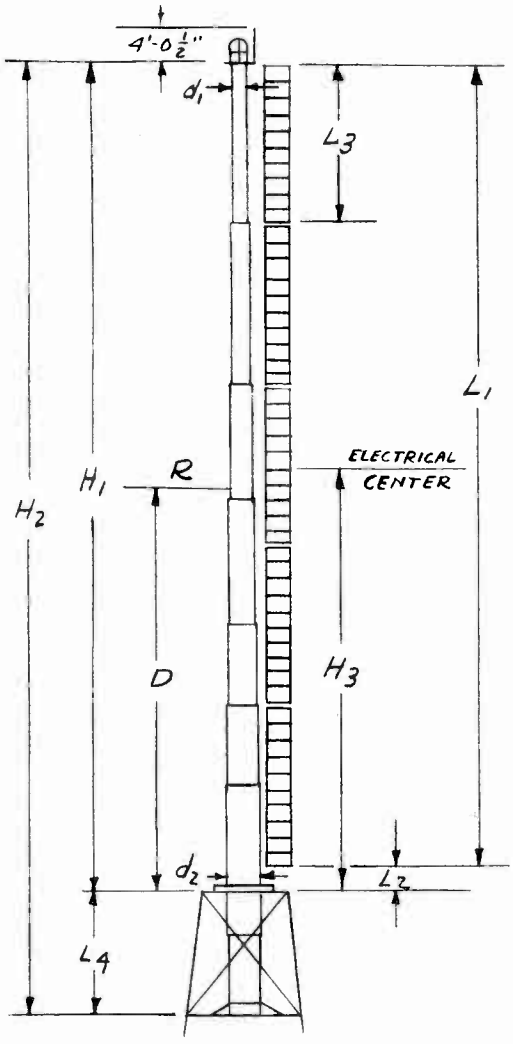
VSWR: 1.1 or better

Gain (with no null fill-in) at Visual Carrier

Channel 9: 8.0

Channel 10: 8.0

Vertical Patterns: Dwg. A1090-5012, -5013 and -5014. Specify null fill-in and/or beam tilt desired.



ENGINEERING DATA FOR FIVE-BAY TYPE 1046-R ANTENNA ARRAY FOR TELEVISION CHANNELS 11, 12 AND 13

MECHANICAL DATA WITH STANDARD MAST

H_1:	86 ft. 3 in.	L_4:	13 ft. 0 in.
H_2:	99 ft. 3 in.	d_1:	4-1/2 in.
H_3:	44 ft. 4-3/4 in. (no null fill-in)	d_2:	16 in.
L_1:	82 ft. 9-1/2 in.	D:	38 ft. 6 in.
L_2:	3 ft. 0 in.	Weight per bay:	325 lbs.
L_3:	16 ft. 5-1/2 in.	Total weight:	12,100 lbs.

Transmission Line Connection is 3 ft. 0 in. above the top of the tower. Specify flange desired.

Standard Mast Dwg.: A1046-60,108

REACTIONS WITH STANDARD MAST WITH NO ICE

	50/33.3 psf	30/20 psf
Shear (R):	5,510 lbs.	3,310 lbs.
Overturning Moment (RxD):	212,000 lb-ft.	127,000 lb-ft.
Twisting Moment:	1,500 lb-ft.	900 lb-ft.

Maximum Design Loading of Standard Mast: 50/33.3 pounds per square foot

ELECTRICAL DATA

Average Power Rating: 31 kw or 55 kw (specify choice)

Horizontal Circularity: ± 2 Db

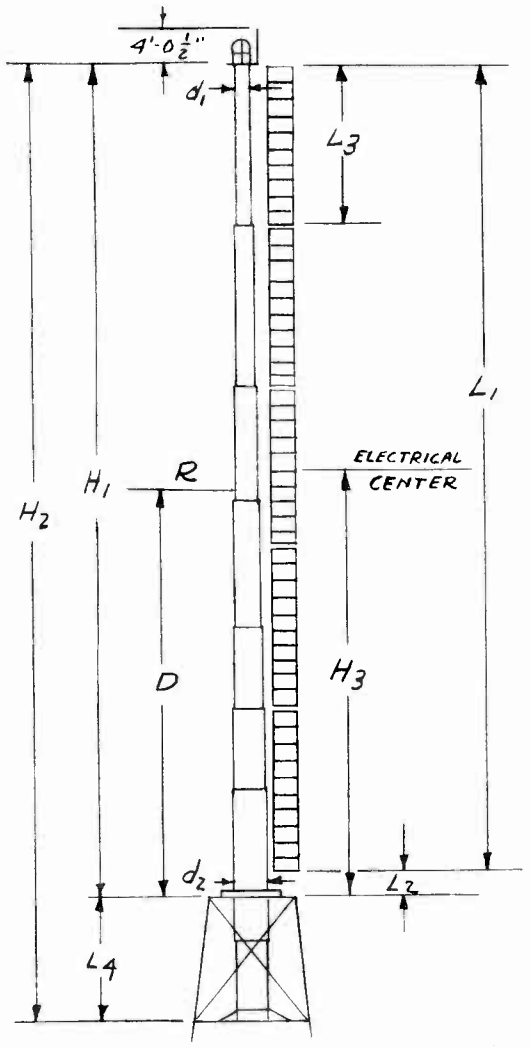
Input Impedance: 51.5 ohms

VSWR: 1.1 or better

Gain (with no null fill-in) at Visual Carrier

Channel 11:	19.9
Channel 12:	20.0
Channel 13:	20.2

Vertical Patterns: Dwg. A1090-5008, -5009, -5010, -5011. Specify null fill-in and/or beam tilt desired.



ENGINEERING DATA FOR 4½-BAY TYPE 1046-R ANTENNA ARRAY FOR TELEVISION CHANNELS 11, 12 AND 13

MECHANICAL DATA WITH STANDARD MAST

H_1: 77 ft. 10 in.
H_2: 90 ft. 10 in.
H_3: 40 ft. 1-5/8 in. (no null fill-in)
L_1: 74 ft. 4-5/16 in.
L_2: 3 ft. 0 in.
L_3: 16 ft. 5-1/2 in.
L_4: 13 ft. 0 in.
d_1: 4-1/2 in.
d_2: 14 in.
D: 34 ft. 10-1/2 in.
Weight per bay: 325 lbs.
Total weight: 10,700 lbs.

Transmission Line Connection is 3 ft. 0 in. above the top of the tower. Specify flange desired.

Standard Mast Dwg.: A1046-60,122

REACTIONS WITH STANDARD MAST WITH NO ICE

	50/33.3 psf	30/20 psf
Shear (R):	4,830 lbs.	2,900 lbs.
Overturning Moment (RxD):	168,400 lb-ft.	101,000 lb-ft.
Twisting Moment:	1,350 lb-ft.	810 lb-ft.

Maximum Design Loading of Standard Mast: 50/33.3 pounds per square foot

ELECTRICAL DATA

Average Power Rating: 31 kw or 55 kw (specify choice)

Horizontal Circularity: ± 2 Db

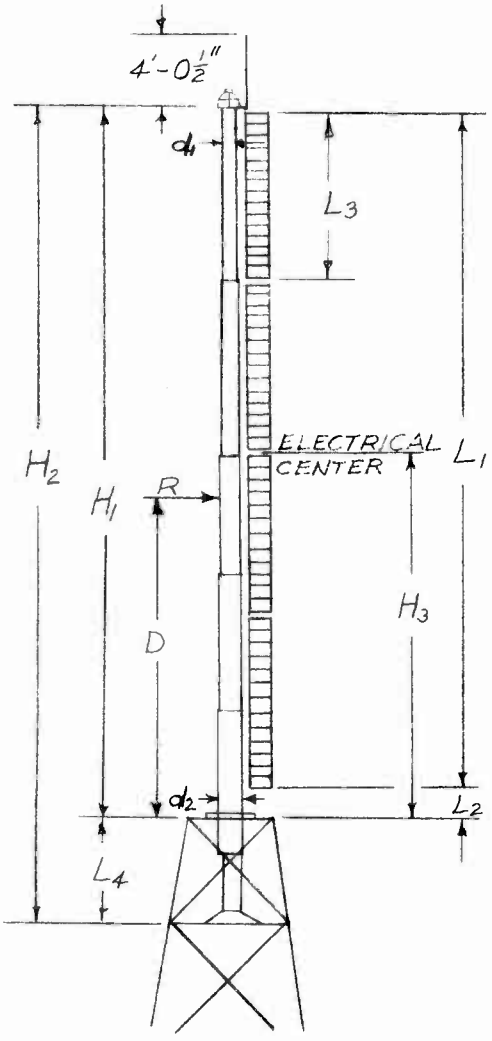
Input Impedance: 51.5 ohms

VSWR: 1.1 or better

Gain (with no null fill-in) at Visual Carrier

Channel 11:	17.9
Channel 12:	18.0
Channel 13:	18.2

Vertical Patterns: Dwg. A1090-5020, -5021, -5022, and -5023. Specify null fill-in and/or beam tilt desired.



ENGINEERING DATA FOR FOUR-BAY TYPE 1046-R ANTENNA ARRAY FOR TELEVISION CHANNELS 11, 12 AND 13

MECHANICAL DATA WITH STANDARD MAST

H_1:	69 ft. 8 in.	L_4:	11 ft. 6 in.
H_2:	81 ft. 2 in.	d_1:	4-1/2 in.
H_3:	36 ft. 1-1/4 in. (no null fill-in)	d_2:	12-3/4 in.
L_1:	66 ft. 2-1/2 in.	D:	31 ft. 6 in.
L_2:	3 ft. 0 in.	Weight per bay:	325 lbs.
L_3:	16 ft. 5-1/2 in.	Total weight:	8,800 lbs.

Transmission Line Connection is 3 ft. 0 in. above the top of the tower. Specify flange desired.

Standard Mast Dwg.: A1046-60,109

REACTIONS WITH STANDARD MAST WITH NO ICE

	50/33.3 psf	30/20 psf
Shear (R):	4,150 lbs.	2,480 lbs.
Overturning Moment (RxD):	131,000 lb-ft.	78,500 lb-ft.
Twisting Moment:	1,200 lb-ft.	720 lb-ft.

Maximum Design Loading of Standard Mast: 50/33.3 pounds per square foot

ELECTRICAL DATA

Average Power Rating: 31 kw or 55 kw (specify choice)

Horizontal Circularity: ± 2 Db

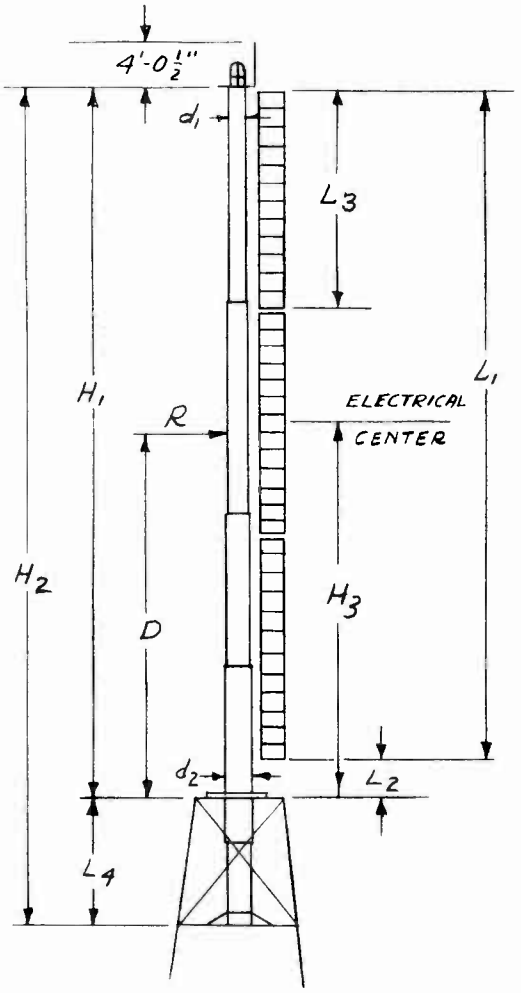
Input Impedance: 51.5 ohms

VSWR: 1.1 or better

Gain (with no null fill-in) at Visual Carrier

Channel 11:	15.9
Channel 12:	16.0
Channel 13:	16.1

Vertical Patterns: Dwg. A1090-5002, -5003, -5004, -5005. Specify null fill-in and/or beam tilt desired.



ENGINEERING DATA FOR THREE-BAY TYPE 1046-R ANTENNA ARRAY FOR TELEVISION CHANNELS 11, 12 AND 13

MECHANICAL DATA WITH STANDARD MAST

H_1:	53 ft. 1 in.	L_4:	11 ft. 6 in.
H_2:	64 ft. 7 in.	d_1:	4-1/2 in.
H_3:	27 ft. 9-3/4 in. (no null fill-in)	d_2:	10-3/4 in.
L_1:	49 ft. 7-1/2 in.	D:	24 ft. 7 in.
L_2:	3 ft. 0 in.	Weight per bay:	325 lbs.
L_3:	16 ft. 5-1/2 in.	Total weight:	5,900 lbs.

Transmission Line Connection is 3 ft. 0 in. above the top of the tower. Specify flange desired.

Standard Mast Dwg.: A1046-60,110

REACTIONS WITH STANDARD MAST WITH NO ICE

	50/33.3 psf	30/20 psf
Shear (R):	2,910 lbs.	1,750 lbs.
Overturning Moment (RxD):	71,500 lb-ft.	42,800 lb-ft.
Twisting Moment:	860 lb-ft.	520 lb-ft.

Maximum Design Loading of Standard Mast: 50/33.3 pounds per square foot

ELECTRICAL DATA

Average Power Rating: 31 kw or 55 kw (specify choice)

Horizontal Circularity: ± 2 Db

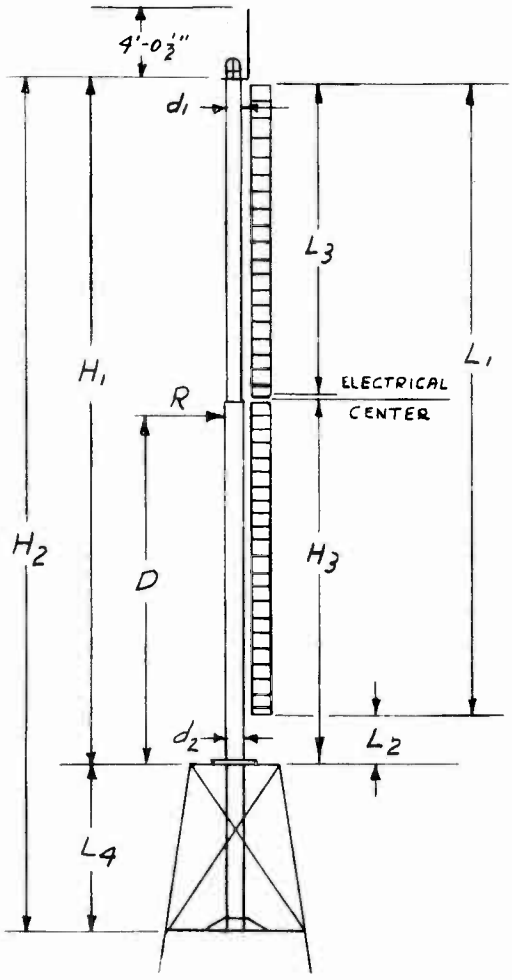
Input Impedance: 51.5 ohms

VSWR: 1.1 or better

Gain (with no null fill-in) at Visual Carrier

Channel 11:	11.9
Channel 12:	12.0
Channel 13:	12.1

Vertical Patterns: Dwg. A1090-5001, -5006 and -5007. Specify null fill-in and/or beam tilt desired.



ENGINEERING DATA FOR TWO-BAY TYPE 1046-R ANTENNA ARRAY FOR TELEVISION CHANNELS 11, 12 AND 13

MECHANICAL DATA WITH STANDARD MAST

H_1:	36 ft. 6 in.	L_4:	10 ft. 0 in.
H_2:	46 ft. 6 in.	d_1:	4-1/2 in.
H_3:	19 ft. 6-1/4 in. (no null fill-in)	d_2:	6-5/8 in.
L_1:	33 ft. 1/2 in.	D:	18 ft. 6 in.
L_2:	3 ft. 0 in.	Weight per bay:	325 lbs.
L_3:	16 ft. 5-1/2 in.	Total weight:	3,500 lbs.

Transmission Line Connection is 3 ft. 0 in. above the top of the tower. Specify flange desired.

Standard Mast Dwg.: A1046-60,111

REACTIONS WITH STANDARD MAST WITH NO ICE

	50/33.3 psf	30/20 psf
Shear (R):	1,610 lbs.	970 lbs.
Overturning Moment (RxD):	29,800 lb-ft.	17,900 lb-ft.
Twisting Moment:	560 lb-ft.	340 lb-ft.

Maximum Design Loading of Standard Mast: 50/33.3 pounds per square foot

ELECTRICAL DATA

Average Power Rating: 31 kw or 55 kw (specify choice)

Horizontal Circularity: ± 2 Db

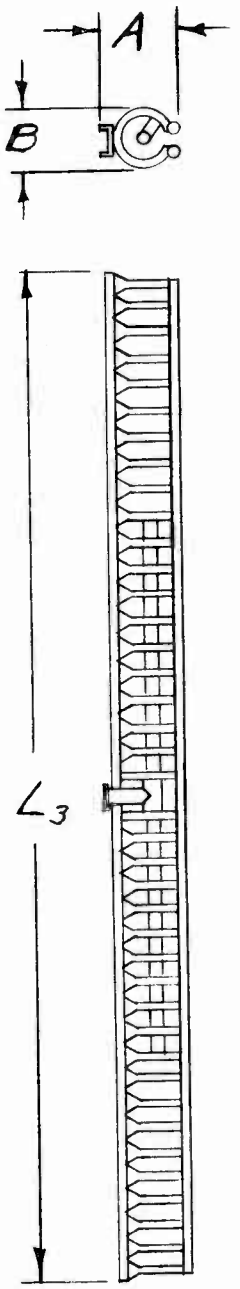
Input Impedance: 51.5 ohms

VSWR: 1.1 or better

Gain (with no null fill-in) at Visual Carrier

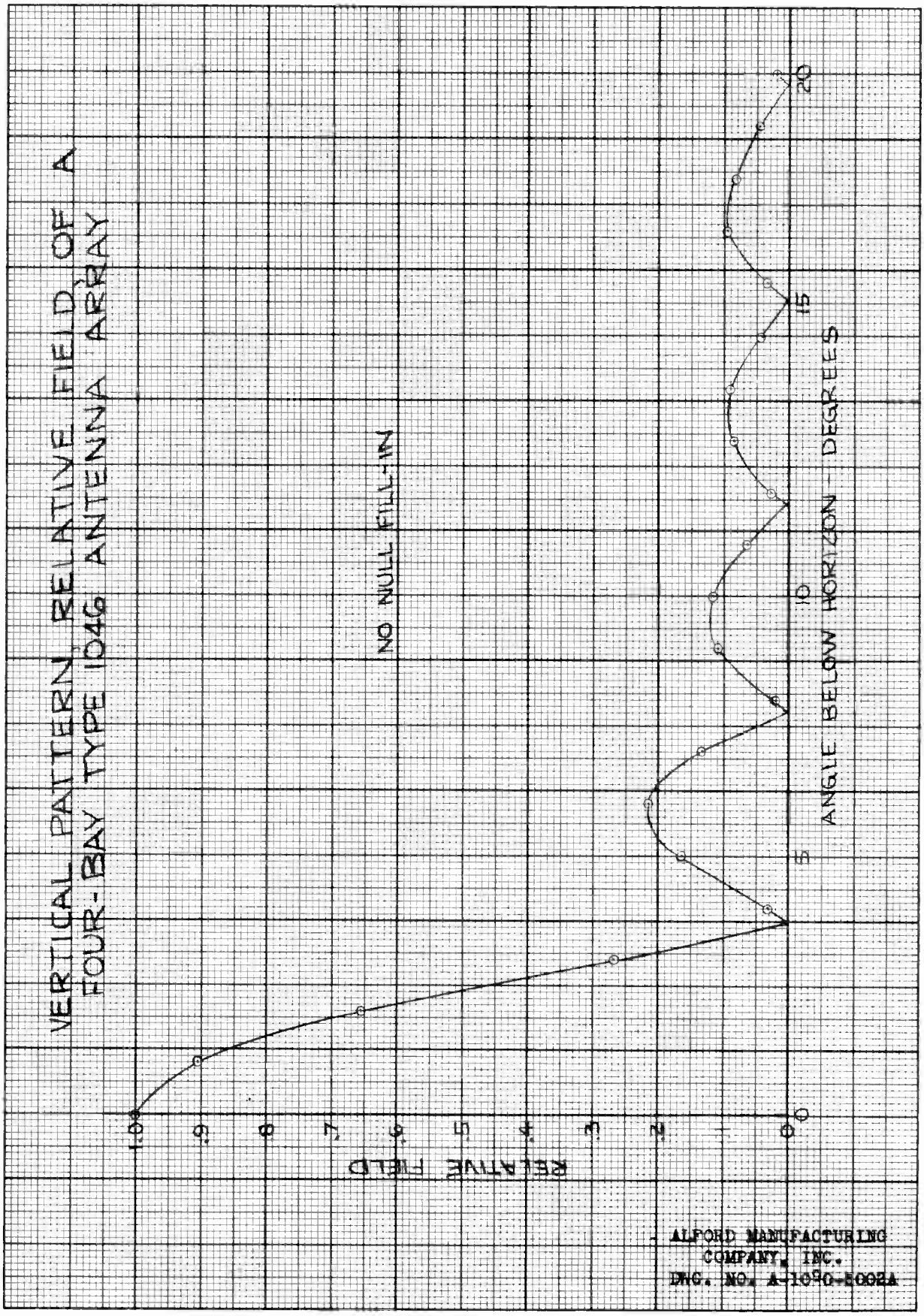
Channel 11:	8.0
Channel 12:	8.0
Channel 13:	8.1

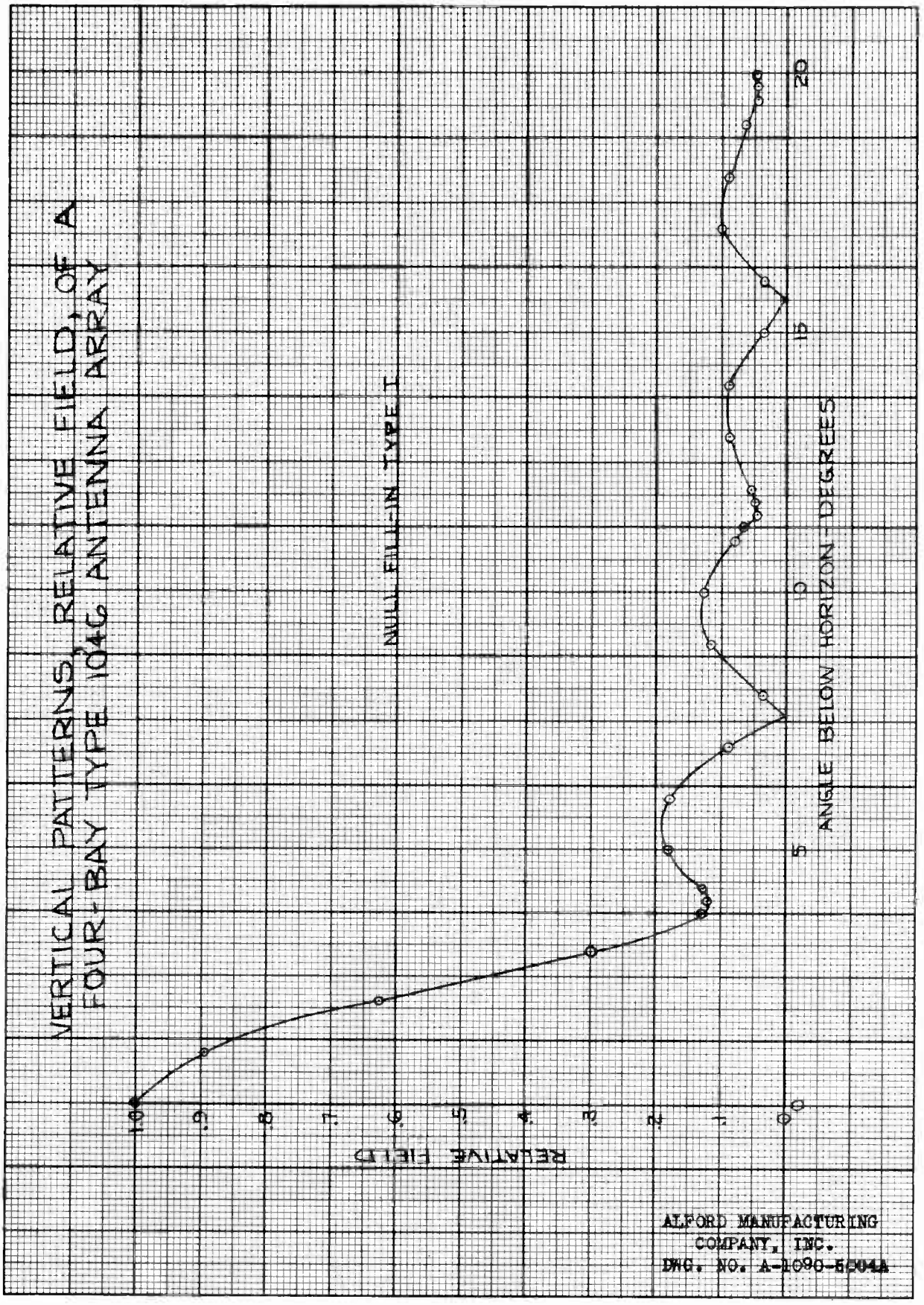
Vertical Patterns: Dwg. A1090-5012, -5013 and -5014. Specify null fill-in and/or beam tilt desired.

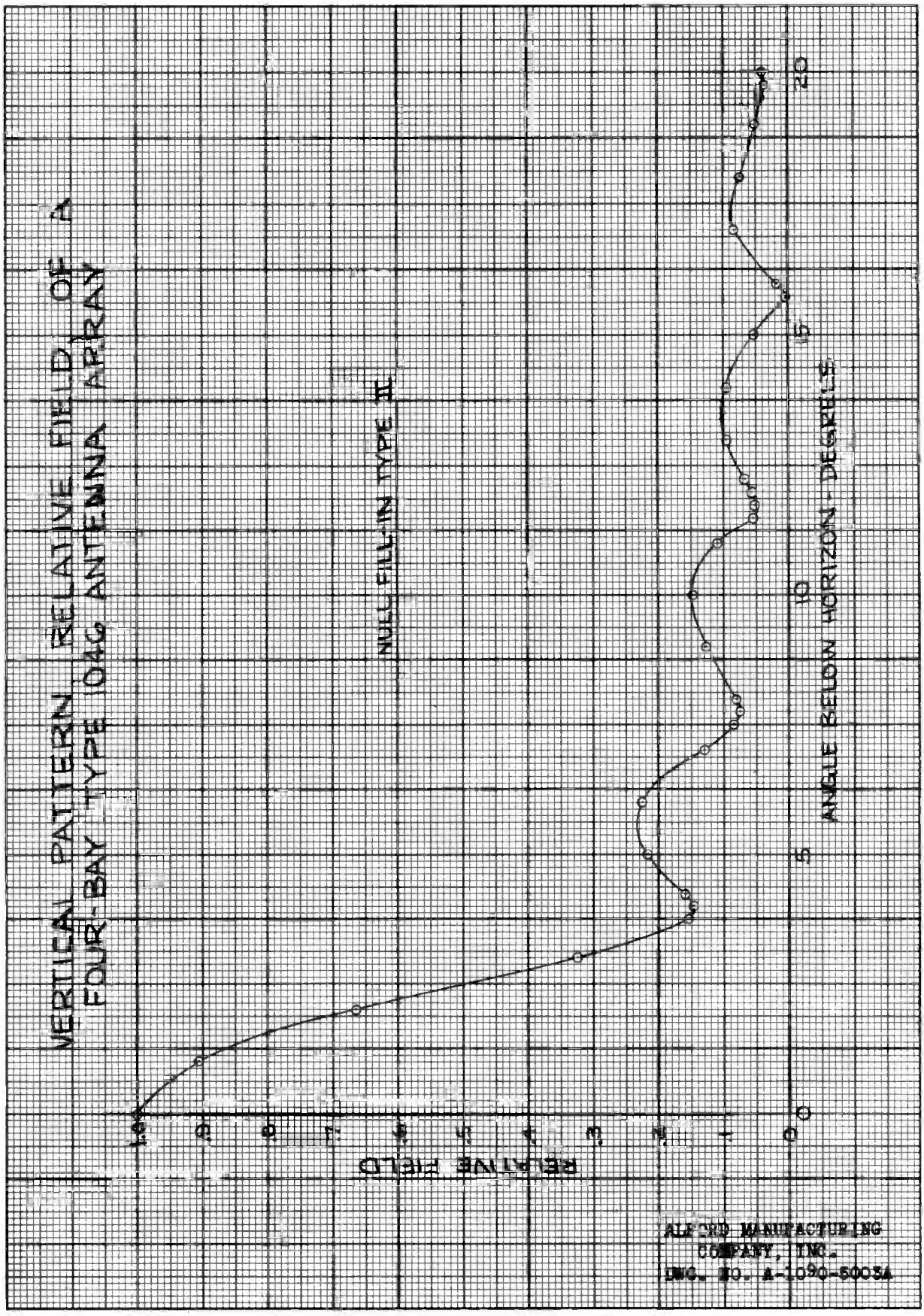


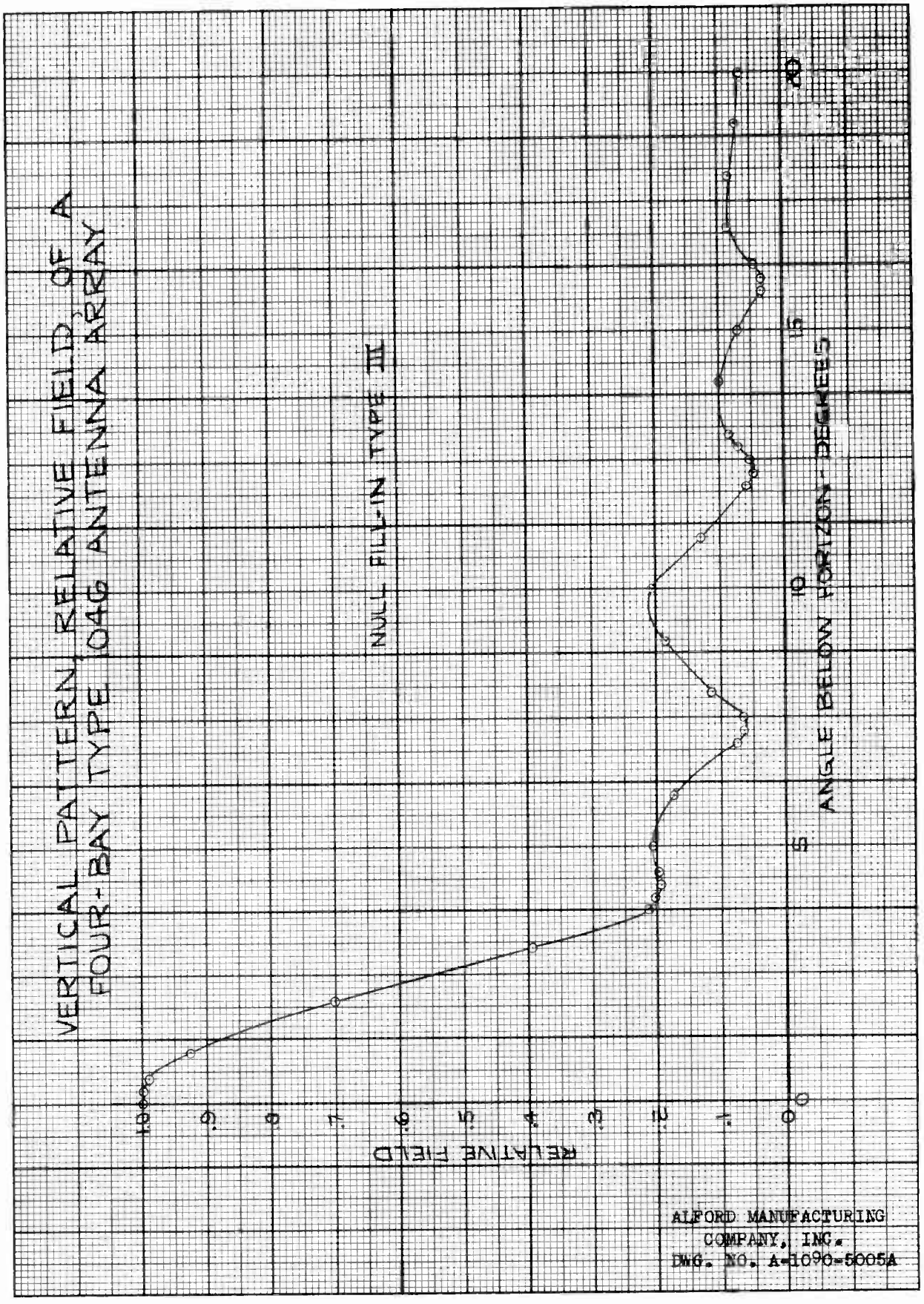
TYPE	CHANNELS	L_3	A	B
1046-P	7 & 8	$18'-8\frac{7}{8}''$	$13\frac{29}{64}''$	$11\frac{1}{8}''$
1046-Q	9 & 10	$17'-7\frac{7}{8}''$	$12\frac{47}{64}''$	$10\frac{7}{16}''$
1046-R	11, 12 & 13	$16'-5\frac{1}{2}''$	$12\frac{1}{64}''$	$9\frac{43}{64}''$

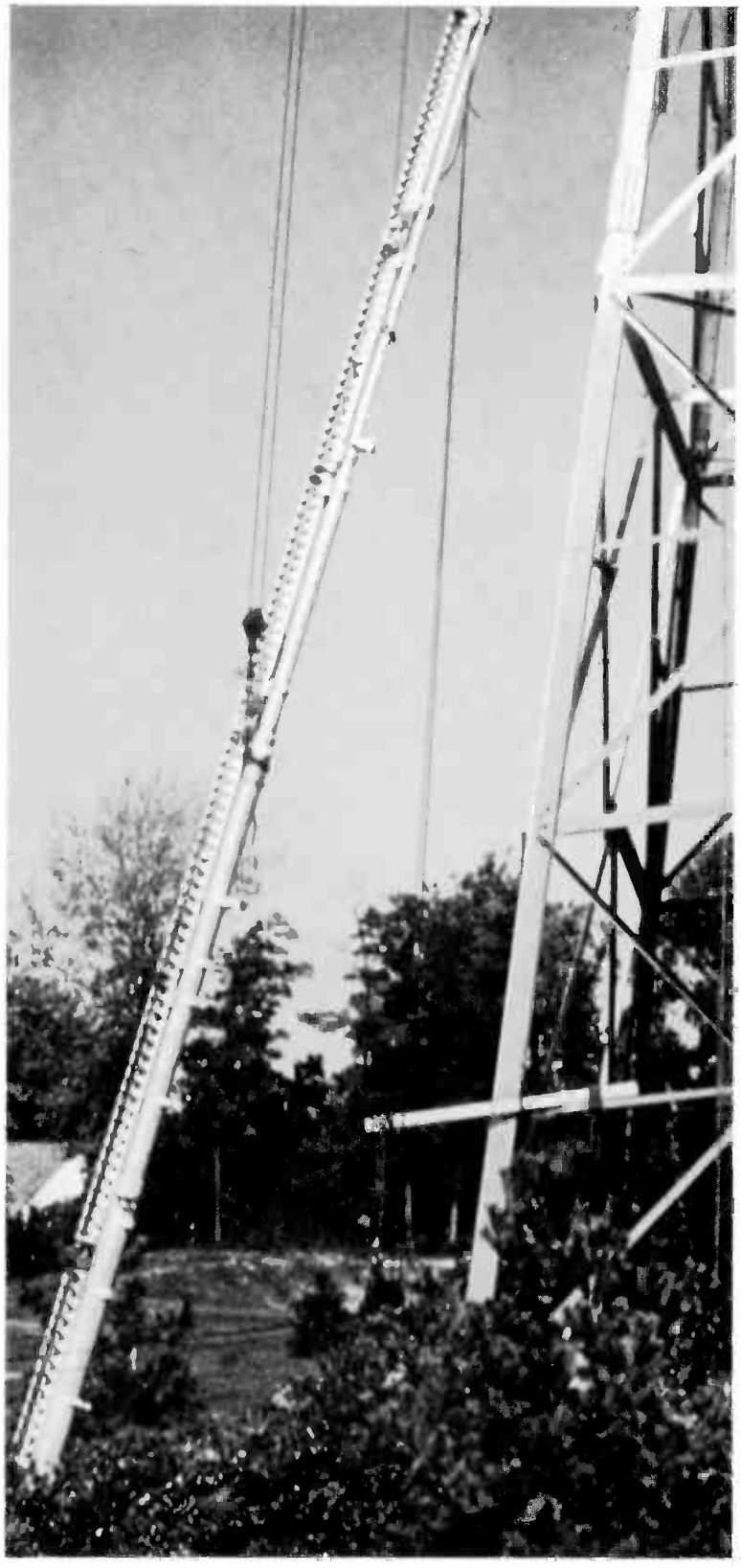
Outline Dimensions of the Type 1046 Antenna Bay


VERTICAL PATTERN, RELATIVE FIELD OF A
FOUR-BAY TYPE 1046 ANTENNA ARRAY
NO NULL FILL-IN
RELATIVE FIELD
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
0
0
5
10
15
20
ANGLE BELOW HORIZON - DEGREES
ALFORD MANUFACTURING
COMPANY, INC.
DWG. NO. A-1090-5008A


VERTICAL PATTERNS, RELATIVE FIELD, OF A FOUR-BAY TYPE 1046 ANTENNA ARRAY
NULL FILL-IN TYPE T
RELATIVE FIELD
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
0
0
5
10
15
20
ANGLE BELOW HORIZON-DEGREES
ALFORD MANUFACTURING COMPANY, INC.
DWG. NO. A-1090-5/04A


VERTICAL PATTERN RELATIVE FIELD OF A FOUR-BAY TYPE 1046 ANTENNA ARRAY
NULL FILL-IN TYPE
RELATIVE FIELD
ANGLE BELOW HORIZON-DEGREES
0
5
10
15
20
ALFORD MANUFACTURING COMPANY, INC.
DWG. NO. A-1090-6003A


VERTICAL PATTERN, RELATIVE FIELD, OF A
FOUR-BAY TYPE 1046 ANTENNA ARRAY
NULL FILL-IN TYPE III
RELATIVE FIELD
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
0
ANGLE BELOW PORIZON - DEGREES
0
5
10
15
20
ALFORD MANUFACTURING
COMPANY, INC.
DWG. NO. A-1090-5005A



STATION: WMAL-TV

CHANNEL: 7

LOCATION: Washington, D.C.

ANTENNA TYPE: AMCI 3½-Bay Type 1046 with a Special Type III Null Fill-in

ANTENNA GAIN: 13.5

DIPLEXER TYPE: AMCI Type 1042S

TRANSMITTER POWER: 25 kilowatts

ERP: 316 kilowatts

Picture taken during installation showing the antenna array and supporting mast just prior to being raised to the top of the tower.

TELEVISION BROADCAST TRANSMITTING ANTENNA
TYPE 1046
FOR CHANNELS 4, 5 AND 6

AMCI®

ALFORD *Manufacturing Co.*

299 ATLANTIC AVE., BOSTON, MASS.

FOREWORD TO ENGINEERING DATA

The Type 1046 Omnidirectional Television Transmitting Antenna is made in three additional sizes to cover Channels 4, 5 and 6 in the VHF Lower Band.

Type 1046-L is used for Channel 4

Type 1046-M is used for Channel 5

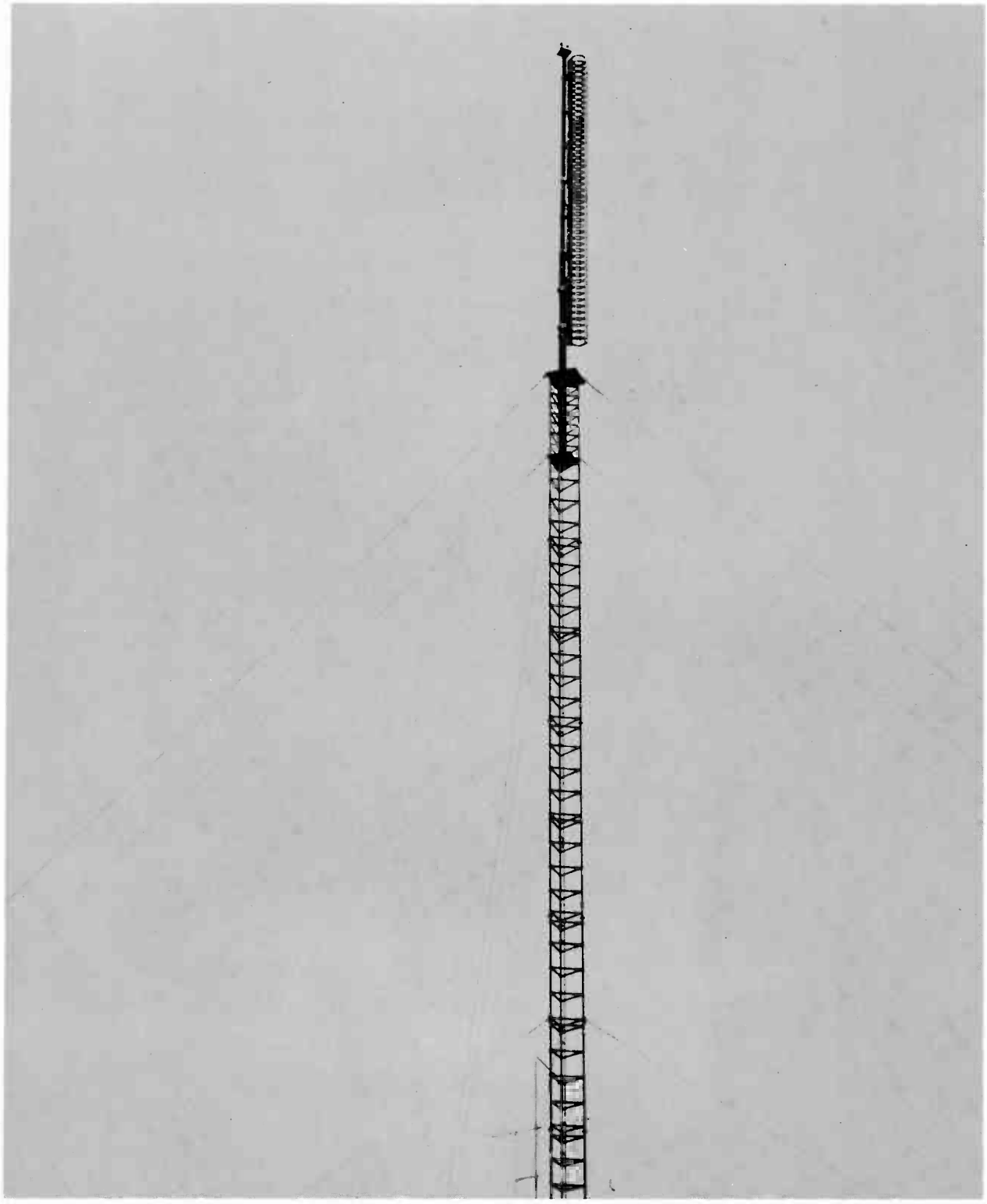
Type 1046-N is used for Channel 6

These Type 1046 VHF Lower Band Antennas are basically scaled versions of the Type 1046 VHF Upper Band Antennas (see previous pages) except for the use of an increased number of slotted rings per bay and a modified feeding arrangement internal to the individual bays which are required to obtain the increased relative bandwidth that is necessary for the lower band channels.

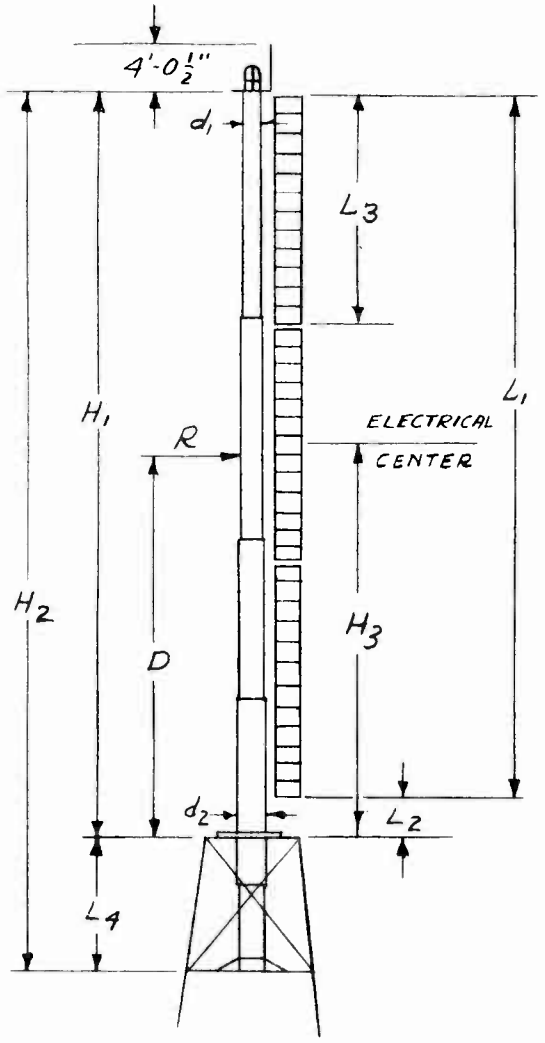
When several bays are stacked to give a higher gain, the bays are joined through the use of a rigid coaxial transmission line harness into a single feed line for the entire array. This type of feed provides an important economic advantage, particularly in the case of high towers, in that it requires only a single transmission line to be installed from the transmitter up the tower to the array.

Any one of the arrays listed on the following pages can be supplied with various degrees of null fill-in and/or beam tilt. There are three standard types of null fill-in which are known as Types I, II and III with Type III having the most complete null fill-in. As with all antenna arrays in general, the more the nulls are filled, the larger is the decrease in gain from that gain which the array has when there is no null fill-in. The gains, the calculated vertical patterns, based on measured half-bay patterns, and the locations of the corresponding centers of radiation of particular null-filled arrays for a particular channel are available on request.

Inquiries are invited for the engineering data on individual arrays not listed on the following pages.



A one-bay Type 1046-N Antenna Array after installation at Station CHEK-TV, Channel 6, Victoria, British Columbia.



ENGINEERING DATA FOR THREE-BAY TYPE 1046-N ANTENNA ARRAY FOR TELEVISION CHANNEL 6

MECHANICAL DATA WITH STANDARD MAST

H_1: 119 ft. 2 in.
H_2: 139 ft. 2 in.
H_3: 60 ft. 10-1/16 in. (no null fill-in)
L_1: 115 ft. 8-1/8 in.
L_2: 3 ft. 0 in.
L_3: 38 ft. 4-3/4 in.
L_4: 20 ft. 0 in.
d_1: 6-5/8 in.
d_2: 24 in.
D: 53 ft. 11 in.

Weight per bay: 1,100 lbs.
Total weight: 28,900 lbs.

Transmission Line Connection is 3 ft. 0 in. above the top of the tower. Specify flange desired.

Standard Mast Dwg.: D1046-60,300

REACTIONS WITH STANDARD MAST WITH NO ICE

	50/33.3 psf	30/20 psf
Shear (R):	12,000 lbs.	7,190 lbs.
Overturning Moment (RxD):	647,000 lb-ft.	388,000 lb-ft.
Twisting Moment:	10,400 lb-ft.	6,240 lb-ft.

Maximum Design Loading of Standard Mast: 50/33.3 pounds per square foot

ELECTRICAL DATA

Average Power Rating: 47 kw

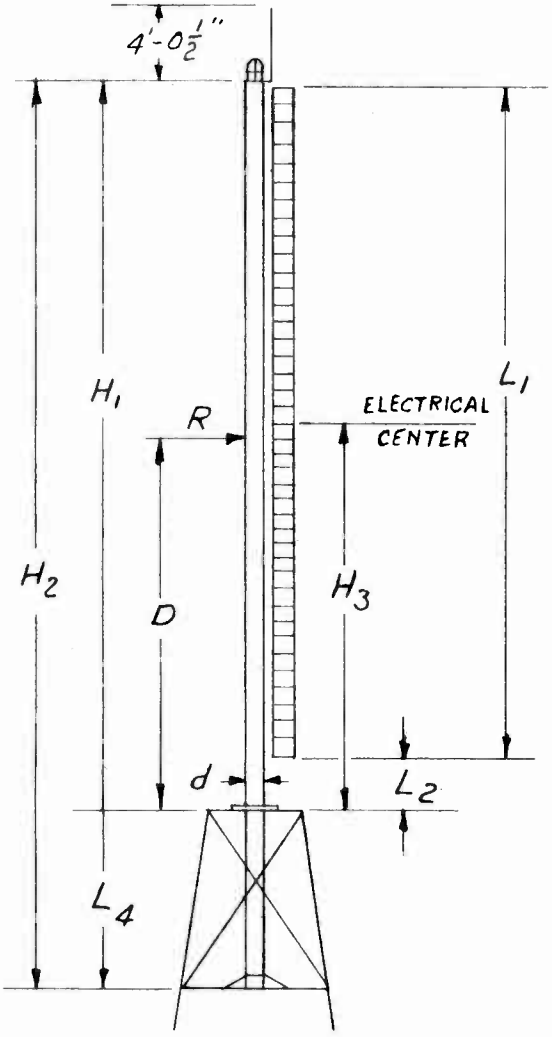
Horizontal Circularity: ± 2 Db

Input Impedance: 51.5 ohms

VSWR: 1.1 or better

Gain (with no null fill-in) at Visual Carrier: 11.7

Vertical Patterns: Dwg. A1090-5001, -5006 and -5007. Specify null fill-in and/or beam tilt desired.



ENGINEERING DATA FOR A ONE AND ONE-HALF BAY TYPE 1046-N ANTENNA ARRAY FOR TELEVISION CHANNEL 6

MECHANICAL DATA WITH STANDARD MAST

H_1:	61 ft. 5 in.	L_4:	11 ft. 6 in.
H_2:	72 ft. 11 in.	d_1:	6-5/8 in.
H_3:	32 ft. 0 in. (no null fill-in)	d_2:	14 in.
L_1:	57 ft. 8 in.	D:	29 ft. 0 in.
L_2:	3 ft. 0 in.	Weight per bay:	1,100 lbs.
		Total weight:	8,500 lbs.

Transmission Line Connection is 3 ft. 0 in. above the top of the tower. Specify flange desired.

Standard Mast Dwg.: D1046-301

REACTIONS WITH STANDARD MAST WITH NO ICE

	50/33.3 psf	30/20 psf
Shear (R):	5,100 lbs.	3,060 lbs.
Overturning Moment (RxD):	148,000 lb-ft.	88,800 lb-ft.
Twisting Moment:	4,520 lb-ft.	2,720 lb-ft.

Maximum Design Loading of Standard Mast: 50/33.3 pounds per square foot

ELECTRICAL DATA

Average Power Rating: 41 kw

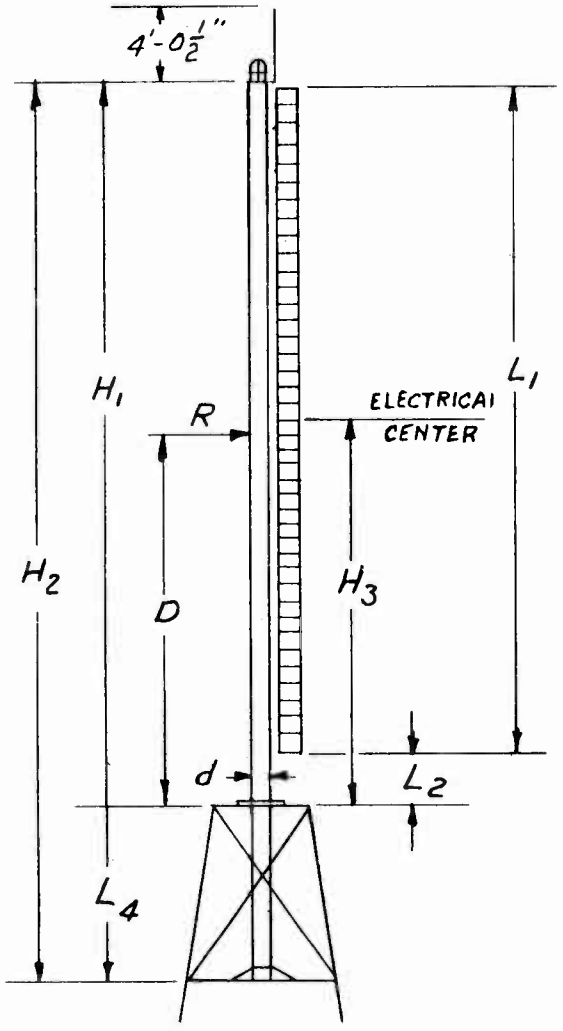
Horizontal Circularity: ± 2 Db

Input Impedance: 51.5 ohms

VSWR: 1.1 or better

Gain (with no null fill-in) at Visual Carrier: 5.9

Vertical Patterns: Specify null fill-in and/or beam tilt desired.



ENGINEERING DATA FOR A ONE AND ONE-QUARTER BAY TYPE 1046-N ANTENNA ARRAY FOR TELEVISION CHANNEL 6

MECHANICAL DATA WITH STANDARD MAST

H_1:	53 ft. 10 in.	L_4:	10 ft. 0 in.
H_2:	63 ft. 10 in. (no null fill-in)	d_1:	6-5/8 in.
H_3:	29 ft. 1-3/4 in.	d_2:	12-3/4 in.
L_1:	48 ft. 3-3/4 in.	D:	26 ft. 11 in.
L_2:	5 ft. 0 in.	Weight per bay:	1,100 lbs.
		Total Weight:	6,700 lbs.

Transmission Line Connection is 3 ft. 0 in. above the top of the tower. Specify flange desired.

Standard Mast Dwg.: D1046-302

REACTIONS WITH STANDARD MAST WITH NO ICE

	50/33.3 psf	30/20 psf
Shear (R):	4,140 lbs.	2,490 lbs.
Overturning Moment (RxD):	111,500 lb-ft.	66,900 lb-ft.
Twisting Moment:	4,260 lb-ft.	2,560 lb-ft.

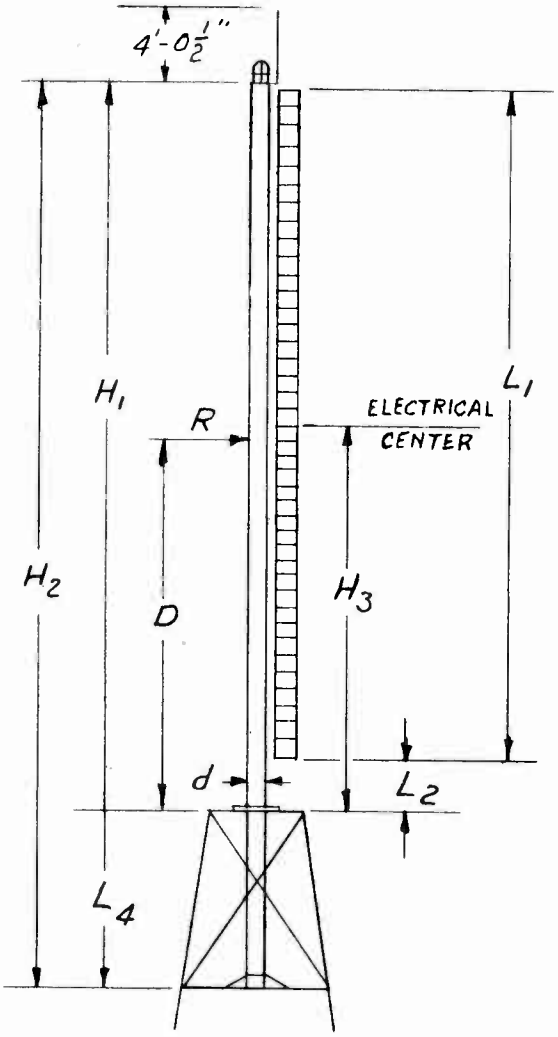
Maximum Design Loading of Standard Mast: 50/33.3 pounds per square foot

ELECTRICAL DATA

Average Power Rating:	35 kw
Horizontal Circularity:	± 2 Db
Input Impedance:	51.5 ohms
VSWR:	1.1 or better

Gain (with no null fill-in) at Visual Carrier: 5.0

Vertical Patterns: Specify null fill-in and/or beam tilt desired.



ENGINEERING DATA FOR A ONE-BAY TYPE 1046-N ANTENNA ARRAY FOR TELEVISION CHANNEL 6

MECHANICAL DATA WITH STANDARD MAST

H_1:	41 ft. 11 in.	L_4:	10 ft. 0 in.
H_2:	51 ft. 11 in.	d_1:	6-5/8 in.
H_3:	22 ft. 2-3/8 in. (no null fill-in)	d_2:	10-3/4 in.
L_1:	38 ft. 4-3/4 in.	D:	21 ft. 3-1/2 in.
L_2:	3 ft. 0 in.	Weight per bay:	1,100 lbs.
		Total Weight:	5,500 lbs.

Transmission Line Connection is 3 ft. 0 in. above the top of the tower. Specify flange desired.

Standard Mast Dwg.: D1046-60,303

REACTIONS WITH STANDARD MAST WITH NO ICE

	50/33.3 psf	30/20 psf
Shear (R):	3,080 lbs.	1,850 lbs.
Overturning Moment (RxD):	65,600 lb-ft.	39,400 lb-ft.
Twisting Moment:	3,410 lb-ft.	2,050 lb-ft.

Maximum Design Loading of Standard Mast: 50/33.3 pounds per square foot

ELECTRICAL DATA

Average Power Rating: 27.5 kw (38.5 kw with special input if required)

Horizontal Circularity: ± 2 Db

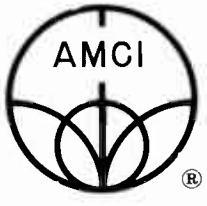
Input Impedance: 51.5 ohms

VSWR: 1.1 or better

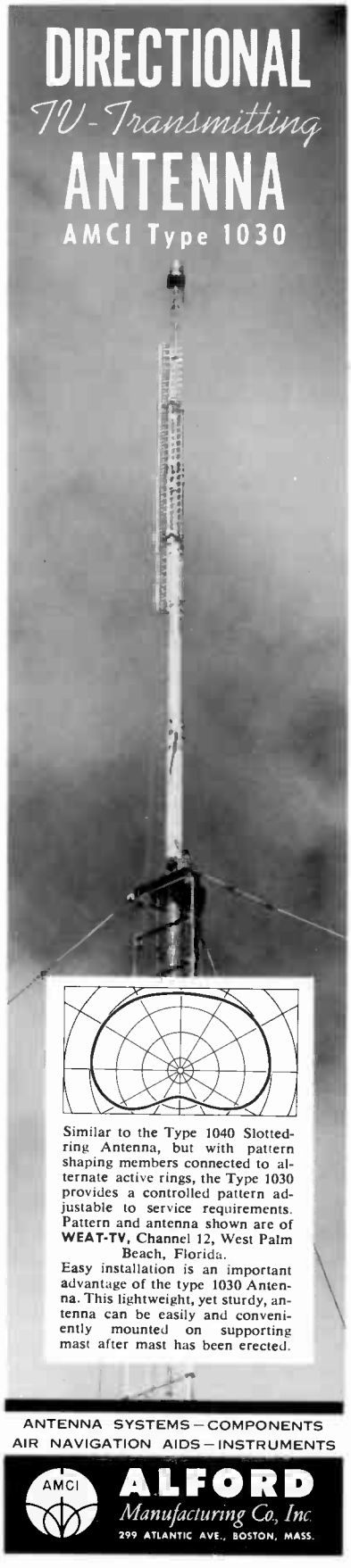
Gain (with no null fill-in) at Visual Carrier: 4.0

Vertical Patterns: Dwg. A1090-5015, -5016. Specify null fill-in and/or beam tilt desired.

TELEVISION BROADCAST TRANSMITTING ANTENNA
TYPE 1030 DIRECTIONAL
FOR CHANNELS 4 THROUGH 13



ALFORD *Manufacturing Co.*
299 ATLANTIC AVE., BOSTON, MASS.



DESCRIPTION

The Type 1030 Directional Antenna is a slotted ring antenna to which pattern shaping members have been added. There are two beam shaping members connected to each alternate active ring. The rings provided with beam shaping members act differently from simple rings in that a substantial portion of the current which normally flows in a ring is directed into the beam shaping members. The horizontal radiation pattern of a modified ring is determined by the shape and the length of the beam shaping members. The radiation pattern of each bay depends on the proportion of the modified loops, as well as on the configuration of the beam shaping members used.

The beam shaping members are not reflectors but are fed radiators just as the loops themselves are. When every alternate ring is modified the spacing between the successive modified rings is under one sixth of a wave length so that the combined effect of the modified rings is similar to that of a sheet rather than that of a stacked array.

Measurements show that the length of the beam shaping elements is not critical in the sense that an inch or two has a small effect on the pattern. The angle between the beam shaping elements has substantial effect on the shape of the pattern. Stabilizing members are therefore used to make sure that the angles between the beam shaping members remain fixed.

Figures 1, 2 and 3 show typical horizontal radiation patterns of several Type 1030 Antennas. These patterns are essentially circular except in one sector where they have a null or nulls approximately 10 decibels below the maximum.

Each bay of the Type 1030 Antenna is fed with teflon insulated 3-1/8 rigid coaxial transmission line.

The Type 1030 Antenna is intended to be used with a Type 1051, 1052 or 1053 Diplexing Filter, depending on the total power to be handled.

CONSTRUCTION

The principal materials used in the antenna are as follows: corrosion resistant aluminum alloys, brass, copper, bronze and stainless steel. Most of the screws and bolts are of stainless steel, the remainder are of silicon bronze. Seals are similar to those used on Type 1046 Antennas.

CHARACTERISTICS

Voltage Standing Wave Ratio: 1.1 or better

Gain: The Maximum power gain of a directional antenna depends not only on its vertical aperture but on the directivity of the horizontal pattern as well. The increase in gain which one achieves in certain directions as a result of this horizontal directivity allows a given ERP to be radiated with a fewer number of directional bays (i.e., a smaller vertical aperture) than with omnidirectional bays. The typical directional horizontal patterns which are shown on the following pages have maximum gains which vary from approximately 5.6 to 7.2 per bay, depending on the pattern chosen, as compared with an RMS or omnidirectional gain of approximately 4.0 per bay.

Horizontal Pattern: Typical horizontal patterns are shown in Figures 1, 2 and 3. Because of the relative ease of achieving a variety of horizontal patterns with the Type 1030 Directional Antennas, inquiries are invited for particular locations where special horizontal patterns are desired.

Power Handling Capacity: The average power handling capacity of each Type 1030 bay is normally 31 kilowatts for the high band channels and 27 kilowatts for the lower band channels. If a 3 1/8 inch coaxial transmission line is used as the main feed line of a multi-bay array, then the average power rating of the array will also be 31 kilowatts for the high band channels and 47 kilowatts for the lower band channels. In those high band cases where the bay or the array is to be operated with a 50 kilowatt transmitter, a special 4 1/8 inch diameter line, manufactured by this company and with the proper adapters to match a

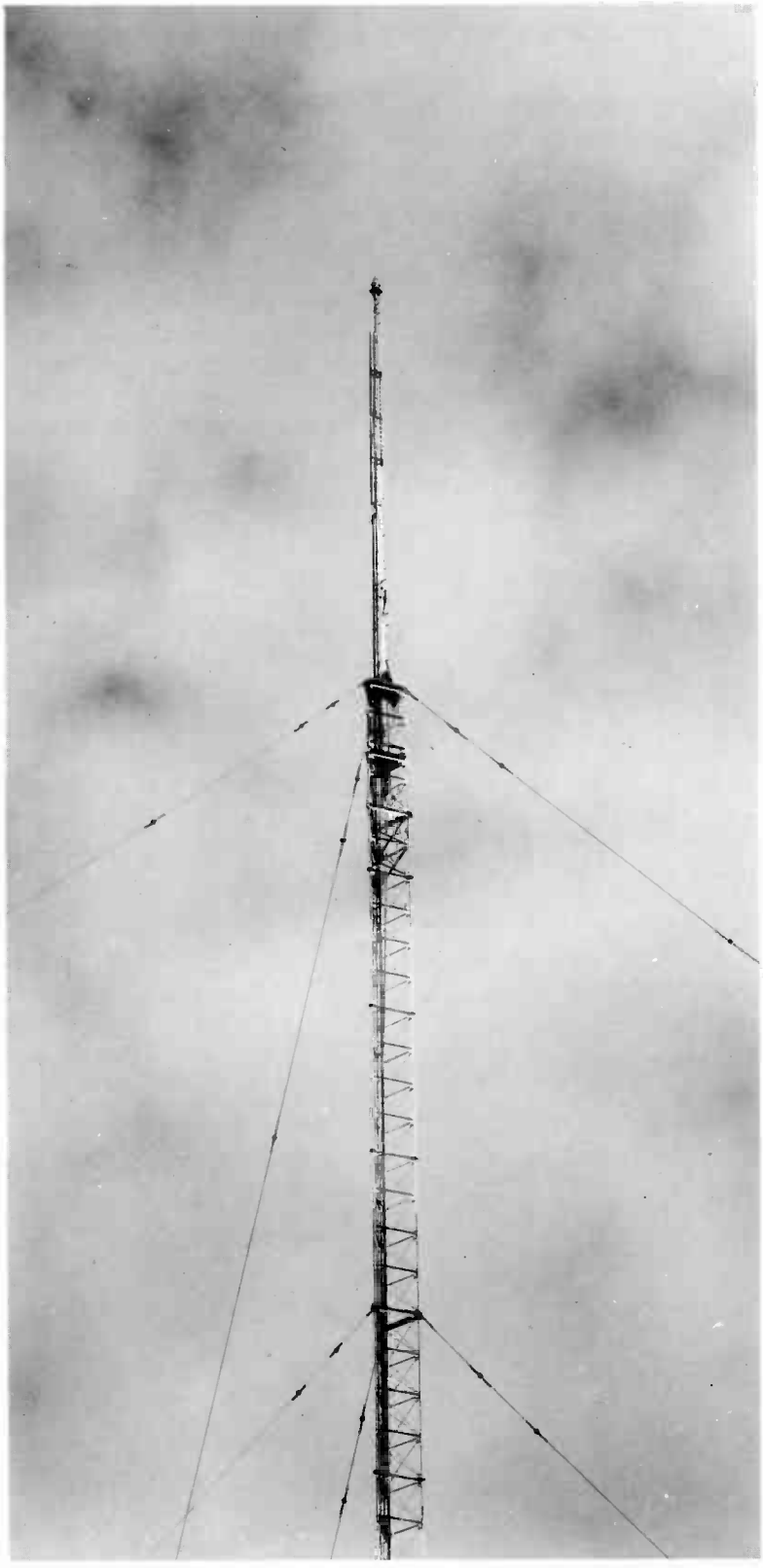
6 1/8 inch diameter line at the input, is used as the main feed line. For special installations requiring even higher power, a 6 1/8 inch diameter feed line can be used.

Weight:

Average weight per bay over the high band channels is approximately 400 lbs. Over the low band channels the average weight per bay is 1500 lbs.

Engineering Data:

Because the mechanical and electrical characteristics vary with the particular directional pattern desired, engineering data sheets for these directional arrays are not contained herein. Inquiries are invited however for the engineering data on any particular directional array.



STATION: WEAT–TV

CHANNEL: 12

LOCATION: West Palm Beach, Florida

ANTENNA TYPE: AMCI Two-Bay Type 1030 Directional

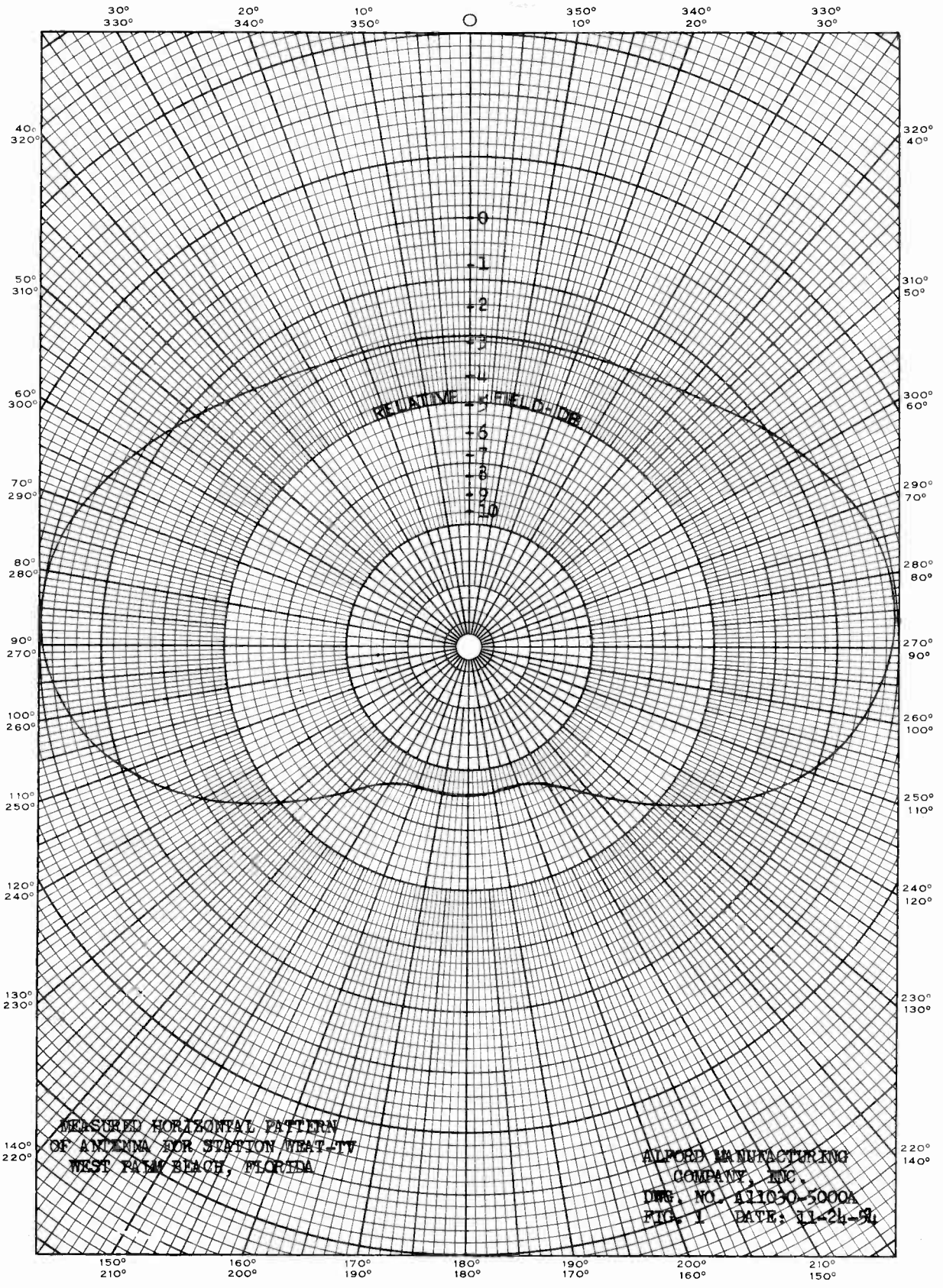
ANTENNA GAIN: 13.8 maximum

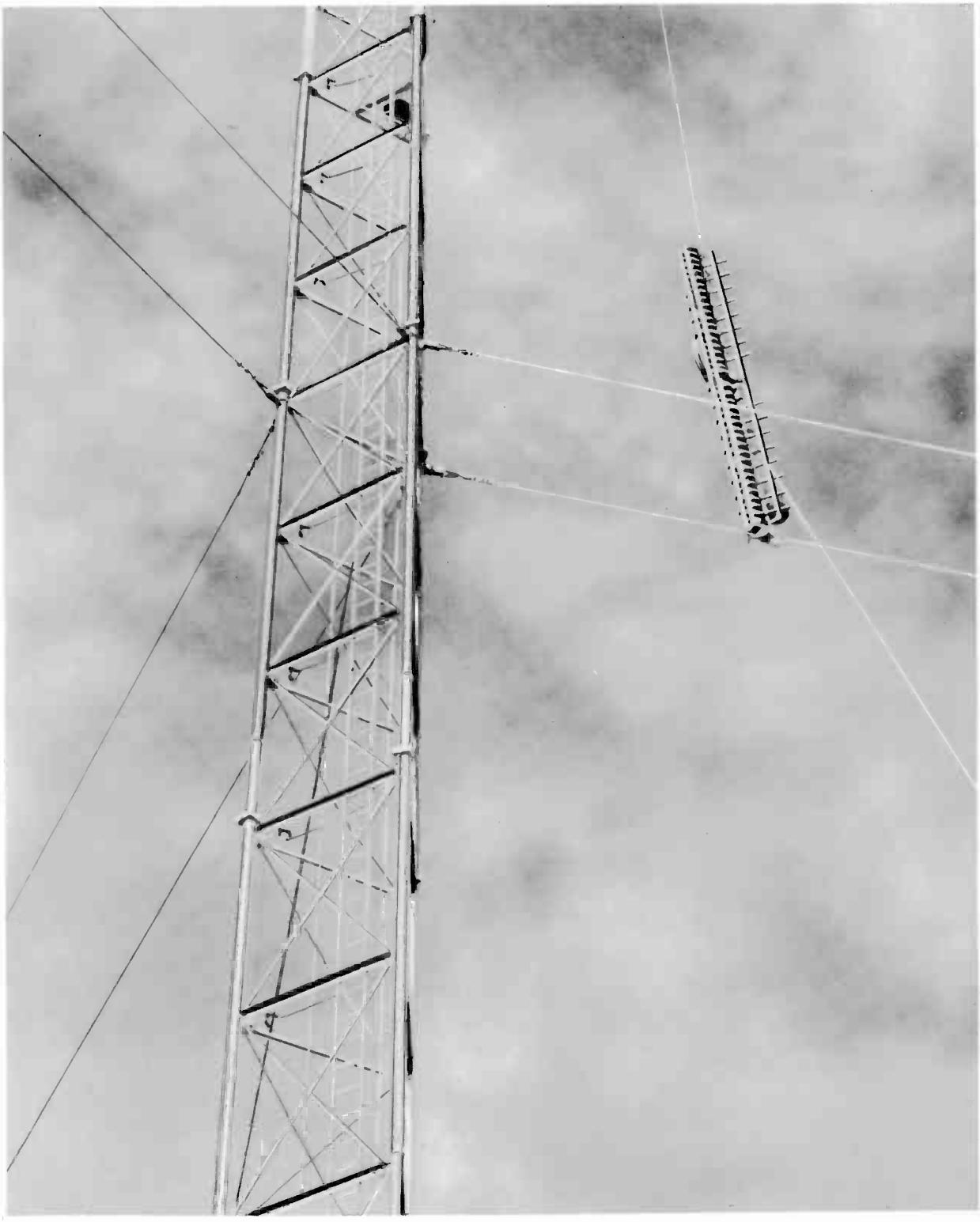
DIPLEXER TYPE: AMCI Type 1042

TRANSMITTER POWER: 10 kilowatts

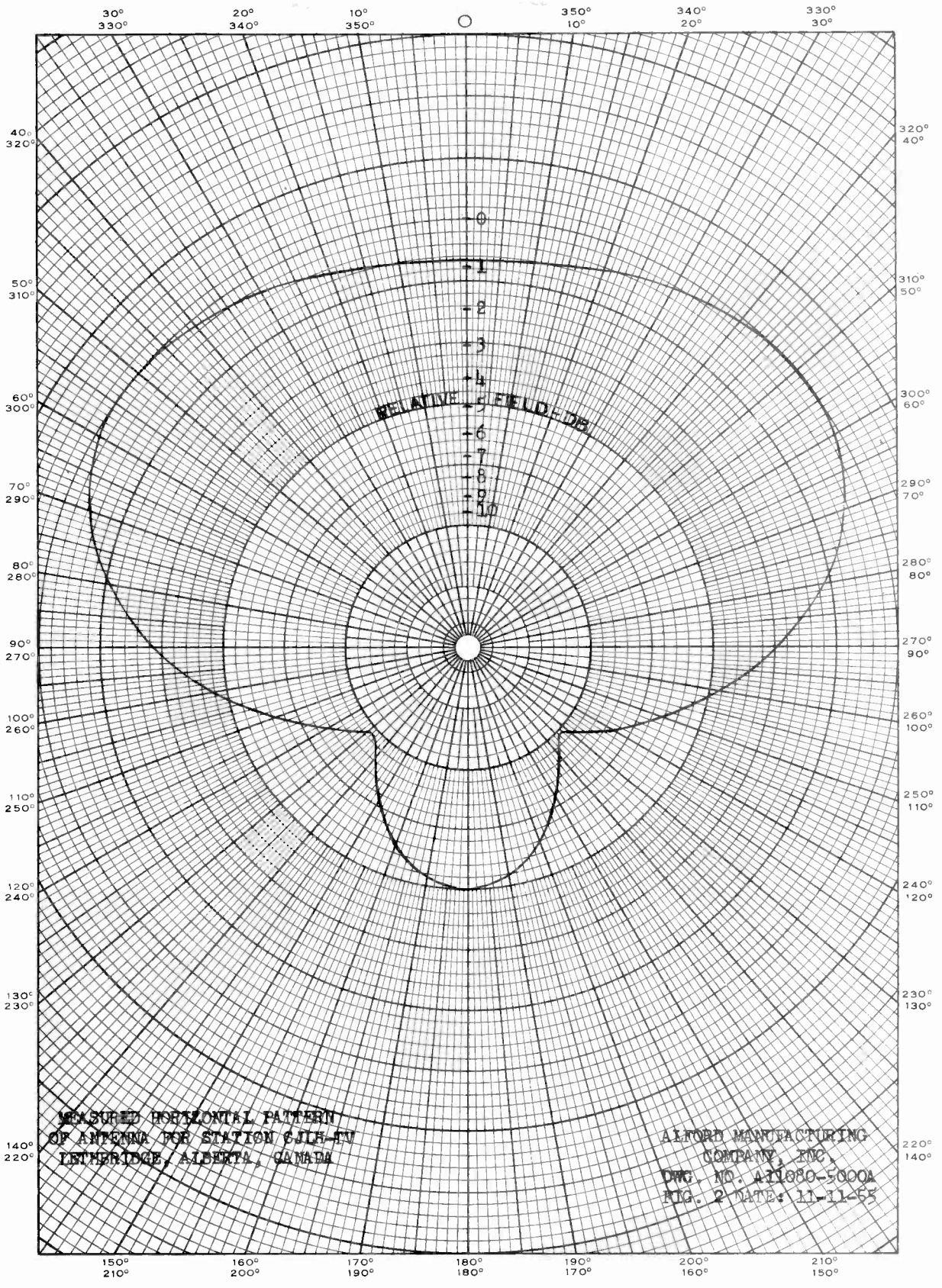
ERP: 112 kilowatts maximum

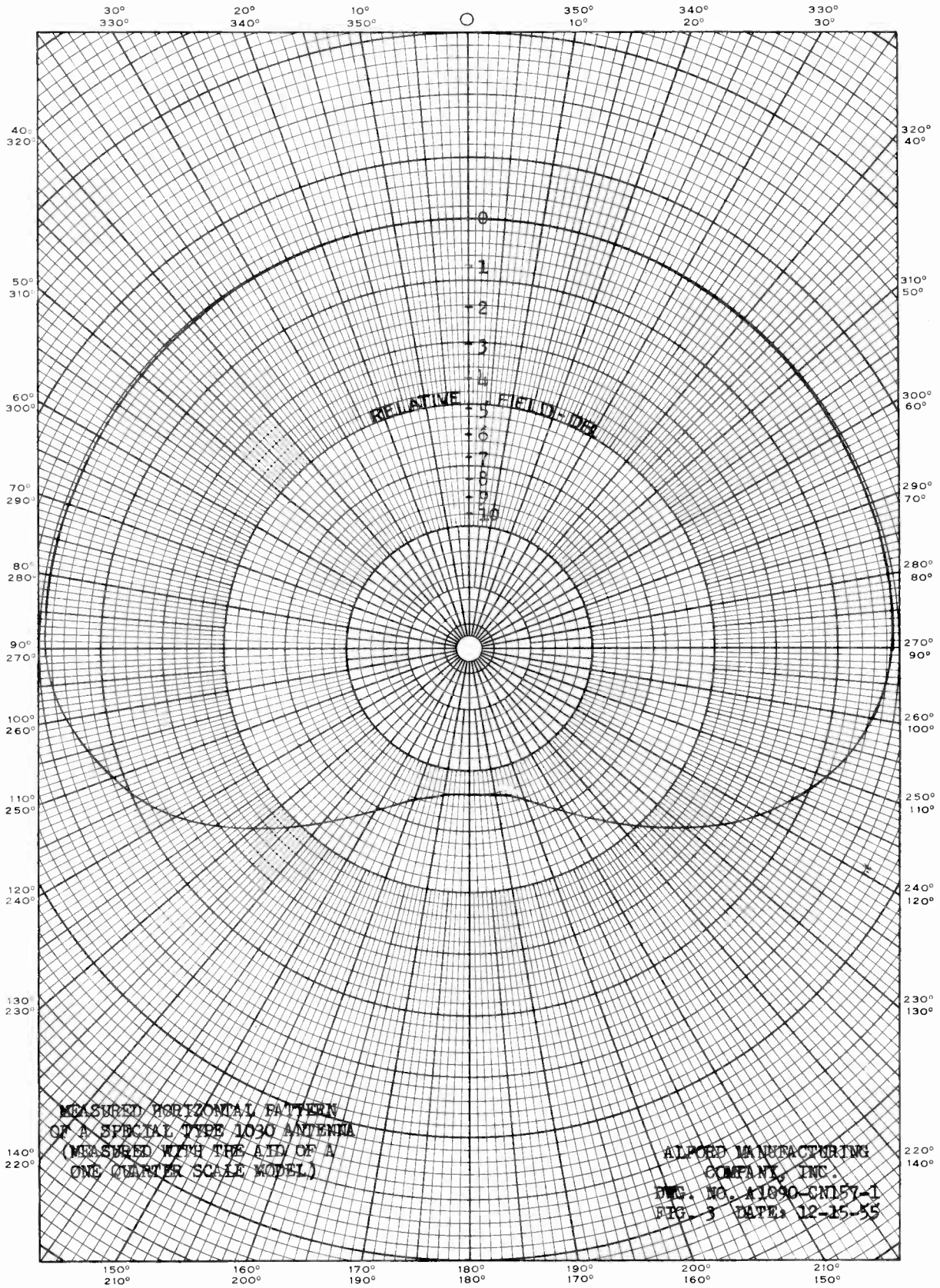
(The tower shown is also a part of the three tower AM Directional Antenna Array of Station WEAT.)


30° 330°
20° 340°
10° 350°
0
350° 10°
340° 20°
330° 30°
40° 320°
50° 310°
60° 300°
70° 290°
80° 280°
90° 270°
100° 260°
110° 250°
120° 240°
130° 230°
140° 220°
150° 210°
160° 200°
170° 190°
180° 180°
190° 170°
200° 160°
210° 150°
320° 40°
310° 50°
300° 60°
290° 70°
280° 80°
270° 90°
260° 100°
250° 110°
240° 120°
230° 130°
220° 140°
RELATIVE FIELD-DB
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
MEASURED HORIZONTAL PATTERN
OF ANTENNA FOR STATION WEAT-TV
WEST PALM BEACH, FLORIDA
ALFORD MANUFACTURING
COMPANY, INC.
DWG. NO. A21030-5000A
FIG. 1 DATE: 11-24-54



Shown above is a portion of a Three-Bay Type 1030S Directional Antenna Array with Type II Null Fill-in during its installation at Station CJLH–TV, Channel 7, in Lethbridge, Alberta, Canada. The maximum gain of the array is 20.8. The picture shows one of the directional bays being raised to the top of the tower.


30° 330°
20° 340°
10° 350°
350° 10°
340° 20°
330° 30°
40° 320°
50° 310°
60° 300°
70° 290°
80° 280°
90° 270°
100° 260°
110° 250°
120° 240°
130° 230°
140° 220°
320° 40°
310° 50°
300° 60°
290° 70°
280° 80°
270° 90°
260° 100°
250° 110°
240° 120°
230° 130°
220° 140°
150° 210°
160° 200°
170° 190°
180° 180°
190° 170°
200° 160°
210° 150°
0
1
2
3
4
5
6
7
8
9
10
RELATIVE FIELD DB
MEASURED HORIZONTAL PATTERN
OF ANTENNA FOR STATION CJLH-TV
LETHBRIDGE, ALBERTA, CANADA
ALFORD MANUFACTURING
COMPANY, INC.
DWG. NO. A11080-5000A
FIG. 2 DATE: 11-11-65


30° 330°
20° 340°
10° 350°
350° 10°
340° 20°
330° 30°
40° 320°
320° 40°
50° 310°
310° 50°
60° 300°
300° 60°
70° 290°
290° 70°
80° 280°
280° 80°
90° 270°
270° 90°
100° 260°
260° 100°
110° 250°
250° 110°
120° 240°
240° 120°
130° 230°
230° 130°
140° 220°
220° 140°
150° 210°
160° 200°
170° 190°
180° 180°
190° 170°
200° 160°
210° 150°
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
RELATIVE FIELD - DB
MEASURED HORIZONTAL PATTERN
OF A SPECIAL TYPE 1030 ANTENNA
(MEASURED WITH THE AID OF A
ONE QUARTER SCALE MODEL)
ALFORD MANUFACTURING
COMPANY, INC.
DWG. NO. A1090-CN157-1
FIG. 3 DATE: 12-15-55

STATION: KFRE-TV

CHANNEL: 12

LOCATION: Fresno, California

ANTENNA TYPE: AMCI Three-Bay Type 1030F-R Directional

ANTENNA GAIN: 17.3 maximum

DIPLEXER TYPE: AMCI Type 1052

TRANSMITTER POWER: 20 kilowatts

ERP: 316 kilowatts maximum

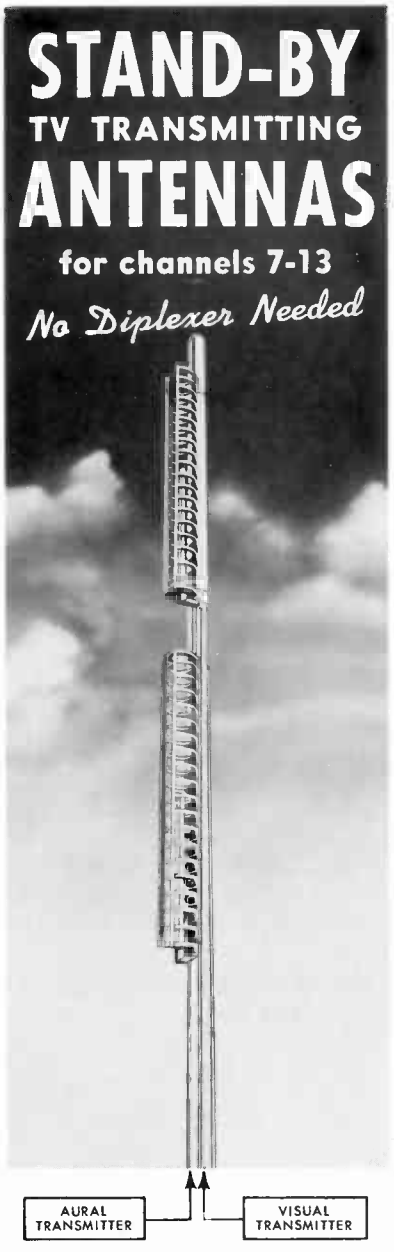
Picture taken during installation showing the antenna array and supporting mast being raised to the top of the tower.

TELEVISION BROADCAST TRANSMITTING ANTENNA
TYPE 1020 STANDBY
FOR CHANNELS 7 THROUGH 13

AMCI®

ALFORD *Manufacturing Co.*

299 ATLANTIC AVE., BOSTON, MASS.



A simple, versatile and economical system consisting of two separate bays of type 1020 slotted-ring antenna can be used with a 50 kw transmitter. No diplexer of any kind is needed. The aural and visual transmission lines need not be of equal lengths.

ANTENNA SYSTEMS – COMPONENTS
AIR NAVIGATION AIDS – INSTRUMENTS

AMCI ALFORD *Manufacturing Co, Inc.*
299 ATLANTIC AVE., BOSTON, MASS.

DESCRIPTION

Two bays of the Type 1020 Standby Antenna make a simple and versatile standby system. No diplexer of any kind is required when the visual transmitter is connected to one of the two bays while the aural transmitter is connected to the other bay as shown at left. This arrangement is made possible by the fact that the signal induced in the lower antenna by the upper antenna (or vice versa) is more than 30 db below the level of the signal in the inducing antenna.

When fed with two separate 3-1/8 inch teflon insulated coaxial transmission lines, the two-bay Type 1020 Standby Antenna may be used with a 50 Kw transmitter.

When two bays are used as independent antennas (without diplexer) the two transmission lines need not be of equal lengths.

In those installations where a diplexer with a single line output such as the AMCI Types 1051, 1052 or 1053 is available, a single Type 1020 Standby Antenna Bay may be used. When fed with a single 3-1/8 inch coaxial transmission line, the antenna may be used with a 25 Kw transmitter. For use with a 50 Kw transmitter, the antenna bay may be supplied with a special 6-1/8 inch coaxial transmission line input.

The power gain of a single Type 1020 Standby Antenna Bay is 2.0. Each bay weighs approximately 175 pounds and is therefore easily installed.

The Type 1020 antennas can be supplied with or without de-icing heaters. Heater power per Type 1020 bay is 2.75 Kw.

The standby antennas may be installed on a variety of supports as illustrated by the following examples:

Example 1. The support may be a tubular round mast of any diameter under about two feet. The two antennas are preferably installed one below the other as illustrated at left. The radiation patterns are omnidirectional, the exact shape depending on the diameter of the mast as shown in Figure 3.

Example 2. The support may be an existing FM antenna of the slotted cylinder type. See Figure 1. The type of radiation pattern which

may be obtained in this case on Channel 8 is shown in Figure 4. If it is expected that the FM and the TV standbys are to be operated simultaneously it is suggested that the drawing of the exact arrangement and the frequency of the FM channel be submitted to this company before ordering.

Example 3. In some cases the arrangement of steel members in a tower is such that a satisfactory pattern may be obtained by mounting the standby antennas on a leg of the tower. See Figure 2. The type of radiation pattern which may be expected is best determined in a particular case by making a model measurement of the pertinent portion of the tower. This company maintains antenna models for such purposes.

CHARACTERISTICS

Voltage standing wave ratio	1.1 or less
Power handling capacity of the standby system	50 Kw
Average power gain of Type 1020 bay	2.0
Circularity when the antennas are mounted on a cylindrical mast	See Figure 3
Outline dimensions	See Figure 5
Weight	Approx. 175 lbs. per bay
Shear force exerted by a Type 1020 bay with a wind pressure of 50 pounds per square foot on projected flat surfaces, not covered with ice	Type 1020-P (Channels 7 or 8): 260 lbs. Type 1020-Q (Channels 9 or 10): 240 lbs. Type 1020-R (Channels 11, 12, or 13): 220 lbs.

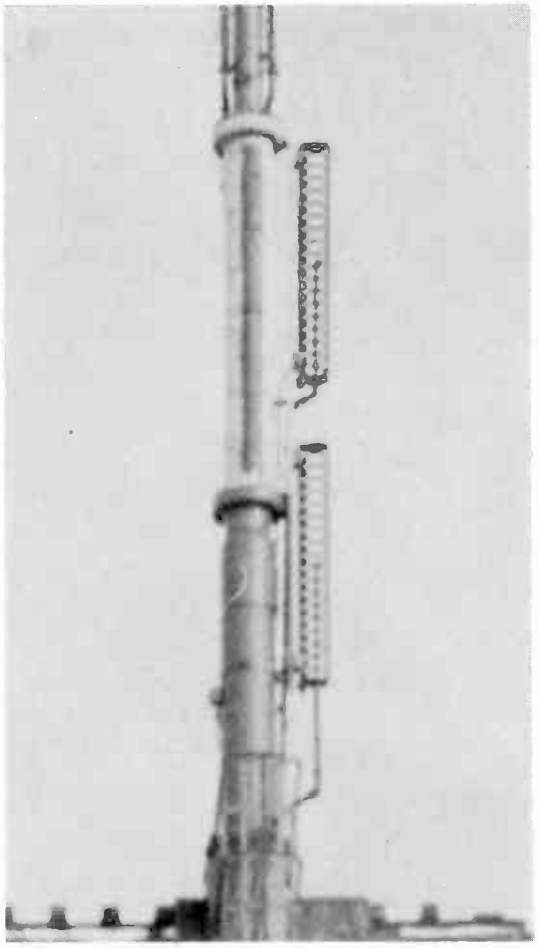


Figure 1

Shown at left is a two-bay Type 1020-P Standby Antenna Array mounted on an FM Pylon by Station WBKB-TV, Channel 7, Chicago, Illinois.

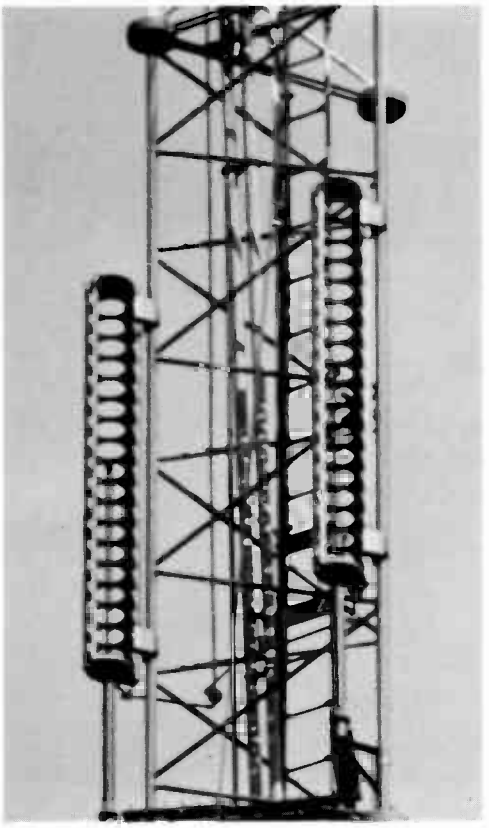


Figure 2

Shown at right is a two-bay Type 1020-P Standby Antenna Array mounted on the legs of a tower by Station WXYZ-TV, Channel 7, Detroit, Michigan.

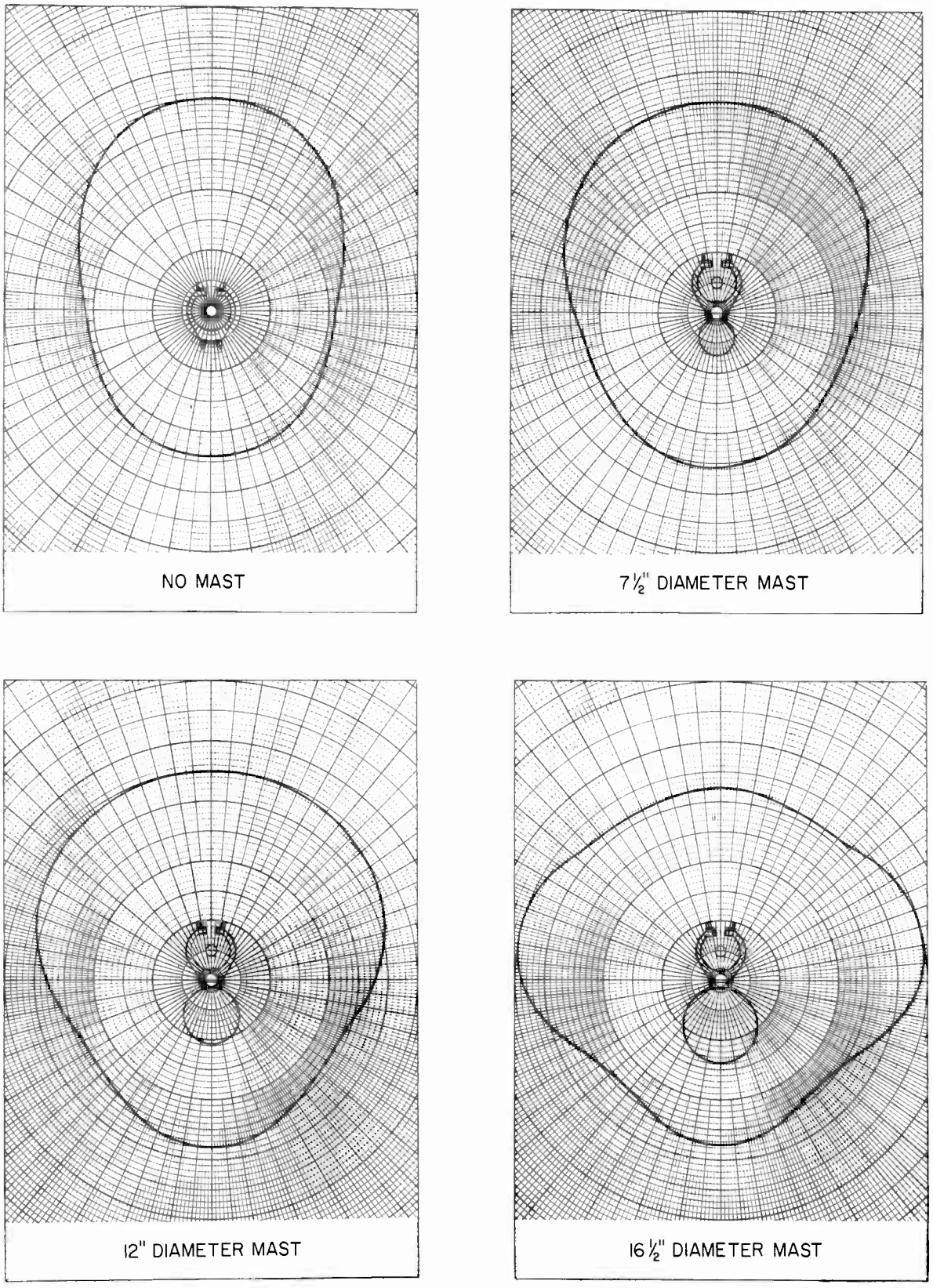
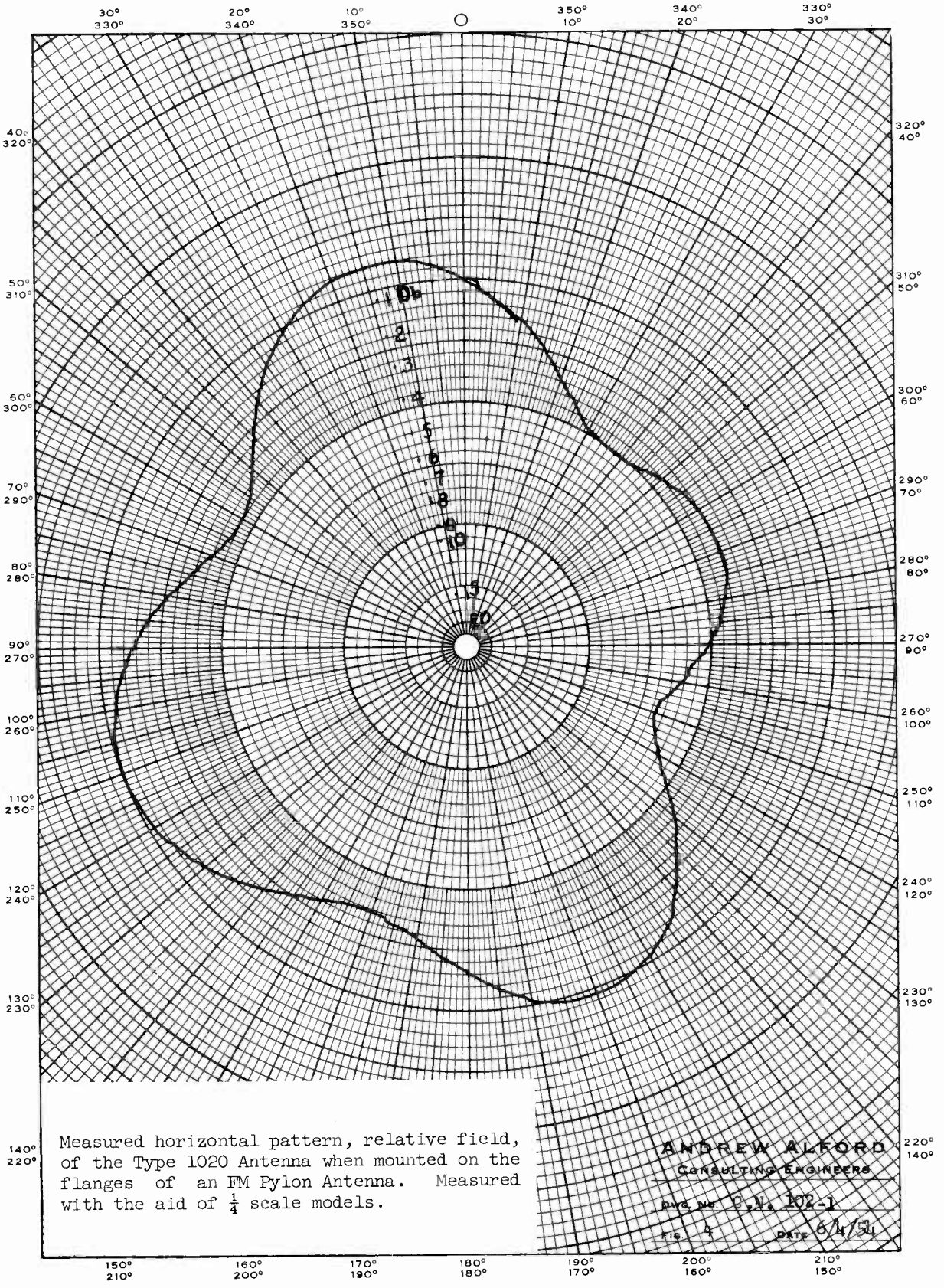
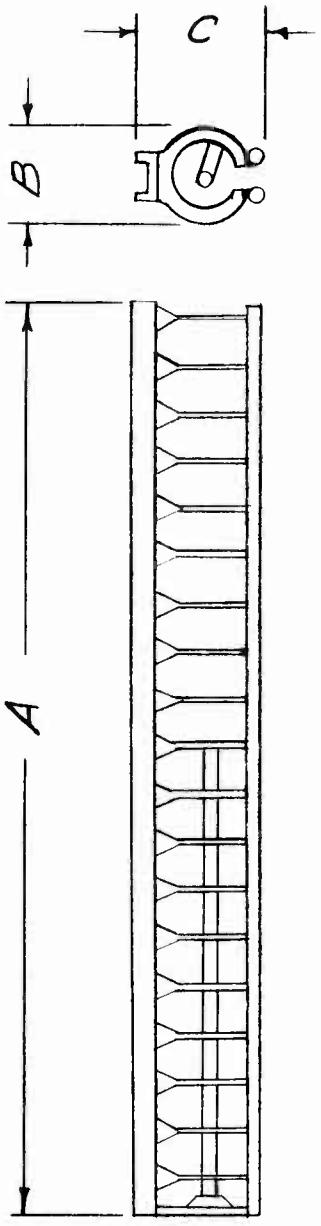


Figure 3. Horizontal Patterns, Relative Field



Measured horizontal pattern, relative field, of the Type 1020 Antenna when mounted on the flanges of an FM Pylon Antenna. Measured with the aid of $\frac{1}{4}$ scale models.



TYPE	CHANNELS	A	B	C
1020-P	7 & 8	8'-11 61/64"	11 1/8"	13 29/64"
1020-Q	9 & 10	8'-5 29/64"	10 7/16"	12 47/64"
1020-R	11, 12 & 13	7'-10 17/64"	9 43/64"	12 1/64"

Figure 5. Outline Dimensions of the Type 1020 Standby Antenna Bay

DIPLEXING FILTER
TYPES 1051, 1052 AND 1053
FOR CHANNELS 2 THROUGH 13

AMCI®

ALFORD *Manufacturing Co.*

299 ATLANTIC AVE., BOSTON, MASS.

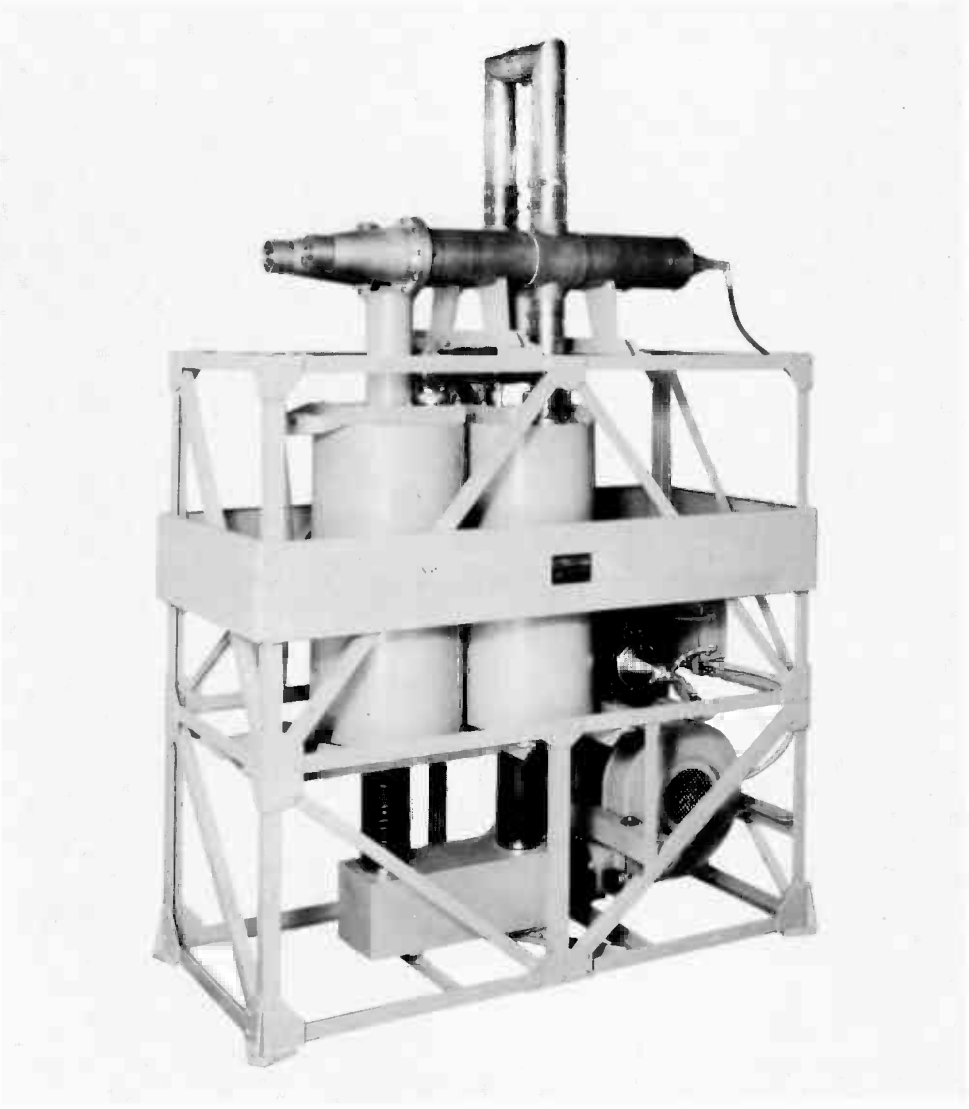
DIPLEXING FILTER

TYPES 1051, 1052 and 1053
for

VHF Television Broadcast Transmission
Channels 2 through 13

DESCRIPTION

The Types 1051, 1052 and 1053 Diplexing Filters are three-terminal networks designed for VHF television transmitting service, black-and-white or color. These networks are intended for use in those cases where the visual and the aural signals are to be transmitted to the antenna through one common feeder.



Type 1052 Diplexing Filter, Channel 12

Each of these diplexing filters is mounted in a single self-contained frame. The filters have two coaxial inputs; one for connection to the visual transmitter and another to the aural transmitter. There is only one output for connection to the antenna. The isolation between the visual and the aural inputs at both the visual and aural carrier frequencies is over 30 db.

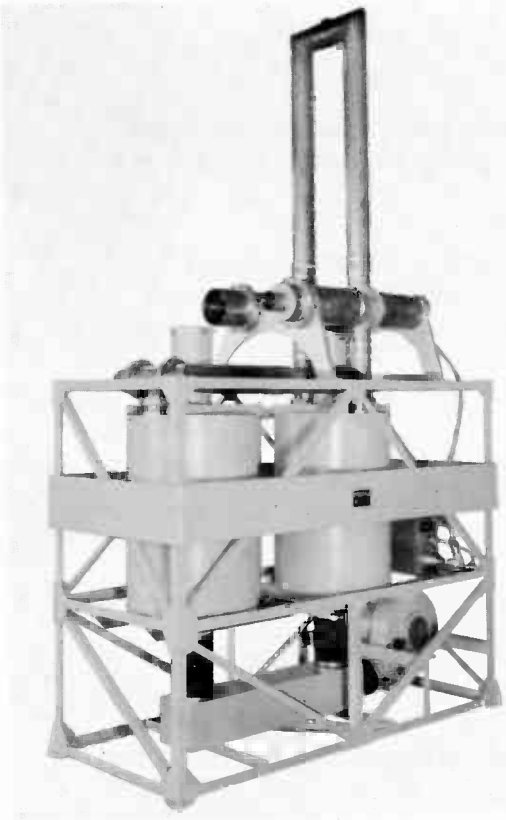
The input voltage standing wave ratio as measured at either input is essentially constant over the entire six megacycle channel.

Because the relative envelope phase delay introduced varies sufficiently slowly with the frequency to be compensated by a relatively simple delay equalizing network (not supplied as a part of the diplexing filter) in the video circuit and because all other characteristics are well within the minimum specifications set up by the FCC, any of these diplexing filters may be used for color transmission.

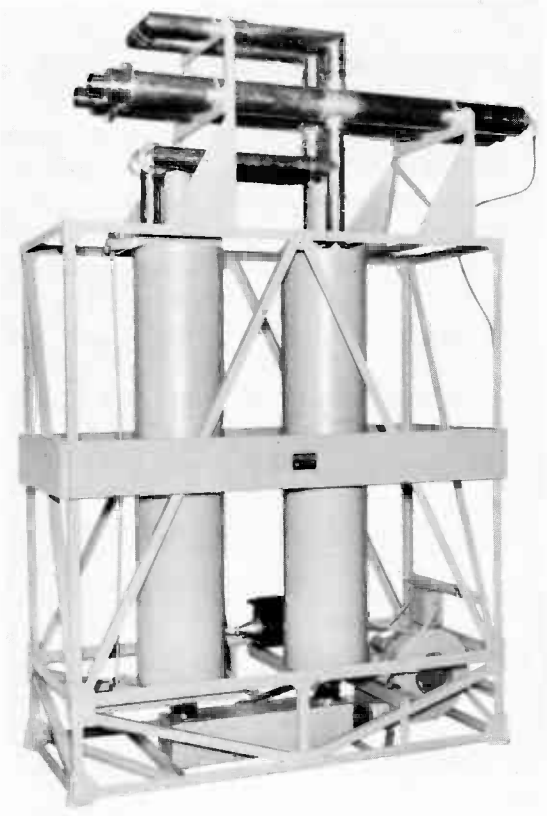
The Type 1051 Diplexing Filter is intended for use with 10 kw peak visual power transmitters, the Type 1052 for use with 25 kw peak visual power transmitters, and the Type 1053 for use with 50 kw peak visual power transmitters.

The insertion loss introduced by these diplexing filters at the visual and aural carrier frequencies of the various channels is given below:

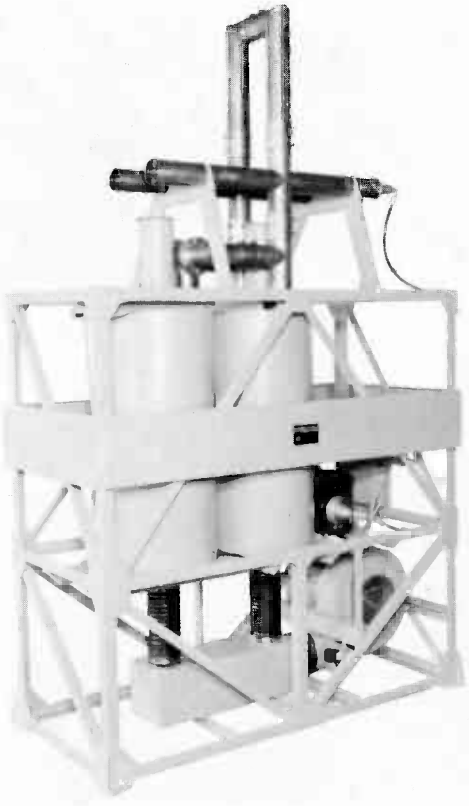
Channel	Types 1051 and 1052		Type 1053	
	Visual Carrier	Aural Carrier	Visual Carrier	Aural Carrier
2	.05 db	.27 db	.05 db	.21 db
3	.05	.28	.05	.22
4	.05	.29	.05	.23
5	.05	.31	.05	.24
6	.05	.32	.05	.25
7	.05	.50	.05	.37
8	.05	.51	.05	.38
9	.05	.52	.05	.38
10	.05	.53	.05	.39
11	.05	.54	.05	.40
12	.05	.55	.05	.41
13	.05	.56	.05	.42



Type 1053 Diplexing Filter, Channel 11



Type 1052 Diplexing Filter, Channel 6



Type 1051 Diplexing Filter, Channel 8

TYPICAL MEASURED CHARACTERISTICS:

(1) Visual Channel Input Impedance: Essentially constant impedance over the entire six megacycle channel. The VSWR throughout the visual portion of the channel is 1.05 or less..... Figure 1

(2) Aural Channel Input Impedance: Essentially constant impedance over the entire six megacycle channel. The VSWR throughout the aural portion of the channel is 1.10 or less..... Figure 2

(3) Visual-to-Aural Rejection: Over 30 db at the visual carrier..... Figure 3

(4) Aural-to-Visual Rejection: Over 30 db at the aural carrier..... Figure 4

(5) Visual Channel Amplitude Response ..... Figure 5

(6) Aural Channel Amplitude Response: ..... Figure 6

(7) Relative Envelope Phase Delay in Visual Channel: Approximately 0.15 microseconds at a modulating frequency of 4.18 mc..... Figure 7

(The above characteristics were measured on a Type 1052 Channel 12 Diplexing Filter.)

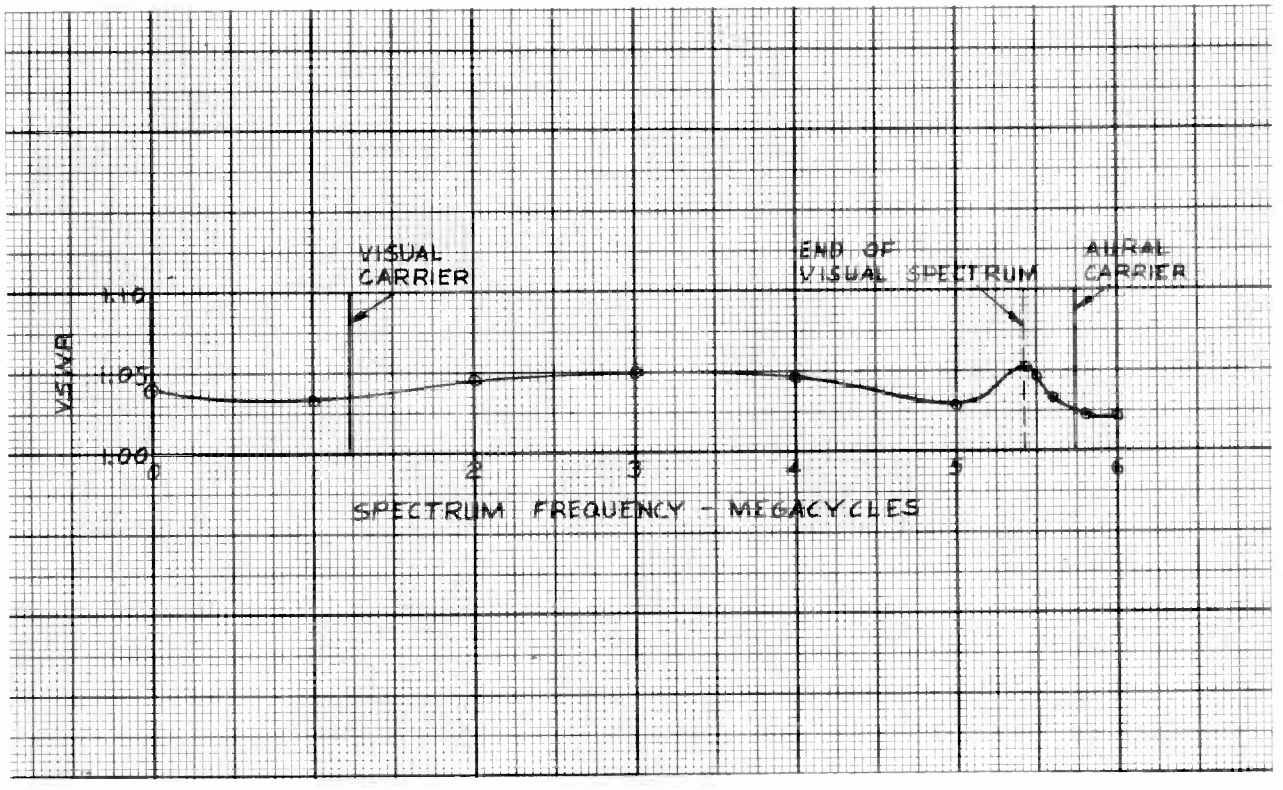


Figure 1. Visual Channel Input Voltage Standing Wave Ratio

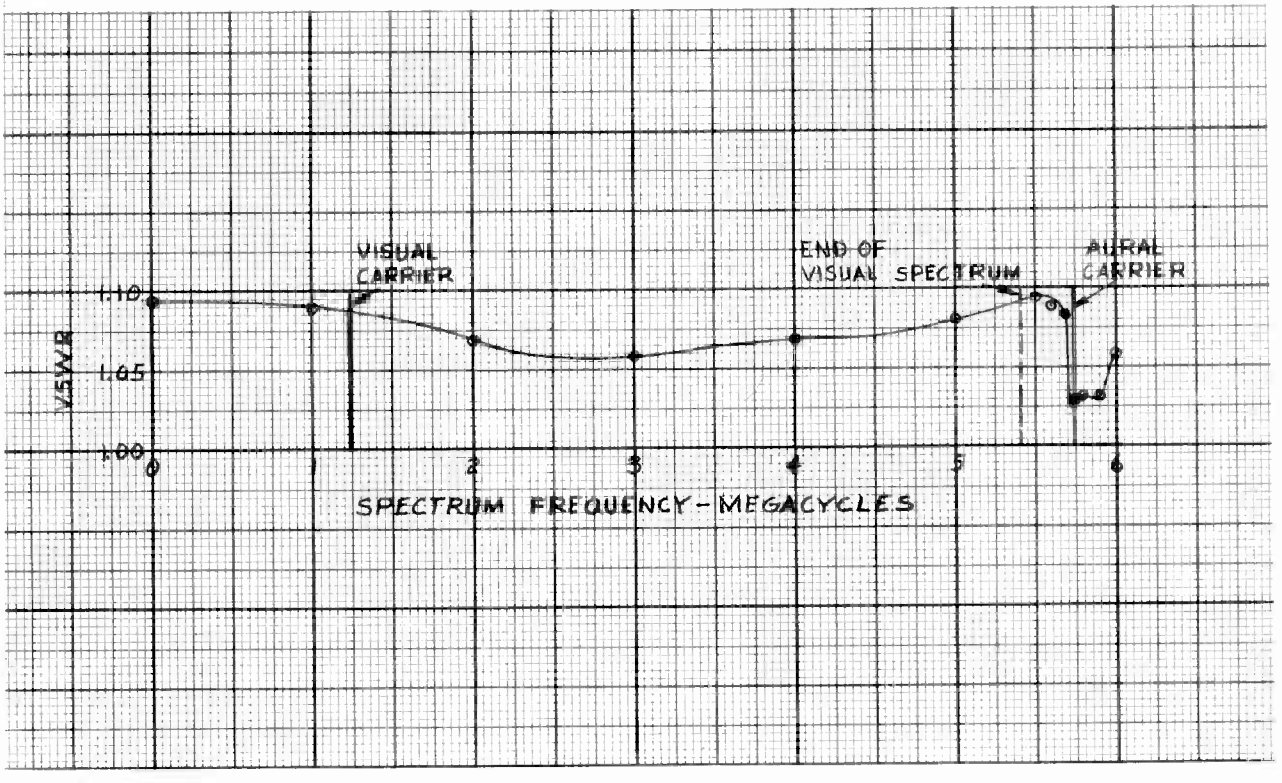


Figure 2. Aural Channel Input Voltage Standing Wave Ratio

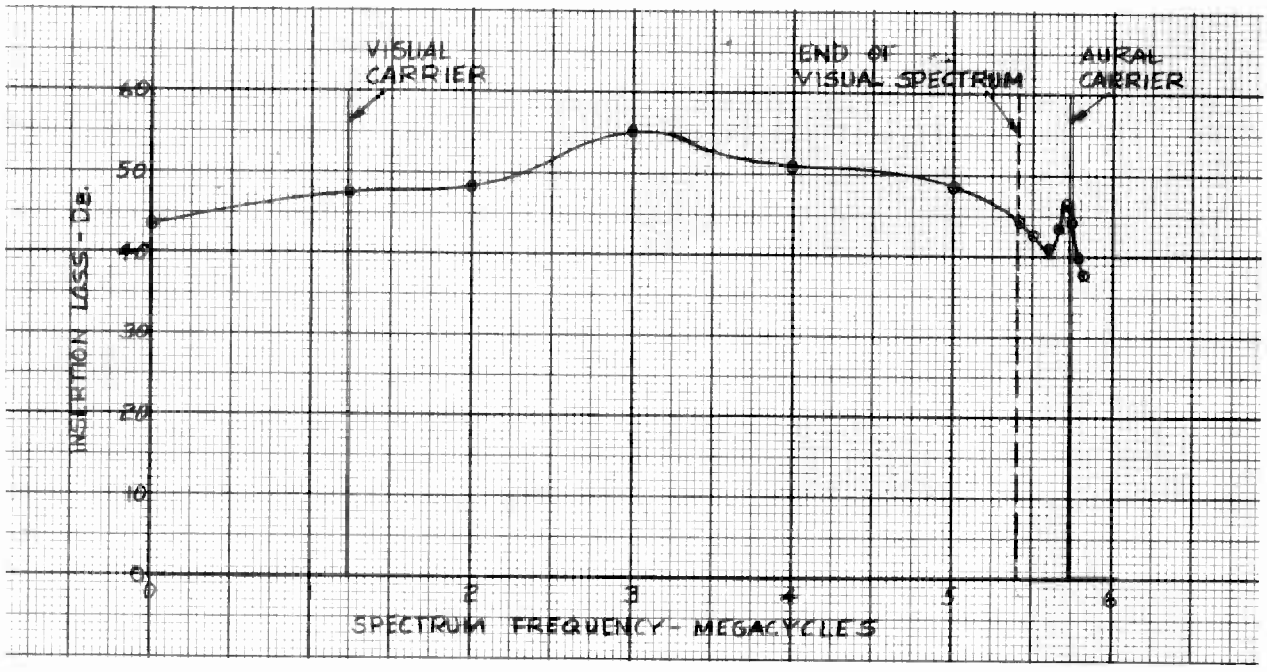


Figure 3. Isolation of Aural Channel from Visual Channel

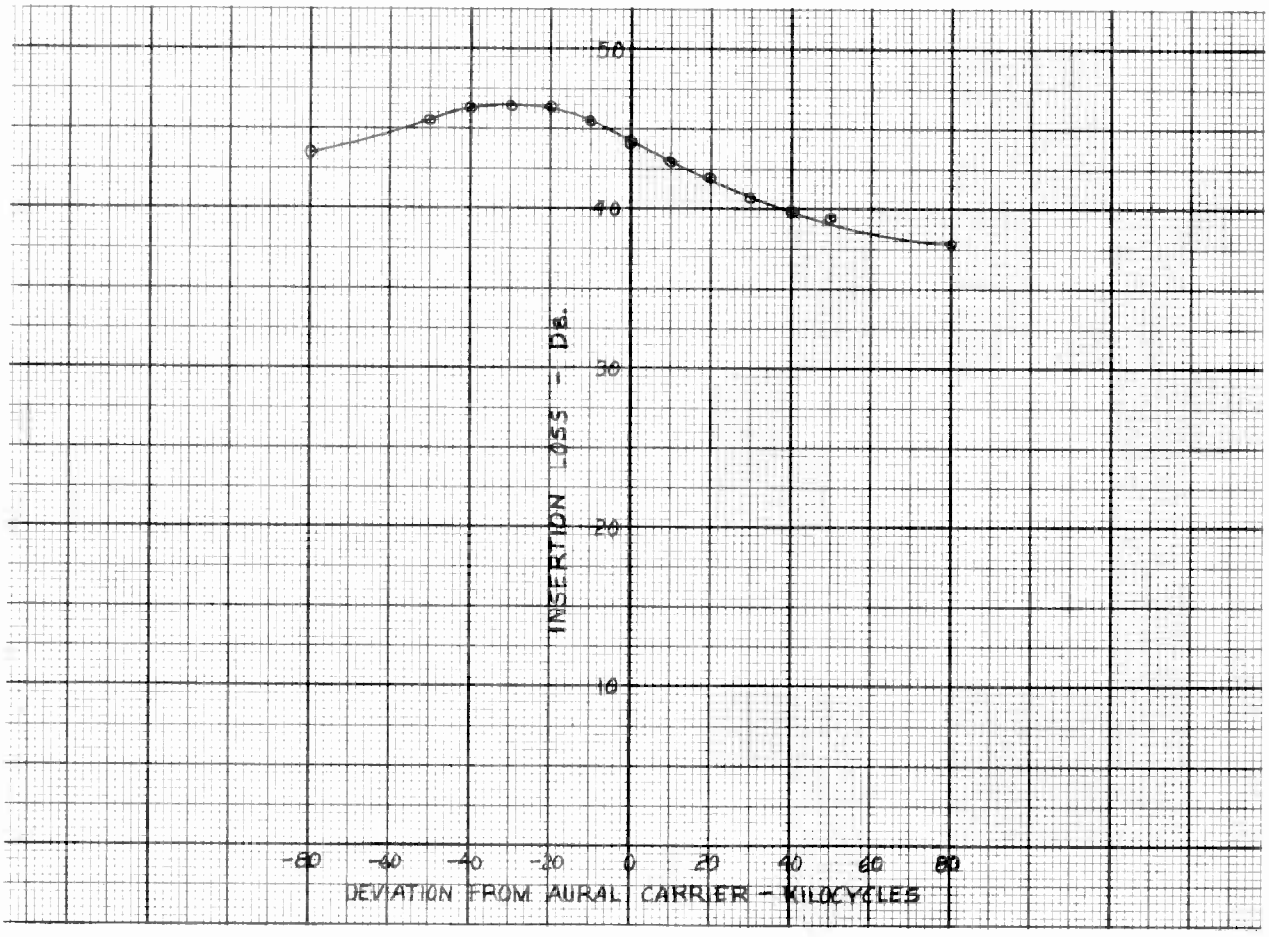


Figure 4. Isolation of Visual Channel from Aural Channel

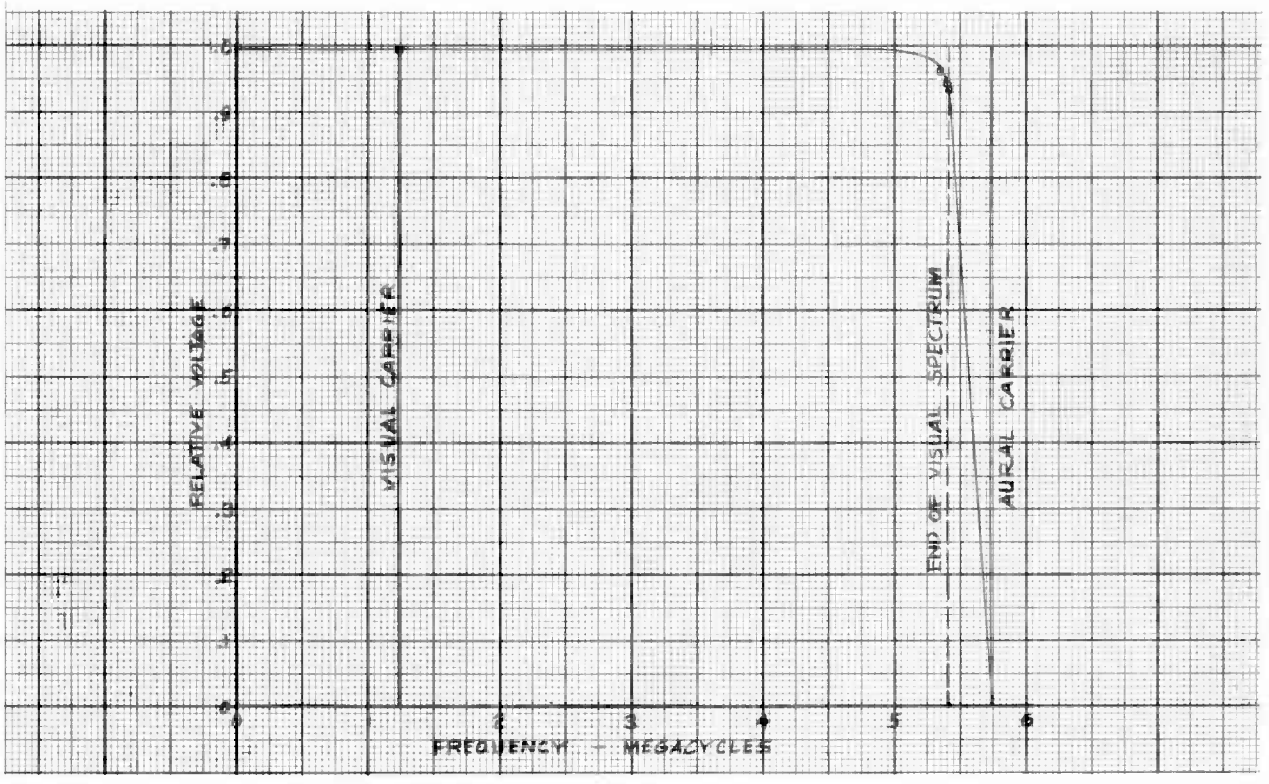


Figure 5. Visual Channel Amplitude Response

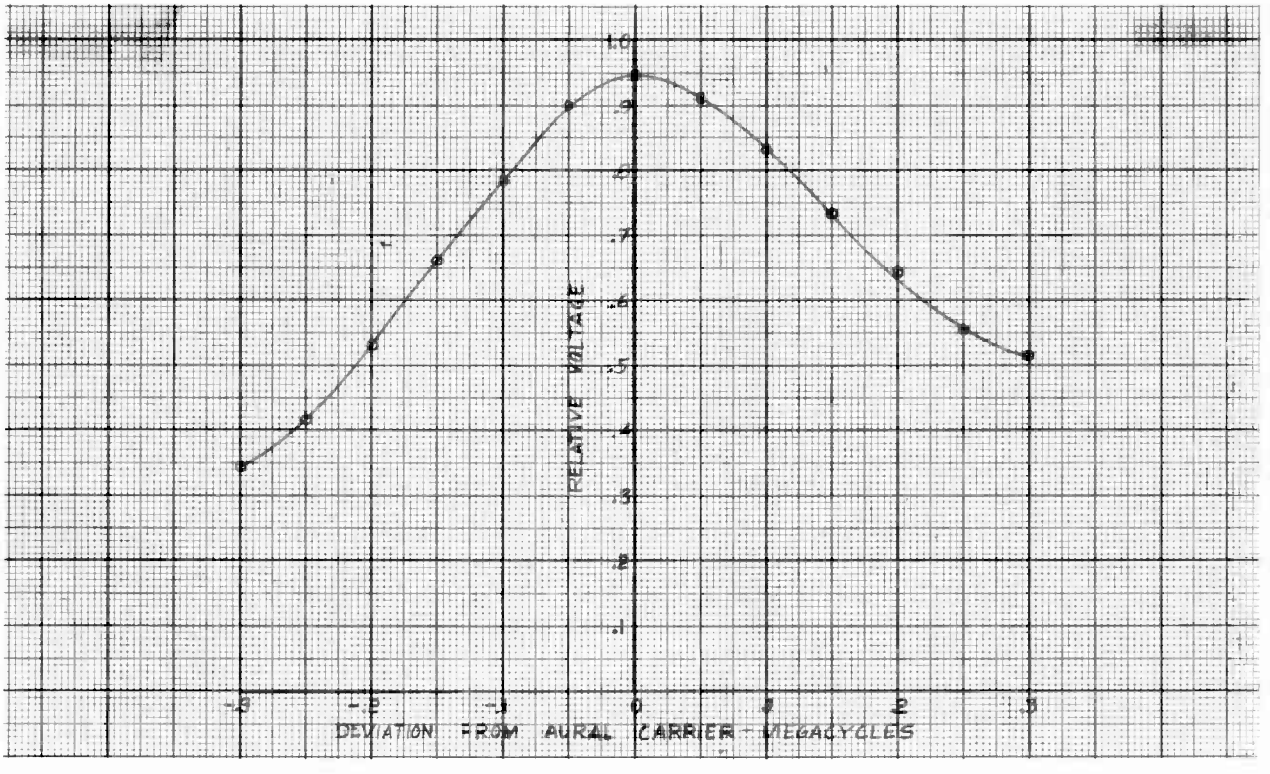


Figure 6. Aural Channel Amplitude Response

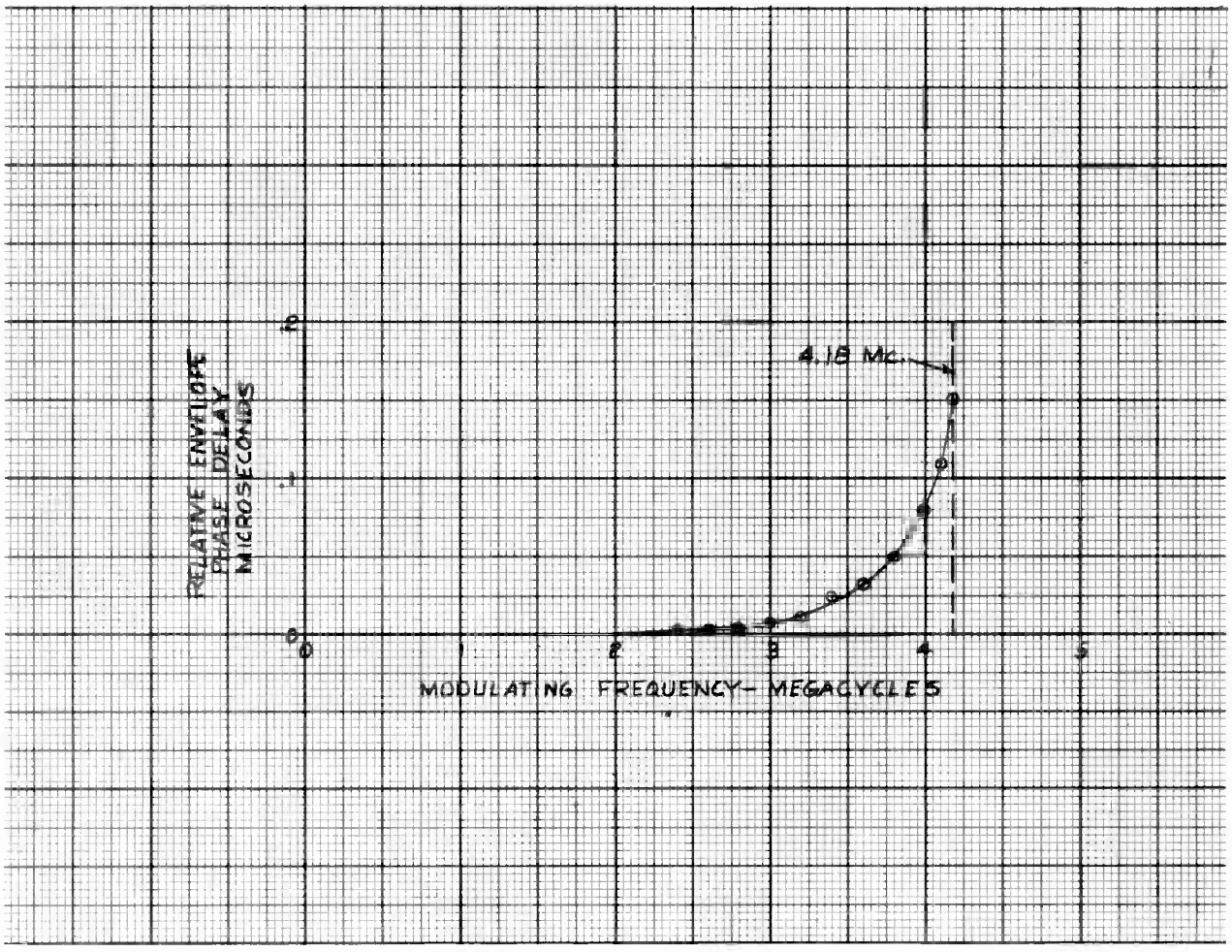


Figure 7. Relative Envelope Phase Delay Introduced into the Visual Channel

SPECIAL ANTENNA SYSTEMS

AMCI®

ALFORD *Manufacturing Co.*

299 ATLANTIC AVE., BOSTON, MASS.

The Alford Manufacturing Company, Inc., welcomes the opportunity of manufacturing special antenna systems.

Examples of such systems supplied by this company are the 16-element array for Channel 2 on the Chrysler Building, New York City, for the Columbia Broadcasting System (see Figure 1) and the 48-element array for Channel 9 on the Empire State Building in New York City for Station WOR-TV (see Figure 2).

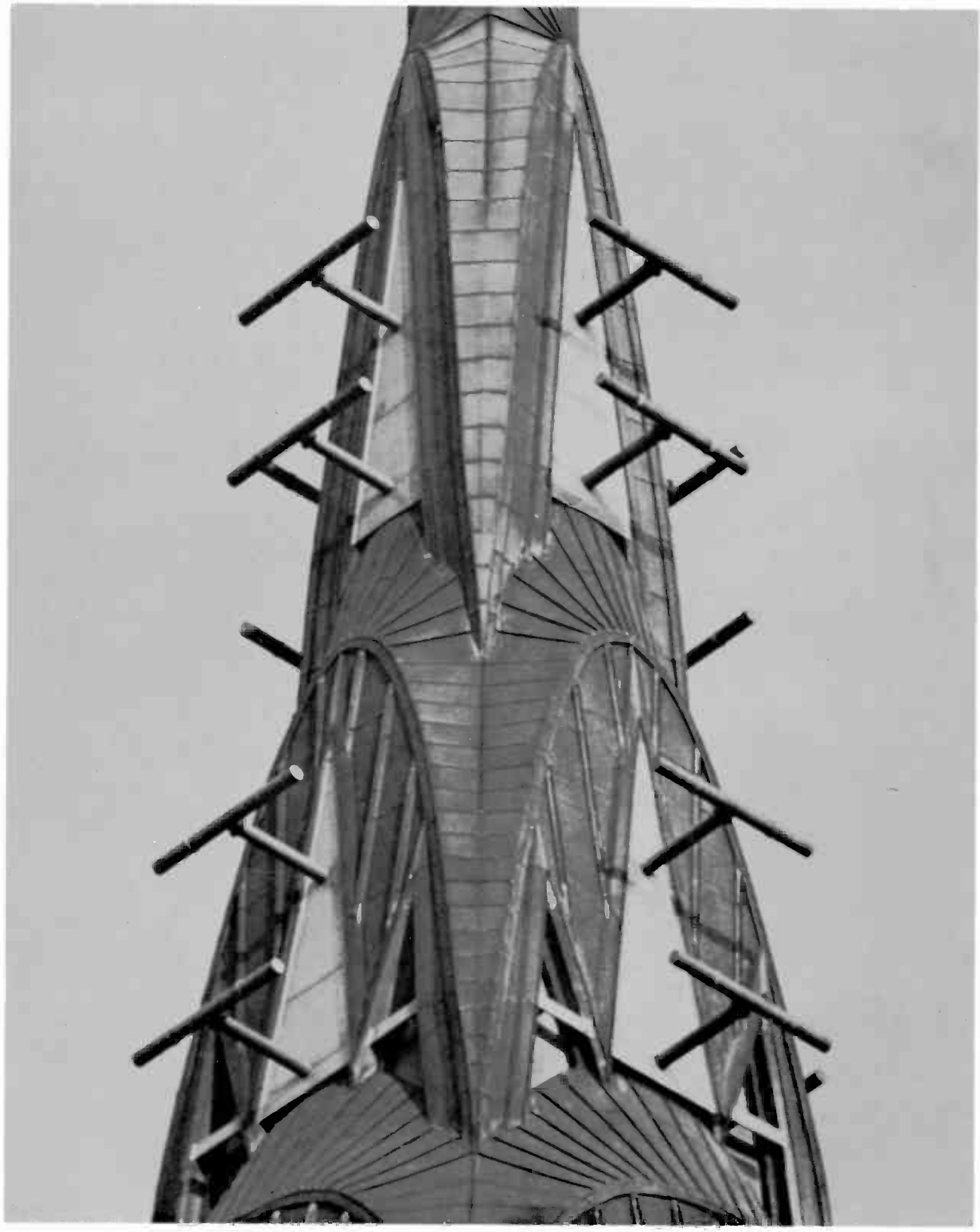


Figure 1. Channel 2 Antenna, Chrysler Building, New York City

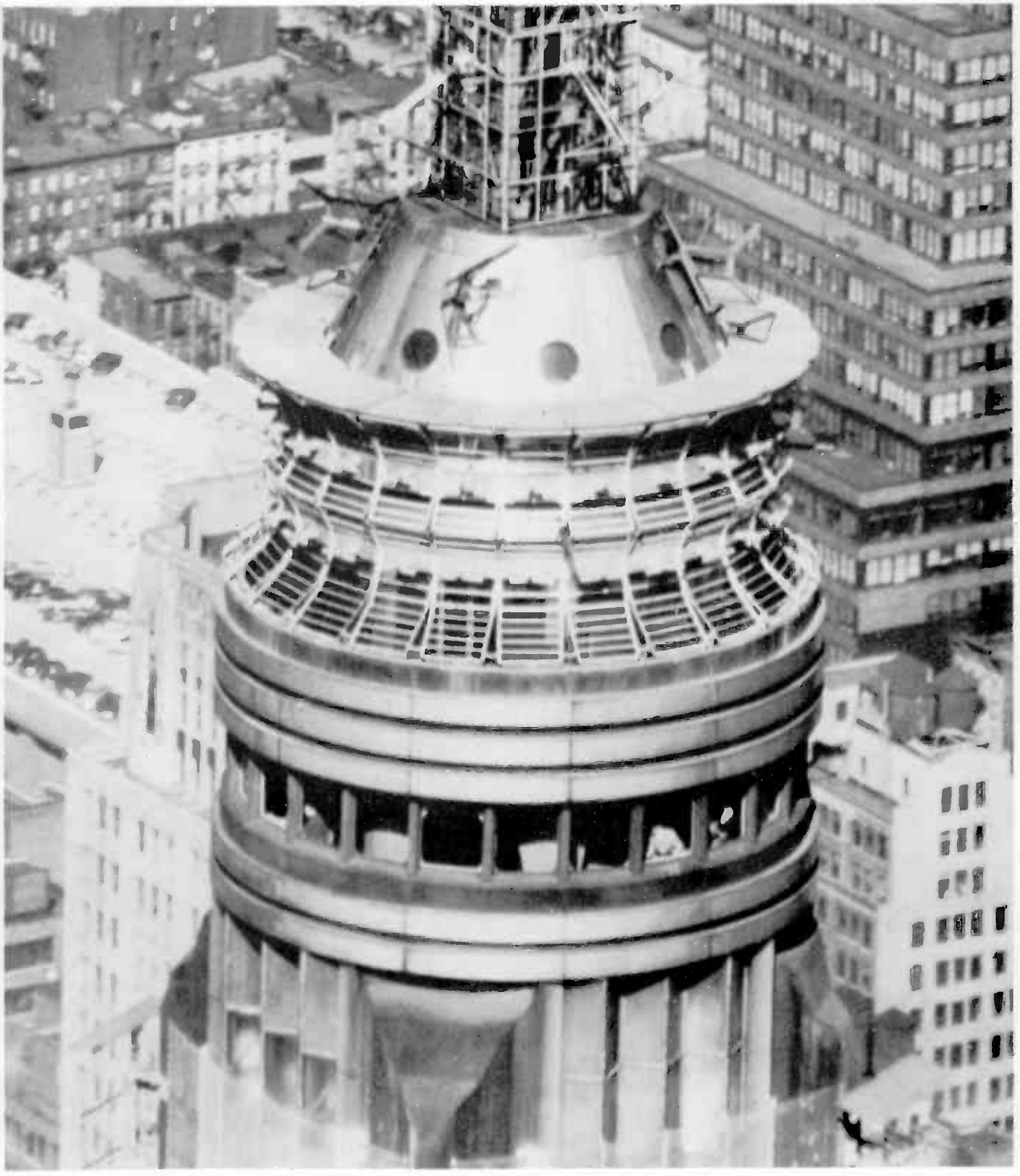


Figure 2. Station WOR-TV Antenna, Empire State Building, New York City

The equipment described herein is manufactured under one or more of the following U.S. Patents:

2,611,867

2,622,196

2,625,654

2,747,182

2,796,589

2,798,217

2,799,017

Other patents pending.

AMCI®

ALFORD *Manufacturing Co.*

299 ATLANTIC AVE., BOSTON, MASS.

NOTICE

The Alford Manufacturing Company reserves the right to make, without notice, modifications of the equipment described in this brochure without affecting its right to sell such equipment under orders based on the brochure description, provided, however, that the modifications shall not materially affect performance. These modifications of equipment may be made by us or our suppliers from time to time for reasons such as improvement in performance, simplification in design, or availability of material. We also reserve the right to withdraw from sale, without notice, any equipment described in our brochures.

All sales and quotations are subject to the terms of our standard contract.

Alford Manufacturing Company