RCA

AM/FM Radio Station Application Data and Reference Guide

for Broadcast Transmitter, Antenna, Remote Pickup and STL Systems

AM/FM

RADIO STATION APPLICATION DATA

AND REFERENCE GUIDE

for

BROADCAST TRANSMITTER, ANTENNA,

REMOTE PICKUP

and

STL SYSTEMS

RCA

6th Edition—RAD-78

Prepared by

Broadcast Systems

Front & Cooper Streets, Camden, New Jersey, U.S.A. 08102

PRICE: FIVE DOLLARS

Data included in this book are primarily for use in filing applications with the U. S. Federal Communications Commission. However, the general information included also has world-wide application. Rules and requirements, of course, vary with individual government regulatory bodies.

Complete information on referenced equipment is included in the current RCA Radio Equipment Catalog. Copies are available on request from RCA Broadcast Systems, Camden, N. J. 08102, U. S. A.

RCA

FOREWORD

This filing information manual presents the equipment engineering data necessary to complete FCC Form 313 and Sections V-A and V-B of Forms 301 and 340. As such, it should provide a quick reference for the specific filing data required. Detailed descriptions and specifications of the complete line of broadcast equipment manufactured by RCA for AM and FM stations are contained in RCA AM and FM broadcast catalogs. RCA also offers custom built equipment to meet special requirements.

A brief explanation of FCC rules is included to assist the reader in planning remote pickup and STL equipment facilities. However, reference should be made directly to the FCC rules to assure compliance and accuracy wherever necessary.

CONTENTS

FCC Form 301 — FEDERAL COMMUNICATIONS COMMISSION — Section V-A

STANDARD BROADCAST ENGINEERING DATA

Name of Applicant

1. Indicate by check mark the purpose of this application. (The items of this Section that are applicable to, and must be answered for, each category are shown to the right of the category.)

- [ ] Construct a new station
- [ ] Change station location to a different city or town
- [ ] Change power
- [ ] Change transmitter location
- [ ] Change frequency
- [ ] Change from DA to Non-DA
- [ ] Change from Non-DA to DA
- [ ] Change in antenna system
- [ ] Change in antenna system (including increase in height by addition of FM or TV antenna)

→ All items

- [ ] Install new Auxiliary Transmitter
- [ ] Install new Alternate Main Transmitter

→ 2 thru 7, and 10

- [ ] Change transmitter (non type accepted)
- [ ] Change Main Studio Location to point outside city limits and not at transmitter site
- [ ] Change Hours of Operation

→ 2 thru 7

- [ ] Other (specify): → 2 thru 7 (and appropriate other items)

If this application is not for a new station, summarize briefly the nature of the changes proposed:

2. Facilities requested

Frequency	Hours of operation	Power in kilowatts Night	Day

3. Station location

State	City or town

4. Transmitter location

State	County
City or town	Street Address (or other identification)

5. Main studio location

State	County
City or town	Street and number, if known

6. Remote control point location

State	City or town

Street Address (or other identification)

7. Transmitter

Make	Type No.	Rated Power
See Page 7		

(If the above transmitter has not been accepted for licensing by the F.C.C., attach as Exhibit No. a complete showing of transmitter details. Showing should include schematic diagram and full details of frequency control. If changes are to be made in licensed transmitter include schematic diagram and give full details of change.)

8. Antenna monitor

Make	Type No.

9. Modulation monitor

Make	Type No.
See Page 7	

10. Antenna system, including ground or counterpoise

Non-Directional Antenna: Day [ ] Night [ ]

Directional Antenna:

- Day only (DA-D) [ ]
- Night only (DA-N) [ ]
- Same constants and power day and night (DA-1) [ ]
- Different constants or power day and night (DA-2) [ ]

(If a directional antenna is proposed submit complete engineering data. Show clearly whether directional operation is for day or night or both. If day and night patterns are different give full information on each pattern. This information is in addition to the information in Paragraph 10 and is submitted as Exhibit No. and signed by the engineer who designed the antenna system.)

Type radiator	Height in feet of complete radiator above base insulator, or above base if grounded.
Overall height in feet above ground. (Without obstruction lighting)	Overall height in feet above mean sea level. (Without obstruction lighting)
Overall height in feet above ground. (With obstruction lighting)	Overall height in feet above mean sea level. (With obstruction lighting)
If antenna is either top loaded or sectionalized, describe fully as Exhibit No.	

Excitation — Series [ ] Shunt [ ]

Geographical coordinates (to nearest second).
For directional antenna give coordinates of center of array.
For single vertical radiator give tower location.

North latitude ° ' "	West longitude ° ' "

If not fully described above, give further details and dimensions including any other antennas mounted on tower and associated isolation circuits as Exhibit No. (Height figures should not include obstruction lighting.)

Submit as Exhibit No. a plot of the transmitter site showing boundary lines, and roads, railroads, or other obstructions; and also layout of the ground system or counterpoise. Show number and dimensions of ground radials or if a counterpoise is used, show height and dimensions.

11. Attach as Exhibit No. a sufficient number of aerial photographs taken in clear weather at appropriate altitudes and angles to permit identification of all structures in the vicinity. The photographs must be marked so as to show compass directions, exact boundary lines of the proposed site, and locations of the proposed 1000 mv/m contour for both day and night operation. Photographs taken in eight different directions from an elevated position on the ground will be acceptable in lieu of the aerial photographs if the data referred to can be clearly shown.

FCC Form 301 — FEDERAL COMMUNICATIONS COMMISSION — Section V-B

FM BROADCAST ENGINEERING DATA

Name of applicant

1. **Purpose of authorization applied for:** (Indicate by check mark)

(If application is for a new station or for any of the changes numbered B through E, complete all paragraphs of this form: If change F is of a character which will change coverage or increase the overall height of the antenna structure more than 20 feet, answer all paragraphs, otherwise complete only paragraphs 2 and 9 and the appropriate other paragraphs; for changes G through I, complete only paragraph 2 and the appropriate other paragraphs; for change J, complete only paragraphs 2 and 5.)

A. ☐ Construct a new station
B. ☐ Change effective radiated power
C. ☐ Change antenna height above average terrain
D. ☐ Change transmitter location
E. ☐ Change frequency
F. ☐ Change antenna system
G. ☐ Change transmitter
H. ☐ Install auxiliary or alternate main transmitter
I. ☐ Other changes (specify)
J. ☐ Change studio location

If this is not for a new station, summarize briefly the nature of the changes proposed.

2. **Facilities requested**

Frequency Mc/s.	Channel No. . . . .
Effective Radiated Power Horizontal kw Vertical kw	Antenna height above average terrain Horizontal feet Vertical feet

3. **Station location**

State	City or town

4. **Transmitter location (principal community)**

State	County
City or town	Street Address (or other identification)

5. **Main studio location**

State	County
City or town	Street address

6. **Remote control point location**

State	City or town
Street Address (or other identification)	

7. **Transmitter**

Make	Type No.	Rated Power

See Page 7

(If the above transmitter has not been accepted for licensing by the F.C.C., attach as Exhibit No. a complete showing of transmitter details. Showing should include schematic diagram and full details of frequency control. If changes are to be made in licensed transmitter include schematic diagram and give full details of change.)

8. **Modulation monitor**

Make	Type No.

See Page 7

9. (a) **Antenna structure:**

Is the proposed construction in the immediate vicinity or does it serve to modify the construction of any standard broadcast station, FM broadcast station, television broadcast station, or other class of radio station? YES ☐ NO ☐

If "Yes", attach as Exhibit No. complete engineering data thereon.

Submit as Exhibit No. a vertical plan sketch for the proposed total structure (including supporting building if any) giving heights above ground in feet for all significant features.

Overall height in feet above ground. (Without obstruction lighting)	Overall height in feet above mean sea level. (Without obstruction lighting)
Overall height in feet above ground (With obstruction lighting)	Overall height in feet above mean sea level. (With obstruction lighting)

See Pages 11 through 24

Height of antenna radiation center in feet above mean level.
Horizontal
Vertical

Geographical coordinates of antenna (to nearest second)
North latitude ° ' "   West longitude ° ' "

(b) **Antenna data**

Make	Type No. or description
No. of sections Horizontal Vertical	Intensity Horizontal Vertical

See Pages 11 through 24

If directional antenna is proposed, give full details including horizontal and vertical plane radiation patterns, as Exhibit No.

Is electrical or mechanical beam tilting proposed? YES ☐ NO ☐
If so, describe fully in Exhibit No.
including horizontal and pertinent vertical radiation patterns.

Will antenna be altered to provide null fill-in? YES ☐ NO ☐

If yes, describe fully in Exhibit No.

10. Transmission line proposed to supply power to the antenna from the transmitter

Make	Type No.	Description

Size (nominal transverse dimension) in inches	Length in feet	Rated efficiency in percent for this length

11. Proposed operation

Transmitter power output in kilowatts	Power dissipation within transmission line in kilowatts
Antenna input power in kilowatts	Effective radiated power in kilowatts (Must be same as shown in Para. 2) Horizontal Vertical

See Pages 25 through 31

12. Will the studios, microphones, and other equipment proposed for transmission of programs be designed for compliance with the FM Technical Standards? Yes ☐ No ☐

13. If this application is for modification of construction permit state briefly as Exhibit No. the present status of construction and indicate when it is expected that construction will be completed.

14 Attach as Exhibit No. map(s) (Sectional Aeronautical Charts where obtainable) of the area proposed to be served and shown drawn thereon:

(a) Proposed transmitter location and the radials along which the profile graphs have been prepared;
(b) The 3.16 ,v/m and the 1 mv/m contours predicted;
(c) On the map(s) showing the 3.16 mV/m contour, clearly indicate the legal boundaries of the principal community proposed to be served. Submit a statement identifying the source relied upon for the placement of the boundaries;
(d) Scale of miles.

Areas and population: (latest census.)

Area (sq. mi.) within 1 mv/m contour	Population within 1 mv/m contour

15. (a) Attach as Exhibit No. a map(s) (topographic where obtainable, such as U. S. Geological Survey quadrangles) for the area within 15 miles of the proposed transmitter location and shown drawn thereon the following data:

1. Proposed transmitter location—accurately plotted;
2. Transmitter location and call letters of all radio stations (except amateur) and the location of established commercial and government receiving stations within 2 miles of the proposed transmitter location;
3. Proposed location of main studio;
4. Character of the area within 2 miles of proposed transmitter location, suitably designated as to residential, business, industrial, and rural nature;
5. At least eight radials each extending to a distance of ten or more miles from the proposed transmitter location, one or more of which must extend through the principal city or cities to be served.
6. If the proposed transmitter location is outside the boundaries of the principal community proposed to be served, the topography of the intervening area must be clearly shown.

b. Attach as Exhibit No. profile graphs for the radials in (a)(5) above. Each graph shall show the elevation of the antenna radiation center. Identify each graph by its bearing from the proposed transmitter location. Direction true north shall be zero azimuth and angles measure clockwise. Show source of topographical data on each.

16. From the profile graphs in 15(b), for the eight mile distance between two and ten miles from the proposed transmitter location, and in accordance with the procedure prescribed in Section 73.313 of the Commission Rules, supply the following tabulation of data:

Radial bearing (degrees true)	Average elevation of radial (2-10 mi.) in feet above mean sea level	Height in feet of antenna radiation center above average elevation of radial 2-10 mi.)	Predicted distance in miles to the 3.16mv/m contour	Predicted distance in miles to the 1mv/m con-
0°	feet	feet	mi.	mi.
45				
90				
135				
180				
225				
270				
315				
(*)				

______ feet (horizontal)

Average ______ Antenna height above average terrain ______ feet (vertical)
(Average of above listed heights -- must be identical with Paragraph 2)

*Radial over principal community if not included above. Do not include in Average.

TRANSMITTER POWER RATINGS

AM TRANSMITTERS (Medium Wave)

Type	Rated Output Power kW	Other Type-Accepted Output Powers kW
BTA-1S (Operating 250W)	.25	—
BTA-1S (Operating 500W)	.50	—
BTA-1S	1.0	.5/.25
BTA-5L2	5.0	1.0/.5
BTA-5SS	5.0	1.0/.5
BTA-10L2	10.0	5.0/1.0
BTA-20L2*	20.0	10.0

*Parallel Systems.
All RCA AM (Medium Wave) Transmitters are available as parallel systems.

FM TRANSMITTERS

Type	No. Outputs	Rated Power, Each Output kW	dBk
BTF-3E1 & BTF-3ES1	1	3.00	4.77
BTF-3 plus 3E1 & BTF-3 plus 3ES1	1	6.00	7.78
BTF-5E1 & 5ES1	1	5.00	6.99
BTF-5 plus 5E1 & BTF-5 plus 5ES1	1	10.00	10.00
BTF-5E2 & BTF-5ES2	1	5.00	6.99
BTF-5 plus 5ES2 & BTF-5 plus 5ES2	1	10.00	10.00
BTF-10E1 & BTF-10ES1	1	10.00	10.00
BTF-10 plus 10E1 & BTF-10 plus 10ES1	1	20.00	13.01
BTF-20E1 & BTF-20ES1	1	20.00	13.01
BTF-40E1 & BTF-40ES1	1	40.00	16.02
BTE-15A (Solid State)	1	.01	−20.00
BTE-115	1	.01	−20.00

MONITORING EQUIPMENT

AM MONITOR DATA

Description	Make	Type
Frequency Monitor	RCA	BW-80
Modulation Monitor	RCA	BW-51
Modulation Monitor	RCA	BW-52
RF Amplifier*	RCA	BW-60
Phase Monitor, Analog Readout	Potomac	AM-19 (204)
Phase Monitor, Digital Readout	Potomac	AM-19-D (210)
Phase Monitor, Precision System	Potomac	PM-19

FM MONITOR DATA

Description	Make	Type
Monaural Frequency & Modulation Monitor	RCA	BW-75A
Monaural Modulation Monitor	RCA	BW-175†
Monaural Frequency Monitor	RCA	BW-176†
Stereo Frequency & Modulation Monitor	RCA	BW-85A & BW-185†
SCA Frequency & Modulation Monitor	RCA	BW-95A & BW-195†
RF Amplifier*	RCA	BW-100

*Required when monitors are located at other than transmitter site.
†Not FCC Type Approved at this printing; filing for type approval will be made.

TRC-15A REMOTE CONTROL SYSTEMS

(For AM/FM Transmitters)

15 metering functions; 30 control functions (15 On/Raise; 15 Off/Lower)

TRC-15AW SYSTEM

Audible Control and Audible Metering Return Over Voice Grade Telephone Line
(DC continuity not required)

Quantity	*Description*
1	Transmitter Unit
1	Studio Unit
1	Meter**

TRC-15-AR SYSTEM

Audible Control Over Internal Subcarrier Generator and Demodulator, and Subaudible Metering Return Over Optional Internal Subcarrier Generator and Demodulator

(Choice of Control Subcarrier Frequency*)

Quantity	*Description*
1	Transmitter Unit
1	Studio Unit
1	Meter**

*When ordering, specify desired control subcarrier frequency. Custom systems can be supplied with any specified subcarrier frequency from 26 to 185 kHz. Standard systems are available with optional frequencies of 26, 41, 67, 110, 135, 185 kHz. Can also be supplied for use with external subcarrier.

**This item to be installed in Studio Unit.

DRS-1A DIGITAL REMOTE CONTROL SYSTEMS

(For AM/FM Transmitters)

Channel Capability

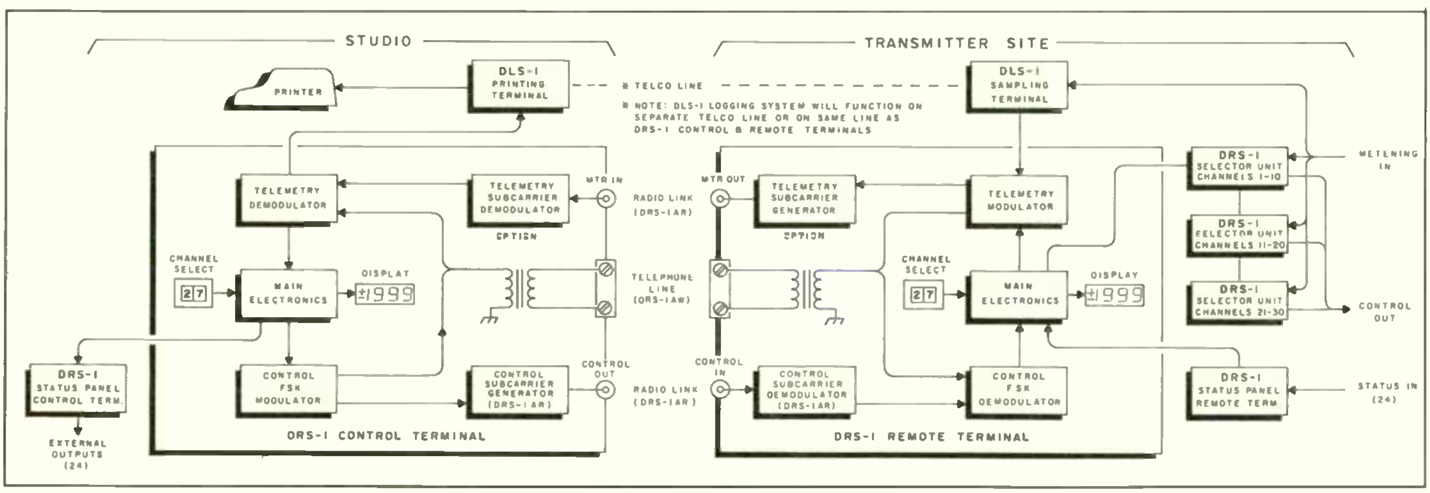
	Minimum	*Expandable*
No. of Channels	10	20/30
Telemetry/Channel	1	1
Control Functions/Channel	2	2

Telemetry Display: Digital LED 3½-digit

Equipment Designations

	Wire	*Radio*
AM Control Systems	DRS-1AW	DRS-1AR
FM Control Systems	DRS-1AW	DRS-1AR

MODEL DRS-1A DIGITAL REMOTE SYSTEM



REMOTE CONTROL SYSTEMS

(For AM/FM Transmitters)

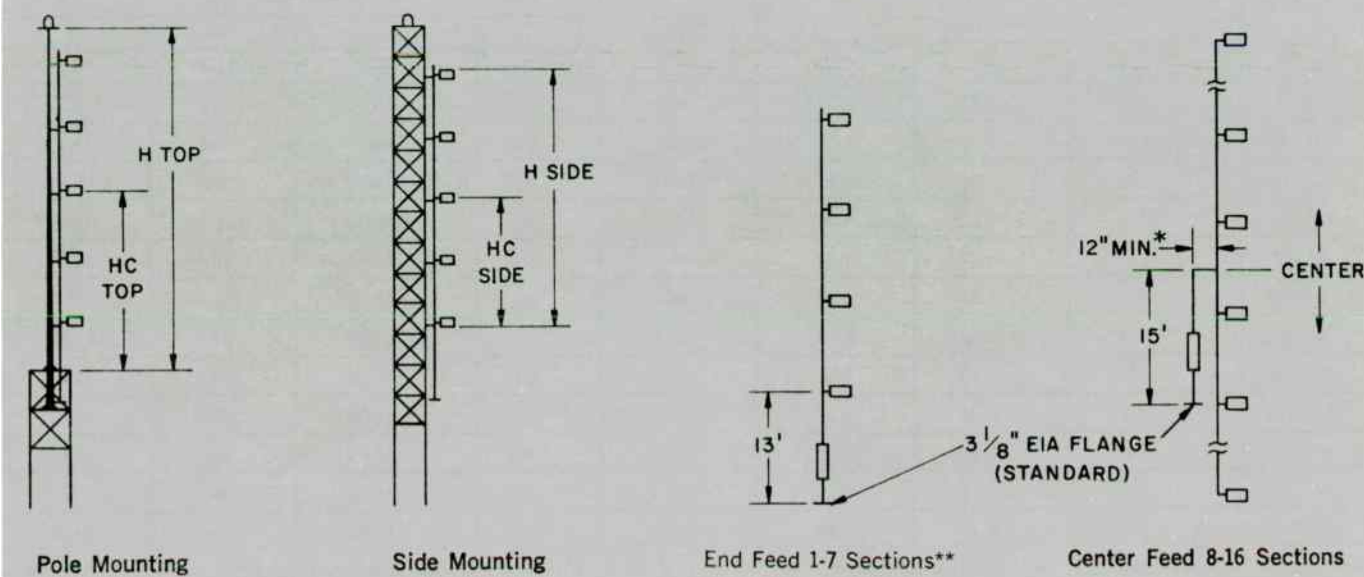
ACCESSORIES FOR REMOTE CONTROL SYSTEMS

Description	*Reference*
Telemetry Subcarrier Generator	BTX-101 (Specify freq. in kHz)
Metering Insertion Unit (for AM carrier telemetry)	MIU-2
Metering Recovery Unit (for AM carrier telemetry)	MRU-1
BTX-101 Subcarrier Gentrator (program plus telemetry)	MI-561062
BTX-101 Low Pass Filter	MI-561065
Telemetry Receiver for FM	TMR-1
DC Amplifier	DCA-1
AM RF Transmission Line Sampling Kit	RFK-1
FM RF Transmission Line Sampling Kit, 3⅛" Line	RFK-2
FM RF Transmission Line Sampling Kit, 1⅝" Line	RFK-3
Tower Light Monitor Kit (2 to 50 amps)	TLK-2
Line Voltage Kit (122 to 240 V, single phase)	LVK-3
Temperature Sensing Kit	TSK-3
Tolerance Alarm (Main Frame) TAU-3	MI-561469A
Modules for TAU-3	MI-561184A

FM ANTENNAS

CIRCULARLY POLARIZED RADIATOR SPECIFICATIONS, BFC SERIES

Mounting Dimensions and Feed Line Locations for BFC Series Antennas



*Can be made to dimension desired to bring input line in line with main vertical run.
**Antennas ordered with beam tilt and/or null fill supplied with center feed.

Mechanical Data, BFC Series

Antenna Type	Freq. MHz	Dimensions in Feet (Meters)[1]								Windload[1] at 50/30 lbs/ft^2 (244/146 kg/m^2)					
		Hc Top		Hc Side		H Top		H Side		Less De-Icers		With De-Icers		With Radomes	
		Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Lbs.	Kg.	Lbs.	Kg.	Lbs.	Kg.
BFC-1B	88	5.0	1.52	0.8	0.24	8.0	2.44	1.7	0.52	178	81	198	90	332	151
	98	5.0	1.52	0.8	0.24	8.0	2.44	1.7	0.52	178	81	198	90	332	151
	108	5.0	1.52	0.8	0.24	8.0	2.44	1.7	0.52	178	81	198	90	332	151
BFC-2B	88	10.6	3.23	6.4	1.95	19.2	5.85	12.8	3.90	337	153	377	171	645	293
	98	10.0	3.05	5.8	1.77	19.0	5.79	11.7	3.57	327	148	367	167	635	288
	108	9.5	2.90	5.4	1.65	18.0	5.49	10.8	3.29	319	145	359	163	627	284
BFC-3B	88	16.2	4.93	11.9	3.63	30.4	9.27	23.9	7.28	495	225	555	252	957	434
	98	15.0	4.57	10.9	3.32	28.9	8.81	21.8	6.64	475	215	535	243	937	425
	108	14.1	4.30	9.9	3.02	27.5	8.38	19.9	6.07	459	208	519	235	921	418
BFC-4B	88	21.7	6.61	17.6	5.36	41.5	12.65	35.2	10.73	653	296	723	328	1269	576
	98	20.0	6.10	15.9	4.85	38.4	11.70	31.8	9.69	623	283	703	319	1239	562
	108	18.6	5.67	14.5	4.42	36.8	11.22	29.0	8.84	599	272	679	308	1215	551
BFC-5B	88	27.3	8.32	23.2	7.07	52.7	16.06	46.4	14.14	810	367	911	413	1581	717
	98	25.0	7.62	20.9	6.37	49.4	15.06	41.8	12.74	791	359	871	395	1541	699
	108	23.2	7.07	19.0	5.79	46.1	14.05	38.1	11.61	763	346	839	381	1510	685
BFC-6B	88	32.9	10.03	28.8	8.78	63.9	19.48	57.6	17.56	970	440	1090	494	1874	850
	98	30.0	9.14	25.4	7.74	59.3	18.07	50.9	15.51	920	417	1040	472	1824	827
	108	27.7	8.44	23.6	7.19	54.9	16.73	47.2	14.39	882	400	1000	454	1784	809
BFC-7B	88	38.5	11.73	34.3	10.45	75.0	22.86	68.7	20.94	1128	512	1268	575	2183	990
	98	35.1	10.70	30.9	9.42	68.7	20.94	61.9	18.87	1068	484	1208	548	2123	963
	108	32.3	9.85	28.1	8.56	64.2	19.57	56.3	17.16	1020	463	1160	526	2075	941
BFC-8B	88	44.0	13.41	40.0	12.19	86.2	26.27	80.0	24.38	1308	593	1468	666	2514	1140
	98	40.1	12.22	35.9	10.94	78.9	24.05	71.9	21.92	1238	562	1398	634	2454	1113
	108	36.8	11.22	32.7	9.97	73.2	22.31	65.4	19.93	1182	536	1342	609	2390	1084
BFC-10B	88	55.2	16.82	51.1	15.58	108.6	33.22	102.2	33.22	1625	737	1875	851	3165	1436
	98	50.1	15.27	46.0	14.02	98.6	30.05	92.0	28.04	1535	696	1735	787	3075	1395
	108	45.9	13.99	41.8	12.74	91.2	27.80	83.7	25.51	1483	673	1663	754	3003	1362
BFC-12B	88	66.4	20.24	62.3	18.99	131.0	39.93	124.7	38.10	1942	881	2182	990	3790	1719
	98	60.1	18.32	56.0	17.07	119.8	36.58	112.1	34.14	1832	831	2072	940	3680	1669
	108	55.0	16.76	51.0	15.54	109.6	33:53	101.9	31.09	1744	791	1984	900	3592	1629
BFC-14B	88	POLE MOUNT		73.5	22.40	POLE MOUNT		147.0	44.81	2258	1024	2538	1151	4414	2002
	98	NOT		66.1	20.15	NOT		132.2	40.23	2128	965	2408	1092	4284	1943
	108	RECOMMENDED		60.0	18.29	RECOMMENDED		120.1	36.58	2088	947	2304	1045	4244	1925
BFC-16B	88	POLE MOUNT		84.7	25.82	POLE MOUNT		169.4	51.51	2575	1168	2895	1313	5039	2286
	98	NOT		76.1	23.20	NOT		152.3	46.33	2425	1100	2745	1245	4889	2218
	108	RECOMMENDED		69.1	21.06	RECOMMENDED		138.3	42.06	2205	1000	2625	1191	4669	2118

[1] Interpolate dimensions and windload for antennas of intermediate frequency.

FM ANTENNAS

CIRCULARLY POLARIZED RADIATOR SPECIFICATIONS, BFC SERIES

Electrical Data

Antenna Type	Power Gain[1]			Field Intensity[2] mV/m	Power Rating[3]			
					with Radomes		without Radomes	
	Power	dB	Field		kW	dBk	kW	dBk
BFC-1B	0.46	−3.37	0.678	93.2	10	10.0	4	6.02
BFC-2B	1.0	0	1.00	137.6	20	13.01	8	9.03
BFC-3B	1.5	1.76	1.23	169.1	30	14.77	12	10.79
BFC-4B	2.1	3.22	1.45	199.4	40	16.02	16	12.04
BFC-5B	2.7	4.31	1.64	225.5	40	16.02	20	13.01
BFC-6B	3.2	5.05	1.79	246.1	40	16.02	24	13.80
BFC-7B	3.8	5.80	1.95	268.1	40	16.02	28	14.47
BFC-8B	4.3	6.34	2.07	284.6	40	16.02	32	15.05
BFC-10B	5.5	7.40	2.35	323.1	40	16.02	40	16.02
BFC-12B	6.6	8.20	2.57	353.4	40	16.02	40	16.02
BFC-14B	7.8	8.92	2.79	383.6	40	16.02	40	16.02
BFC-16B	8.9	9.49	2.98	409.8	40	16.02	40	16.02

[1] Power gain in each polarization.

[2] For each polarization, the field gain is equal to the square root of the power gain. The effective field intensity in mV/m at one mile (1.604 km) for 1 kW input is equal to 137.6 times the field gain.

[3] Power Rating based on a 40°C ambient. Multiply values listed by 0.8 for 50°C ambient. BFC-5 and larger antennas with greater power ratings are available on special order.

Deadweight in Pounds (kg)[1]:	Less De-Icers	With De-Icers	With Radomes
Single Section	109 (49)	197 (89)	140 (63)
Two Sections	173 (78)	322 (146)	235 (107)
Three Sections	237 (108)	424 (215)	310 (141)
Four Sections	301 (137)	599 (272)	425 (193)
Five Sections	365 (166)	751 (341)	520 (236)
Six Sections	429 (195)	876 (397)	615 (278)
Seven Sections	493 (224)	1028 (466)	710 (322)
Eight Sections	582 (264)	1178 (534)	830 (376)
Ten Sections	710 (322)	1455 (660)	1020 (462)
Twelve Sections	838 (380)	1732 (786)	1210 (549)
Fourteen Sections	966 (438)	2009 (911)	1400 (635)
Sixteen Sections	1094 (496)	2286 (1037)	1590 (721)

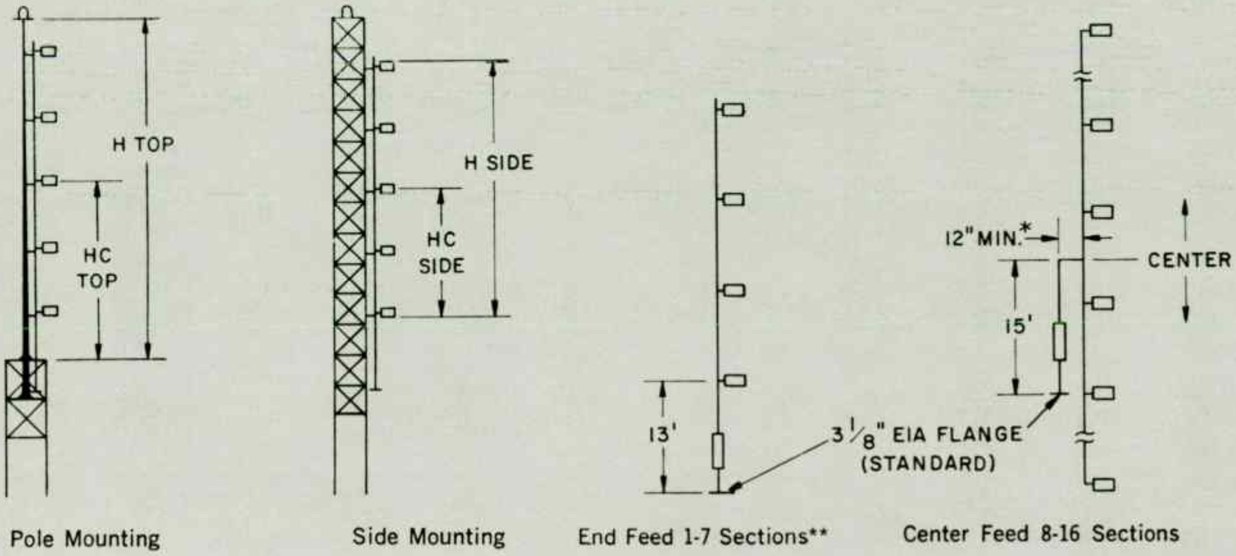
[1] Weight includes feed system to antenna input connection and 13-to-18-inch (330 to 457 mm) extension brackets for mounting.

[2] De-Icer power: 750 watts per bay, nominal. May be wired for 208 or 240 V service.

FM ANTENNAS

CIRCULARLY POLARIZED RADIATOR SPECIFICATIONS, BFG SERIES

Mounting Dimensions and Feed Line Locations, BFG Series FM Antennas.



*Can be made to dimension desired to bring input line in line with main vertical run.
**Antennas ordered with beam tilt and/or null fill supplied with center feed.

Mechanical Data, BFG Series

Antenna Type	Freq. MHz	Dimensions[1] (See Drawing) Hc Top Feet	Hc Top Meters	Hc Side Feet	Hc Side Meters	H Top Feet	H Top Meters	H Side Feet	H Side Meters	Windload[1] at 50/30 lbs/ft^2 (244/146 kg/m^2) Less De-Icers Lbs.	Less De-Icers Kg.	With De-Icers Lbs.	With De-Icers Kg.	With Radomes Lbs.	With Radomes Kg.
BFG-1A	88	5.0	1.52	0.8	0.24	8.0	2.44	1.7	0.52	178	81	198	90		
	98	5.0	1.52	0.8	0.24	8.0	2.44	1.7	0.52	178	81	198	90		
	108	5.0	1.52	0.8	0.24	8.0	2.44	1.7	0.52	178	81	198	90		
BFG-2A	88	10.6	3.23	6.4	1.95	19.2	5.85	12.8	3.90	337	153	377	171		
	98	10.0	3.05	5.8	1.77	19.0	5.79	11.7	3.57	327	148	367	167		
	108	9.5	2.90	5.4	1.65	18.0	5.49	10.8	3.29	319	145	359	163		
BFG-3A	88	16.2	4.93	11.9	3.63	30.4	9.27	23.9	7.28	495	225	555	252	BFG ANTENNAS NOT AVAILABLE WITH RADOMES	
	98	15.0	4.57	10.9	3.32	28.9	8.81	21.8	6.64	475	215	535	243		
	108	14.1	4.30	9.9	3.02	27.5	8.38	19.9	6.07	459	208	519	235		
BFG-4A	88	21.7	6.61	17.6	5.36	41.5	12.65	35.2	10.73	653	296	723	328		
	98	20.0	6.10	15.9	4.85	38.4	11.70	31.8	9.69	623	283	703	319		
	108	18.6	5.67	14.5	4.42	36.8	11.22	29.0	8.84	599	272	679	308		
BFG-5A	88	27.3	8.32	23.2	7.07	52.7	16.06	46.4	14.14	810	367	911	413		
	98	25.0	7.62	20.9	6.37	49.4	15.06	41.8	12.74	791	359	871	395		
	108	23.2	7.07	19.0	5.79	46.1	14.05	38.1	11.61	763	346	839	381		
BFG-6A	88	32.9	10.28	28.8	8.78	63.9	19.48	57.6	17.56	970	440	1090	494		
	98	30.0	9.14	25.4	7.74	59.3	18.07	50.9	15.51	920	417	1040	472		
	108	27.7	8.44	23.6	7.19	54.9	16.73	47.2	14.39	882	400	1000	454		
BFG-7A	88	38.5	11.73	34.3	10.45	75.0	22.86	68.7	20.94	1128	512	1268	575		
	98	35.1	10.70	30.9	9.42	68.7	20.94	61.9	18.87	1068	484	1208	548		
	108	32.3	9.85	28.1	8.56	64.2	19.57	56.3	17.16	1020	463	1160	526		
BFG-8A	88	44.0	13.41	40.0	12.19	86.2	26.27	80.0	24.38	1308	593	1468	666		
	98	40.1	12.22	35.9	10.94	78.9	24.05	71.9	21.92	1238	562	1398	634		
	108	36.8	11.22	32.7	9.97	73.2	22.31	69.4	21.15	1182	536	1342	609		
BFG-10A	88	55.2	16.82	51.1	15.58	108.6	33.10	102.2	31.15	1625	737	1875	851		
	98	50.1	15.27	46.0	14.02	98.6	30.05	92.0	28.04	1535	692	1735	787		
	108	45.9	13.99	41.8	12.74	91.2	27.80	83.7	25.51	1483	673	1663	754		
BFG-12A	88	66.4	20.24	62.3	18.99	131.0	39.92	124.7	38.01	1942	881	2182	990		
	98	60.1	18.32	56.0	17.07	119.8	36.52	112.1	34.17	1832	831	2072	1234		
	108	55.0	16.76	51.0	15.54	109.6	33.41	101.9	31.06	1744	791	1984	900		
BFG-14A	88	POLE MOUNT NOT RECOMMENDED		73.5	22.40	POLE MOUNT NOT RECOMMENDED		147.0	44.81	2258	1024	2538	1151		
	98			66.1	20.15			132.2	40.29	2128	965	2408	1092		
	108			60.0	18.29			120.1	36.61	2088	947	2304	1045		
BFG-16A	88	POLE MOUNT NOT RECOMMENDED		84.7	25.82	POLE MOUNT NOT RECOMMENDED		169.4	51.63	2575	1168	2895	1313		
	98			76.1	23.20			152.3	46.42	2425	1100	2745	1245		
	108			69.1	21.06			138.3	42.15	2205	1000	2625	1191		

1 Interpolate dimensions and windload for antennas of intermediate frequency.

FM ANTENNAS

CIRCULARLY POLARIZED RADIATOR SPECIFICATIONS, BFG SERIES

Type BFG-

Antenna Type	Power Gain[1] Power	dB	Power Rating[2] kW	dBk
BFG-1	0.9	−0.45	6	7.78
BFG-2A	2.0	3.01	12	10.79
BFG-3A	3.0	4.77	18	12.55
BFG-4A	4.2	6.23	24	13.80
BFG-5A	5.4	7.32	30	14.77
BFG-6A	6.4	5.06	36	15.56
BFG-7A	7.6	8.80	40[2]	16.02
BFG-8A	8.6	9.34	40[2]	16.02
BFG-10A	11.0	10.41	40[2]	16.02
BFG-12A	13.2	11.20	40[2]	16.02
BFG-14A	15.6	11.93	40[2]	16.02
BFG-16A	17.8	12.50	40[2]	16.02

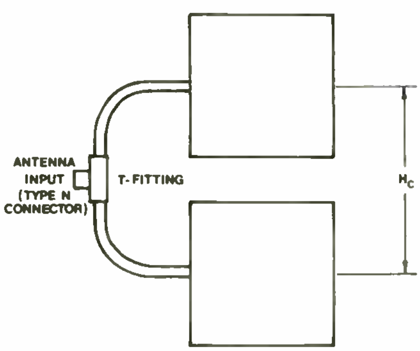
[1] Horizontal and vertical gain combined. Horizontally polarized gain may be specified at any level between 50 and 75 percent of total gain listed. Vertical power gain is then equal to the combined gain less the horizontal gain. For each polarization, the field gain is equal to the square root of the power gain. The effective field intensity at one mile (1.604 km) for 1 kW input is equal to 137.5 times the field gain.

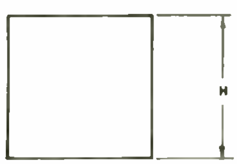
[2] Power Rating based on a 40°C ambient. Multiply values listed by 0.8 for 50°C ambient. BFG-7 and larger antennas with greater power ratings are available on special order.

Weight in Pounds (kg):[1]	Less De-Icers	With
Single Section	111 (50)	200 (91)
Two Sections		328 (149)
Three Sections	243 (110)	483 (219)
Four Sections	309 (140)	611 (277)
Five Sections	375 (170)	766 (347)
Six Sections	441 (200)	894 (406)
Seven Sections	507 (230)	1049 (476)
Eight Sections	598 (271)	1202 (545)
Ten Sections	730 (331)	1485 (674)
Twelve Sections	862 (391)	1768 (802)
Fourteen Sections	994 (451)	2051 (930)
Sixteen Sections	1126 (511)	2334 (1059)

[1] Weight includes feed system to antenna input and 13- to 18-inch (330 to 457mm) extension brackets for mounting.

CIRCULARLY POLARIZED RADIATOR SPECIFICATIONS, BFI SERIES





Mechanical Data, BFI Series

Antenna Type	Freq. MHz	Dimensions (See Drawing) Hc Side Feet	Hc Side Meters	H Side Feet	H Side Meters	Windload at 50/30 lbs/ft^2 (244/146/kg^2) Less De-Icers Lbs.	Kg.
	88	0.8	0.24	1.25	0.52	32	15
BFI-1C	98	0.8	0.24	1.25	0.52	32	15
	108	0.8	0.24	1.25	0.52	32	15
	88	6.4	1.95	12.8	3.90	69	31
BFI-2C	98	5.8	1.77	11.7	3.57	69	31
	108	5.4	1.65	10.8	3.29	69	31
	88	0.8	0.24	1.25	0.52	32	15
BFI-1H	98	0.8	0.24	1.25	0.52	32	15
	108	0.8	0.24	1.25	0.52	32	15
	88	6.4	1.95	12.8	3.90	69	31
BFI-2H	98	5.8	1.77	11.7	3.57	69	31
	108	5.4	1.65	10.8	3.29	69	31

Electrical Data

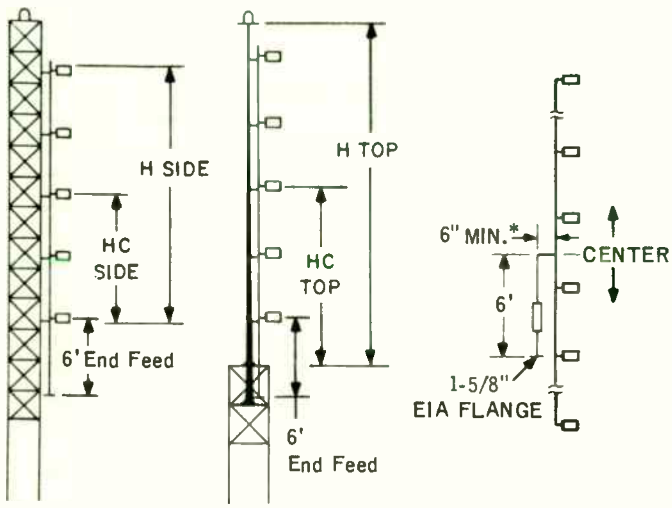
Antenna Type	Power Gain Power	dB	Field	Field Intensity[1]	Power Rating kW	dBk
BFI-1C	0.46	−3.37	0.68	93.2	0.5	−3
BFI-2C	1.00	0	1.00	137.5	0.5	−3
BFI-1H	0.90	−0.45	0.95	130.0	0.5	−3
BFI-2H	1.90	3.01	1.41	194.0	0.5	−3

[1] For each polarization, the field gain is equal to the square root of the power gain. The effective field intensity in mV/m at one mile (1.604 km) for 1kW input is equal to 137.5 times the field gain.

FM ANTENNAS

CIRCULARLY POLARIZED RADIATOR SPECIFICATIONS, BFH SERIES

Mounting Dimensions and Feed Line Locations, BFH Series FM Antennas.



Side Mounting | Pole Mounting | Center Feed

*Can be made to dimension desired to bring input line in line with main vertical run.

Electrical Data

Antenna Type	Power Gain[1]			Field Intensity[2]	Power Rating	
	Power	dB	Field		kW	dBk
BFH-1	0.46	−3.37	0.678	93.2	2	3.01
BFH-2	1.0	0	1.00	137.5	4	6.02
BFH-3	1.5	1.76	1.23	168.4	6	7.78
BFH-4	2.1	3.22	1.45	199.2	8	9.03
BFH-5	2.7	4.31	1.64	225.2	8	9.03
BFH-6	3.2	5.05	1.79	246.0	8	9.03
BFH-7	3.8	5.80	1.95	268.0	8	9.03
BFH-8	4.3	6.34	2.07	285.2	8	9.03

[1]Power gain in each polarization.

[2]For each polarization, the field gain is equal to the square root of the power gain. The effective field intensity in mV/m at one mile (1.604 km) for 1 kW input is equal to 137.6 times the field gain.

Weight in Pounds (Kg):	Less De-icers	With De-icers[2]	With Radomes
Single Section	42 (19)	130 (59)	57 (26)
Two Sections	89 (40)	238 (108)	119 (54)
Three Sections	136 (62)	373 (160)	181 (82)
Four Sections	183 (83)	481 (218)	243 (110)
Five Sections	230 (104)	616 (279)	305 (138)
Six Sections	277 (126)	724 (328)	367 (167)
Seven Sections	324 (147)	859 (390)	429 (195)
Eight Sections	371 (168)	967 (439)	491 (223)

[1]Weight includes elements, feed system to antenna input and 13- to 18-inch (330- to 457mm) extension brackets for mounting.

Mechanical Data, BFH Series

Antenna Type	Freq. MHz	Dimensions[1] (See Drawing)								Windload[1] at 50/30 lbs/ft² (244/146/kg²)			
		Hc Top		Hc Side		H Top		H Side		Less De-Icers		With De-Icers[2]	
		Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Lbs.	Kg.	Lbs.	Kg.
BFH-1	88	5.0	1.52	0.8	0.24	8.0	2.44	1.7	0.52	116	53	139	63
	98	5.0	1.52	0.8	0.24	8.0	2.44	1.7	0.52	116	53	139	63
	108	5.0	1.52	0.8	0.24	8.0	2.44	1.7	0.52	116	53	139	63
BFH-2	88	10.6	3.23	6.4	1.95	19.2	5.85	12.8	3.90	220	100	264	120
	98	10.0	3.05	5.8	1.77	19.0	5.79	11.7	3.57	213	97	257	117
	108	9.5	2.90	5.4	1.65	18.0	5.49	10.8	3.29	208	94	252	114
BFH-3	88	16.2	4.93	11.9	3.63	30.4	9.27	23.9	7.28	322	146	389	176
	98	15.0	4.57	10.9	3.32	28.9	8.81	21.8	6.64	309	140	375	170
	108	14.1	4.30	9.9	3.02	27.5	8.38	19.9	6.07	299	136	364	165
BFH-4	88	21.7	6.61	17.6	5.36	41.5	12.65	35.2	10.73	425	193	507	259
	98	20.0	6.10	15.9	4.85	38.4	11.70	31.8	9.69	405	184	493	224
	108	18.6	5.67	14.5	4.42	36.8	11.22	29.0	8.84	390	177	476	216
BFH-5	88	27.3	8.32	23.2	7.07	52.7	16.06	46.4	14.14	527	239	638	289
	98	25.0	7.62	20.9	6.37	49.4	15.06	41.8	12.74	515	234	610	277
	108	23.2	7.07	19.0	5.79	46.1	14.05	37.1	11.61	496	225	588	267
BFH-6	88	32.9	10.28	28.8	8.78	63.9	19.48	57.6	17.50	631	286	763	346
	98	30.0	9.14	25.4	7.74	59.3	18.07	51.9	15.51	599	272	728	330
	108	27.7	8.44	23.6	7.19	54.9	16.73	47.2	14.39	574	260	700	318
BFH-7	88	38.5	11.73	34.3	10.45	75.0	22.86	68.7	20.94	734	333	888	403
	98	35.1	10.70	30.9	9.42	68.7	20.94	61.9	18.87	695	315	846	384
	108	32.3	9.85	28.1	8.56	64.2	19.57	56.3	17.16	663	301	812	368
BFH-8	88	44.0	13.41	40.0	12.19	86.2	26.27	80.0	24.38	851	386	1028	466
	98	40.1	12.22	35.9	10.94	78.9	24.05	71.9	21.92	805	365	979	445
	108	36.8	11.22	32.7	9.97	73.2	22.31	65.4	21.15	769	349	940	426

[1]Interpolate dimensions and windload for antennas of intermediate frequencies.
[2]De-Icer power: 750 watt per bay, nominal. May be wired for 208 or 240 V service.

FM ANTENNAS

CIRCULARLY POLARIZED PANEL RADIATOR SPECIFICATIONS, BFB SERIES

	ELECTRICAL SPECIFICATIONS									MECHANICAL SPECIFICATIONS							
	GAIN							Approx. Array Height[3]		Windload at 50/33 PSF[2]				Weight[2]			
Antenna Type	Horizontal			Vertical			Field Intensity[1]			Without Radome(s)		With Radome(s)		Without Radome(s)		With Radome(s)	
	Power	dB	Field	Power	dB	Field		FT	M	LBS	KG	LBS	KG	LBS	KG	LBS	KG
BFB-1	0.46	−3.37	0.678	0.46	3.37	0.678	93.2	8	2.44	1425	647	1730	785	800	363	850	386
BFB-2	1.0	0	1.0	1.0	0	1.0	137.5	18	5.49	2835	1287	3445	1564	1500	621	1600	727
BFB-3	1.5	1.76	1.23	1.5	1.76	1.23	169.1	28	8.53	4240	1925	5155	2340	2300	1044	2450	1114
BFB-4	2.1	3.22	1.45	2.1	3.22	1.45	199.4	38	11.6	5725	2599	6945	3153	3200	1453	3400	1545
BFB-5	2.7	4.31	1.64	2.7	4.31	1.64	225.5	48	14.6	7640	3469	9160	4159	4000	1816	4250	1932
BFB-6	3.3	5.19	1.82	3.3	5.19	1.82	250.2	58	17.7	8655	3929	10485	4760	4700	2134	5000	2273
BFB-7	3.9	5.91	1.97	3.9	5.91	1.97	270.9	68	20.7	10745	4878	12880	5848	5600	2542	5950	2705
BFB-8	4.4	6.43	2.10	4.4	6.43	2.10	288.8	78	23.8	11990	5443	14430	6551	6400	2906	6800	3091
BFB-10	5.5	7.40	2.35	5.5	7.40	2.35	323.1	98	29.9	15600	7082	18650	8467	8000	3632	8500	3864
BFB-12	6.6	8.20	2.57	6.6	8.20	2.57	353.4	118	35.9	18560	8426	22220	10088	9500	4313	10100	4591
BFB-14	7.7	8.86	2.77	7.7	8.86	2.77	380.9	138	42.1	23430	10637	27700	12576	12000	5448	12700	5773
BFB-16	8.8	9.44	2.97	8.8	9.44	2.97	408.4	158	48.2	27110	12308	31990	14523	14200	6446	15000	6818

[1] For each polarization, the field gain is equal to the square root of the power gain. The effective field intensity in mV/m at one mile (1.604 km) for 1 kW input is equal to 137.6 times the field gain.

[2] Weights and wind loads are estimated for three panels per layer on a triangular cross section tower. Other factors could increase or decrease estimate. Please verify weight and windloads data with your RCA Representative.

[3] See illustration, next page.

Accommodates Split-Feed System

The BFB- antenna is designed to operate with a single 3-1/8, 4-1/16 or 6-1/8-inch coaxial transmission line between array input and transmitter. However, the array may be arranged to operate from two transmission lines from the transmitter so that, in the event of failure of some array component, the inoperable section can be switched out of service and operation continued, with circular polarization, from the other "half" of the array at reduced ERP until the outage is corrected. See block diagram, next page.

Power Rating Considerations

Two factors determine the power rating of a BFB- antenna array: each panel in an array has a 5 kW (rms) power-input limitation and an "equivalent peak-power" (EPP) rating of 22 kW. EPP is expressed as:
$EPP = (\sqrt{P_1} + \sqrt{P_2} + \sqrt{P_3} \ldots)^2$ where P_1, P_2, P_3 . . . is the power (in watts) of each station sharing the array. For situations where all sharing stations have equal power EPP is expressed as:

$$EPP = n^2P$$

where n is the number of stations sharing and P the power of each station.

To illustrate, assume a 12-layer array with three panels per layer or 36 panels with a power gain of 6.6 and a per-panel EPP of 22 kW Array:

$$EPP = (36)\ (22) = 792 \text{ kW}.$$

Thus, a 36-panel array is rated at 792 kW EPP. The equivalent peak power of seven 100-kW ERP stations, each with 15.2 kW (100/6.6) into the array is:

$$\text{Array EPP} = 7^2\ (15.2) = 745 \text{ kW}.$$

Therefore, a 12-layer, 36-panel array can handle seven 100-kW ERP stations, each with 15.2 kW of transmitter power. The rms power per panel is:

$$P = 7(15.2)/36 = 2.96 \text{ kW per panel}.$$

Since the individual panel rating is 5 kW, 2.96 kW per panel is well within rating.

Specifications

Frequency Range ....88-108 MHz

Panel Bandwidth (Adjustable) ....6 MHz

Power Input Rating (per panel) ....5 kW rms; 22 kW EPP

FM ANTENNAS

CIRCULARLY POLARIZED PANEL RADIATOR SPECIFICATIONS, BFJ SERIES

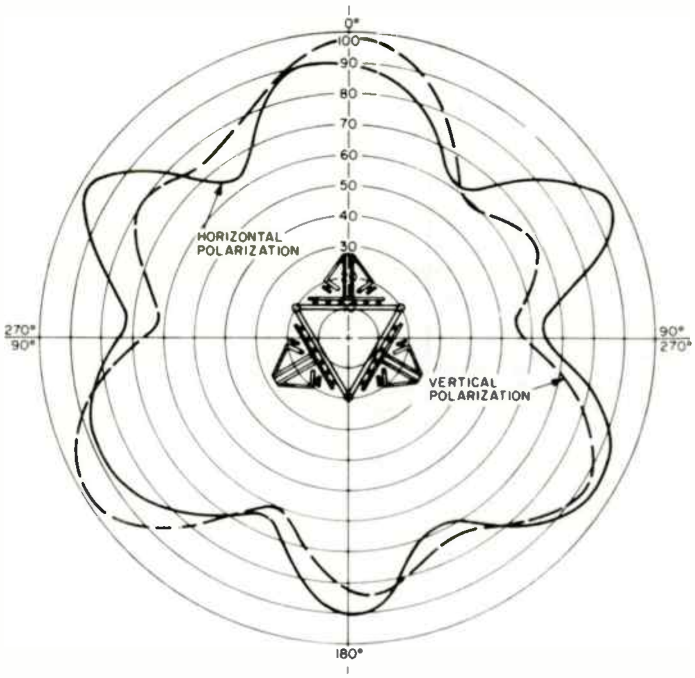
Antenna Type	Power Input Rating kW	ELECTRICAL SPECIFICATIONS: GAIN, Horizontal: Power	dB	Field	GAIN, Vertical: Power	dB	Field	Field[1] Intensity	MECHANICAL SPECIFICATIONS: Approx. Array Height: Ft.	M	WINDLOAD AT 50/30 PSF[2], Without Radomes: lbs.	kg	WINDLOAD, With Radomes: lbs.	kg	WEIGHT[2], Without Radomes: lbs.	kg	WEIGHT, With Radomes: lbs.	kg
BFJ-1	10	.46	−3.37	0.678	.46	−3.37	0.678	93.3	7	2.13	705	320	775	352	610	277	650	295
BFJ-2	20	1.0	0	1.0	1.0	0	1.0	137.6	17	5.18	1410	640	1550	703	1220	553	1300	590
BFJ-3	30	1.5	1.76	1.23	1.5	1.76	1.23	169.2	27	8.23	2115	959	2325	1055	1830	830	1950	885
BFJ-4	40	2.1	3.22	1.45	2.1	3.22	1.45	199.5	37	11.28	2820	1279	3100	1406	2440	1107	2600	1179
BFJ-5	45	2.7	4.31	1.64	2.7	4.31	1.64	225.7	47	14.33	3525	1599	3875	1758	3050	1383	3250	1474
BFJ-6	45	3.3	5.19	1.82	3.3	5.19	1.82	250.4	57	17.37	4230	1919	4650	2109	3660	1660	3900	1769
BFJ-8	45	4.4	6.43	2.10	4.4	6.43	2.10	289.0	77	23.47	5640	2558	6200	2812	4880	2214	5200	2359
BFJ-10	45	5.5	7.40	2.35	5.5	7.40	2.35	323.4	97	29.57	7050	3198	7750	3515	6100	2767	6500	2948
BFJ-12	45	6.6	8.20	2.57	6.6	8.20	2.57	353.6	117	35.66	8460	3837	9300	4218	7320	3320	7800	3538

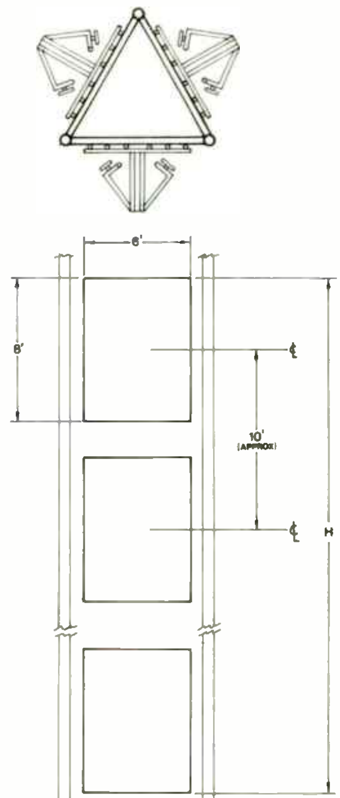
[1] Effective free-space field intensity at one mile (1.609 kM) in millivolts per meter for 1 kW antenna input power for either equivalent horizontally polarized component or equivalent vertically polarized component.

[2] Weights and windloads are calculated for three panels per layer on a triangular cross section tower.

FM ANTENNAS

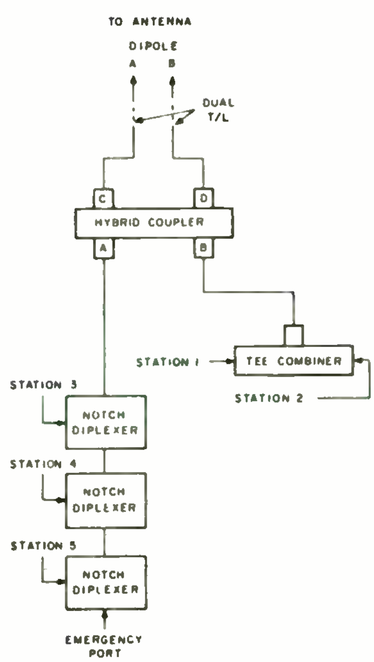
HORIZONTAL RADIATION PATTERNS, BFB ANTENNA MOUNTED ON 10 FT. FACE OF TRIANGULAR TOWER





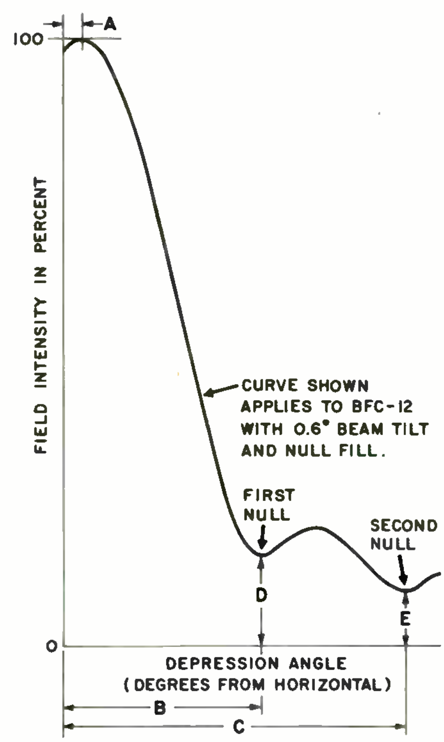
CENTER OF RADIATION AT PHYSICAL CENTER OF ANTENNA

SPLIT FEED SYSTEM



Typical five-station shared-antenna scheme for FM-broadcast stations using a Type BFB- Panel Antenna.

VERTICAL RADIATION PATTERNS, BFC SERIES



Above drawing to be used with tabulation on next page.

FM ANTENNAS

VERTICAL RADIATION PATTERNS, BFC SERIES

Antenna Type*	No. of Sections	Pattern Number	Power Gain**	Beam Tilt A°	B°	C°	1st Null D%	2nd Null E%
BFC-1B	1	61667-DRW	.46	0	84	—	5.0	—
BFC-2B	2	61667-ERW	1.0	0	30	—	0	—
BFC-3B	3	3-0-0	1.5	0	19.5	41.5	0	0
BFC-4B	4	61667-FRW	2.1	0	14.5	30.0	0	0
BFC-4B	4	4-0-10	2.1	0	14.5	30.0	10.0	0
BFC-4B	4	4-0-15	2.0	0	14.3	30.0	15.0	0
BFC-4B	4	4-1-10	2.0	1	15.7	30.0	10.0	2.0
BFC-5B	5	5-0-0	2.7	0	11.5	37.0	0	0
BFC-6B	6	6-0-0	3.2	0	9.6	19.5	0	0
BFC-6B	6	6-0-10	3.1	0	9.6	19.0	10.0	5.0
BFC-6B	6	6-0-12.5	3.14	0	9.8	19.0	12.0	6.0
BFC-6B	6	6-0-15	2.95	0	9.7	19.0	15.0	7.5
BFC-6B	6	6-05-11-5	3.1	0.5	10.3	19.0	11.0	4.5
BFC-6B	6	6-1-12-4	3.1	1.0	11.0	19.0	12.0	4.0
BFC-7B	7	7-0-0	3.8	0	8.2	16.5	0	0
BFC-8B	8	8-0-0	4.3	0	7.2	14.5	0	0
BFC-8B	8	8-0-5	4.3	0	7.2	14.5	5.0	3.0
BFC-8B	8	8-0-10	4.1	0	7.3	14.5	10.0	7.5
BFC-8B	8	8-0-15.5-11	3.95	0	7.5	14.0	15.0	11.0
BFC-8B	8	8-0.5-00	4.28	0.5	8.0	14.5	0	0
BFC-8B	8	8-0.75-00	4.22	0.75	8.2	14.5	0	0
BFC-8B	8	8-1.0-00	4.18	1.0	8.6	14.5	0	0
BFC-8B	8	8-0.5-10-6	4.1	0.5	7.9	14.5	10.0	6.0
BFC-8B	8	8-0.75-10-5.5	4.1	0.75	8.3	14.5	10.0	5.5
BFC-8B	8	8-1.0-10	4.1	1.0	8.6	—	10.0	—
BFC-8B	8	8-1.0-15	3.9	1.0	9.0	14.0	15.0	6.5
BFC-10B	10	10-0-0	5.5	0	5.8	11.5	0	0
BFC-10B	10	10-0-10-8.5-5.5	5.19	0	6.0	11.5	10.0	8.5
BFC-10B	10	10-0.5-0	5.44	0.5	6.4	11.5	0	0
BFC-10B	10	10-0.75-0	5.36	0.75	6.8	11.5	0	0
BFC-10B	10	10-1.0-0	5.26	1.0	7.1	11.5	0	0
BFC-10B	10	10-0.5-10-7	5.21	0.5	6.6	11.5	10.0	7.0
BFC-12B	12	12-0-0	6.6	0	4.8	9.6	0	0
BFC-12B	12	12-0-10-4	6.37	0	4.9	9.5	10.5	5.0
BFC-12B	12	12-0.5-0	6.48	0.5	5.5	9.5	0	0
BFC-12B	12	12-0.75-0	6.36	0.75	5.8	9.6	0	0
BFC-12B	12	12-1-0	6.19	1.0	6.1	9.6	0	0
BFC-12B	12	12-0.3-6.5	6.50	0.3	5.1	9.7	6.5	0
BFC-12B	12	12-0.4-20-6	5.7	0.4	5.5	9.3	20.0	6.0
BFC-12B	12	12-0.5-11-6-4	6.3	0.5	5.4	10.0	11.0	6.5
BFC-12B	12	12-0.6-15-9	5.93	0.6	5.8	10.0	15.0	9.0
BFC-12B	12	12-1-10	6.0	1.0	6.2	9.6	10.0	0
BFC-12B	12	12-1-13-6.5-7	6.0	1.0	6.3	9.9	13.0	6.5
BFC-12B	12	12-1-17-9-9	5.78	1.0	6.5	10.0	16.5	8.5
BFC-12B	12	12-1.5-12	5.53	1.5	7.3	9.8	12.0	0
BFC-14B	14	14-0-0	7.8	0	4.1	8.2	0	0
BFC-14B	14	14-0-10-6	7.52	0	4.2	8.2	10.0	6.0
BFC-14B	14	14-0-15	7.1	0	4.2	8.0	15.5	9.0
BFC-14B	14	14-0.5-0	7.64	0.5	4.7	8.2	0	0
BFC-14B	14	14-0.75-0	7.45	0.75	5.0	8.2	0	0
BFC-14B	14	14-1.0-0	7.19	1.0	5.5	8.2	0	0
BFC-14B	14	14-0.5-15	7.3	0.5	4.8	8.2	15.0	2.5
BFC-14B	14	14-0.5-20	6.35	0.5	5.2	7.9	20.0	7.5
BFC-14B	14	14-0.75-14	7.1	0.75	5.3	8.0	14.0	3.5
BFC-14B	14	14-1-10-6	7.2	1.0	5.4	8.4	10.0	6.0
BFC-16B	16	16-0-0	8.9	0	3.6	7.2	0	0
BFC-16B	16	16-0-10-7-3	8.46	0	3.6	7.1	10.5	7.0
BFC-16B	16	16-0-15-10-4	8.25	0	3.7	7.0	15.0	10.0
BFC-16B	16	16-0.25-0	8.85	0.25	4.0	7.1	2.0	2.0
BFC-16B	16	16-0.5-0	8.69	0.5	4.2	7.0	0	0
BFC-16B	16	16-0.75-0	8.41	0.75	4.6	7.2	0	0
BFC-16B	16	16-1.0-0	8.09	1.0	4.8	7.2	0	0
BFC-16B	16	16-0.75-15-3	8.1	0.75	4.7	7.1	15.0	3.0
BFC-16B	16	16-0.75-29	7.3	0.75	4.4	7.6	29.0	8.5

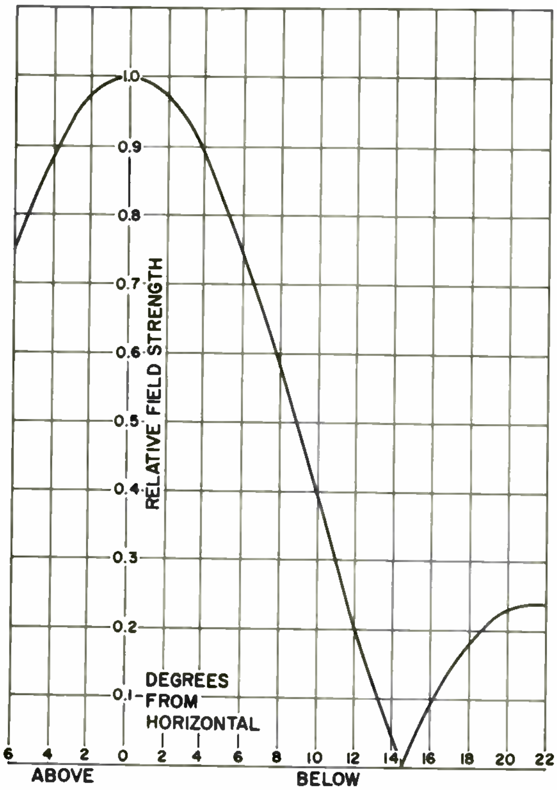
For definition, see vertical radiation pattern on preceding page.

*Patterns listed apply to BFB, BFC, BFG, BFH and BFI antennas.
**Gain of main lobe.

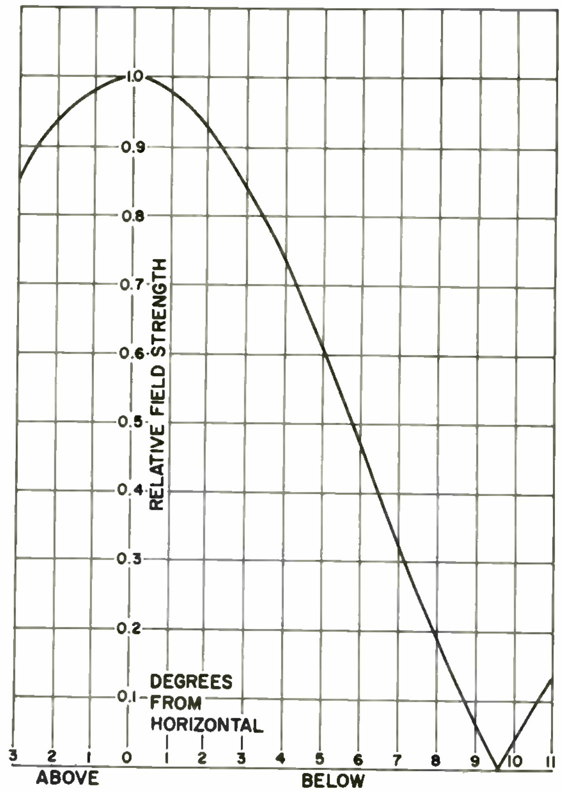
FM ANTENNAS

VERTICAL RADIATION PATTERNS, BFC SERIES

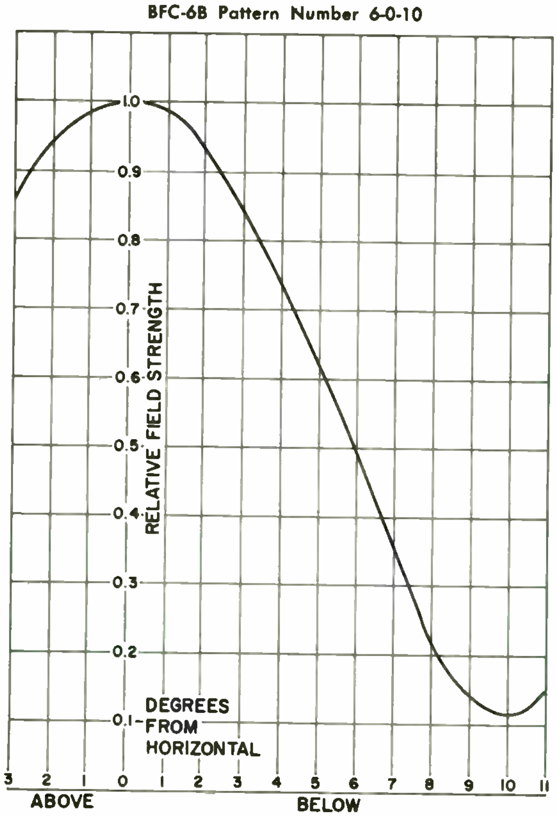
BFC-4 Pattern Number 61667-FRW



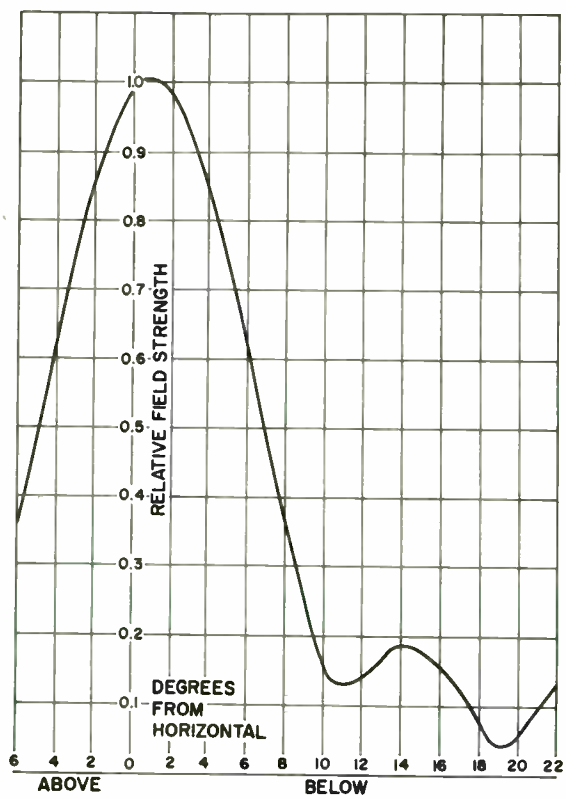
BFC-6 Pattern Number 6-0-0



BFC-6B Pattern Number 6-0-10



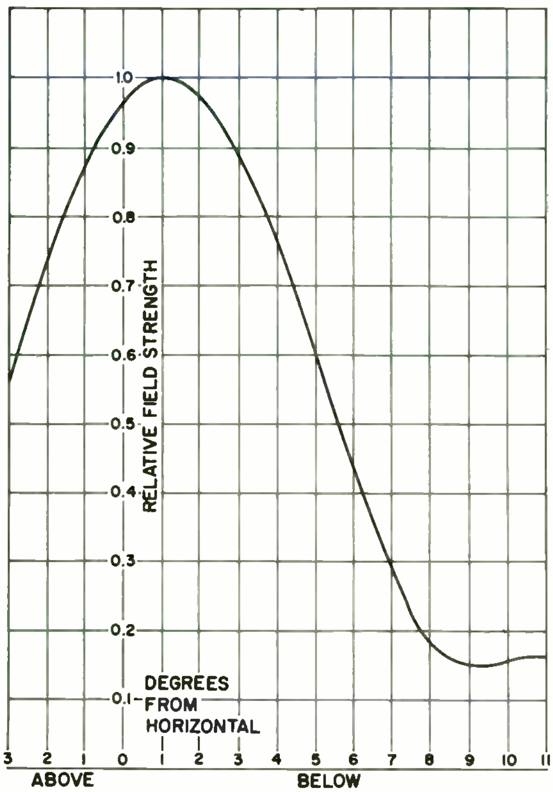
BFC-6B Pattern Number 6-1-12-4



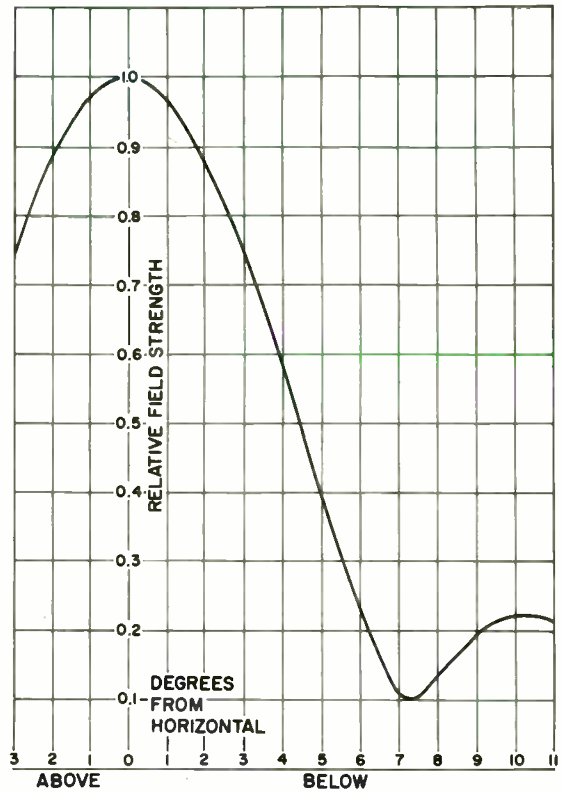
FM ANTENNAS

VERTICAL RADIATION PATTERNS, BFC SERIES

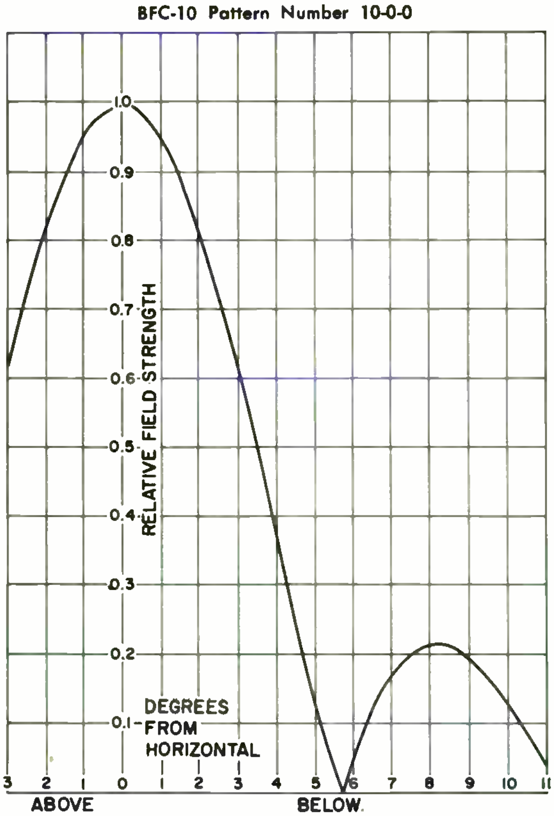
BFC-8 Pattern Number 8-1-15



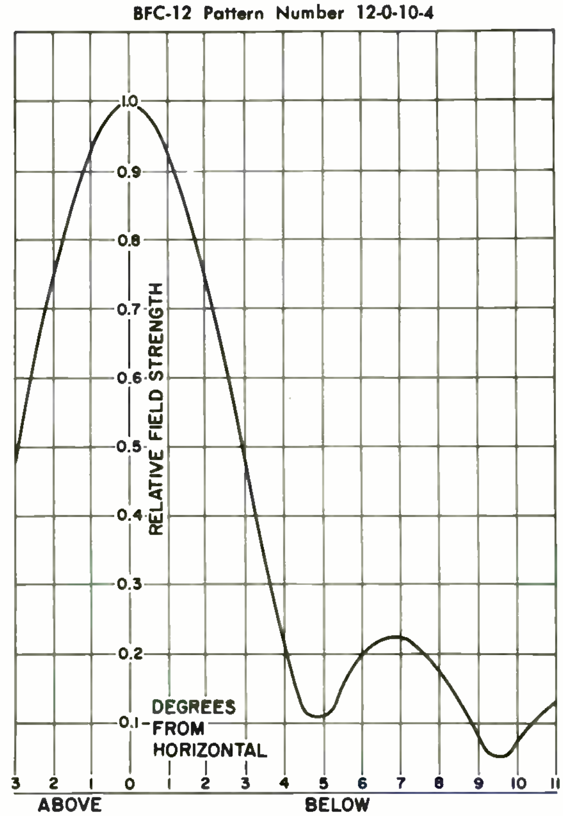
BFC-8B Pattern Number 8-0-10



BFC-10 Pattern Number 10-0-0



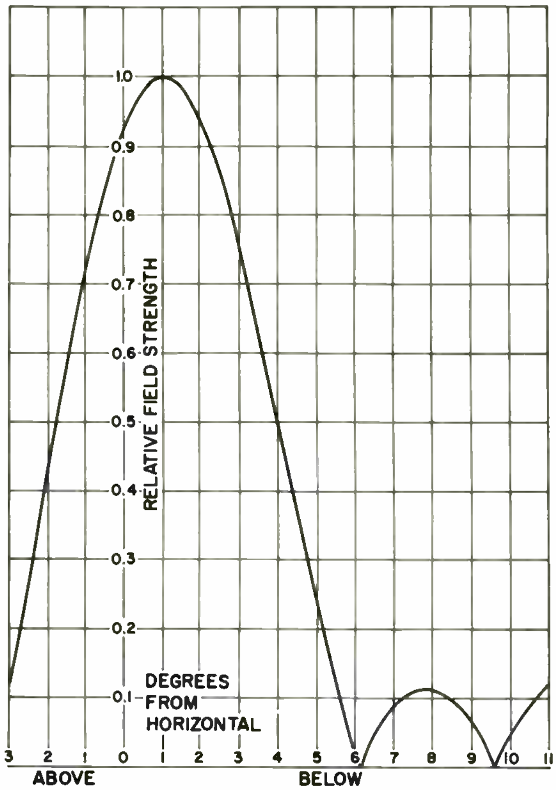
BFC-12 Pattern Number 12-0-10-4



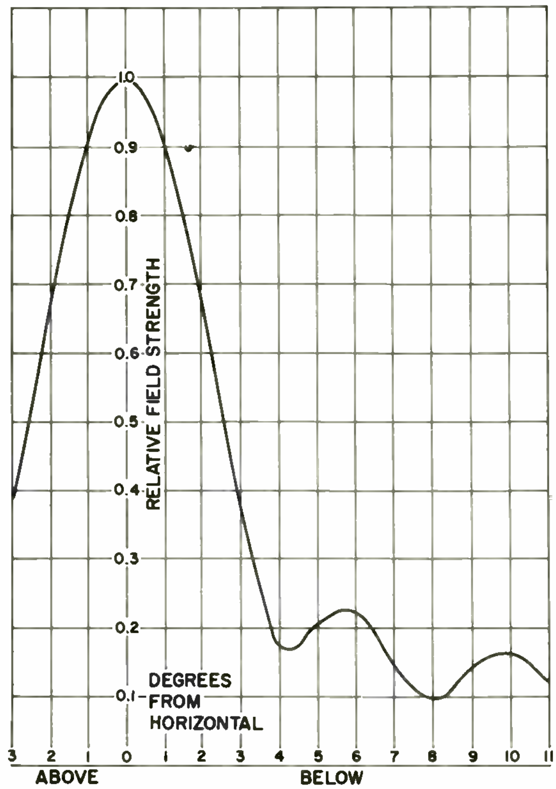
FM ANTENNAS

VERTICAL RADIATION PATTERNS, BFC SERIES

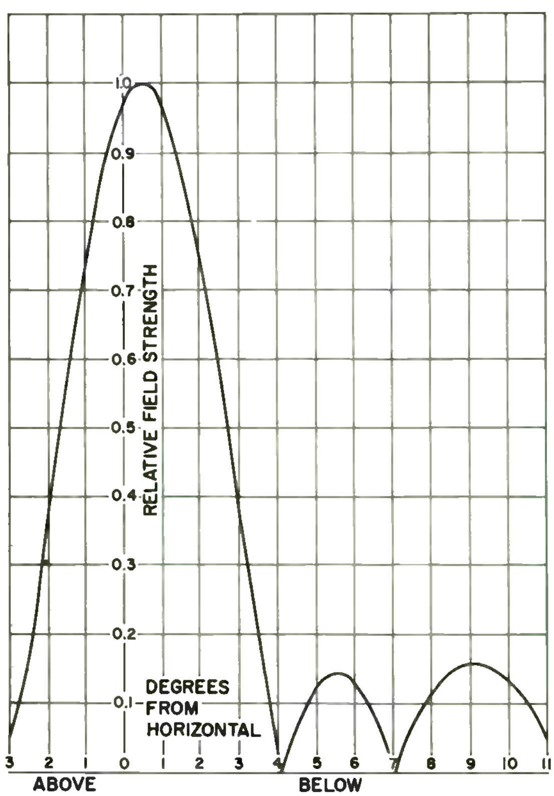
BFC-12 Pattern Number 12-1-0



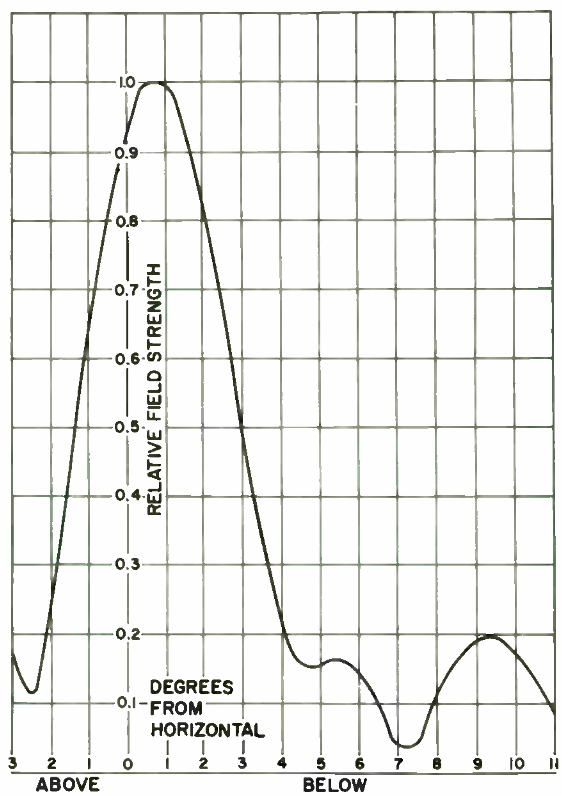
BFC-14 Pattern Number 14-0-18-10



BFC-16 Pattern Number 16-0-0.5-0

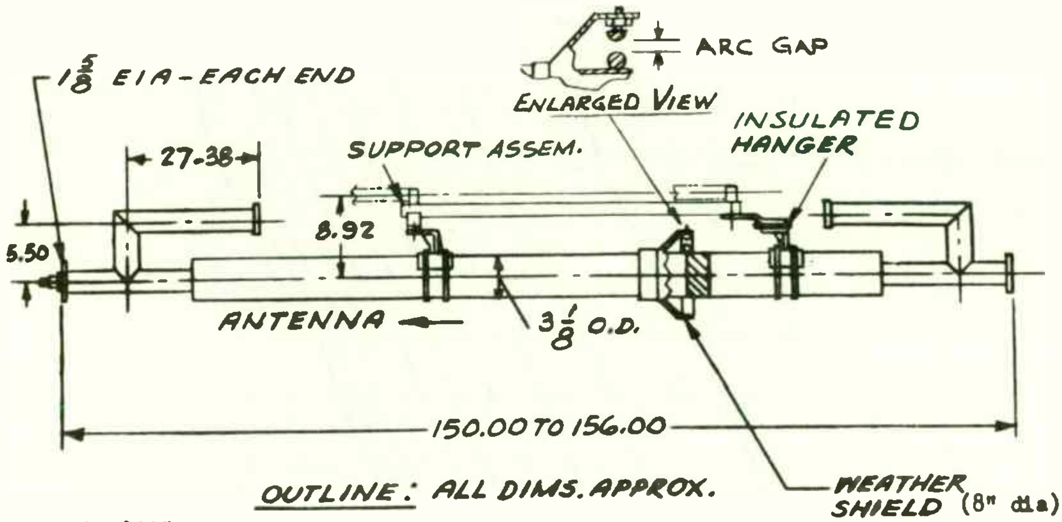


BFC-16 Pattern Number 16-0.75-15-3



FM ANTENNAS

AM/FM ISOLATION UNIT



Type BAF-15A (10kW)

Mechanical Specifications

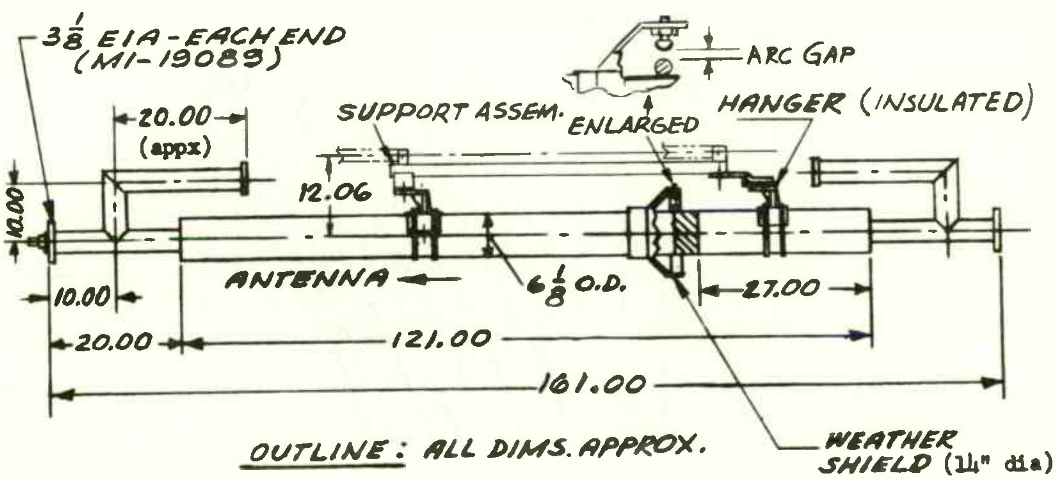
Mounting .... Vertical
Maximum Gas Pressure for Pressurizing .... 30 PSIG
Weight (approx.) .... 55 lbs.
Connectors .... Coaxial Line (1⅝ inch) EIA

Accessory

Adapter required to connect to MI-19112 line MI-19112-62

Electrical Specifications

Frequency Range .... 88-108 MHz
Impedance .... 50 ohms
VSWR .... 1.08 or better
Maximum Power FM .... 10 kW
Maximum Tower Base Voltage AM .... 10 kV Peak
Internal Capacitance at AM .... 130 PF
Insertion Loss .... 0.1 dB max.
2nd Harmonic Rejection .... 70 dB
4th Harmonic Rejection .... 50 dB
6th Harmonic Rejection .... 30 dB
Arc Gap Setting at Factory .... 0.08 inches



Type BAF-16A (40 kW)

Mechanical Specifications

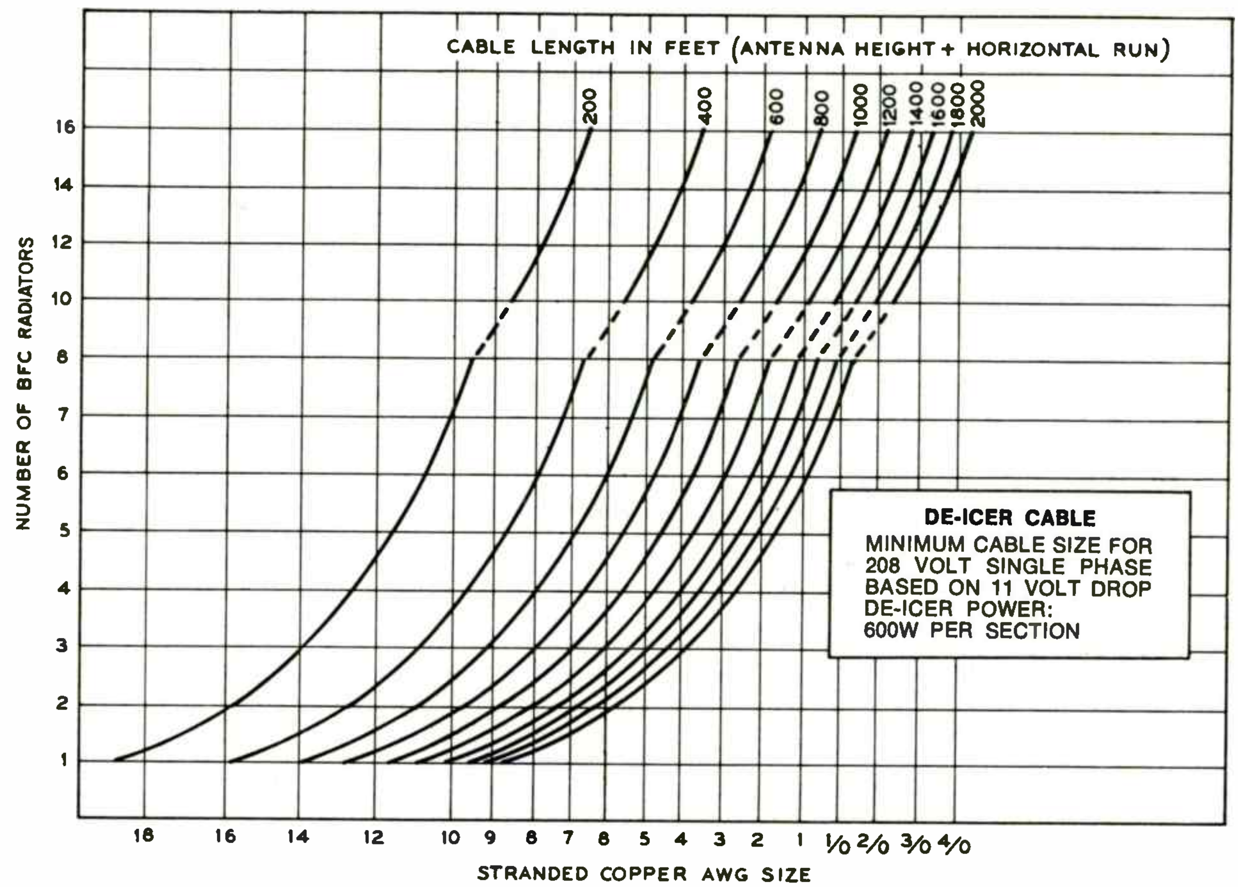
Mounting .... Vertical
Maximum Gas Pressure for Pressurizing .... 12 PSIG
Weight (approx.) .... 100 lbs.
Connectors .... Coaxial Line (3⅛ inch) EIA

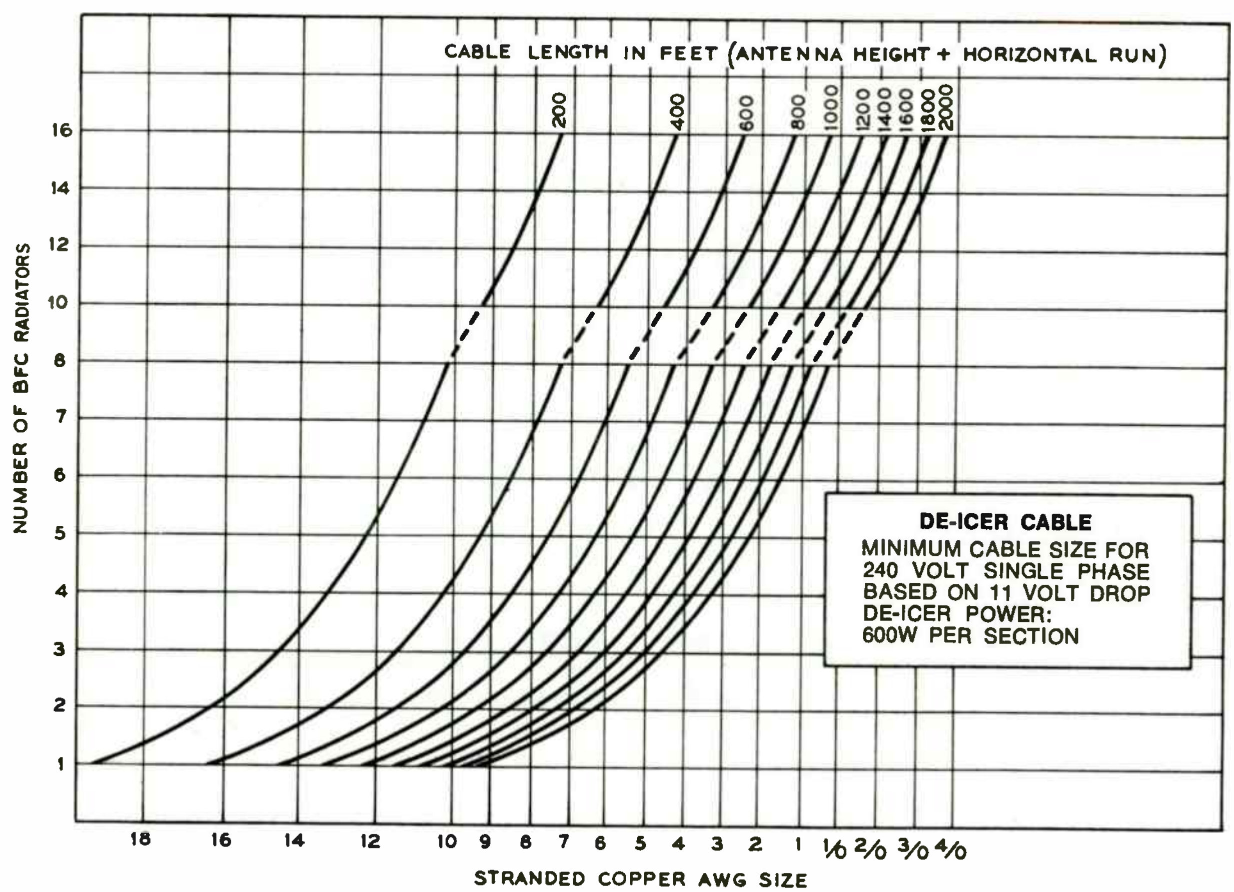
Electrical Specifications

Frequency Range .... 88-108 MHz
Impedance .... 50 ohms
VSWR .... 1.08 or better
Maximum Power FM .... 40 kW
Maximum Tower Base Voltage AM .... 14 kV Peak
Internal Capacitance at AM .... 130 PF
Insertion Loss .... 0.1 dB max.
2nd Harmonic Rejection .... 80 dB
4th Harmonic Rejection .... 60 dB
6th Harmonic Rejection .... 40 dB
Arc Gap Setting at Factory .... 0.08 inches

FM ANTENNAS

DE-ICER CABLES AND POWER, BFC, BFG, BFH SERIES





COAXIAL TRANSMISSION LINE

COAXIAL LINE TYPES AND SPECIFICATIONS

RIGID 50-OHM IMPEDANCE—TEFLON INSULATED

Nominal Diameter	Recommended Service	Coupling Device	Pressure Tight	Power Rating 1 MHz[1]	Power Rating 100 MHz	Efficiency	Weight per 100 Ft Lbs/kg	Type Number	Catalog Reference[2]
1⅝″	FM, VHF-TV	Unflanged	No	28.5	See Curves	See Curves	115/52	MI-561565	RA.5011
3⅛″	AM, FM, TV	Universal	Yes	94			280/127	MI-27791D	RA.5011
3⅛″	AM, FM, VHF-TV	Unflanged	No	94			230/104	MI-27791K	RA.5011
3⅛″	FM, TV	Bolt Flange	Yes	94			270/122	MI-19089	TR.2301
6⅛″	FM, VHF-TV	Unflanged	No				625/284	MI-561579	RA.5011
4-1/16″	FM, TV	Universal	Yes					MI-561673E	
4-1/16″	FM, VHF-TV	Unflanged	No					MI-561673K	

RIGID 51.5 OHM IMPEDANCE—STEATITE AND TEFLON INSULATED**

Nominal Diameter	Recommended Service	Coupling Device	Pressure Tight	Power Rating 1 MHz[1]	Power Rating 100 MHz	Efficiency	Weight per 100 Ft Lbs/kg	Type Number	Catalog Reference[2]
1⅝″	AM, FM	Bolt Flange	Yes	25	See Curves	See Curves	125/57	MI-19112	TR.2401
1⅝″	AM, FM	Unflanged	No	25			120/54	MI-19112	TR.2401
3⅛″	AM, FM, VHF-TV	Bolt Flange	Yes	94			250/113	MI-19113C	RA.5011
3⅛″	AM, FM	Unflanged	No	94			265/120	MI-19113C	RA.5011
3⅛″*	AM, FM, VHF-TV*	Bolt Flange*	Yes*	92			255/115*	MI-19313C*	RA.5011
3⅛″*	AM, FM, VHF-TV*	Unflanged*	No*	92			240/109*	MI-19313C*	RA.5011
6⅛″	AM, FM, VHF-TV	Bolt Flange	Yes	288			730/331	MI-19314C	TR.2401
6⅛″	AM, FM, VHF-TV	Unflanged	No	288			695/316	MI-19314C	TR.2401

*Teflon insulated.
**Not recommended for new installations.

SEMI-RIGID 50-OHM IMPEDANCE—POLYETHYLENE INSULATED HELIAX—ANDREW CORP.

Nominal Diameter	Recommended Service	Coupling Device	Pressure Tight	Power Rating 1 MHz[1]	Power Rating 100 MHz	Efficiency	Weight per 100 Ft Lbs/kg	Type Number	Catalog Reference[2]
½″	AM, FM	Continuous[3]	Yes	2.5	See Curves	See Curves	24/11	HJ450	RA.5011
⅞″	AM, FM	Continuous[3]	Yes	11.0			54/25	HJ5-50	RA.5011
1⅝″	AM, FM	Continuous[3]	Yes	36.25			104/47	HJ7-50	RA.5011
3″	AM, FM	Continuous[3]	Yes	80.0			178/81	HJ8-50	RA.5011
4″	AM, FM	Continuous[3]	Yes	122.5			250/114	HJ11-50	RA.5011
5″	AM, FM	Continuous[3]	Yes	191.25			330/151	HJ9-50	RA.5011

SEMI-RIGID 50-OHM IMPEDANCE—FOAM INSULATED HELIAX—ANDREW CORP.

Nominal Diameter	Recommended Service	Coupling Device	Pressure Tight	Power Rating 1 MHz[1]	Power Rating 100 MHz	Efficiency	Weight per 100 Ft Lbs/kg	Type Number	Catalog Reference[2]
⅜″	AM, FM	Continuous[3]	No	—	See Curves	See Curves	11/5	FHJ2-50	RA.5011
½″	AM, FM	Continuous[3]	No	4.75			16/7	LDF4-50	RA.5011
⅞″	AM, FM	Continuous[3]	No	11.0			33/15	LDF5-50	RA.5011
1⅝″	AM, FM	Continuous[3]	No	36.25			140/64	FHJ7-50	RA.5011

SEMI-RIGID 50 OHM IMPEDANCE—POLYETHYLENE INSULATED WELLFLEX—CABLEWAVE SYSTEMS, INC.

Nominal Diameter	Recommended Service	Coupling Device	Pressure Tight	Power Rating 1 MHz[1]	Power Rating 100 MHz	Efficiency	Weight per 100 Ft Lbs/kg	Type Number	Catalog Reference[2]
½″	AM, FM	Continuous[3]	Yes	2.75	See Curves	See Curves	16/7	HCC 12-50	RA.5011
⅞″	AM, FM	Continuous[3]	Yes	11.0			55/25	HCC 78-50	RA.5011
1⅝″	AM, FM	Continuous[3]	Yes	37.0			92/42	HCC 158-50	RA.5011
3″	AM, FM	Continuous[3]	Yes	78.0			175/80	HCC 300-50	RA.5011
3½″	AM, FM	Continuous[3]	Yes	110.0			200/91	HCC 312-50	RA.5011

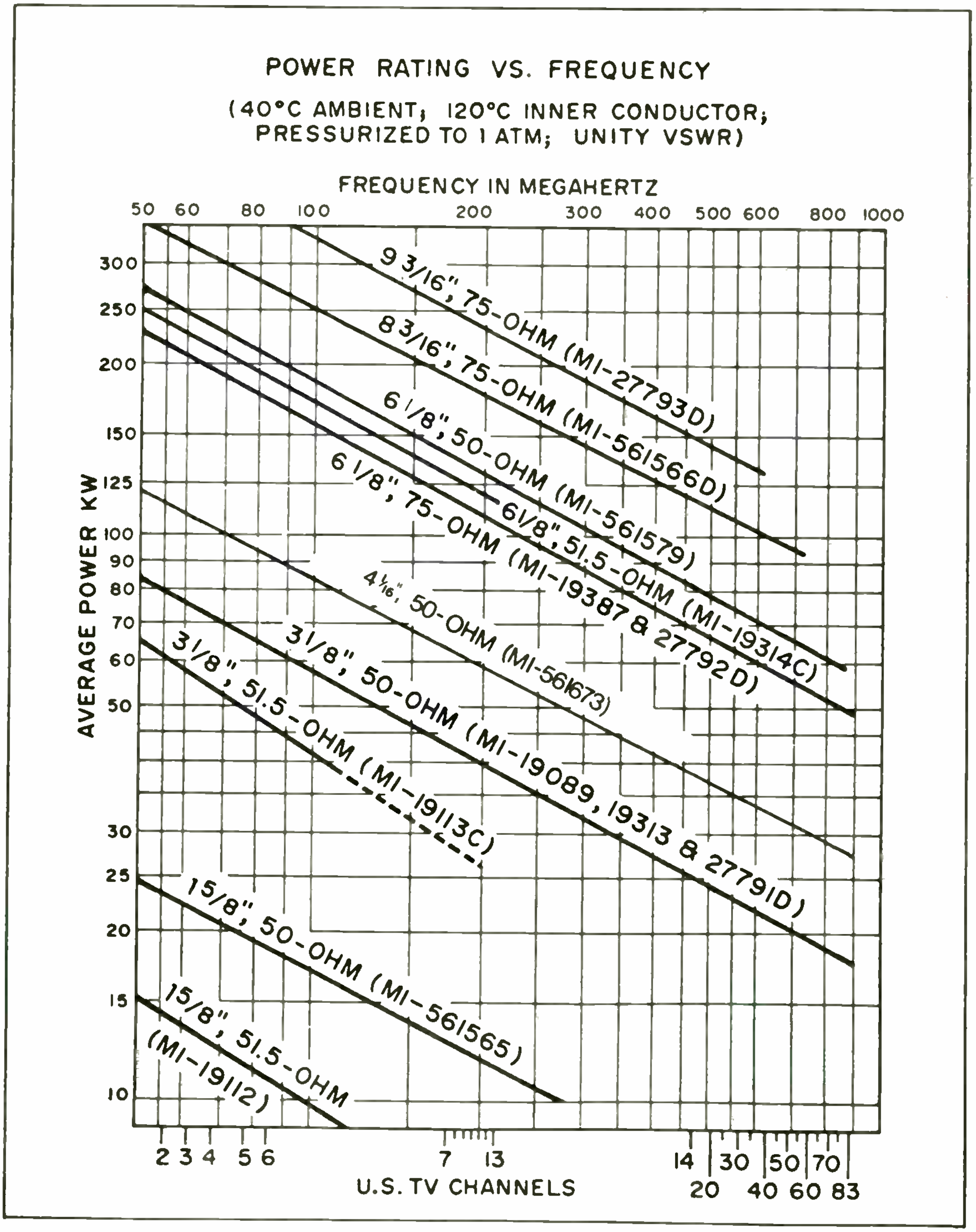
SEMI-RIGID 50 OHM IMPEDANCE—FOAM INSULATED WELLFLEX—CABLEWAVE SYSTEMS, INC.

Nominal Diameter	Recommended Service	Coupling Device	Pressure Tight	Power Rating 1 MHz[1]	Power Rating 100 MHz	Efficiency	Weight per 100 Ft Lbs/kg	Type Number	Catalog Reference[2]
⅜″	AM, FM	Continuous[3]	No	—	See Curves	See Curves	9/4	FCC 38-50	RA.5011
½″	AM, FM	Continuous[3]	No	4.88			16/7	FCC 12-50	RA.5011
⅞″	AM, FM	Continuous[3]	No	11.00			48/22	FCC 78-50	RA.5011
1⅝″	AM, FM	Continuous[3]	No	37.00			120/55	FCC 158-50	RA.5011

[1] In kW at 100% modulation, unity VSWR.
[2] Available at any RCA Broadcast Field Office or Transmission Line Marketing, RCA Bldg. 2-5, Camden, N. J. 08102.
[3] Attachable connectors available.

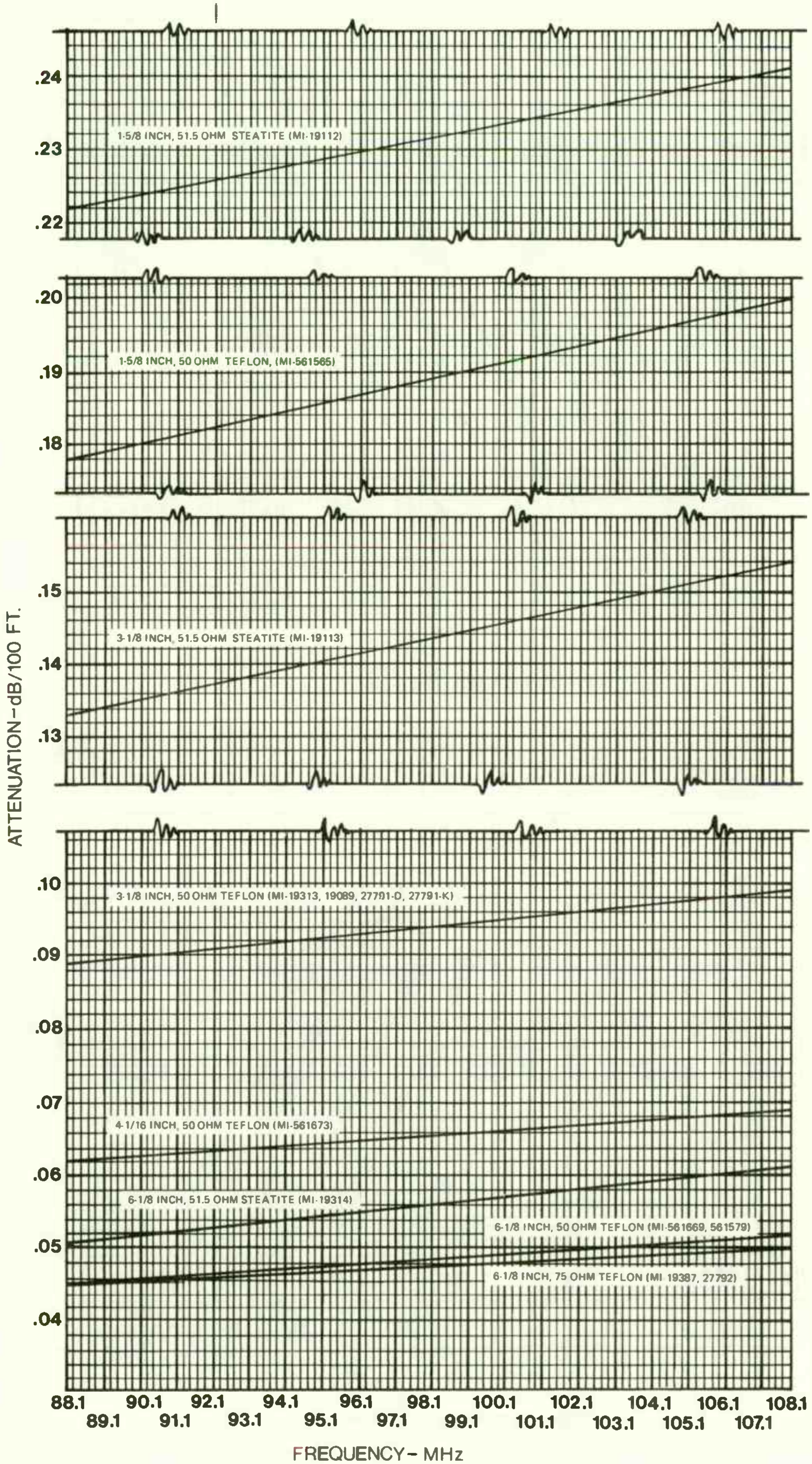
COAXIAL TRANSMISSION LINE

RIGID COAXIAL LINE SPECIFICATIONS



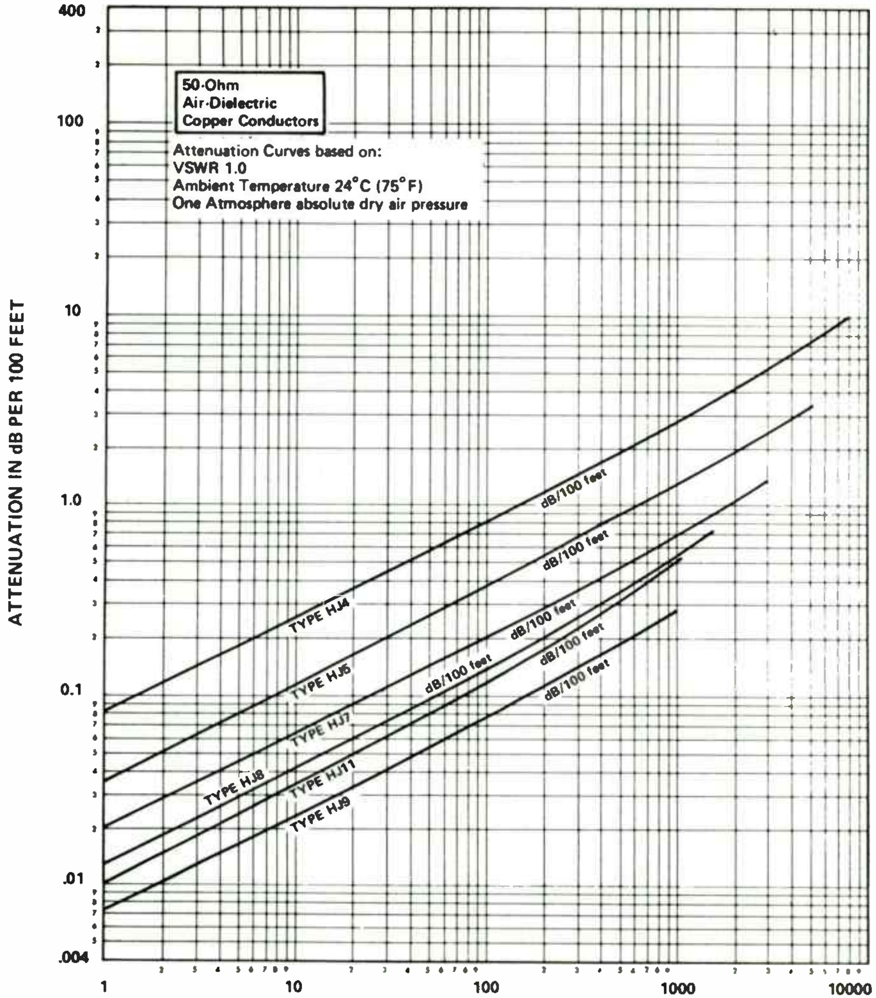
COAXIAL TRANSMISSION LINE

RIGID COAXIAL LINE — ATTENUATION AT FM FREQUENCIES

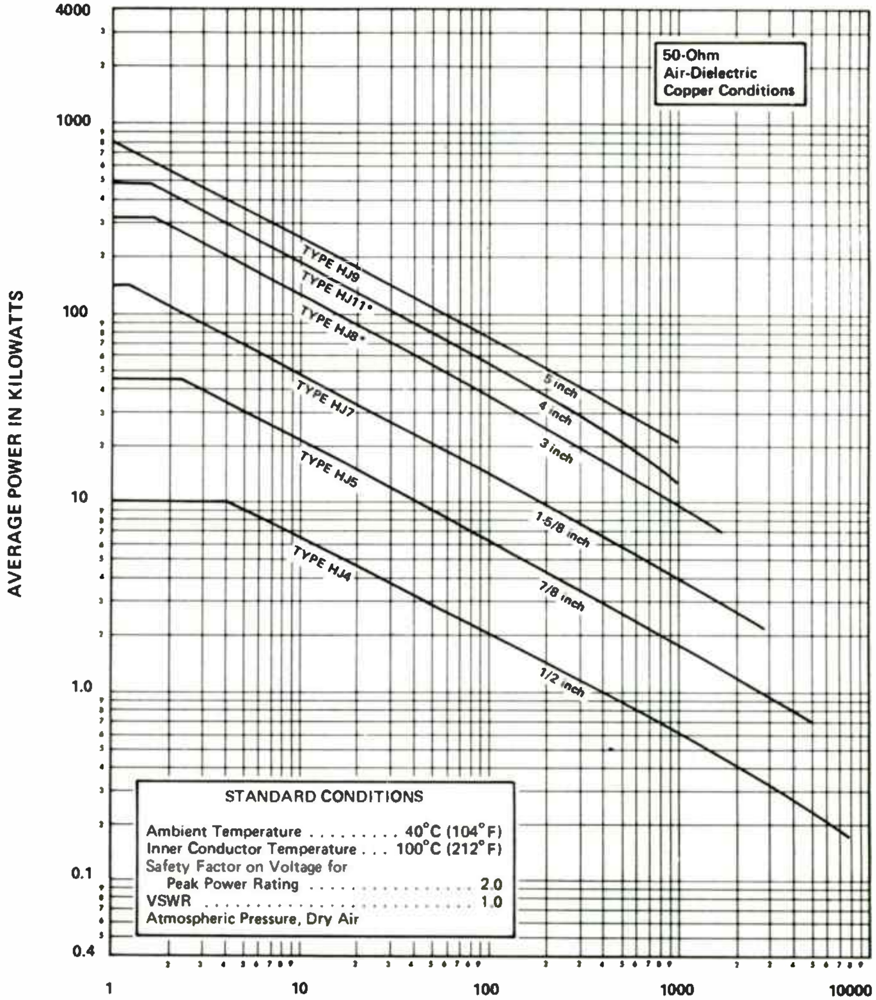


Attenuation and Power Curves for Andrews 50-Ohm Air Dielectric Heliax at Unity VSWR

HELIAX® CABLE ATTENUATION



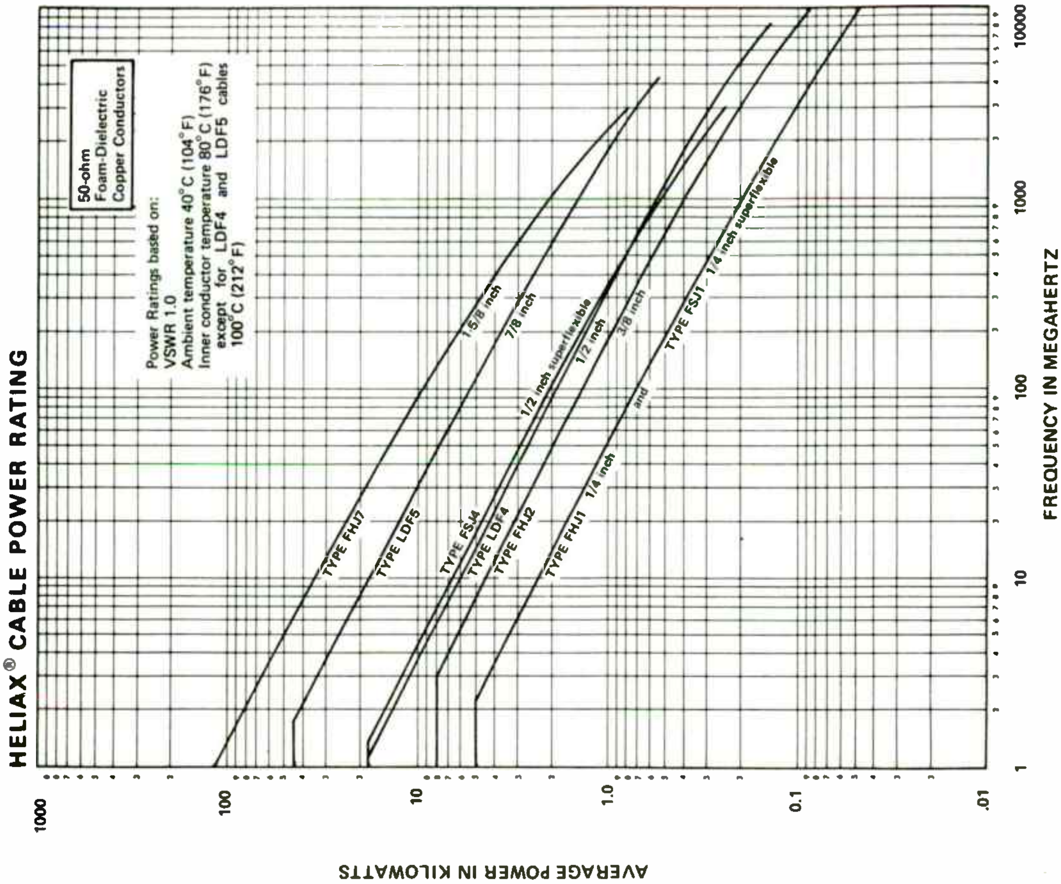
HELIAX® CABLE POWER RATING

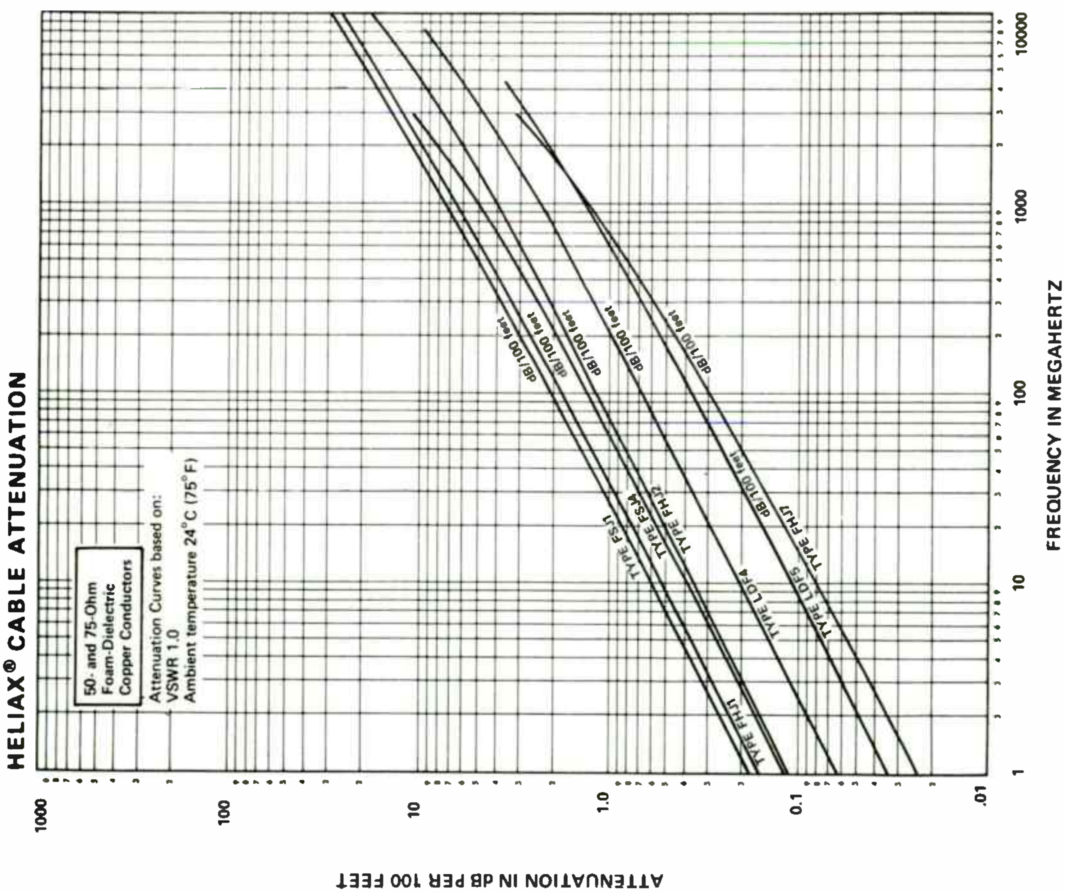


*Based on 121°C (250°F) inner conductor temperature. Cables employ a special high temperature dielectric.

COAXIAL TRANSMISSION LINE

Attenuation and Power Curves for Andrews 50-Ohm Foam Heliax at Unity VSWR

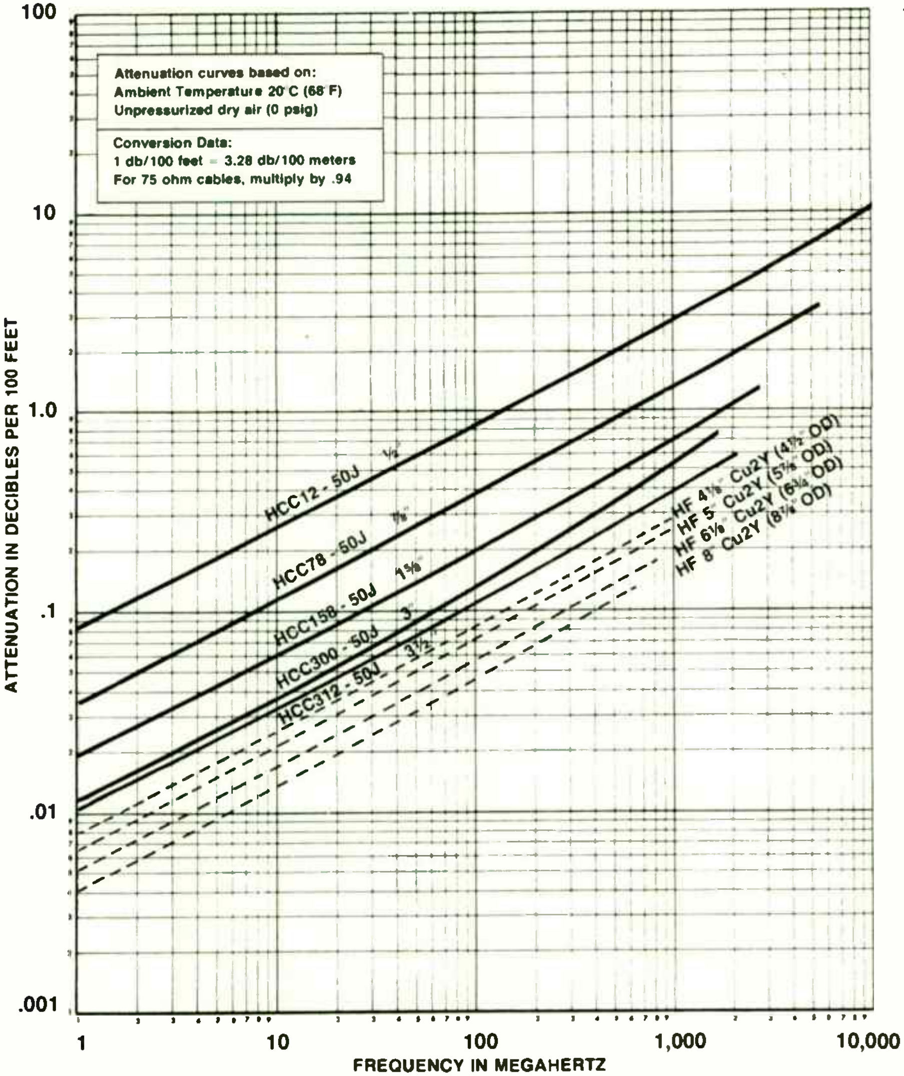




Attenuation and Power Curves for Cablewave Air Wellflex Cable

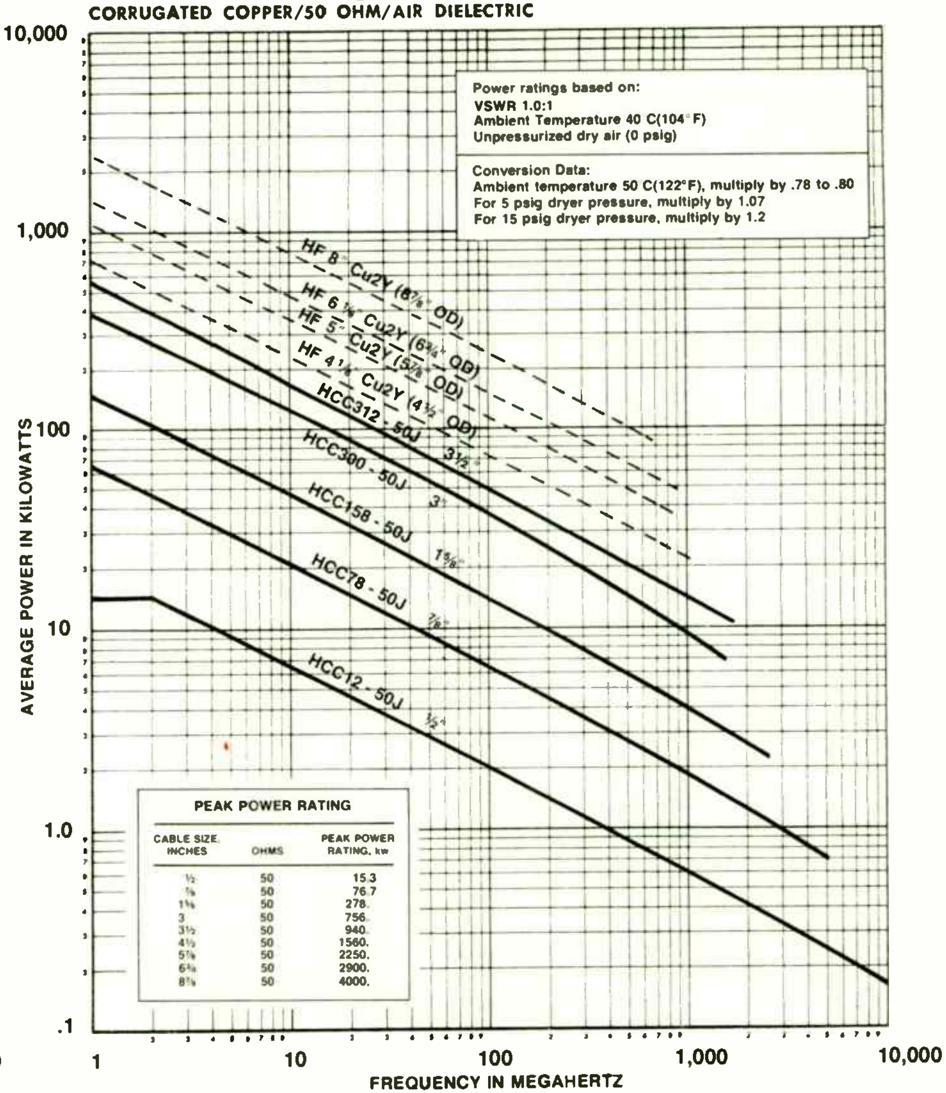
Air Wellflex Cable Attenuation

CORRUGATED COPPER/50 OHM/AIR DIELECTRIC



Air Wellflex Average Power Rating

CORRUGATED COPPER/50 OHM/AIR DIELECTRIC



PEAK POWER RATING

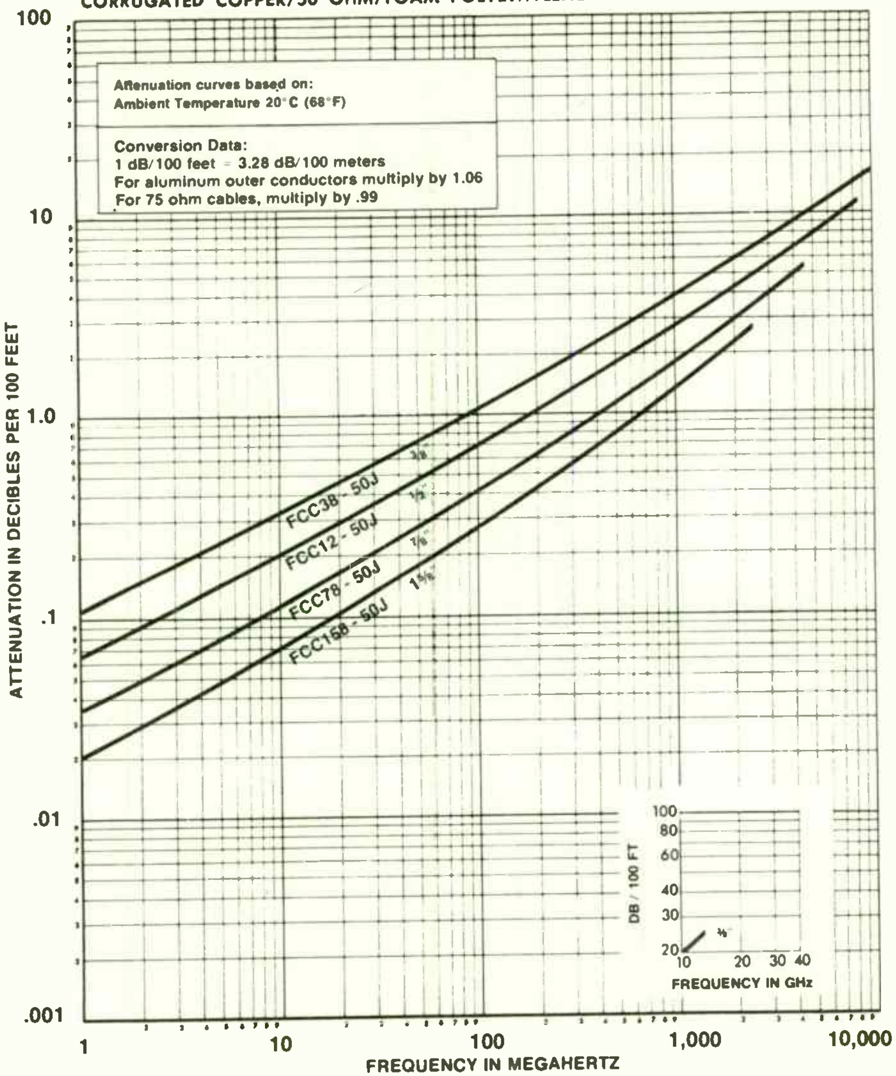
CABLE SIZE, INCHES	OHMS	PEAK POWER RATING, kw
½	50	15.3
⅞	50	76.7
1⅝	50	278.
3	50	756.
3½	50	940.
4½	50	1560.
5⅝	50	2250.
6¼	50	2900.
8⅝	50	4000.

COAXIAL TRANSMISSION LINE

Attenuation and Power Curves for Cablewave Foam Wellflex Cable

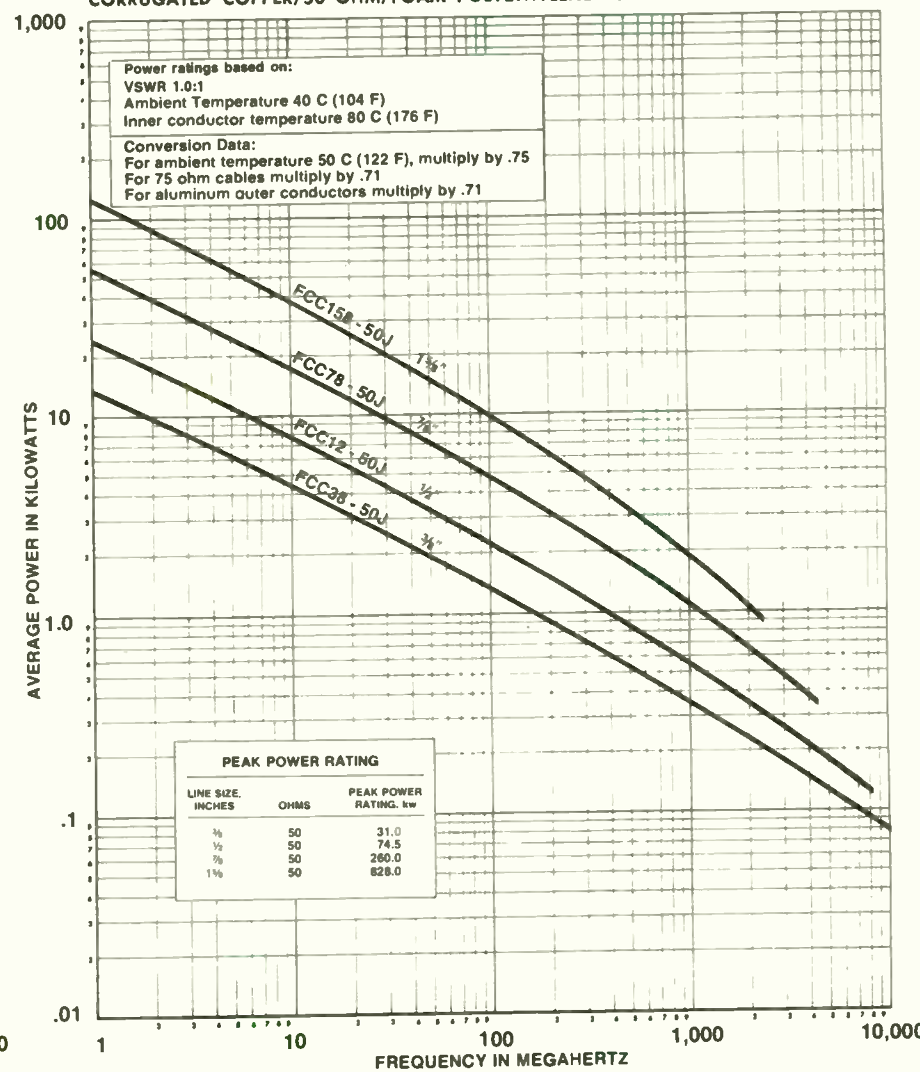
Foam Wellflex Cable Attenuation

CORRUGATED COPPER/50 OHM/FOAM POLYETHYLENE DIELECTRIC



Foam Wellflex Average Power Rating

CORRUGATED COPPER/50 OHM/FOAM POLYETHYLENE DIELECTRIC



PEAK POWER RATING

LINE SIZE, INCHES	OHMS	PEAK POWER RATING, kw
3/8	50	31.0
1/2	50	74.5
7/8	50	260.0
1 5/8	50	828.0

AUXILIARY BROADCAST SERVICES

FCC rules provide for the use of radio transmitting apparatus to supply a uxiliary services in connection with AM and FM broadcasting. These include:

Remote Pickup Mobile Stations, which may be used for relaying aural broadcast program material.

Remote Pickup Base Stations, used principally to provide communication with remote mobile stations, and for other uses under special circumstances. Equipment, frequency assignments, technical operation and channel availability are identical with those for the mobile stations. Base stations, however, are permanently installed at a fixed location and do not normally carry program material.

Studio-to-Transmitter Links, which are available to the licensees of AM and FM broadcast stations and are used to relay programs from the studio to the transmitter of the station. The licensee of both an AM and FM station may use the same STL for both stations. The STL may also be used to provide communication between studio and transmitter when no programs are being transmitted, or if multiplexing is employed, may be used for communication during program transmission.

Radio Order Circuits, which are authorized for use over remote pickup base stations for two-way communication between the studio and transmitter of a broadcast station which has a radio STL. Radio order circuits are licensed for unlimited time operation, but their use is secondary to other needs for the same frequencies.

FM Inter-City Relay Stations, which are authorized only when suitable common carrier facilities are not available. Radio or wire lines may be used. Frequencies are the same as those used for broadcast STL's. Directional antennas are required, and they may be operated by remote control.

The brief explanations of FCC rules contained in this data book are intended to assist the reader in planning remote pickup and STL equipment, and should not be considered authoritative for every purpose. Reference should be made to the full text of Part 4 of the FCC rules to assure accuracy when necessary. Outside U.S.A., local rules should prevail.

Special Note: All transmitters marketed after August 31, 1977 shall be type accepted by the FCC for use under Auxiliary Broadcast Services.

STL AND INTERCITY RELAY FREQUENCIES

(Emission: 430-F-3; Frequency in MHz)

947.0	949.5
947.5	950.0
948.0	950.0
948.5	951.0
949.0	951.5

RADIO ORDER CIRCUIT FREQUENCIES

Group	Frequency	Type Emission
I	26.07	20-A-3 or 20-F-3
	26.11	
	26.45	
J	26.09	20-A-3 or 20-F-3
	26.13	
	26.47	

AUXILIARY BROADCAST SERVICES

REMOTE PICKUP ALLOCATIONS AND AUTHORIZATIONS

The following groups of frequencies are allocated for assignment to remote pickup broadcast stations. A licensee may have one or more frequencies assigned for operation in the same area, but is limited within each "division" to assignments from a single "group".

Division	Group	Frequencies	Type Emission	Shared	Remarks
1	A	1606 kHz[1]	10-A-3	No	
		1622 kHz		No	
		1646 kHz		No	
2	D	25.87 MHz[2]	20-A-3/20-F-3	No	
		26.15 MHz		No	
		26.25 MHz		No	
		26.35 MHz		No	
2	E	25.91 MHz[2]	20-A-3/20-F-3	No	
		26.17 MHz		No	
		26.27 MHz		No	
		26.37 MHz		No	
2	F	25.95 MHz[2]	20-A-3/20-F-3	No	
		26.19 MHz		No	
		26.29 MHz		No	
		26.39 MHz		No	
2	G	25.99 MHz[2]	20-A-3/20-F-3	No	
		26.21 MHz		No	
		26.31 MHz		No	
		26.41 MHz		No	
2	H	26.03 MHz[2]	20-A-3/20-F-3	No	
		26.23 MHz		No	
		26.33 MHz		No	
		26.43 MHz		No	
3	I	26.07 MHz[2]	20-A-3/20-F-3	No	When used for radio order circuits
		26.11 MHz		No	such use is secondary to all other
		26.45 MHz		No	permissible uses.
3	J	26.09 MHz[2]	20-A-3/20-F-3	No	
		26.13 MHz		No	
		26.47 MHz		No	
4	K_1	152.87 MHz[3] & [8]	30-A-3/60-F-3	Yes	
		152.93 MHz		Yes	
		152.99 MHz		Yes	
		153.05 MHz		Yes	Shared with Industrial Radio Services
		153.11 MHz		Yes	which have first priority on the
		153.17 MHz		Yes	frequencies.
		153.23 MHz		Yes	
		153.29 MHz		Yes	
		153.35 MHz		Yes	
	K_2	161.64 MHz[5] & [8]	30-A-3/30-F-3	Yes	
		161.67 MHz		Yes	
		161.70 MHz		Yes	
		161.73 MHz		Yes	
		161.76 MHz		Yes	
		(Following frequencies used in Puerto Rico & Virgin Islands only)			
		160.89 MHz	60-A-3/60-F-3	Yes	
		160.95 MHz		Yes	
		160.01 MHz		Yes	
		161.07 MHz		Yes	
		161.13 MHz		Yes	
		161.19 MHz		Yes	
		161.25 MHz		Yes	
		161.31 MHz		Yes	
		161.37 MHz		Yes	
5	L	166.25 MHz[4]	25-A-3/25-F-3	No	
5	M	170.15 MHz[4]	25-A-3/25-F-3	No	
6	N_1	450.05 MHz	50-A-3/50-F-3	No	Program & Cues
		450.15 MHz		No	Program & Cues
		450.25 MHz		No	Program & Cues
		450.35 MHz		No	Program & Cues
		450.45 MHz		No	Program & Cues
		450.55 MHz		No	Program & Cues
		455.05 MHz		No	Program & Cues
		455.15 MHz		No	Program & Cues
		455.25 MHz		No	Program & Cues
		455.35 MHz		No	Program & Cues
		455.45 MHz		No	Program & Cues
		455.55 MHz		No	Program & Cues

AUXILIARY BROADCAST SERVICES

REMOTE PICKUP ALLOCATIONS AND AUTHORIZATIONS

Division	Group	Frequencies	Type Emission	Shared	Remarks
6	N_2	450.0875 MHz	50-A-3/50-F-3	No	Comm., Program Materials & Cues
		450.1125 MHz		No	Comm., Program Materials & Cues
		450.1875 MHz		No	Comm., Program Materials & Cues
		450.2125 MHz		No	Comm., Program Materials & Cues
		450.2875 MHz		No	Comm., Program Materials & Cues
		450.3125 MHz		No	Comm., Program Materials & Cues
		450.3875 MHz		No	Comm., Program Materials & Cues
		450.4125 MHz		No	Comm., Program Materials & Cues
		450.4875 MHz		No	Comm., Program Materials & Cues
		450.5125 MHz	50-A-3/50-F-3	No	Comm., Program Materials & Cues
		450.5875 MHz		No	Comm., Program Materials & Cues
		450.6125 MHz		No	Comm., Program Materials & Cues
		455.0875 MHz		No	Comm., Program Materials & Cues
		455.1125 MHz		No	Comm., Program Materials & Cues
		455.1875 MHz		No	Comm., Program Materials & Cues
		455.2125 MHz		No	Comm., Program Materials & Cues
		455.2875 MHz		No	Comm., Program Materials & Cues
		455.3125 MHz		No	Comm., Program Materials & Cues
		455.3875 MHz		No	Comm., Program Materials & Cues
		455.4125 MHz		No	Comm., Program Materials & Cues
		455.4875 MHz		No	Comm., Program Materials & Cues
		455.5125 MHz		No	Comm., Program Materials & Cues
		455.5875 MHz		No	Comm., Program Materials & Cues
		455.6125 MHz		No	Comm., Program Materials & Cues
7	P	450.01 MHz[6]	10-A-3/10-F-3		Tone Signalling OPR. Comm., TSL
		450.02 MHz			Tone Signalling OPR. Comm., TSL
		450.98 MHz			Tone Signalling OPR. Comm., TSL
		450.99 MHz			Tone Signalling OPR. Comm., TSL
		455.01 MHz			Tone Signalling OPR. Comm., TSL
		455.02 MHz			Tone Signalling OPR. Comm., TSL
		455.98 MHz			Tone Signalling OPR. Comm., TSL
		455.99 MHz			Tone Signalling OPR. Comm., TSL
8	R	450.650 MHz[7]	50-A-3/50-F-3		Program
		450.700 MHz			Program
		450.750 MHz			Program
		450.800 MHz			Program
		450.850 MHz			Program
		455.650 MHz			Program
		455.700 MHz			Program
		455.750 MHz			Program
		455.800 MHz			Program
		455.850 MHz			Program
8	S	450.925 MHz[7]	100-A-3/100-F-3		Special Wideband Program Material
		455.925 MHz			Special Wideband Program Material

[1] Subject to the condition that no harmful interference is caused to the reception of standard broadcast stations.

[2] Subject to the condition that no harmful interference is caused to the reception of broadcasting stations.

[3] Subject to the condition that no harmful interference is caused to stations operating in accordance with the Table of Frequency Allocations set forth in Part 2 of FCC Rules and Regulations.

[4] Operation on the frequencies 166.25 MHz and 170.15 MHz is not authorized (I) within the area bounded on the west by the Mississippi River, on the north by the parallel of latitude 37°30'N., and on the east and south by that arc of the circle with center at Springfield, Ill., and radius equal to the airline distance between Springfield, Ill., and Montgomery, Alabama, subtended between the foregoing west and north boundaries; (II) within 150 miles of New York City; and (III) in Alaska or outside the continental United States; and is subject to the condition that no harmful interference is caused to government radio stations in the band 162-174 MHz.

[5] These frequencies may not be used by remote pickup stations in Puerto Rico or the Virgin Islands.

[6] The use of these frequencies is limited to operational communications, including tone and signalling transmissions.

[7] The use of these frequencies is limited to the transmission of program material and cues and orders immediately necessary thereto.

[8] Frequencies in Group K_1 and K_2 will not be licensed to network entities. Frequencies in Group K_1 will not be authorized to new stations for use on board aircraft.

AUXILIARY BROADCAST SERVICES

REMOTE PICKUP ALLOCATIONS AND AUTHORIZATIONS

USES AUTHORIZED FOR BROADCAST REMOTE PICKUP

Broadcasters may use remote pickup stations at their discretion and the choice does not depend on whether or not wire lines are available.

Remote pickup broadcast stations may be used for:

(A) Transmission of AM, FM, or the aural portion of TV *program* material originating outside a regular studio.
(Normally only Mobile stations are used)

(B) Orders and related communications directly concerning such transmissions.
(Both Base and Mobile stations may be so used)
They may *not* be used to provide mobile telephone systems to station personnel.

(C) Emergency program or order circuits from studios in the event of failure of regular wire circuits.
(Both Base and Mobile stations may be so used)
They may *not* be so used on a regular basis.

(D) Coordination of the activities of portable or mobile stations.

(E) Two-way communication between the studio and transmitter of a broadcast station which has a radio STL.
(Base stations only)

(F) Mobile communications in connection with adjustment and maintenance of antenna system, or in connection with field intensity surveys.
(Both Base and Mobile stations may be so used)
Authorized only under STA.

(G) In Alaska, Hawaii, Puerto Rico and Virgin Islands for Intercity Relay and STL.
(Both Base and Mobile stations may be so used)

(H) Low power broadcast auxiliary stations such as: cue and control signal transmitters and wireless microphones.

SAMPLE REMOTE PICKUP OR STL APPLICATION (FCC FORM 313)

This sample form contains information for both the Model PCL-505 Monaural STL and Model PCL-505/C Composite Stereo STL. Bracketed [ ] information applies only to the Model PCL-505/C Composite Stereo STL.

FCC Form 313
February 1977

Approved by GAO
B-180227 (R0175)

Federal Communications Commission
WASHINGTON, D. C. 20554

APPLICATION FOR AUTHORIZATION IN THE AUXILIARY RADIO BROADCAST SERVICES

(FOR COMMISSION USE ONLY)

File No.

Name of applicant (see Instruction E)

APPLICANT SHOULD NOT USE THIS BOX

Post Office address (Number, Street, City, State and ZIP Code)

INSTRUCTIONS

A. This form is to be used by licensees or permittees of existing Standard (AM), FM, and Television Broadcast stations when applying for Remote Pick-up, STL, and other stations coming under the Auxiliary Radio Broadcast Services (See Part 74 of the Rules).

B. A separate FCC Form 313 must be filed for each station authorization being requested. Complete all paragraphs if for a new station or for modification of construction permit or license; complete paragraphs 1, 3, 4, and 7 if for a license. (This form is to be used for RENEWAL of license ONLY when there have been changes in the information shown on the station license being renewed; when there have been no changes use FCC Form 313-R.) When this form is filed for renewal, complete all paragraphs necessary to indicate changes.

C. Prepare and file two copies (three for Television), with the Federal Communications Commission, Washington, D. C. 20554.

D. Number exhibits serially in the spaces provided in the body of the form and date each exhibit.

E. The name of the applicant must be stated exactly as it appears in the authorization for the broadcast station with which the auxiliary station is to be used.

F. This application shall be personally signed by the applicant, if the applicant is an individual; by one of the partners, if the applicant is a partnership; by an officer, if the applicant is a corporation; by a member who is an officer, if the applicant is an unincorporated association; by such duly elected or appointed officials as may be competent to do so under the laws of the applicable jurisdiction, if the applicant is an eligible government entity; or by the applicant's attorney in case of the applicant's physical disability or of his absence from the United States. The attorney shall, in the event he signs for the applicant, separately set forth the reason why the application is not signed by the applicant. In addition, if any matter is stated on the basis of the attorney's belief only (rather than his knowledge), he shall separately set forth his reasons for believing that such statements are true.

G. Items 4(a) and 4(b) apply to stations at fixed locations only and Item 4(c) applies to mobile stations only. All parts of Items 4(a) and (b) must be answered on all applications for new fixed stations and modifications thereof. Item 4(b) means the point of communication of the transmitter being applied for. (For Remote Pickup stations, the point of communication is normally the base station location for mobile units and the mobile units for base stations.)

1. Purpose of this application (indicate below)

(a) Type of station requested (see Instruction A):

Studio-Transmitter Link

(b) Call Sign of existing Permit or of License being renewed:

(c) Kind of authorization requested:

- ☐ New Station (Construction Permit and license)
- ☐ License to replace expired license.
- ☐ Modification of Existing Authorization (Construction Permit and license)
- ☐ Renewal and Modification (see Instruction B)

(d) Modification of existing authorization:

Call ....

- Change frequency .... ☐
- Replace equipment .... ☐
- Change power .... ☐
- Change transmitter location .... ☐
- Install different antenna system .... ☐
- Other modification (explain below) .... ☐

(e) Broadcast station(s) with which auxiliary station is to be used:
Call Sign(s)

2. If cost involved exceeds $10,000, submit as Exhibit No. a statement itemizing cost and showing how cost will be met (cash, etc.).

3. Facilities requested

FREQUENCIES	POWER [1]	TYPE OF EMISSION [2]	COMMUNICATION BANDWIDTH (kHz)[3]
	7 Watts	See Attachment	See Attachment

[1] For amplitude modulation television (A5), give maximum antenna input power during synchronizing pulses. If particulars are not fully described above, such as aural and visual carrier frequencies for television and type of emission, etc., supply this information here:

[2] Use emission symbols listed in Part 2 of Commission's Rules.

[3] Communication bandwidth is the actual bandwidth of the emission plus twice the frequency tolerance. (See appropriate service rules for permissible bandwidth.)

4. Location of proposed transmitter

(a) For stations with fixed location

City	County	State

Street and number (or other description of location)

NORTH LATITUDE	WEST LONGITUDE
° ' "	° ' "

(b) Receiving point (See Instruction G)

City	County	State

Street and number (or other description of location)

(c) For portable or mobile operation

Area in which station is to be used:

(All previous editions of this form are cancelled.)

SAMPLE REMOTE PICKUP OR STL APPLICATION (FCC FORM 313)

This sample form contains information for both the Model PCL-505 Monaural STL and Model PCL-505/C Composite Stereo STL. Bracketed [ ] information applies only to the Model PCL-505/C Composite Stereo STL.

BROADCAST APPLICATION (Form 313) — Page 2

5. Antenna system

(a) Description (including manufacturer and type number, if any)

Parabolic section in one plane
Type - Scala PR-450U

Is a directional antenna system to be used? . . . . YES ☐ NO ☐
If "Yes," specify antenna gain in the main lobe of radiation, preferably in terms of free-space field in millivolts per meter for 1 kilowatt at 1 mile.

17.6 dB over reference dipole

Direction of radiation of the main lobe of the transmitting antenna in degrees, measured in a clockwise direction with true north as zero azimuth. (If more than one antenna is used, give direction for each.)

(b) Supply the following for fixed installations only:

Overall height to top of supporting structure, including all appurtenances	Over-all height above mean sea level in feet

Description and height of supporting structure (differentiate between structure now existent and that to be erected.) Attach as Exhibit No. a sketch of vertical plan, showing heights of significant portions.

(c) Is supporting structure to be used in common for the antenna system of another class of station? YES ☐ NO ☐
If the answer is "Yes," give:

Class of station(s) Call letters

6. Transmitting apparatus proposed to be installed

Manufacturer	Type No.	Maximum rated power output
Moseley Associates, Inc.	PCL-505 (PCL-505/C)	9 Watts

Oscillator.

Type of circuit	Frequency
Hartley V. C. O.	$F_o \div 12$

Tubes:

Make	Type	Number
various	2N4427 or equiv.	1

Last radio stage:

Tubes

Make	Type	Number
Motorola or equivalent	HMW710 or equiv.	1

Normal total plate current in last radio stage	Plate voltage	Method of modulation
2.4A	13.5 VDC	FM

7. Frequency and modulation

For what percentage of modulation or swing is the transmitter designed? $\pm$40 kHz=100% ($\pm$60 kHz=100%)

What is the guaranteed frequency tolerance in percent? $\pm$ 0.0005

Describe means incorporated in the transmitter for maintaining the frequency tolerance stated above.

V. C. O. phase locked to a crystal mounted in temperature-controlled oven

What external means will be employed by the applicant to insure that the assigned frequency is maintained with the tolerance specified by the Commission's Rules?

THE APPLICANT hereby waives any claim to the use of any particular frequency or of the ether as against the regulatory power of the United States because of the previous use of the same, whether by license or otherwise, and requests an authorization in accordance with this application. (See Section 304 of the Communications Act of 1934.) THE APPLICANT represents that this application is not filed for the purpose of impeding, obstructing, or delaying determination on any other application with which it may be in conflict. THE APPLICANT acknowledges that all the statements made in this application and attached exhibits are considered material representations, and that all the exhibits are a material part hereof and are incorporated herein as if set out in full in the application.

CERTIFICATION

I certify that the statements in this application are true, complete, and correct to the best of my knowledge and belief, and are made in good faith.

Signed and dated this ______ day of ______________, 19 ____

____
(NAME OF APPLICANT)

By ______________________________
(SIGNATURE)

Title ______________________________

WILLFUL FALSE STATEMENTS MADE ON THIS FORM ARE PUNISHABLE BY FINE AND IMPRISONMENT. U.S. CODE, TITLE 18 SECTION 1001.

Exhibits furnished as required by this form:

Exhibit No.	Para. No. of Form	Name of officer or employee (1) by whom or (2) under whose direction exhibit was prepared (show which)	Official title

AUXILIARY BROADCAST SERVICES

CHART A PCL-505 STL EQUIPMENT APPLICATION DATA

Information for Section 3 (Facilities Requested) of FCC Form 313

The following information will assist in completing Section 3 (Facilities Requested) of FCC Form 313 for the Model PCL-505 Aural STL.

		SYSTEM CONFIGURATION *Covered by Application*	*Frequency with Respect* *to channel center*	Emission	Bandwidth
	1	SINGLE STL — Monaural Use	On Center	110F3	120 kHz
	2	SINGLE STL — Monaural Use with Type II Control	On Center	110F9	120 kHz
	3	SINGLE STL — Monaural with 67 kHz SCA (same if Type III control is included)	On Center	230F9	240 kHz
	4	DUAL STL — FM Stereo L or R channel L or R channel	 +125 kHz —125 kHz	 110F3 110F3	 120 kHz 120 kHz
PCL-505	5	DUAL STL — FM Stereo & SCA L or R channel L or R channel & 67 kHz SCA	 +125 kHz —125 kHz	 110F3 230F9	 120 kHz 240 kHz
	6	DUAL STL — FM Stereo & SCA with Type III Remote Control System L or R channel & control L or R channel & 67 kHz SCA	 +125 kHz —125 kHz	 110F9 230F9	 120 kHz 240 kHz
	7	DUAL STL — FM Stereo with Type II Remote Control System L or R channel & control L or R channel	 +125 kHz —125 kHz	 110F9 110F3	 120 kHz 120 kHz
	8	COMPOSITE STEREO STL — FM Stereo	On Center	226F9	236 kHz
	9	COMPOSITE STEREO STL — FM Stereo & SCA (67 kHz)	On Center	270F9	280 kHz
PCL-505/C	10	COMPOSITE STEREO STL with Type II/C Radio Remote Control System	On Center	340F9	350 kHz
	11	COMPOSITE STEREO STL with Type II/C Radio Remote Control System and program subcarrier channel	On Center	490F9	500 kHz

MODEL RPL-3A FOR 148-174 MHz

Notes: 1. When the RPL-3A is to be used with the Model AMP-3A RF Power Amplifier, use information shown in parentheses ( ).

2. Designator selection depends upon operating channel (See FCC 74.402).

FCC Form 313
February 1977

Approved by GAO
B-180227 (R0175)

Federal Communications Commission
WASHINGTON, D. C. 20554

APPLICATION FOR AUTHORIZATION IN THE AUXILIARY RADIO BROADCAST SERVICES

APPLICANT SHOULD NOT USE THIS BOX

(FOR COMMISSION USE ONLY)

File No.

Name of applicant (see Instruction E)

Post Office address (Number, Street, City, State and ZIP Code)

INSTRUCTIONS

A. This form is to be used by licensees or permittees of existing Standard (AM), FM, and Television Broadcast stations when applying for Remote Pick-up, STL, and other stations coming under the Auxiliary Radio Broadcast Services (See Part 74 of the Rules).

B. A separate FCC Form 313 must be filed for each station authorization being requested. Complete all paragraphs if for a new station or for modification of construction permit or license; complete paragraphs 1, 3, 4, and 7 if for a license. (This form is to be used for RENEWAL of license ONLY when there have been changes in the information shown on the station license being renewed; when there have been no changes use FCC Form 313-R.) When this form is filed for renewal, complete all paragraphs necessary to indicate changes.

C. Prepare and file two copies (three for Television), with the Federal Communications Commission, Washington, D. C. 20554.

D. Number exhibits serially in the spaces provided in the body of the form and date each exhibit.

E. The name of the applicant must be stated exactly as it appears in the authorization for the broadcast station with which the auxiliary station is to be used.

F. This application shall be personally signed by the applicant, if the applicant is an individual; by one of the partners, if the applicant is a partnership; by an officer, if the applicant is a corporation; by a member who is an officer, if the applicant is an unincorporated association; by such duly elected or appointed officials as may be competent to do so under the laws of the applicable jurisdiction, if the applicant is an eligible government entity; or by the applicant's attorney in case of the applicant's physical disability or of his absence from the United States. The attorney shall, in the event he signs for the applicant, separately set forth the reason why the application is not signed by the applicant. In addition, if any matter is stated on the basis of the attorney's belief only (rather than his knowledge), he shall separately set forth his reasons for believing that such statements are true.

G. Items 4(a) and 4(b) apply to stations at fixed locations only and Item 4(c) applies to mobile stations only. All parts of Items 4(a) and (b) must be answered on all applications for new fixed stations and modifications thereof. Item 4(b) means the point of communication of the transmitter being applied for. (For Remote Pickup stations, the point of communication is normally the base station location for mobile units and the mobile units for base stations.)

1. Purpose of this application (indicate below)

(a) Type of station requested (see Instruction A):
remote pickup

(b) Call Sign of existing Permit or of License being renewed:

(c) Kind of authorization requested:

☐ New Station (Construction Permit and license)

☐ License to replace expired license.

☐ Modification of Existing Authorization (Construction Permit and license)

☐ Renewal and Modification (see Instruction B)

(d) Modification of existing authorization:

Call ....

Change frequency .... ☐

Replace equipment .... ☐

Change power .... ☐

Change transmitter location .... ☐

Install different antenna system .... ☐

Other modification (explain below) .... ☐

(e) Broadcast station(s) with which auxiliary station is to be used:
Call Sign(s)

2. If cost involved exceeds $10,000, submit as Exhibit No. a statement itemizing cost and showing how cost will be met (cash, etc.).

3. Facilities requested

FREQUENCIES	POWER [1]	TYPE OF EMISSION [2]	COMMUNICATION BAND - WIDTH (kHz)[3]
	10 watts (40 watts)	25F3 (30F3)(See Note 2)	25 kHz (30 kHz)

[1] For amplitude modulation television (A5), give maximum antenna input power during synchronizing pulses. If particulars are not fully described above, such as aural and visual carrier frequencies for television and type of emission, etc., supply this information here:

[2] Use emission symbols listed in Part 2 of Commission's Rules.

[3] Communication bandwidth is the actual bandwidth of the emission plus twice the frequency tolerance. (See appropriate service rules for permissible bandwidth.)

4. Location of proposed transmitter

(a) For stations with fixed location

City	County	State

Street and number (or other description of location)

NORTH LATITUDE ° ' ''

WEST LONGITUDE ° ' ''

(b) Receiving point (See Instruction G)

City	County	State

Street and number (or other description of location)

(c) For portable or mobile operation

Area in which station is to be used:

(All previous editions of this form are cancelled.)

MODEL RPL-3A FOR 148-174 MHz

Notes: 1. When the RPL-3A is to be used with the Model AMP-3A RF Power Amplifier, use information shown in parentheses ( ).

2. Designator selection depends upon operating channel (See FCC 74.402).

BROADCAST APPLICATION (Form 313) — Page 2

5. Antenna system

(a) Description (including manufacturer and type number, if any)

Is a directional antenna system to be used? . . . . YES ☐ NO ☐
If "Yes," specify antenna gain in the main lobe of radiation, preferably in terms of free-space field in millivolts per meter for 1 kilowatt at 1 mile.

Direction of radiation of the main lobe of the transmitting antenna in degrees, measured in a clockwise direction with true north as zero azimuth. (If more than one antenna is used, give direction for each.)

(b) Supply the following for fixed installations only:

Overall height to top of supporting structure, including all appurtenances	Over-all height above mean sea level in feet

Description and height of supporting structure (differentiate between structure now existent and that to be erected.) Attach as Exhibit No. a sketch of vertical plan, showing heights of significant portions.

(c) Is supporting structure to be used in common for the antenna system of another class of station? YES ☐ NO ☐
If the answer is "Yes," give:

Class of station(s) — Call letters

6. Transmitting apparatus proposed to be installed

Manufacturer	Type No.	Maximum rated power output
Moseley Associates, Inc.	RPL-3A (+ AMP-3A)	15 watts (40 watts)

Oscillator.

Type of circuit	Frequency
Hartley volt.-controlled crystal osc.	$\frac{f_o}{36}$

Tubes:

Make	Type	Number
various	2N4259 or equiv.	1

Last radio stage.

Tubes

Make	Type	Number
CTC or equiv.	2N5946 (JO-3040)	1

Normal total plate current in last radio stage	Plate voltage	Method of modulation
1.6 amps (4 amps)	11.5 VDC (13.5 VDC)	FM

7. Frequency and modulation

For what percentage of modulation or swing is the transmitter designed? $\pm$ 5 kHz = 100% modulation

What is the guaranteed frequency tolerance in percent?
0.00025%

Describe means incorporated in the transmitter for maintaining the frequency tolerance stated above.

crystal temperature compensated

What external means will be employed by the applicant to insure that the assigned frequency is maintained with the tolerance specified by the Commission's Rules?

THE APPLICANT hereby waives any claim to the use of any particular frequency or of the ether as against the regulatory power of the United States because of the previous use of the same, whether by license or otherwise, and requests an authorization in accordance with this application. (See Section 304 of the Communications Act of 1934.) THE APPLICANT represents that this application is not filed for the purpose of impeding, obstructing, or delaying determination on any other application with which it may be in conflict. THE APPLICANT acknowledges that all the statements made in this application and attached exhibits are considered material representations, and that all the exhibits are a material part hereof and are incorporated herein as if set out in full in the application.

CERTIFICATION

I certify that the statements in this application are true, complete, and correct to the best of my knowledge and belief, and are made in good faith.

Signed and dated this ________ day of ________________, 19 ______

____
(NAME OF APPLICANT)

By ________________________________
(SIGNATURE)

Title ________________________________

WILLFUL FALSE STATEMENTS MADE ON THIS FORM ARE PUNISHABLE BY FINE AND IMPRISONMENT. U.S. CODE, TITLE 18 SECTION 1001.

Exhibits furnished as required by this form:

Exhibit No.	Para. No. of Form	Name of officer or employee (1) by whom or (2) under whose direction exhibit was prepared (show which)	Official title

MODEL RPL-4A FOR 450-470 MHz

Notes: 1. When the RPL-4A is to be used with the Model AMP-4A RF Power Amplifier, use information shown in parenthese ( ).

2. Designator selection depends upon operating channel (See FCC 74.402).

FCC Form 313
February 1977

Approved by GAO
B-180227 (R0175)

Federal Communications Commission
WASHINGTON, D. C. 20554

APPLICATION FOR AUTHORIZATION IN THE AUXILIARY RADIO BROADCAST SERVICES

APPLICANT SHOULD NOT USE THIS BOX

(FOR COMMISSION USE ONLY)

File No.

Name of applicant (see Instruction E)

Post Office address (Number, Street, City, State and ZIP Code)

INSTRUCTIONS

A. This form is to be used by licensees or permittees of existing Standard (AM), FM, and Television Broadcast stations when applying for Remote Pick-up, STL, and other stations coming under the Auxiliary Radio Broadcast Services (See Part 74 of the Rules).

B. A separate FCC Form 313 must be filed for each station authorization being requested. Complete all paragraphs if for a new station or for modification of construction permit or license; complete paragraphs 1, 3. 4, and 7 if for a license. (This form is to be used for RENEWAL of license ONLY when there have been changes in the information shown on the station license being renewed; when there have been no changes use FCC Form 313-R.) When this form is filed for renewal, complete all paragraphs necessary to indicate changes.

C. Prepare and file two copies (three for Television), with the Federal Communications Commission, Washington, D. C. 20554.

D. Number exhibits serially in the spaces provided in the body of the form and date each exhibit.

E. The name of the applicant must be stated exactly as it appears in the authorization for the broadcast station with which the auxiliary station is to be used.

F. This application shall be personally signed by the applicant, if the applicant is an individual; by one of the partners, if the applicant is a partnership; by an officer, if the applicant is a corporation; by a member who is an officer, if the applicant is an unincorporated association; by such duly elected or appointed officials as may be competent to do so under the laws of the applicable jurisdiction, if the applicant is an eligible government entity; or by the applicant's attorney in case of the applicant's physical disability or of his absence from the United States. The attorney shall, in the event he signs for the applicant, separately set forth the reason why the application is not signed by the applicant. In addition, if any matter is stated on the basis of the attorney's belief only (rather than his knowledge), he shall separately set forth his reasons for believing that such statements are true.

G. Items 4(a) and 4(b) apply to stations at fixed locations only and Item 4(c) applies to mobile stations only. All parts of Items 4(a) and (b) must be answered on all applications for new fixed stations and modifications thereof. Item 4(b) means the point of communication of the transmitter being applied for. (For Remote Pickup stations, the point of communication is normally the base station location for mobile units and the mobile units for base stations.)

1. Purpose of this application (indicate below)

(a) Type of station requested (see Instruction A):

remote pickup

(b) Call Sign of existing Permit or of License being renewed:

(c) Kind of authorization requested:

☐ New Station (Construction Permit and license)

☐ License to replace expired license.

☐ Modification of Existing Authorization (Construction Permit and license)

☐ Renewal and Modification (see Instruction B)

(d) Modification of existing authorization:

Call ....

Change frequency .... ☐

Replace equipment .... ☐

Change power .... ☐

Change transmitter location .... ☐

Install different antenna system .... ☐

Other modification (explain below) .... ☐

(e) Broadcast station(s) with which auxiliary station is to be used:

Call Sign(s)

2. If cost involved exceeds $10,000, submit as Exhibit No. a statement itemizing cost and showing how cost will be met (cash, etc.).

3. Facilities requested

FREQUENCIES	POWER [1]	TYPE OF EMISSION [2]	COMMUNICATION BAND WIDTH (kHz)[3]
	10 watts (32 watts)	25F3 (50F3)(See Note 2)	25 kHz (50 kHz)

[1] For amplitude modulation television (A5), give maximum antenna input power during synchronizing pulses. If particulars are not fully described above, such as aural and visual carrier frequencies for television and type of emission, etc., supply this information here:

[2] Use emission symbols listed in Part 2 of Commission's Rules.

[3] Communication bandwidth is the actual bandwidth of the emission plus twice the frequency tolerance. (See appropriate service rules for permissible bandwidth.)

4. Location of proposed transmitter

(a) For stations with fixed location

City	County	State

Street and number (or other description of location)

NORTH LATITUDE	WEST LONGITUDE
° ' "	° ' "

(b) Receiving point (See Instruction G)

City	County	State

Street and number (or other description of location)

(c) For portable or mobile operation

Area in which station is to be used:

(All previous editions of this form are cancelled.)

MODEL RPL-4A FOR 450-470 MHz

Notes: 1. When the RPL-4A is to be used with the Model AMP-4A RF Power Amplifier, use information shown in parenthese ( ).

2. Designator selection depends upon operating channel (See FCC 74.402).

BROADCAST APPLICATION (Form 313) — Page 2

5. Antenna system

(a) Description (including manufacturer and type number, if any)

Is a directional antenna system to be used? . . . . YES ☐ NO ☐
If "Yes," specify antenna gain in the main lobe of radiation, preferably in terms of free-space field in millivolts per meter for 1 kilowatt at 1 mile.

Direction of radiation of the main lobe of the transmitting antenna in degrees, measured in a clockwise direction with true north as zero azimuth. (If more than one antenna is used, give direction for each.)

(b) Supply the following for fixed installations only:

Overall height to top of supporting structure, including all appurtenances	Over-all height above mean sea level in feet

Description and height of supporting structure (differentiate between structure now existent and that to be erected.) Attach as Exhibit No. a sketch of vertical plan, showing heights of significant portions.

(c) Is supporting structure to be used in common for the antenna system of another class of station? YES ☐ NO ☐
If the answer is "Yes," give:

Class of station(s) Call letters

6. Transmitting apparatus proposed to be installed

Manufacturer	Type No.	Maximum rated power output
Moseley Associates, Inc.	RPL-4A + AMP-4A)	15 watts (40 watts)

Oscillator.

Type of circuit	Frequency
Hartley volt.-controlled crystal osc.	fo / 108

Tubes:

Make	Type	Number
various	2N4259 or equiv.	1

Last radio stage.

Tubes

Make	Type	Number
(CTC or equiv.	2N5946 (CM40-12)	1

Normal total plate current in last radio stage	Plate voltage	Method of modulation
1.5 amps(3.7 amps)	11.5 VDC (13.5 VDC)	FM

7. Frequency and modulation

For what percentage of modulation or swing is the transmitter designed? ± 5 kHz & ± 10 kHz=100% mod. (Note 2)

What is the guaranteed frequency tolerance in percent?
0.00025%

Describe means incorporated in the transmitter for maintaining the frequency tolerance stated above.

crystal temperature compensated

What external means will be employed by the applicant to insure that the assigned frequency is maintained with the tolerance specified by the Commission's Rules?

THE APPLICANT hereby waives any claim to the use of any particular frequency or of the ether as against the regulatory power of the United States because of the previous use of the same, whether by license or otherwise, and requests an authorization in accordance with this application. (See Section 304 of the Communications Act of 1934.) THE APPLICANT represents that this application is not filed for the purpose of impeding, obstructing, or delaying determination on any other application with which it may be in conflict. THE APPLICANT acknowledges that all the statements made in this application and attached exhibits are considered material representations, and that all the exhibits are a material part hereof and are incorporated herein as if set out in full in the application.

CERTIFICATION

I certify that the statements in this application are true, complete, and correct to the best of my knowledge and belief, and are made in good faith.

Signed and dated this ________ day of ____________________, 19 ______

____
(NAME OF APPLICANT)

WILLFUL FALSE STATEMENTS MADE ON THIS FORM ARE PUNISHABLE BY FINE AND IMPRISONMENT. U.S. CODE, TITLE 18 SECTION 1001.

By ______________________________
(SIGNATURE)

Title ______________________________

Exhibits furnished as required by this form

Exhibit No.	Para. No. of Form	Name of officer or employee (1) by whom or (2) under whose direction exhibit was prepared (show which)	Official title

REFERENCE DATA

FM BROADCAST STATION CLASSES & FREQUENCIES

Channel No.	Frequency	For Class	Channel No.	Frequency	For Class
201	88.1 MHz	†	251*	98.1 MHz	B-C
202	88.3 MHz	†	252*	98.3 MHz	A
203	88.5 MHz	†	253*	98.5 MHz	B-C
204	88.7 MHz	†	254*	98.7 MHz	B-C
205	88.9 MHz	†	255*	98.9 MHz	B-C
206	89.1 MHz	†	256*	99.1 MHz	B-C
207	89.3 MHz	†	257*	99.3 MHz	A
208	89.5 MHz	†	258*	99.5 MHz	B-C
209	89.7 MHz	†	259*	99.7 MHz	B-C
210	89.9 MHz	†	260*	99.9 MHz	B-C
211	90.1 MHz	†	261*	100.1 MHz	A
212	90.3 MHz	†	262*	100.3 MHz	B-C
213	90.5 MHz	†	263*	100.5 MHz	B-C
214	90.7 MHz	†	264*	100.7 MHz	B-C
215	90.9 MHz	†	265*	100.9 MHz	A
216	91.1 MHz	†	266*	101.1 MHz	B-C
217	91.3 MHz	†	267*	101.3 MHz	B-C
218	91.5 MHz	†	268*	101.5 MHz	B-C
219	91.7 MHz	†	269*	101.7 MHz	A
220	91.9 MHz	†	270*	101.9 MHz	B-C
221	92.1 MHz	A	271*	102.1 MHz	B-C
222	92.3 MHz	B-C	272*	102.3 MHz	A
223	92.5 MHz	B-C	273*	102.5 MHz	B-C
224	92.7 MHz	A	274*	102.7 MHz	B-C
225	92.9 MHz	B-C	275*	102.9 MHz	B-C
226	93.1 MHz	B-C	276*	103.1 MHz	A
227	93.3 MHz	B-C	277*	103.3 MHz	B-C
228	93.5 MHz	A	278*	103.5 MHz	B-C
229	93.7 MHz	B-C	279*	103.7 MHz	B-C
230	93.9 MHz	B-C	280*	103.9 MHz	A
231	94.1 MHz	B-C	281*	104.1 MHz	B-C
232	94.3 MHz	A	282*	104.3 MHz	B-C
233	94.5 MHz	B-C	283*	104.5 MHz	B-C
234	94.7 MHz	B-C	284*	104.7 MHz	B-C
235	94.9 MHz	B-C	285*	104.9 MHz	A
236	95.1 MHz	B-C	286*	105.1 MHz	B-C
237	95.3 MHz	A	287*	105.3 MHz	B-C
238	95.5 MHz	B-C	288*	105.5 MHz	A
239	95.7 MHz	B-C	289*	105.7 MHz	B-C
240	95.9 MHz	A	290*	105.9 MHz	B-C
241	96.1 MHz	B-C	291*	106.1 MHz	B-C
242	96.3 MHz	B-C	292*	106.3 MHz	A
243	96.5 MHz	B-C	293*	106.5 MHz	B-C
244	96.7 MHz	A	294*	106.7 MHz	B-C
245	96.9 MHz	B-C	295*	106.9 MHz	B-C
246	97.1 MHz	B-C	296*	107.1 MHz	A
247	97.3 MHz	B-C	297*	107.3 MHz	B-C
248	97.5 MHz	B-C	298*	107.5 MHz	B-C
249'	97.7 MHz	A	299*	107.7 MHz	B-C
250	97.9 MHz	B-C	300*	107.9 MHz	B-C

†For classes of noncommercial educational stations and their definition, refer to FCC Rules and Regulations, Paragraph 73.504.

* In Hawaii, the band 98-108 MHz is allocated for non-broadcast use, and the frequencies 98.1-107.9 MHz will not be assigned in Hawaii for use by FM broadcast stations.

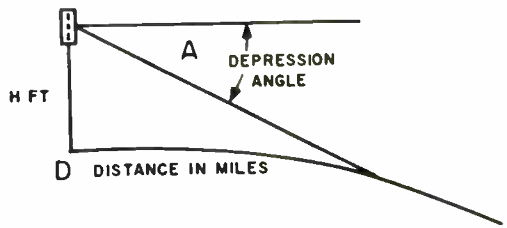
DISTANCE IN MILES TO RECEIVING LOCATION AND DEPRESSION ANGLES FOR VARIOUS FM ANTENNA HEIGHTS

H—Height in feet to Electrical center of antenna

D_h—Distance to horizon $= \sqrt{2H}$ (4/3 earth radius)

A_h—Depression angle to horizon $= \frac{.0216H}{D_h}$

The relationship $D = \frac{.0109\ H}{A}$ gives approximate distances to intercept at various depression angles.



Height H in Feet	D_h	A_h	Depression Angle																			
			0.5°	1°	1.5°	2°	2.5°	3°	3.5°	4°	4.5°	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	15°
200	20.0	.216	4.6	2.21	1.45	1.07	0.86	0.71	0.61	0.54	0.48	0.43	0.36	0.31	0.27	0.24	0.22	0.20	0.18	0.17	0.15	0.14
300	24.5	.268	7.2	3.35	2.18	1.64	1.30	1.07	0.92	0.80	0.71	0.64	0.55	0.46	0.41	0.37	0.33	0.30	0.27	0.25	0.23	0.21
400	28.3	.304	9.9	4.49	2.90	2.18	1.75	1.42	1.24	1.06	0.94	0.86	0.73	0.62	0.54	0.49	0.46	0.40	0.36	0.33	0.31	0.29
500	31.6	.343	12.6	5.60	3.65	2.72	2.16	1.82	1.55	1.36	1.21	1.09	0.92	0.78	0.68	0.61	0.55	0.50	0.45	0.42	0.39	0.36
600	34.6	.375	16.0	6.81	4.8	3.61	2.64	2.15	1.86	1.63	1.42	1.31	1.09	0.92	0.81	0.73	0.65	0.59	0.54	0.50	0.46	0.43
700	37.4	.405	19.9	7.98	5.2	3.87	3.08	2.54	2.16	1.90	1.68	1.50	1.25	1.06	0.94	0.83	0.74	0.68	0.62	0.57	0.53	0.50
800	40.0	.435	24.2	9.2	5.9	4.49	3.52	2.89	2.50	2.17	1.90	1.75	1.45	1.22	1.05	0.97	0.86	0.78	0.72	0.67	0.61	0.58
900	42.4	.452	29.5	10.5	6.7	5.05	3.98	3.28	2.80	2.45	2.13	1.96	1.62	1.36	1.19	1.09	0.97	0.88	0.81	0.75	0.69	0.65
1000	45.0	.487	36.2	11.6	7.4	5.51	4.39	3.65	3.10	2.70	2.39	2.15	1.79	1.52	1.32	1.18	1.08	0.98	0.90	0.83	0.77	0.72
1200	49.0	.530	—	14.1	9.0	6.75	5.32	4.39	3.77	3.19	2.85	2.61	2.15	1.81	1.59	1.44	1.29	1.18	1.08	1.00	0.92	0.87
1400	53.0	.577	—	16.7	10.4	7.66	6.12	5.13	4.33	3.77	3.35	3.00	2.48	2.11	1.85	1.63	1.45	1.36	1.24	1.15	1.06	1.00
1600	56.6	.620	—	19.4	12.0	9.10	7.10	5.85	5.02	4.35	3.80	3.40	2.84	2.40	2.13	1.91	1.72	1.55	1.44	1.32	1.23	1.16
1800	60.0	.650	—	22.3	13.6	10.25	8.00	6.60	5.65	4.90	4.30	3.90	3.19	2.69	2.39	2.15	1.94	1.75	1.62	1.48	1.38	1.30
2000	63.2	.683	—	25.4	15.4	11.25	8.89	7.30	6.25	5.45	4.80	4.30	3.60	3.04	2.68	2.38	2.13	2.00	1.83	1.70	1.56	1.46
5000	100.0	1.080	—	—	42.9	29.5	22.80	18.75	15.85	13.75	12.10	10.90	9.01	7.75	6.73	6.00	5.40	4.90	4.50	4.15	3.84	3.60

REFERENCE DATA

FM RANGE CHART

The ground wave signal range chart, shown on the following page, is intended to be used for determining approximate coverage of FM broadcast stations operating in the 88-108 MHz band. The effect of transmitting antenna height and radiated power on field strength is indicated, and field strength vs. distance from the transmitting antenna is also shown.

To find the approximate radius of an area within a given field strength contour, proceed as follows:

1. Determine field strength in μV/m required and find this figure along extreme right-hand vertical column.
2. Follow the diagonal line corresponding to required field strength until it intersects with the vertical line representing radiated power.
3. From this point, lay a ruler or straight edge across the chart and along the vertical line corresponding to antenna height, read distance in miles to the μV/m contour selected.

The chart may also be used to find the value of radiated power required to cover a given area.

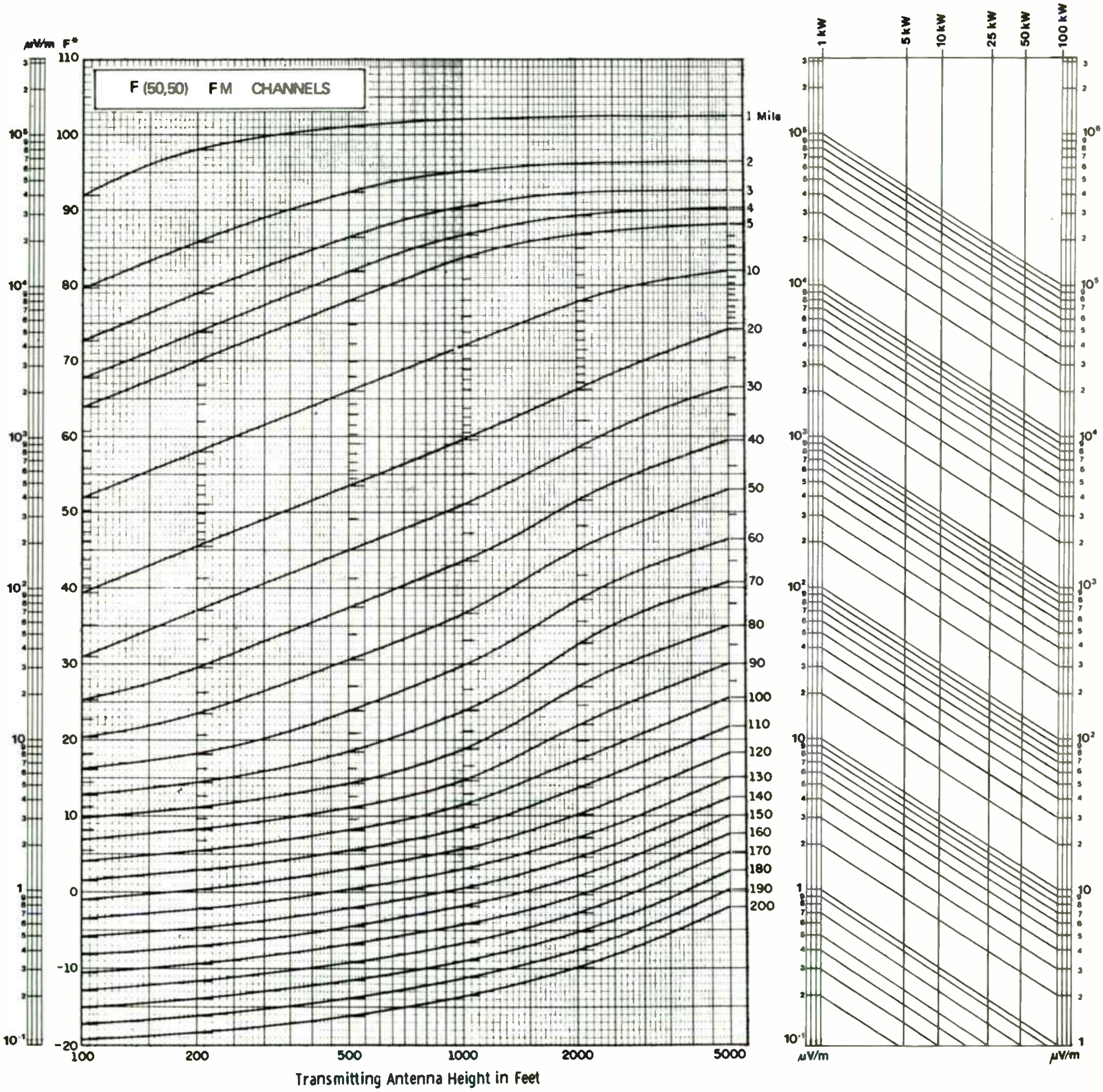
For example:

Find radiated power required to produce 1000 μV/m signal at a distance of 30 miles with an antenna 500 feet high.

1. From the 500 foot mark on the "antenna height" scale, follow the vertical line upwards and locate the 30 mile point.
2. Lay a ruler or straight-edge across the chart from this point, taking care that the ruler is parallel with the bottom edge of the chart.
3. Mark the point where the ruler intersects with the diagonal line representing 1000 μV/m and then from this point, place the ruler vertically on the chart and read approximately 30 kW radiated power on the scale at the upper right of the chart.

REFERENCE DATA

FM ESTIMATED FIELD STRENGTH CHART



FM CHANNELS

ESTIMATED FIELD STRENGTH EXCEEDED AT 50 PERCENT
OF THE POTENTIAL RECEIVER LOCATIONS FOR AT LEAST 50 PERCENT
OF THE TIME AT A RECEIVING ANTENNA HEIGHT OF 30 FEET

* Field Strength (F) in Decibels Above One Microvolt Per Meter for One Kilowatt Radiated Power.

FCC Par. 73.333, Figure 1 (Ed. 8/76)

SMPTE, LOS ANGELES TO FOCUS ON PRODUCTION AND POST PRODUCTION

This month's 121st Conference of the SMPTE will take on a decidedly international flavor and reflect the growing importance of television and electronics.

WHEN THOUSANDS OF Society engineers gather at the Century Plaza in Los Angeles later this month for the 121st Conference of the SMPTE, they will indulge in one of the largest and most comprehensive programs ever put together by this organization. Those members who have attended these conferences regularly will find some significant changes that reflect the way the motion picture and television industries themselves are changing.

Of the 91 papers scheduled for presentation, more than half will relate directly to television and electronics, reflecting the growing role that these technologies are playing in Hollywood as well as the rest of the country. Moreover, the growing importance of the international television and film industries is reflected by the great number of papers authored by representatives from Japan, Germany, England, Belgium, France, and other countries. A panel discussion scheduled for Wednesday morning (October 24) will feature a report on the state of the television and film industries in the People's Republic of China.

The broadening of the industry into consumer and industrial markets will also be reflected in sessions devoted to these two growing areas.

With more than 150 exhibitors scheduled to appear in Los Angeles, the increased importance of the Society's membership to manufacturers is reflected. The exhibits will add an important dimension to papers presented as delegates will be able to adjourn from the papers to the exhibit floors and find practical representations of the latest

With nearly two years of one-inch videotape technology under its belt, the SMPTE will cover advances in on-line and off-line editing approaches

List Of SMPTE Exhibitors

Booth#	Exhibitor
Santa Monica Room (section A)	
101–103	Convergence
104,105	Canon
106,107	NEC
108	Rank Cintel
109	Rank Precision
110	Chrosziel/Film-Technic
111–113	Matthews
114	Strand Century
116	Cinema Products
124–126	Oxberry
127	Listec
128,129	Multi-Track
130,131	General Electric
Los Angeles Room (Section B)	
201–204	3M Co.
205,206	Bosch Fernseh
207,208	Lenco
209–211	Fujinon
212,213	Ampex
214,215	Vital
216	Agfa-Gevaert
217	JVC
219	Ampex
225–227	TeleMation
230–237	Philips
238,239	Tektronix
240,241	Grass Valley
242,243	Datatron
244	Fuji

continued on page 108

the terrain roughness factor exceeds 50 meters the predicted coverage will be reduced.

The effective radiated power in kilowatts is entered, followed by pressing key C. The ERP is the power delivered to the antenna multiplied by the antenna gain relative to a half-wave dipole. Section 73.684 (c) specifies details including consideration of depression angles.

Next the field strength is specified and the calculator determines the distance. Enter dBu/m and press key E or enter mV/m and press key D. The mV/m value will be converted to dBu/m followed by the calculation of the distance in miles. The field strengths designated for various grades of service are shown in Figure 2. These field strengths are the value occuring at a receiving antenna height of 30 feet. The field strength should be exceeded at 50 per cent of the locations, 50 per cent of the time at the distance calculated.

The curve-fit equation was developed for the area of the field strength charts between 0 and 80 dBu/m/kW on the left hand vertical axis. Therefore, following key D or E the calculator will stop and indicate an error display condition if the dBu/m/kW value is outside this region. Calculations may be resumed by pressing R/S (TI-59) or pressing E twice (HP-67/97) and a distance answer will be obtained. In this case the answer should be checked against the field intensity chart to insure accuracy. Most predictions of a practical nature will fall in the 0 and 80 dBu/m/kW region and the error warning will not occur.

A discussion of the accuracy of the calculator results must cover several aspects. Since the basic intent is to duplicate the FCC field intensity charts, the coverage predictions will be no more accurate than the FCC techniques. The basic concern here is not the accuracy of the FCC techniques, but how accurately the calculator programs duplicate the FCC result.

To analyze the accuracy, 100 test points were selected to evenly cover the most used area of the field strength charts. These points are at intersections of specific mileage curves so that interpolation is not required. See Figure 3 for typical test point locations. When one kilowatt ERP is used, the dBu/m values of each test point should yield the corresponding mileage. The percent error of computed distance for each point was used to construct the histograms of Figure 4. These histograms allow an estimate of the probability of achieving a specified accuracy. For instance, for Chs. 7–13, 97 per cent of the points have less than 3.5 per cent error.

The 100 test points also allow identification of the areas of the chart where the curve-fit equation has greatest error. For instance, the FM and TV Ch. 2–6 error distribution shows four points grouped around five percent error. Three of these are at 5000 feet antenna height and 10, 30, and 40 miles distance, which is a little-used area. The fourth point is 4.6 percent error at 1600 feet antenna height and 10 miles. The TV Ch. 7–13 error distribution shows three points with greater than 3.5 percent error. The largest error of 5.6 percent occurs at 2400 feet and 20 miles. At 140 feet and 50 miles the error is 4.5 percent and at 1200 feet and 14 miles the error is 4 percent. The technique of least squares curve fit reduces slightly the curvature and smoothes out the 20-mile line on the Ch. 7–13 chart.

These approximations of the FCC coverage prediction techniques may not have suitable accuracy for formal submission to the Commission, but their ease and speed are very useful. Trade-off studies of changes in power of antenna height are now much quicker and the difficulties of interpolation between mileage curves are eliminated. The convenience of performing predictions with only a calculator and magnetic cards is refreshing. **BM/E** tenna site to determine the average terrain. Enter the height above average terrain in feet and press calculator key A.

For the current practice of no terrain roughness correction simply press calculator key B. The programs, however, have the option of adjusting the coverage distance for the terrain shape by use of the terrain roughness correction technique in sections 73.684 (h), (i), (j), (k), and (l). Inputs to the formula in FCC 73.684 (1) are frequency in mHz and terrain roughness factor in meters.

For FM the frequency is entered and keys 2nd, C (TI-59) or f,c (HP-67/97) are pressed. For TV the channel number is entered and keys 2nd, A or f, a are pressed. The calculator program will automatically use the visual carrier frequency of the channel selected. The terrain roughness factor is defined in 73.684 (h) as "the difference, in meters, between elevations exceeded by all points on the profile for 10 percent and 90 percent, respectively, of the" path between six and 31 miles from the transmitter. This is illustrated by FCC 73.699, Figure 10d. The terrain roughness factor is entered and keys 2nd, B or f,b are pressed. When

FM And TV Coverage Predictions Using Programable Calculators

The FCC FM and TV field intensity charts can be approximated by the equation described below.

D = distance in miles
HAT = transmitting antenna height in feet
y = field strength in dBu/m for one kilowatt
x = 1n(HAT)
a_{ij} = constant coefficients

$$D = e^z$$

$$\begin{aligned}z = {} & a_{11} + a_{12}x + a_{13}x^2 + a_{14}x^3 + a_{15}x^4 + \\ & [a_{21} + a_{22}x + a_{23}x^2 + a_{24}x^3 + a_{25}x^4]\, y + \\ & [a_{31} + a_{32}x + a_{33}x^2 + a_{34}x^3 + a_{35}x^4]\, y^2 + \\ & [a_{41} + a_{42}x + a_{43}x^2 + a_{44}x^3 + a_{45}x^4]\, y^3 + \\ & [a_{51} + a_{52}x + a_{55}x^2 + a_{54}x^3 + a_{55}x^4]\, y^4\end{aligned}$$

Coefficients for FM and TV Ch. 2–6 (50,50)

3.68	5.368×10^{-1}	-9.454×10^{-2}	6.257×10^{-3}	0
1.1654	-7.2486×10^{-1}	1.6038×10^{-1}	-1.5565×10^{-2}	5.6445×10^{-4}
-9.2989×10^{-2}	5.5882×10^{-2}	-1.2486×10^{-2}	1.2408×10^{-3}	-4.6425×10^{-5}
1.8513×10^{-3}	-1.1238×10^{-3}	2.5306×10^{-4}	-2.534×10^{-5}	9.565×10^{-7}
-1.1158×10^{-5}	6.8286×10^{-6}	-1.5485×10^{-6}	1.5598×10^{-7}	-5.9243×10^{-9}

Coefficients for TV Ch. 7–13 (50,50)

-1.0853×10^{-1}	2.8637	-6.3275×10^{-1}	6.2572×10^{-2}	-2.250×10^{-3}
3.027×10^{-1}	-1.3214×10^{-1}	1.0406×10^{-2}	8.1064×10^{-4}	-8.4713×10^{-5}
-2.3076×10^{-2}	8.53×10^{-3}	-5.6669×10^{-4}	-6.6569×10^{-5}	6.0401×10^{-6}
1.8218×10^{-4}	3.8694×10^{-6}	-3.0194×10^{-5}	5.7564×10^{-6}	-2.9646×10^{-7}
2.3293×10^{-7}	-8.6776×10^{-7}	3.8419×10^{-7}	-5.6377×10^{-8}	2.6497×10^{-9}

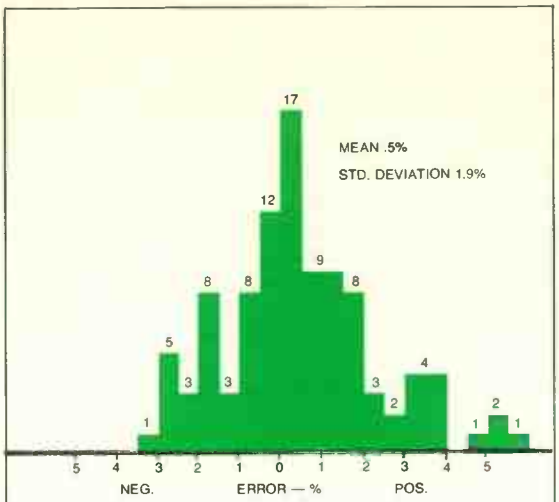
FCC Grades Of TV Service

	Channels 2-6	Channels 7-13
Principal Community	74 dBu/m	77 dBu/m
Grade A	68 dBu/m	71 dBu/m
Grade B	47 dBu/m	56 dBu/m

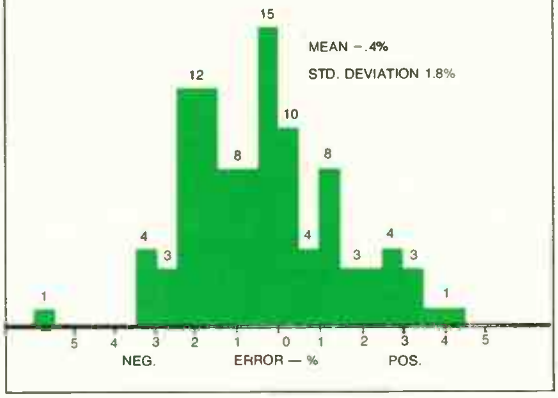
FM Grades Of Service

	FCC	CCIR Rec. 412-1 Mono	CCIR Rec. 412-1 Stereo
Principal Community	3.16mV/m	3 mV/m	5 mV/m
Urban Areas	1 mV/m	1 mV/m	2 mV/m
Rural Areas	.05 mV/m	.25 mV/m	.5 mV/m

Error distribution for 100 test points, FM and TV Ch. 2 – 6



Error distribution for 100 test points, TV Ch. 7 – 13



The calculator program is based on a long equation that approximates the information on the FCC field intensity charts. See Figure 3 for a typical chart. These empirical curves show the relationship between field strength, antenna height, and distance. Least squares curve-fit techniques are commonly used to develop mathematical expressions for the relationship between two variables. An extension of these techniques was used to develop the equation shown in Figure 1 to approximately compute distance for a given field strength and antenna height. Since the FM and low band TV 50,50 field intensity charts are identical, one equation serves for both. The curve-fit equations for low band and high band have identical forms but different sets of 25 constant coefficients.

The curve-fit equation is much too complex to evaluate by hand. Therefore, some type of automatic calculations must be used. The hand-held programmable calculators, TI-59 and HP-67/97, have the appropriate capability, including program storage on magnetic cards. The program listings for these calculators are too long to be printed here but will be available for a limited time free of charge from Harris Broadcast Products. (See Editor's Note with this article.) A program listing in BASIC is also available for those with personal computers. These programs are based on FCC sections 73.313 and 73.684, "Prediction of Coverage."

With some user aids, including display confirmation of input data and printer instructions, the HP-67/97 program uses nearly all the calculator memory. Two magnetic cards (four sides) are required for the 224 program steps and 22 storage registers used. The TI-59/PC-100 program occupies both sides of one magnetic card and includes alphanumeric printed codes to identify the printed values. The program without printer operation can probably be condensed to fit a TI-58, but the manual entry without magnetic cards seems prohibitive.

Entry of data into the calculator is easy. The antenna height is the height of the radiation center of the antenna above the average terrain. Sections 73.684 (d), (e), (f) and (g) specify the technique to be used on the elevations between two and 10 miles from the an-problem. Once the tape guides are factory set and sealed they normally require no readjustment unless some part affecting tape height or tension has been replaced but not properly adjusted or positioned. We recommend that you leave all guides alone and look to the transport for more obvious problems affecting the tape path.

If it is necessary to alter the tape path, we use the monoscope segment of the standard Sony alignment tape. Monoscope contains no burst or chroma information which may present a false indication during your tape path setup.

Sony's alignment tape label advises against the use of the tape for the path adjustment. We have no knowledge of any better guide for these adjustments. We have used this tape repeatedly for path adjustment and find it very satisfactory.

Tape guides and interchange

Problems we have found with defective guides and how they affect the playback RF envelope are as follows:

- *Breathing or Flutter*. The RF envelope varies in amplitude as the tape moves through the tape path. The upper and lower tape guide flanges may become grooved or cut by the tape's edge when the machine is continually used over a long period of time. To cure this problem, rotate the existing guides to a previously unused area. Adhesive or oxide may accumulate on guide surfaces and should be removed since it can cause tape to move erratically and squeal.
- *Loose Guides*. The entire guide post assembly may become loose at the point where it attaches to the chassis. This allows the guide sufficient side movement to cause fluctuation in the RF envelope during playback.
- *Non-Linearity of RF Envelope*. In addition to guide wear problems, other assemblies common to the tape path can cause the RF envelope to become distorted and nonlinear in its overall appearance. The tension regulator arm which affects skew or back tension is subject to bearing failure and can cause the tension regulator arm to move to a position not parallel to the head drum. This causes the tape to ride up or down, depending on which bearing has failed. The tape then enters the head drum assembly at an improper angle, causing the RF envelope to appear distorted as though a guide were improperly adjusted.

Interchange: skew

Thus far we have only discussed interchange problems affecting tracking. Mechanical interchange, as it relates to tape tension, is almost as important.

The proper back tension on the tape and its standardization from machine to machine will affect the playback. If back tension is not the same on all record or playback decks, the tape may be stretched while recording due to unusually high skew tension. If this same tape is played back on a normally adjusted machine, it can cause insert editing problems. Tape tension should always be uniform.

The manufacturer's procedures should be followed to set proper skew tension. A calibration instrument such as the Tentelometer can also be used.

Since it is impossible to cover every adjustment that needs to be performed to optimize your machine's performance, we have attempted to bring to your attention some of the major problem areas in helical editing equipment. We hope you find our suggestions a helpful guideline when troubleshooting your equipment to localize machine failures. **BM/E**

COVERAGE PREDICTIONS USING PROGRAMMABLE CALCULATORS

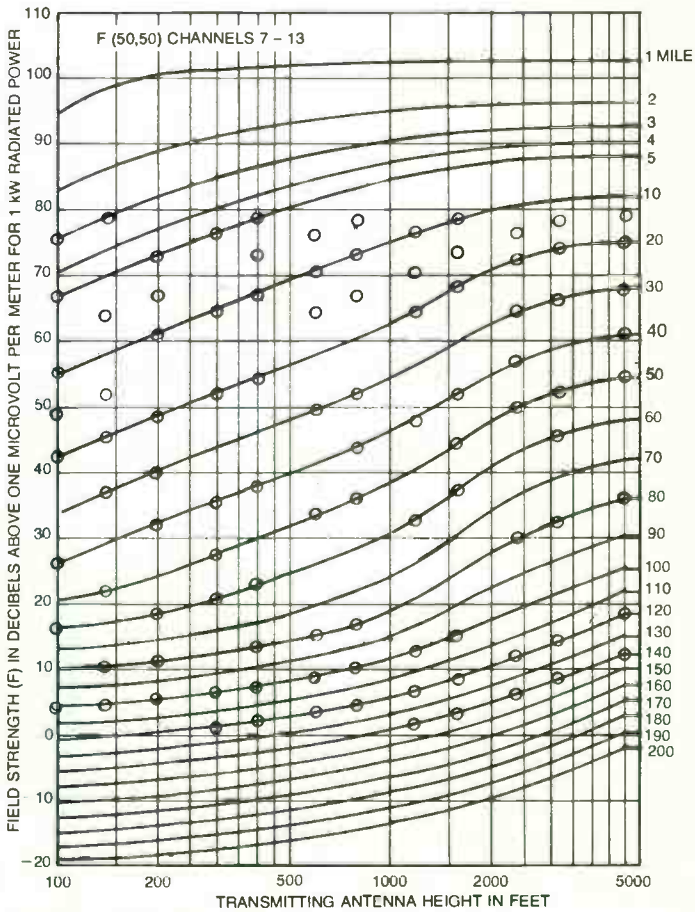
FM and TV broadcast coverage can now be accurately estimated using a new equation that approximates the FCC 50,50 curves.

By E.C. Westenhaver

Editor's note: The program listings referred to in this article are far too lengthy to be published here. Harris Corp. assures us, however, that the complete listings for any of the calculators mentioned or BASIC language listings for readers using personal computers can be obtained free of charge by writing to Harris Corp., Transmitter Product Development, P.O. Box 4290, Quincy, Ill. 62301.

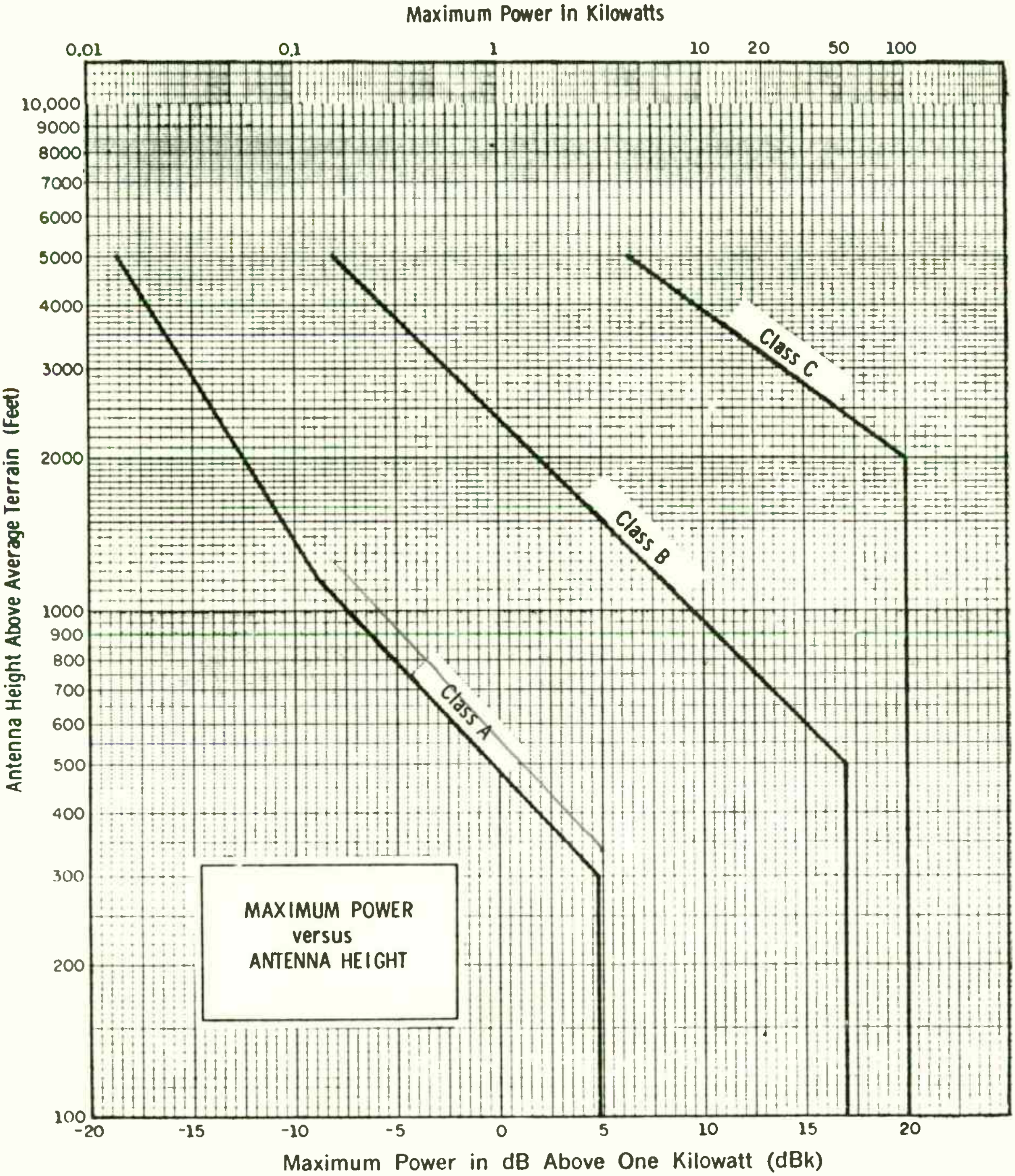
E.C. Westenhaver is employed by the Harris Corporation in its transmitter product development section.

POWERFUL HAND-HELD programmable calculators such as the TI-59 and HP-67/97 and a new equation which curve fits the FCC field strength charts now allow for accurate estimation of FM and TV coverage with a few simple keystrokes. Consider, for instance, an FM station with an antenna height of 640 feet and 27.5 kW ERP. The following sequence will give the distance to the 1mV/m contour. Enter 640, press key A, press key B, enter 27.5, press key C, enter 1, and press key D. Seventeen seconds later the calculator will indicate 31.5 miles. Compare this to the traditional methods using sliding scales and interpolation on the field strength charts.



Location of 100 test points, FM and TV Ch. 2 – 6

REFERENCE DATA



FCC Par. 73.333, Figure 3 (Ed. 9/72)

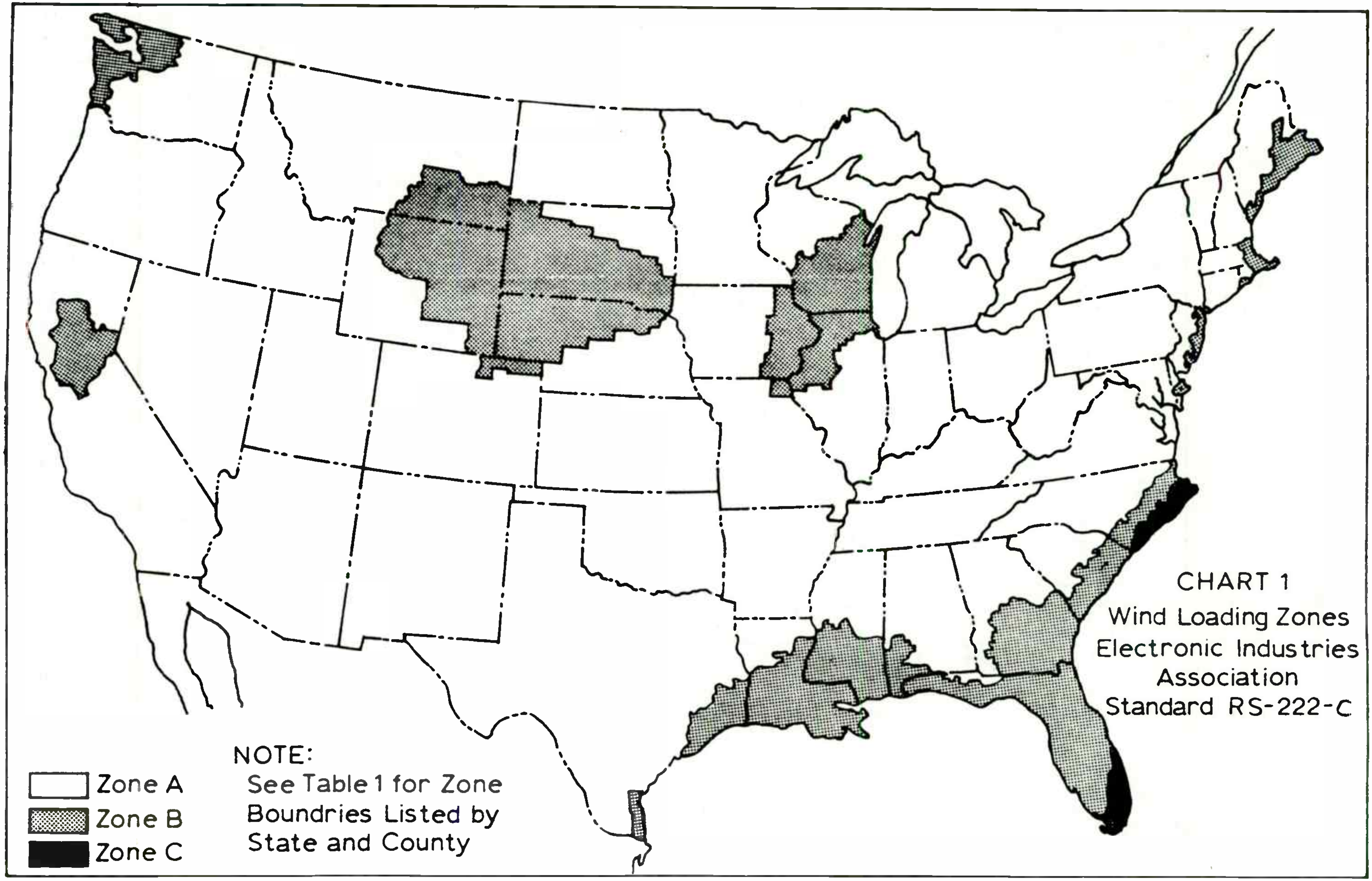
FOOTAGE TABLE FOR BROADCAST TOWER HEIGHTS

550 kHz TO 1070 kHz

kHz	METERS	1 WAVE	½ WAVE	¼ WAVE
550	545	1787.6	893.8	446.8
560	536	1758.0	879.0	439.5
570	526	1725.3	862.6	431.3
580	517	1695.7	847.8	423.9
590	509	1669.5	834.7	417.3
600	500	1640.0	820.0	410.0
610	492	1612.7	806.3	403.1
620	484	1587.5	799.7	396.8
630	476	1561.2	780.6	390.3
640	469	1546.3	773.1	386.5
650	462	1515.3	757.6	378.8
660	455	1492.4	746.2	373.1
670	448	1469.4	734.7	367.3
680	441	1446.4	723.2	361.1
690	435	1426.8	713.4	356.2
700	429	1407.1	703.5	351.2
710	423	1387.4	693.7	346.8
720	417	1367.7	683.8	341.9
730	411	1348.0	674.0	337.0
740	405	1328.4	664.2	332.1
750	400	1312.0	656.0	328.0
760	395	1295.6	647.8	323.4
770	390	1279.2	639.6	319.8
780	385	1262.8	631.4	315.7
790	380	1246.4	623.2	311.6
800	375	1230.0	615.0	307.5
810	370	1213.6	606.8	303.4
820	366	1200.4	600.2	300.1
830	361	1184.0	592.0	296.0
840	357	1170.9	585.4	292.7
850	353	1157.8	578.9	289.4
860	349	1144.7	572.3	286.1
870	345	1131.6	565.8	282.9
880	341	1118.4	559.2	279.6
890	337	1105.3	552.6	276.3
900	333	1092.2	546.1	273.0
910	330	1082.4	541.2	270.6
920	326	1069.2	534.6	267.3
930	323	1059.4	529.7	264.8
940	319	1046.3	523.1	261.5
950	316	1036.4	518.2	259.1
960	313	1026.6	513.3	256.6
970	309	1013.5	506.7	253.3
980	306	1003.6	501.8	250.9
990	303	993.8	496.9	248.4
1000	300	984.0	492.0	246.0
1010	297	974.1	487.5	243.7
1020	294.1	964.6	482.3	241.1
1030	291.3	955.3	477.6	238.8
1040	288.5	946.2	473.1	236.5
1050	285.7	937.1	468.5	234.2
1060	283.0	928.2	464.1	232.0
1070	280.4	919.7	459.8	229.9

1080 kHz TO 1600 kHz

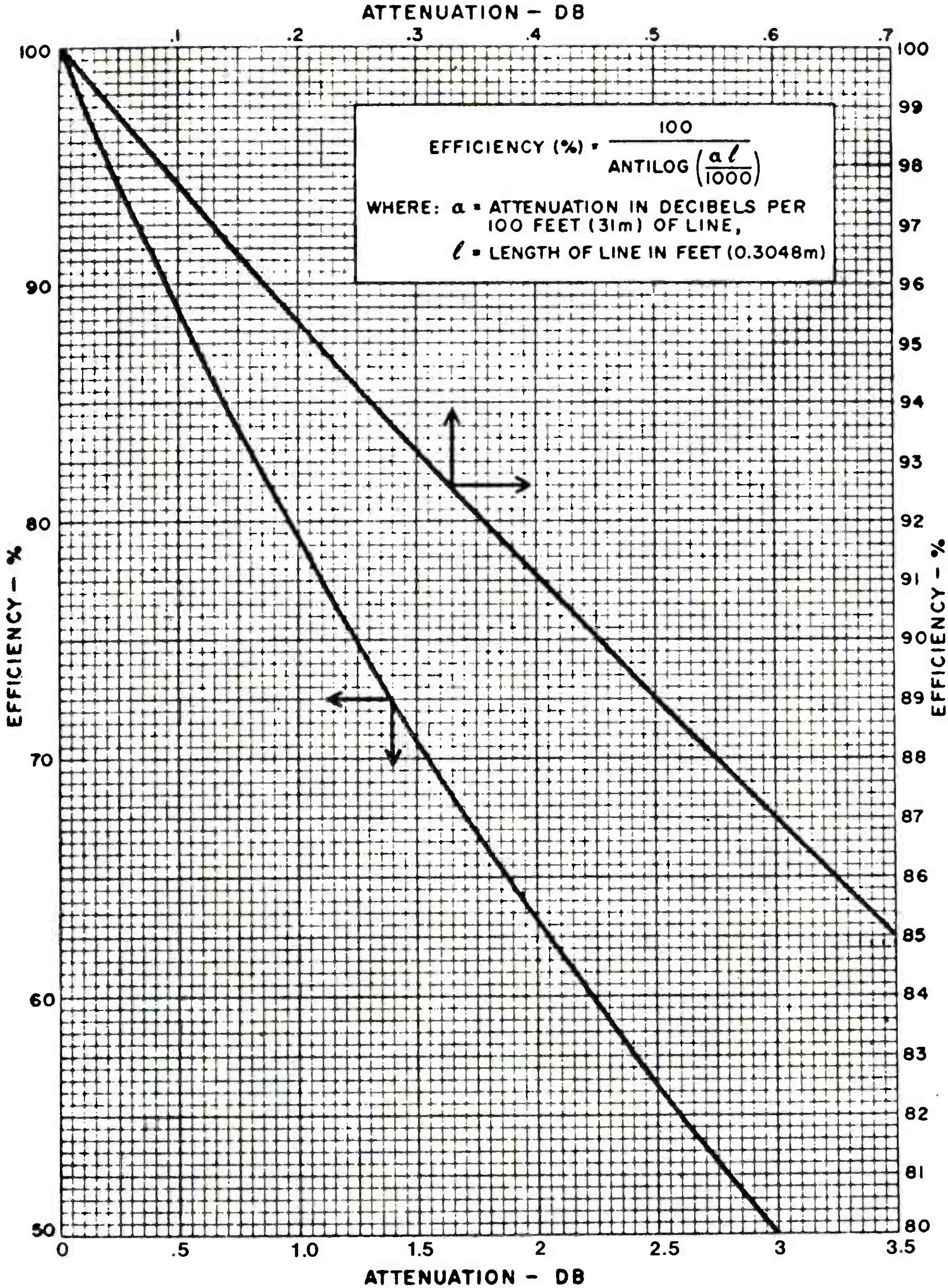
kHz	METERS	1 WAVE	½ WAVE	¼ WAVE
1080	277.8	911.1	455.5	227.7
1090	275.2	902.6	451.3	225.6
1100	272.7	894.4	447.2	223.6
1110	270.3	886.5	443.2	221.6
1120	267.9	879.0	439.5	219.7
1130	265.5	870.8	435.4	217.7
1140	263.2	862.6	431.3	215.6
1150	260.9	855.7	427.8	213.9
1160	258.6	847.8	423.9	211.9
1170	256.4	840.9	420.4	210.2
1180	254.2	834.7	417.3	208.6
1190	252.1	826.8	413.4	206.7
1200	250.0	820.0	410.0	205.0
1210	247.9	813.1	406.5	203.2
1220	245.9	806.3	403.1	201.5
1230	243.9	799.1	399.5	199.7
1240	241.9	793.7	396.8	198.4
1250	240.0	787.2	393.6	196.8
1260	238.1	780.9	390.4	195.2
1270	236.2	774.7	387.3	193.6
1280	234.4	768.8	384.4	192.2
1290	232.6	762.9	381.4	190.7
1300	230.8	757.0	378.5	189.2
1310	229.0	751.1	375.5	187.7
1320	227.3	746.2	373.1	186.5
1330	225.6	739.9	369.9	184.9
1340	223.9	734.7	367.3	183.6
1350	222.2	728.8	364.4	182.2
1360	220.6	723.2	361.1	180.5
1370	219.0	718.3	359.1	179.5
1380	217.4	713.4	356.2	178.1
1390	215.8	707.8	353.1	176.5
1400	214.3	703.5	351.2	175.6
1410	212.8	696.9	348.4	174.2
1420	211.3	693.7	346.8	173.4
1430	209.8	688.1	344.0	172.0
1440	208.3	683.8	341.9	170.9
1450	206.9	678.6	339.3	169.6
1460	205.5	674.0	337.0	168.5
1470	204.1	669.4	334.7	167.3
1480	202.7	664.2	332.1	166.5
1490	201.3	660.2	330.1	165.0
1500	200.0	656.0	328.0	164.0
1510	198.7	651.7	325.8	162.9
1520	197.4	647.8	323.4	161.7
1530	196.1	643.2	321.6	160.8
1540	194.8	639.6	319.8	159.9
1550	193.5	634.6	317.3	158.6
1560	192.3	631.4	315.7	157.8
1570	191.1	626.8	313.4	156.7
1580	189.9	623.2	311.6	155.8
1590	188.7	618.9	309.4	154.7
1600	187.5	615.0	307.5	153.7



Location of wind loading zones based on 50 year mean recurrence interval chart from distribution of extreme winds in the United States by H. C. S. Thom published in the proceedings of the American Society of Civil Engineers. April 1960.

REFERENCE DATA

dB/EFFICIENCY CONVERSION CHART



$$\text{EFFICIENCY (\%)} = \frac{100}{\text{ANTILOG}\left(\frac{a\ell}{1000}\right)}$$

WHERE: a = ATTENUATION IN DECIBELS PER 100 FEET (31m) OF LINE,
ℓ = LENGTH OF LINE IN FEET (0.3048m)

Conversion Table, kW vs. dBk

kW	dBk	kW	dBk	kW	dBk	kW	dBk	kW	dBk	kW	dBk	kW	dBk
0.5	−3.01	8.2	9.14	15.9	12.01	23.6	13.73	31.3	14.96	39.0	15.91	46.7	16.69
0.6	−2.22	8.3	9.19	16.0	12.04	23.7	13.75	31.4	14.97	39.1	15.92	46.8	16.70
0.7	−1.55	8.4	9.24	16.1	12.07	23.8	13.77	31.5	14.98	39.2	15.93	46.9	16.71
0.8	−0.97	8.5	9.29	16.2	12.10	23.9	13.78	31.6	15.00	39.3	15.94	47.0	16.72
0.9	−0.46	8.6	9.34	16.3	12.12	24.0	13.80	31.7	15.01	39.4	15.95	47.1	16.73
1.0	0.00	8.7	9.40	16.4	12.15	24.1	13.82	31.8	15.02	39.5	15.97	47.2	16.74
1.1	0.41	8.8	9.44	16.5	12.17	24.2	13.84	31.9	15.04	39.6	15.98	47.3	16.75
1.2	0.79	8.9	9.49	16.6	12.20	24.3	13.86	32.0	15.05	39.7	15.99	47.4	16.76
1.3	1.14	9.0	9.54	16.7	12.23	24.4	13.87	32.1	15.07	39.8	16.00	47.5	16.77
1.4	1.46	9.1	9.59	16.8	12.25	24.5	13.89	32.2	15.08	39.9	16.01	47.6	16.78
1.5	1.76	9.2	9.64	16.9	12.28	24.6	13.91	32.3	15.09	40.0	16.02	47.7	16.79
1.6	2.04	9.3	9.68	17.0	12.30	24.7	13.93	32.4	15.11	40.1	16.03	47.8	16.79
1.7	2.30	9.4	9.73	17.1	12.33	24.8	13.94	32.5	15.12	40.2	16.04	47.9	16.80
1.8	2.55	9.5	9.78	17.2	12.36	24.9	13.96	32.6	15.13	40.3	16.05	48.0	16.81
1.9	2.79	9.6	9.82	17.3	12.38	25.0	13.98	32.7	15.15	40.4	16.06	48.1	16.82
2.0	3.01	9.7	9.87	17.4	12.41	25.1	14.00	32.8	15.16	40.5	16.07	48.2	16.83
2.1	3.22	9.8	9.91	17.5	12.43	25.2	14.01	32.9	15.17	40.6	16.09	48.3	16.84
2.2	3.42	9.9	9.96	17.6	12.46	25.3	14.03	33.0	15.19	40.7	16.10	48.4	16.85
2.3	3.62	10.0	10.00	17.7	12.48	25.4	14.05	33.1	15.20	40.8	16.11	48.5	16.86
2.4	3.80	10.1	10.04	17.8	12.50	25.5	14.07	33.2	15.21	40.9	16.12	48.6	16.87
2.5	3.98	10.2	10.09	17.9	12.53	25.6	14.08	33.3	15.22	41.0	16.13	48.7	16.88
2.6	4.15	10.3	10.13	18.0	12.55	25.7	14.10	33.4	15.24	41.1	16.14	48.8	16.88
2.7	4.31	10.4	10.17	18.1	12.58	25.8	14.12	33.5	15.25	41.2	16.15	48.9	16.89
2.8	4.47	10.5	10.21	18.2	12.60	25.9	14.13	33.6	15.26	41.3	16.16	49.0	16.90
2.9	4.62	10.6	10.25	18.3	12.62	26.0	14.15	33.7	15.28	41.4	16.17	49.1	16.91
3.0	4.77	10.7	10.29	18.4	12.65	26.1	14.17	33.8	15.29	41.5	16.18	49.2	16.92
3.1	4.91	10.8	10.33	18.5	12.67	26.2	14.18	33.9	15.30	41.6	16.19	49.3	16.93
3.2	5.05	10.9	10.37	18.6	12.70	26.3	14.20	34.0	15.31	41.7	16.20	49.4	16.94
3.3	5.19	11.0	10.41	18.7	12.72	26.4	14.22	34.1	15.33	41.8	16.21	49.5	16.95
3.4	5.31	11.1	10.45	18.8	12.74	26.5	14.23	34.2	15.34	41.9	16.22	49.6	16.95
3.5	5.44	11.2	10.49	18.9	12.76	26.6	14.25	34.3	15.35	42.0	16.23	49.7	16.96
3.6	5.56	11.3	10.53	19.0	12.79	26.7	14.27	34.4	15.37	42.1	16.24	49.8	16.97
3.7	5.68	11.4	10.57	19.1	12.81	26.8	14.28	34.5	15.38	42.2	16.25	49.9	16.98
3.8	5.80	11.5	10.61	19.2	12.83	26.9	14.30	34.6	15.39	42.3	16.26	50.0	16.99
3.9	5.91	11.6	10.64	19.3	12.86	27.0	14.31	34.7	15.40	42.4	16.27	50.1	17.00
4.0	6.02	11.7	10.68	19.4	12.88	27.1	14.33	34.8	15.42	42.5	16.28	50.2	17.01
4.1	6.13	11.8	10.72	19.5	12.90	27.2	14.35	34.9	15.43	42.6	16.29	50.3	17.02
4.2	6.23	11.9	10.76	19.6	12.92	27.3	14.36	35.0	15.44	42.7	16.30	50.4	17.02
4.3	6.33	12.0	10.79	19.7	12.94	27.4	14.38	35.1	15.45	42.8	16.31	50.5	17.03
4.4	6.43	12.1	10.83	19.8	12.97	27.5	14.39	35.2	15.47	42.9	16.32	50.6	17.04
4.5	6.53	12.2	10.86	19.9	12.99	27.6	14.41	35.3	15.48	43.0	16.33	50.7	17.05
4.6	6.63	12.3	10.90	20.0	13.01	27.7	14.42	35.4	15.49	43.1	16.34	50.8	17.06
4.7	6.72	12.4	10.93	20.1	13.03	27.8	14.44	35.5	15.50	43.2	16.35	50.9	17.07
4.8	6.81	12.5	10.97	20.2	13.05	27.9	14.46	35.6	15.51	43.3	16.36	51.0	17.08
4.9	6.90	12.6	11.00	20.3	13.07	28.0	14.47	35.7	15.53	43.4	16.37	51.1	17.08
5.0	6.99	12.7	11.04	20.4	13.10	28.1	14.49	35.8	15.54	43.5	16.38	51.2	17.09
5.1	7.08	12.8	11.07	20.5	13.12	28.2	14.50	35.9	15.55	43.6	16.39	51.3	17.10
5.2	7.16	12.9	11.11	20.6	13.14	28.3	14.52	36.0	15.56	43.7	16.40	51.4	17.11
5.3	7.24	13.0	11.14	20.7	13.16	28.4	14.53	36.1	15.58	43.8	16.41	51.5	17.12
5.4	7.32	13.1	11.17	20.8	13.18	28.5	14.55	36.2	15.59	43.9	16.42	51.6	17.13
5.5	7.40	13.2	11.21	20.9	13.20	28.6	14.56	36.3	15.60	44.0	16.43	51.7	17.13
5.6	7.48	13.3	11.24	21.0	13.22	28.7	14.58	36.4	15.61	44.1	16.44	51.8	17.14
5.7	7.56	13.4	11.27	21.1	13.24	28.8	14.59	36.5	15.62	44.2	16.45	51.9	17.15
5.8	7.63	13.5	11.30	21.2	13.26	28.9	14.61	36.6	15.63	44.3	16.46	52.0	17.16
5.9	7.71	13.6	11.34	21.3	13.28	29.0	14.62	36.7	15.65	44.4	16.47	52.1	17.17
6.0	7.78	13.7	11.37	21.4	13.30	29.1	14.64	36.8	15.66	44.5	16.48	52.2	17.18
6.1	7.85	13.8	11.40	21.5	13.32	29.2	14.65	36.9	15.67	44.6	16.49	52.3	17.19
6.2	7.92	13.9	11.43	21.6	13.34	29.3	14.67	37.0	15.68	44.7	16.50	52.4	17.19
6.3	7.99	14.0	11.46	21.7	13.36	29.4	14.68	37.1	15.69	44.8	16.51	52.5	17.20
6.4	8.06	14.1	11.49	21.8	13.38	29.5	14.70	37.2	15.71	44.9	16.52	52.6	17.21
6.5	8.13	14.2	11.52	21.9	13.40	29.6	14.71	37.3	15.72	45.0	16.53	52.7	17.22
6.6	8.20	14.3	11.55	22.0	13.42	29.7	14.73	37.4	15.73	45.1	16.54	52.8	17.23
6.7	8.26	14.4	11.58	22.1	13.44	29.8	14.74	37.5	15.74	45.2	16.55	52.9	17.23
6.8	8.33	14.5	11.61	22.2	13.46	29.9	14.76	37.6	15.75	45.3	16.56	53.0	17.24
6.9	8.39	14.6	11.64	22.3	13.48	30.0	14.77	37.7	15.76	45.4	16.57	53.1	17.25
7.0	8.45	14.7	11.67	22.4	13.50	30.1	14.79	37.8	15.77	45.5	16.58	53.2	17.26
7.1	8.51	14.8	11.70	22.5	13.52	30.2	14.80	37.9	15.79	45.6	16.59	53.3	17.27
7.2	8.57	14.9	11.73	22.6	13.54	30.3	14.81	38.0	15.80	45.7	16.60	53.4	17.28
7.3	8.63	15.0	11.76	22.7	13.56	30.4	14.83	38.1	15.81	45.8	16.61	53.5	17.28
7.4	8.69	15.1	11.79	22.8	13.58	30.5	14.84	38.2	15.82	45.9	16.62	53.6	17.29
7.5	8.75	15.2	11.82	22.9	13.60	30.6	14.86	38.3	15.83	46.0	16.63	53.7	17.30
7.6	8.81	15.3	11.85	23.0	13.62	30.7	14.87	38.4	15.84	46.1	16.64	53.8	17.31
7.7	8.86	15.4	11.88	23.1	13.64	30.8	14.89	38.5	15.85	46.2	16.65	53.9	17.32
7.8	8.92	15.5	11.90	23.2	13.65	30.9	14.90	38.6	15.87	46.3	16.66	54.0	17.32
7.9	8.98	15.6	11.93	23.3	13.67	31.0	14.91	38.7	15.88	46.4	16.67	54.1	17.33
8.0	9.03	15.7	11.96	23.4	13.69	31.1	14.93	38.8	15.89	46.5	16.67	54.2	17.34
8.1	9.08	15.8	11.99	23.5	13.71	31.2	14.94	38.9	15.90	46.6	16.68	54.3	17.35

Conversion Table, kW vs. dBk

kW	dBk	kW	dBk	kW	dBk	kW	dBk	kW	dBk	kW	dBk	kW	dBk
54.4	17.36	62.3	17.94	70.1	18.46	77.9	18.92	85.6	19.32	93.3	19.70	300	24.77
54.5	17.36	62.4	17.94	70.2	18.46	78.0	18.92	85.7	19.33	93.4	19.70	316	25.00
54.6	17.37	62.5	17.95	70.3	18.47	78.1	18.93	85.8	19.33	93.5	19.71	320	25.05
54.7	17.38	62.6	17.96	70.4	18.48	78.2	18.93	85.9	19.34	93.6	19.71	340	25.31
54.8	17.39	62.7	17.97	70.5	18.48	78.3	18.94	86.0	19.34	93.7	19.72	360	25.56
54.9	17.40	62.8	17.97	70.6	18.49	78.4	18.94	86.1	19.35	93.8	19.72	380	25.80
55.0	17.40	62.9	17.99	70.7	18.49	78.5	18.95	86.2	19.36	93.9	19.73	400	26.02
55.1	17.41	63.0	17.99	70.8	18.50	78.6	18.95	86.3	19.36	94.0	19.73	420	26.23
55.2	17.42	63.1	18.00	70.9	18.51	78.7	18.96	86.4	19.37	94.1	19.74	440	26.43
55.3	17.43	63.2	18.01	71.0	18.51	78.8	18.97	86.5	19.37	94.2	19.74	460	26.63
55.4	17.44	63.3	18.01	71.1	18.52	78.9	18.97	86.6	19.38	94.3	19.75	480	26.81
55.5	17.44	63.4	18.02	71.2	18.52	79.0	18.98	86.7	19.38	94.4	19.75	500	26.99
55.6	17.45	63.5	18.03	71.3	18.53	79.1	18.98	86.8	18.39	94.5	19.75	520	27.16
55.7	17.46	63.6	18.03	71.4	18.54	79.2	18.99	86.9	19.39	94.6	19.76	540	27.32
55.8	17.47	63.7	18.04	71.5	18.54	79.3	18.99	87.0	19.40	94.7	19.76	560	27.48
55.9	17.47	63.8	18.05	71.6	18.55	79.4	19.00	87.1	19.40	94.8	19.77	580	27.63
56.0	17.48	63.9	18.06	71.7	18.56	79.5	19.00	87.2	19.41	94.9	19.77	600	27.78
56.1	17.49	64.0	18.06	71.8	18.56	79.6	19.01	87.3	19.41	95.0	19.78	620	27.92
56.2	17.50	64.1	18.07	71.9	18.57	79.7	19.01	87.4	19.42	95.1	19.78	640	28.06
56.3	17.51	64.2	18.08	72.0	18.57	79.8	19.02	87.5	19.42	95.2	19.79	660	28.19
56.4	17.51	64.3	18.08	72.1	18.58	79.9	19.03	87.6	19.43	95.3	19.79	680	28.32
56.5	17.52	64.4	18.09	72.2	18.59	80.0	19.03	87.7	19.43	95.4	19.80	700	28.45
56.6	17.53	64.5	18.10	72.3	18.59	80.1	19.04	87.8	19.43	95.5	19.80	720	28.57
56.7	17.54	64.6	18.10	72.4	18.60	80.2	19.04	87.9	19.44	95.6	19.80	740	28.69
56.8	17.54	64.7	18.11	72.5	18.60	80.3	19.05	88.0	19.44	95.7	19.81	760	28.81
56.9	17.55	64.8	18.12	72.6	18.61	80.4	19.05	88.1	19.45	95.8	19.81	780	28.92
57.0	17.56	64.9	18.12	72.7	18.62	80.5	19.06	88.2	19.45	95.9	19.82	800	29.03
57.1	17.57	65.0	18.13	72.8	18.62	80.6	19.06	88.3	19.46	96.0	19.82	820	29.14
57.2	17.57	65.1	18.14	72.9	18.63	80.7	19.07	88.4	19.46	96.1	19.83	840	29.24
57.3	17.58	65.2	18.14	73.0	18.63	80.8	19.07	88.5	19.47	96.2	19.83	860	29.34
57.4	17.59	65.3	18.15	73.1	18.64	80.9	19.08	88.6	19.47	96.3	19.84	880	29.44
57.5	17.60	65.4	18.16	73.2	18.65	81.0	19.08	88.7	19.48	96.4	19.84	900	29.54
57.6	17.60	65.5	18.16	73.3	18.65	81.1	19.09	88.8	19.48	96.5	19.85	920	29.64
57.7	17.61	65.6	18.17	73.4	18.66	81.2	19.10	88.9	19.49	96.6	19.85	940	29.73
57.8	17.62	65.7	18.18	73.5	18.66	81.3	19.10	89.0	19.49	96.7	19.85	960	29.82
57.9	17.63	65.8	18.18	73.6	18.67	81.4	19.11	89.1	19.50	96.8	19.86	980	29.91
58.0	17.63	65.9	18.19	73.7	18.67	81.5	19.11	89.2	19.50	96.9	19.86	1000	30.00
58.1	17.64	66.0	18.20	73.8	18.68	81.6	19.12	89.3	19.51	97.0	19.87	1100	30.41
58.2	17.65	66.1	18.20	73.9	18.69	81.7	19.12	89.4	19.51	97.1	19.87	1200	30.79
58.3	17.66	66.2	18.21	74.0	18.69	81.8	19.13	89.5	19.52	97.2	19.88	1300	31.14
58.4	17.66	66.3	18.22	74.1	18.70	81.9	19.13	89.6	19.52	97.3	19.88	1400	31.46
58.5	17.67	66.4	18.22	74.2	18.70	82.0	19.14	89.7	19.53	97.4	19.89	1500	31.76
58.6	17.68	66.5	18.23	74.3	18.71	82.1	19.14	89.8	19.53	97.5	19.89	1600	32.04
58.7	17.69	66.6	18.23	74.4	18.72	82.2	19.15	89.9	19.54	97.6	19.89	1700	32.30
58.8	17.69	66.7	18.24	74.5	18.72	82.3	19.15	90.0	19.54	97.7	19.90	1800	32.55
58.9	17.70	66.8	18.25	74.6	18.73	82.4	19.16	90.1	19.55	97.8	19.90	1900	32.79
59.0	17.71	66.9	18.25	74.7	18.73	82.5	19.16	90.2	19.55	97.9	19.91	2000	33.01
59.1	17.72	67.0	18.26	74.8	18.74	82.6	19.17	90.3	19.56	98.0	19.91	2100	33.22
59.2	17.72	67.1	18.27	74.9	18.74	82.7	19.18	90.4	19.56	98.1	19.92	2200	33.42
59.3	17.73	67.2	18.27	75.0	18.75	82.8	19.18	90.5	19.57	98.2	19.92	2300	33.62
59.4	17.74	67.3	18.28	75.1	18.76	82.9	19.19	90.6	19.57	98.3	19.93	2400	33.80
59.5	17.75	67.4	18.29	75.2	18.76	83.0	19.19	90.7	19.58	98.4	19.93	2500	33.98
59.6	17.75	67.5	18.29	75.3	18.77	83.1	19.20	90.8	19.58	98.5	19.93	2600	34.15
59.7	17.76	67.6	18.30	75.4	18.77	83.2	19.20	90.9	19.59	98.6	19.94	2700	34.31
59.8	17.77	67.7	18.31	75.5	18.78	83.3	19.21	91.0	19.59	98.7	19.94	2800	34.47
59.9	17.77	67.8	18.31	75.6	18.79	83.4	19.21	91.1	19.60	98.8	19.95	2900	34.62
60.0	17.78	67.9	18.32	75.7	18.79	83.5	19.22	91.2	19.60	98.9	19.95	3000	34.77
60.1	17.79	68.0	18.33	75.8	18.80	83.6	19.22	91.3	19.60	99.0	19.96	3100	34.91
60.2	17.80	68.1	18.33	75.9	18.80	83.7	19.23	91.4	19.61	99.1	19.96	3200	35.05
60.3	17.80	68.2	18.34	76.0	18.81	83.8	19.23	91.5	19.61	99.2	19.97	3300	35.19
60.4	17.81	68.3	18.34	76.1	18.81	83.9	19.24	91.6	19.62	99.3	19.97	3400	35.31
60.5	17.82	68.4	18.35	76.2	18.82	84.0	19.24	91.7	19.62	99.4	19.97	3500	35.44
60.6	17.82	68.5	18.36	76.3	18.83	84.1	19.25	91.8	19.63	99.5	19.98	3600	35.56
60.7	17.83	68.6	18.36	76.4	18.83	84.2	19.25	91.9	19.63	99.6	19.98	3700	35.68
60.8	17.84	68.7	18.37	76.5	18.84	84.3	19.26	92.0	19.64	99.7	19.99	3800	35.80
60.9	17.85	68.8	18.38	76.6	18.84	84.4	19.26	92.1	19.64	99.8	19.99	3900	35.91
61.0	17.85	68.9	18.38	76.7	18.85	84.5	19.27	92.2	19.65	99.9	20.00	4000	36.02
61.1	17.86	69.0	18.39	76.8	18.85	84.6	19.27	92.3	19.65	100	20.00	4100	36.13
61.2	17.87	69.1	18.39	76.9	18.86	84.7	19.28	92.4	19.66	120	20.79	4200	36.23
61.3	17.87	69.2	18.40	77.0	18.86	84.8	19.28	92.5	19.66	140	21.46	4300	36.33
61.4	17.88	69.3	18.41	77.1	18.87	84.9	19.29	92.6	19.67	160	22.04	4400	36.43
61.5	17.89	69.4	18.41	77.2	18.88	85.0	19.29	92.7	19.67	180	22.55	4500	36.53
61.6	17.90	69.5	18.42	77.3	18.88	85.1	19.30	92.8	19.68	200	23.01	4600	36.63
61.8	17.90	69.6	18.43	77.4	18.89	85.2	19.30	92.9	19.68	220	23.42	4700	36.72
61.9	17.91	69.7	18.43	77.5	18.89	85.3	19.31	93.0	19.68	240	23.80	4800	36.81
62.0	17.92	69.8	18.44	77.6	18.90	85.4	19.31	93.1	19.69	260	24.15	4900	36.90
62.1	17.92	69.9	18.44	77.7	18.90	85.5	19.32	93.2	19.69	280	24.47	5000	36.99
62.2	17.93	70.0	18.45	77.8	18.91								

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