Type 798 Series GRANGER®

Short-Range HF Antennas

- **2-30 MHz Frequency Range**
- **Up to 10 kW Average, 30 kW Peak Power Rating**
- **Circular Polarization**
- **Essentially Omnidirectional**
- **2.0:1 Maximum VSWR**
- **Short-Range Communications (Shore/Ship, Ground/Air and Base/Mobile)**

General Description

The 798 Series antennas are designed for skywave communication at distances up to 300 miles. The 2-30 MHz range encompasses all the frequencies which normally propagate by skywave at these distances, and the configuration of radiating elements concentrates radiation at the high elevation angles required.

With conventional antennas and typical transmitters, reliable communications by groundwave are restricted to distances of 50 to 75 miles – even less in rugged terrain or through dense foliage. Skywave transmission, with appropriate antennas, is the only means of obtaining reliable HF communication at distances of 300 miles or more.

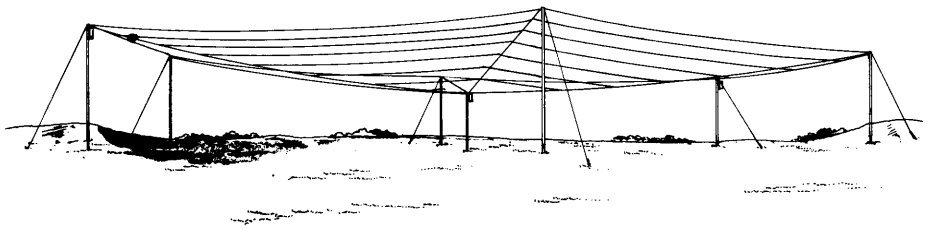
Applications

The 798 Series antennas are ideal for communication with mobile stations located in the region beyond the range of reliable groundwave propagation, but too close to be reached by skywaves radiated at the lower elevation angles appropriate for longer distances. Its omnidirectional pattern provides coverage of all points within a 300-mile radius.

An analysis of the signal-to-noise ratio which will be achieved under various combinations of sun spot activity, season, time and location, showed that, for 2.5 kW transmitter power, the received signal-to-noise in a 3kHz band at the optimum working frequency will be at least 20 dB, even if the mobile antenna provides no useful power gain over isotropic levels.

In addition, the 798 Series antennas are efficient at both ends of a short-range circuit because both transmitting and receiving antennas contribute high gain to the system. The analysis showed that, using a 1 kW transmitter on a 300-mile circuit, the received signal-to-noise ratio in a 3 kHz band at the optimum working frequency will be 20 dB or better.

The radiation characteristics are also perfectly adapted to local broadcasting in the tropical shortwave broadcast bands (2300-2495 kHz, 3200-4000 kHz and 4750-5050 kHz) and the lower HF broadcast bands (3900-4000 kHz,5959-6200 kHz, 7100-7300 kHz and 9500-9775 kHz). They are well suited for vertical incidence sounding since they direct radiation toward the zenith at all frequencies up to 13



MHz, the highest critical frequency ordinarily encountered in ionospheric sounding.

The 798 Series antennas can be used with transmitting multicouplers, enabling two or more transmitters to use the antennas simultaneously. This permits simultaneous transmission of the message at different frequencies in order to ensure effective communication in the face of jamming or interference, or to minimize loss of coverage due to "blanketing" by sporadic E patches.

Features

Adaptibility. The 798 Series antennas occupy only three-quarters of an acre of land and can be erected on rough or rocky ground. The land can be used for agricultural purposes since no ground screen is required. A variety of input impedances is available to permit operation with any HF transmitter in common use today.

Strength and Durability. All materials used in the 798 Series have been selected for maximum corrosion resistance: epoxy-bonded fiberglass for suspension system, aluminum-clad steel radiators and manganese-bronze, aluminum or non-magnetic stainless steel fittings. These materials will resist the attacks of highly corrosive agents, such as salt spray.

Ease of Shipment and Erection. The antennas are shipped as a kit containing all parts necessary to erect a complete antenna with the exception of support poles, concrete and reinforcing bars used in the guy anchors. Installation is simple and rapid. All parts of the antenna curtain and its suspension system are cut and adjusted to exact length so that no calculation, cutting or adjustment is required for erection on level land. Built-in adjustment points are provided to permit erection without modification on uneven terrain.

Antenna Radiation Patterns. The suitability of the antenna's radiation patterns at short ranges is shown in Figures 1 and 2. Figure 1, a plot of ray paths on a skywave transmission chart, shows that radiation must be directed at elevation angles above 50 to reach points less than 300 miles distant. This assumes reflection from the F layer at a virtual height of about 300 km.

During E-layer propagation, low-path losses compensate for reduced directive gain at the lower elevation angles required, resulting in performance better than that achieved during F-layer propagation at distances up to 220 miles. Beyond 220 miles E-layer performance declines somewhat, but remains greatly superior to that achieved by a monopole antenna.

Characteristics

Type	Short-range HF, omnidirectional
Frequency Range, MHz	2-30
Power Rating, kW	Up to 10 average, 30 peak
Polarization	Circular
VSWR	2.0:1 maximum
Directive Gain, dBi	+6.5, minimum
Azimuth Plane Radiation Patterns	Essentially omnidirectional
Elevation Plane Radiation Patterns	See figure 2
Efficiency	+90% above 6 MHz (see figure 4)
Wind Survival Rating, mph (km/h)	
Without Ice	120 (190)
With 1/2 in (12 mm) Radial Ice	100 (160)

Figure 2 shows the elevation plane radiation patterns for the 798 Series antennas. Up to 15 MHz, radiation is directed toward the zenith in a single lobe, with the directivity between 3 and 8 dB above isotropic at all angles above 50. Above 13 MHz, which is the highest frequency at which vertically incident signals are normally reflected, the directivity in the direction of the zenith decreases, and higher directivity is obtained at the somewhat lower elevation angles at which propagation will take place. Between 6-10 MHz, the radiation patterns are not perfectly omnidirectional. Nevertheless, adequate directivity at the required elevation angles is achieved.

Elevation Plane Radiation Patterns Series 798 Antennas
Directivity in dB Realtive to Isotropic

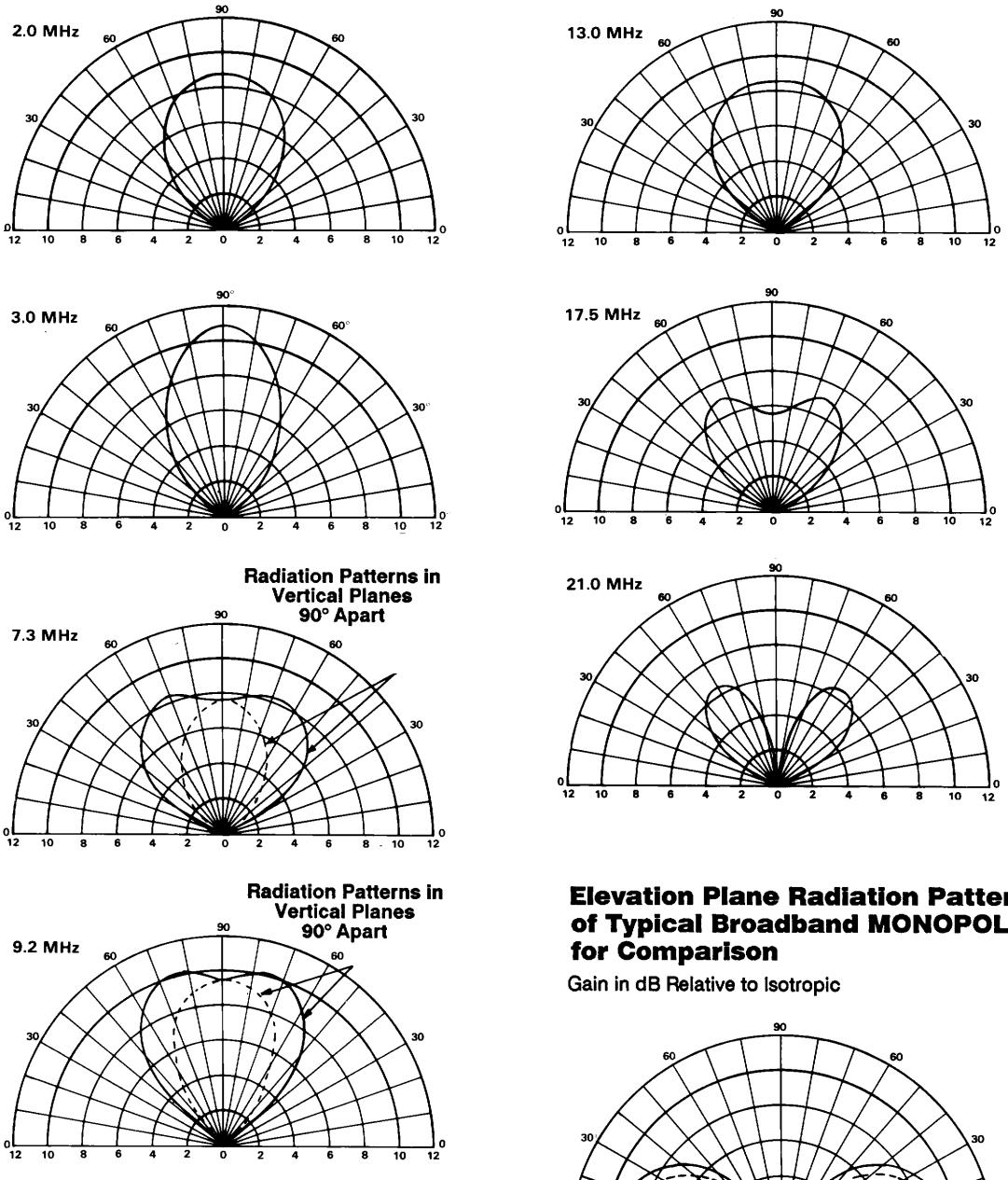


Figure 2

Elevation Plane Radiation Pattern of Typical Broadband MONOPOLE for Comparison

Gain in dB Relative to Isotropic

——— Solid Line: pattern over perfect ground.
------ Dashed Line: pattern over average soil.

Figure 3

Plot of Ray Paths on Skywave Chart

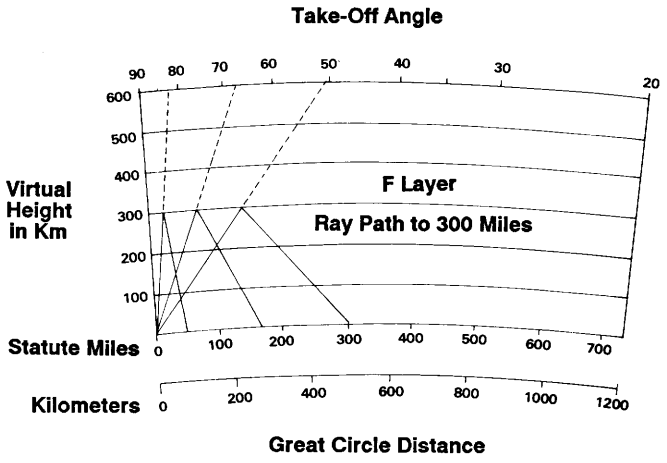


Figure 1

Efficiency as a Function of Frequency

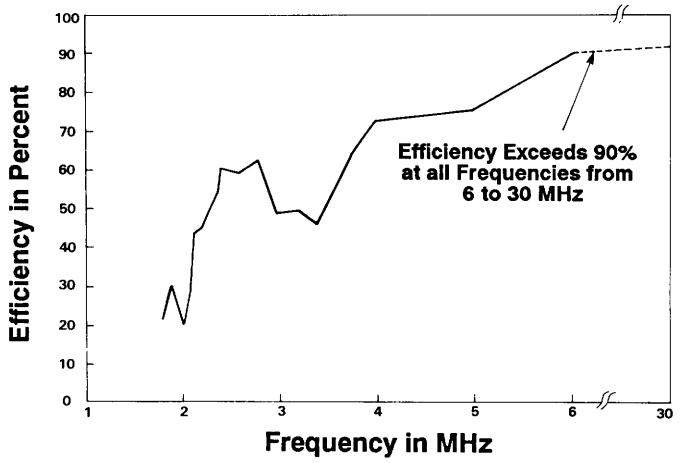


Figure 4

Antenna Dimensions for Clarity, Antenna Radiators Are Not Shown

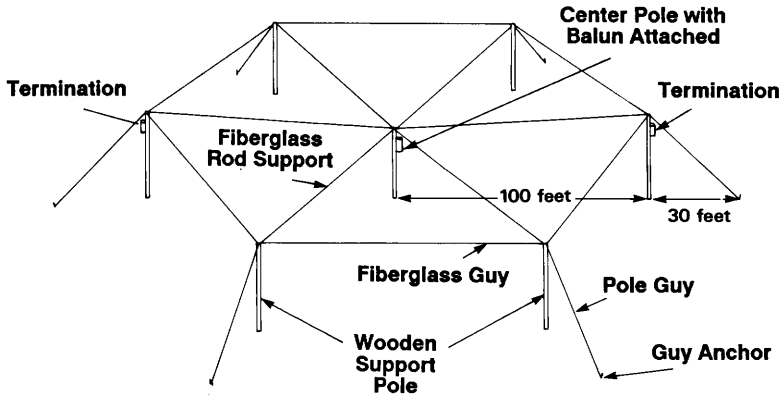


Figure 5

Accessories

The 798 Series antennas include all parts required to erect an operational installation, with the exception of the six support poles, concrete, concrete reinforcing bars and transmission line. It is anticipated that the user will procure support poles locally. Class 4 Douglas fir poles, or the equivalent, 35 feet long, are recommended. For situations in which it is not feasible to procure poles locally, two types of vertical supports are offered as accessories.

Optional Accessories (Normally supplied by customer):

Pole Kit: Six Class 4 Douglas firpoles, 35' long, pressure treated. Spar Kit: Six sectionalized wooden spars with additional guying and attachment fittings. Maximum length of the packaged elements is 20'.

Ordering Information

Type No.	Frequency Range MHz	Power Rating kW Average	Power Rating kW Peak	Input Impedance ohms	Input Connector
798-1	2-30	Receive Only		50	Type N Female, coaxial
798-4	2-30	10*	30	50	1-5/8 in EIA Female, coaxial
798-5	2-30	10*	30	600	Open Lines
798-6	2-30	10*	30	300	Open Lines

*2.2-20 MHz, 5 kW average - 2.0-2.2 MHz

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