MICROWAVE ANTENNAS

KS-21972 CONICAL ANTENNA AND WAVEGUIDE SYSTEM

DESCRIPTION

CONTENTS PAGE

1. GENERAL

1.01 This section contains equipment data, transmission characteristics, and other information pertaining to the KS-21972 conical antenna and associated circular waveguide.

1.02 Whenever this section is reissued, the reason for reissue will be listed in this paragraph.

1.03 The KS-21972 conical antenna, which is made predominantly of fiberglass reinforced plastic, has been developed as a replacement for and alternate to the KS-15676 pyramidal shaped horn-reflector antenna, which was fabricated of aluminum but is no longer being manufactured.

1.04 This antenna is designed to transmit and receive horizontally and vertically polarized radio signals in the 4-, 6-, and 11-GHz common carrier bands.

2. INTRODUCTION

2.01 The KS-21972 conical antenna stands about 23 feet in height and projects approximately 13 feet above the mounting platform. The bottom of the feed horn extends 10 feet 1-3/4 inches below the mounting platform. Towers designed for application of the KS-15676 antenna will require modification for installation of the KS-21972 conical antenna if the mounting elevation of the waveguide support platform is to be changed.

2.02 The effective aperture area of the KS-21972 conical antenna is 70.88 square feet. The aperture area is protected by a fiberglass radome which is factory laminated to the unitized antenna body. Accordingly, replacements for the radome are not available for field application.

2.03 The KS-21972 conical antenna will withstand an internal pressure of 15 inches of water (0.54 psi), and at a pressure of 5.5 inches of water (0.2 psi) will have a leak rate not exceeding 10 cubic feet of air per hour. When pressurized to 0.2 psi, the antenna will safely sustain a wind pressure of 62.5 pounds per square foot (125 mi/h).

3. EQUIPMENT FEATURES

3.01 Figures 1 and 2 show the complete KS-21972 conical antenna assembly and its associated subassembly lists.

3.02 List numbers have been assigned to cover the various components available under KS-21972 as follows:

List 1	Conical Antenna
List 2	Feed Horn
List 3	Support Ring
List 4	Azimuth Tool
List 5	Elevation Tool
List 6	Support Beams
List 7	Lightning Rod
List 8	Access Ladder
List 9	Safety Rail
List 10	Repair Kit
List 11	Hanger Rod Support Bracket

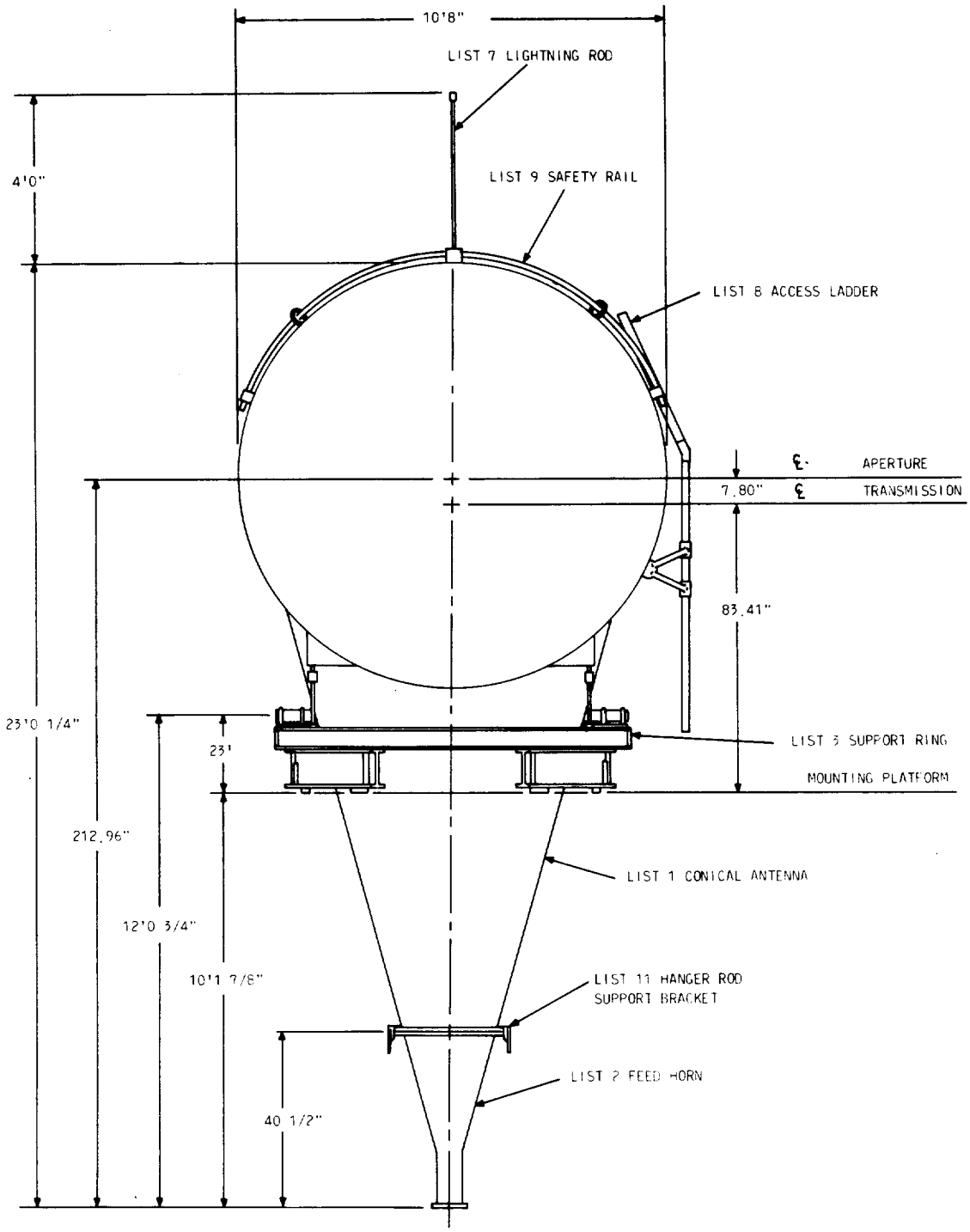

Fig. 1—KS-21972 Conical Antenna (Front View)

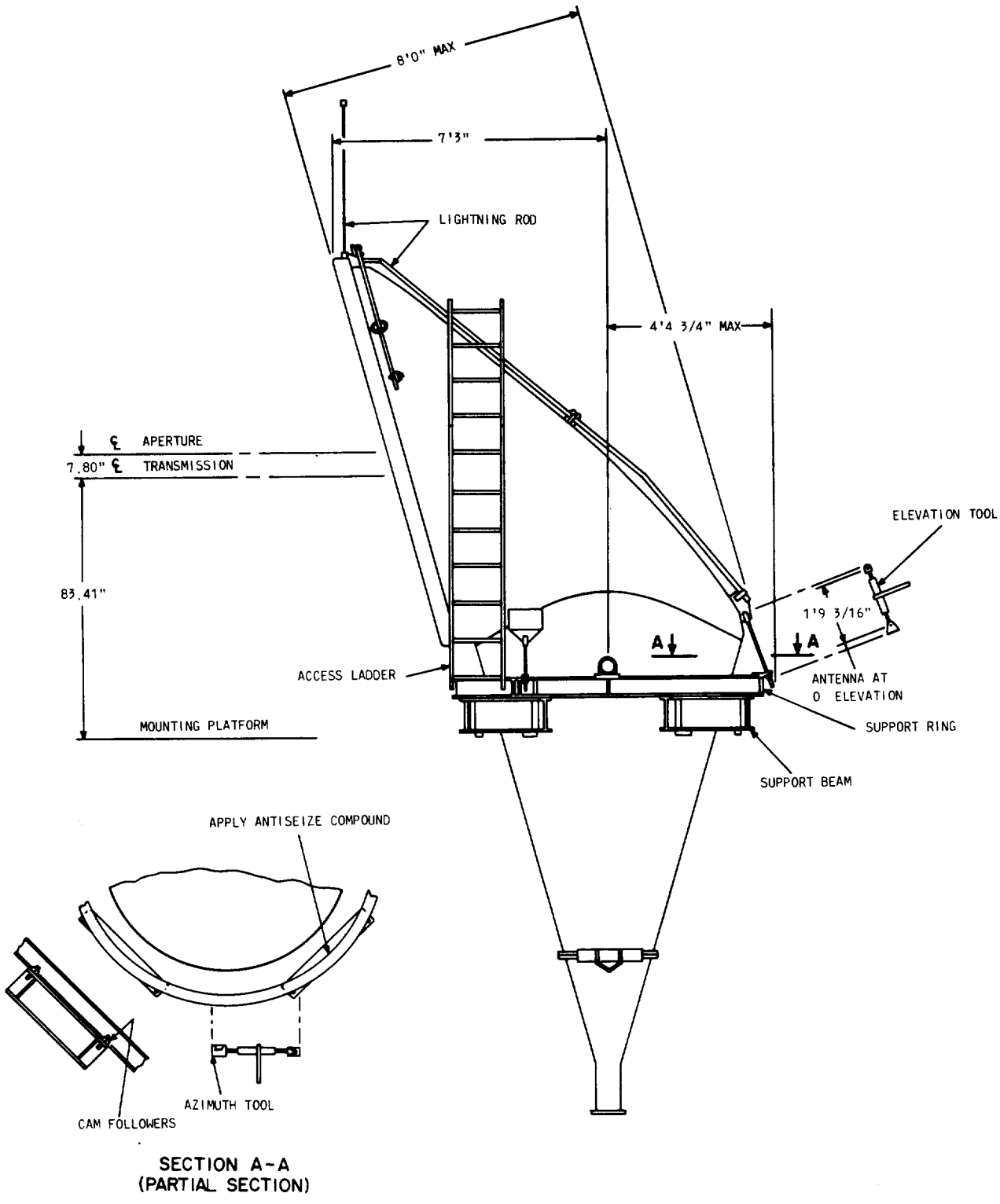

Fig. 2—KS-21972 Conical Antenna (Side View)

Additional list numbers have also been established to provide under one package various combinations of the above unit components. These package list numbers and their respective components are:

List 50 L1, L2, L3, L9, and L11
List 51 L1, L2, L3, L6, L9, and L11
List 52 L1, L2, L3, L6, L7, L9, and L11
List 53 L1, L2, L3, L4, L5, L6, L7, L8, L9, and L11

3.03 A brief description of each list number is as follows:

List 1—Provides the body of the conical antenna. It is of unitized fiberglass construction and includes the radome which is factory laminated to the antenna body. The radome is not available for replacement in the field.

List 2—Provides the feed horn. It is an electromagnetic horn constructed of fiberglass with a molded-in feed termination consisting of a flanged section of WC281 waveguide. The other end has a fiberglass flange which mates with the List 1 antenna.

List 3—Provides the support ring. It supports the antenna and provides the means for orientation of the antenna.

List 4—Provides the azimuth tool. It is a tool for smoothly orienting the antenna through ±5 degrees of azimuth. One end is attached to the List 3 support ring, and the other end is attached to the List 6 support beam. Once the antenna has been aligned, the List 4 azimuth tool is removed, and rail clips provided with List 6 are used to lock the antenna on its proper azimuth bearing.

List 5—Provides the elevation tool. It is a tool for smoothly orienting the antenna through ±5 degrees of elevation. One end is attached to the List 1 antenna (elevation support assembly) and the other end is attached to the List 3 support ring (elevation support plate). Once the antenna has been aligned, the List 5 elevation tool is removed, and the stabilizer rods provided with List 3 are used to lock the antenna on its proper elevation bearing.

List 6—Provides the support beams (4). These beams are designed to permit the direct mounting of the KS-21972 conical antenna on tower platforms.

List 7—Provides a lightning rod. The lightning rod and associated components are designed to impart a 45-degree cone of protection to the antenna against damage from lightning.

List 8—Provides an access ladder. The ladder provides a means of access to the top of the antenna for installation, maintenance, and repair operations. The ladder should not be left in place when not in use.

List 9—Provides a safety rail. The safety rail mounts to the top forward part of the antenna. The safety rail is intended for use in attaching lanyards and safety belts during maintenance and repair operations.

List 10—Provides a repair kit. The repair kit provides material and instructions for the field repair of minor damages (such as bullet holes) to the fiberglass antenna.

List 11—Provides a pair of brackets that are attached to the antenna at the antenna/feed-horn flange joint. These brackets provide a means of supporting the AT-8566 "C" hanger plate support rods (thermal rods) to the antenna.

Note: When ordering List 1 conical antennas, the color desired must be specified as either white or orange. The List 2 feed horn will

automatically be provided in the same color specified in List 1.

Example: 1—KS-21972 List 1 Conical Antenna — Orange

4. TRANSMISSION CHARACTERISTICS

4.01 A coating of flame-sprayed zinc on the interior surface of the antenna confines and guides the electromagnetic energy. Microwave absorber, judiciously located within the antenna, reduces the edge diffraction of the energy to a level sufficient to develop a satisfactory radiation pattern.

4.02 Typical smoothed patterns, representative of an antenna transmitting and receiving horizontally and vertically polarized signals at frequencies of 3.95, 5.95, and 10.7 GHz are given in Fig. 3 through 8.

4.03 The gain of the antenna at midband frequencies is as follows:

MIDBAND FREQUENCY (GHz)	GAIN (dBi)
3.950	39.8 ±0.5
6.175	43.5 ±0.5
11.155	47.7 ±0.5

4.04 The return loss at all frequencies in the 4-, 6-, and 11-GHz bands shall be a minimum of 40 dB, which corresponds to a VSWR of less than 1.02.

5. CIRCULAR WAVEGUIDE

5.01 Circular waveguide with an inside diameter of 2.812 inches is used to mate with the output flange of the KS-21972 conical antenna feed horn.

A. Rigid—Precision Bent

5.02 ED-59409-72 rigid circular WC281 waveguide is recommended for use between the KS-21972 List 2 feed horn and the main vertical rigid circular waveguide run. This waveguide is precision bent to meet job conditions for antennas with tilt angles and hanger plate offsets.

5.03 In order to compensate for the thermal expansion differences between the tower steel and the combination of copper waveguide and fiberglass, a pair of bimetal thermal compensating rods are required to support the waveguide run.

5.04 These thermal rods, called AT-8566 "C" hanger plate support rods, support the main vertical waveguide run through a floating hanger plate and expand or contract at the same rate as the antenna feed horn and the copper waveguide. The thermal rods are attached between the KS-21972 List 11 hanger rod support brackets and the waveguide hanger plate.

B. Flexible

5.05 KS-20104 flexible circular WC281 waveguide is available for use between the KS-21972 List 2 feed horn and the main vertical rigid circular waveguide run. However, because of improved transmission characteristics, ED-59409-72 circular rigid WC281 waveguide is recommended in place of the flexible waveguide section.

5.06 The KS-20104 List 1 (8 feet long) flexible circular WC281 waveguide is a source of cross-modulation distortion in all three of the common carrier bands. It is fragile in comparison to the rigid copper waveguide and therefore more susceptible to damage, which may cause transmission impairments. The grooves in the walls interact with the radio signal passing through, resulting in the generation of higher order modes which in turn result in echoes.

5.07 Where the installation of a flexible circular WC281 waveguide is necessary, because of unusual job conditions, a flexible waveguide restrainer per ED-99995-50 Group 13 shall be used to restrain the flexible waveguide section.

C. Rigid

5.08 ED-59409-20 or -70 rigid circular WC281 waveguide provides the lengths of waveguide required to connect the hanger plate level to the required systems combining networks.

6. REFERENCES

6.01 ***Bell System Practices:***

SECTION	TITLE
402-422-200	Microwave Antennas, KS-21972 Conical Antenna and Waveguide System, Antenna Assembly and Installation
804-331-158	Outdoor Waveguide for Microwave Communication Systems

6.02 ***Drawings:***

NUMBER	DRAWING
ED-97718-11	Toll Systems, Typical Applications for 4-, 6- and 11-GHz Outdoor Waveguide Associated With the KS-21972 Conical Antenna

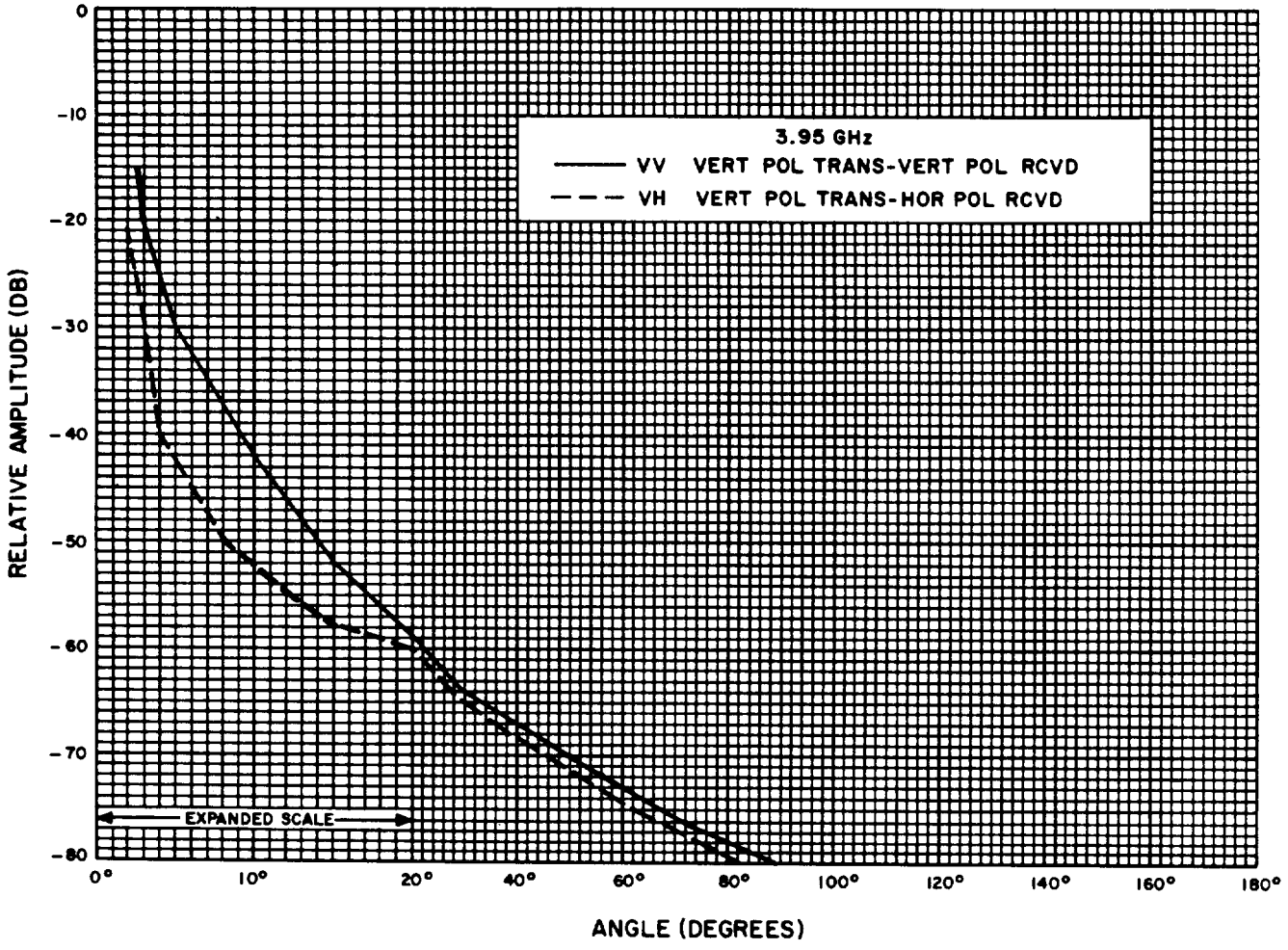

Fig. 3—KS-21972 Conical Antenna, 3.95 GHz, Vertical Polarization Transmitted

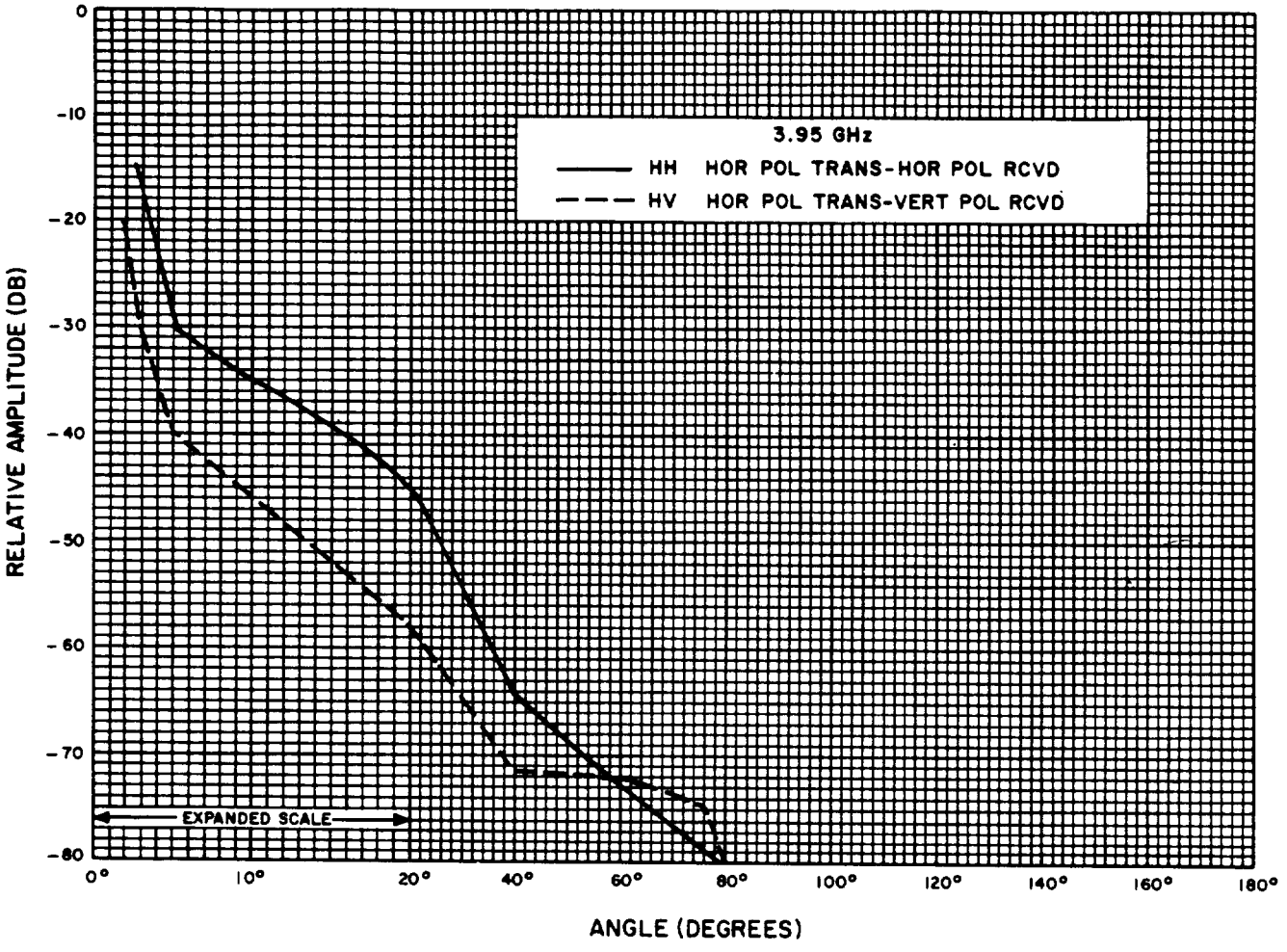

Fig. 4—KS-21972 Conical Antenna, 3.95 GHz, Horizontal Polarization Transmitted

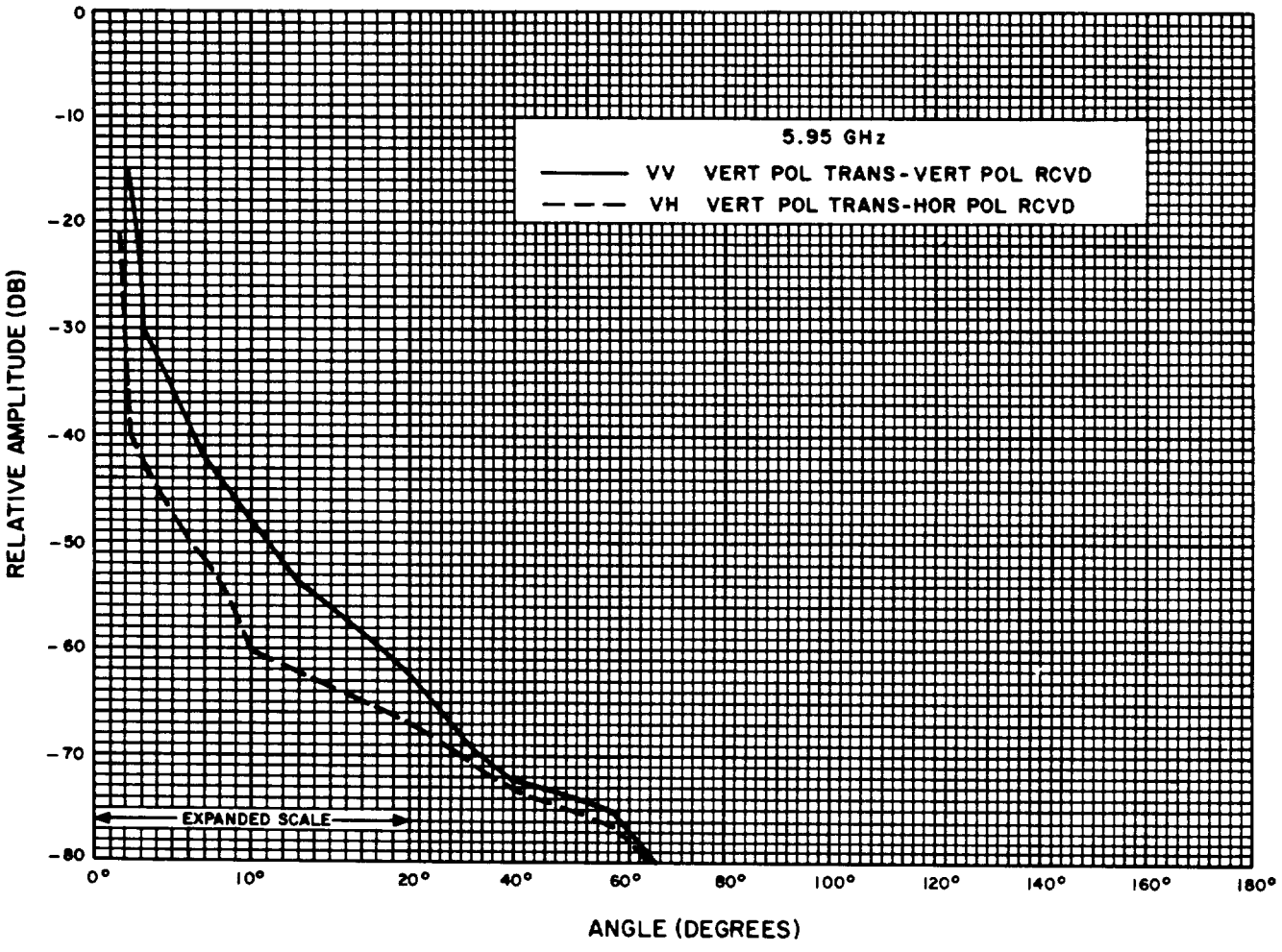

Fig. 5—KS-21972 Conical Antenna, 5.95 GHz, Vertical Polarization Transmitted

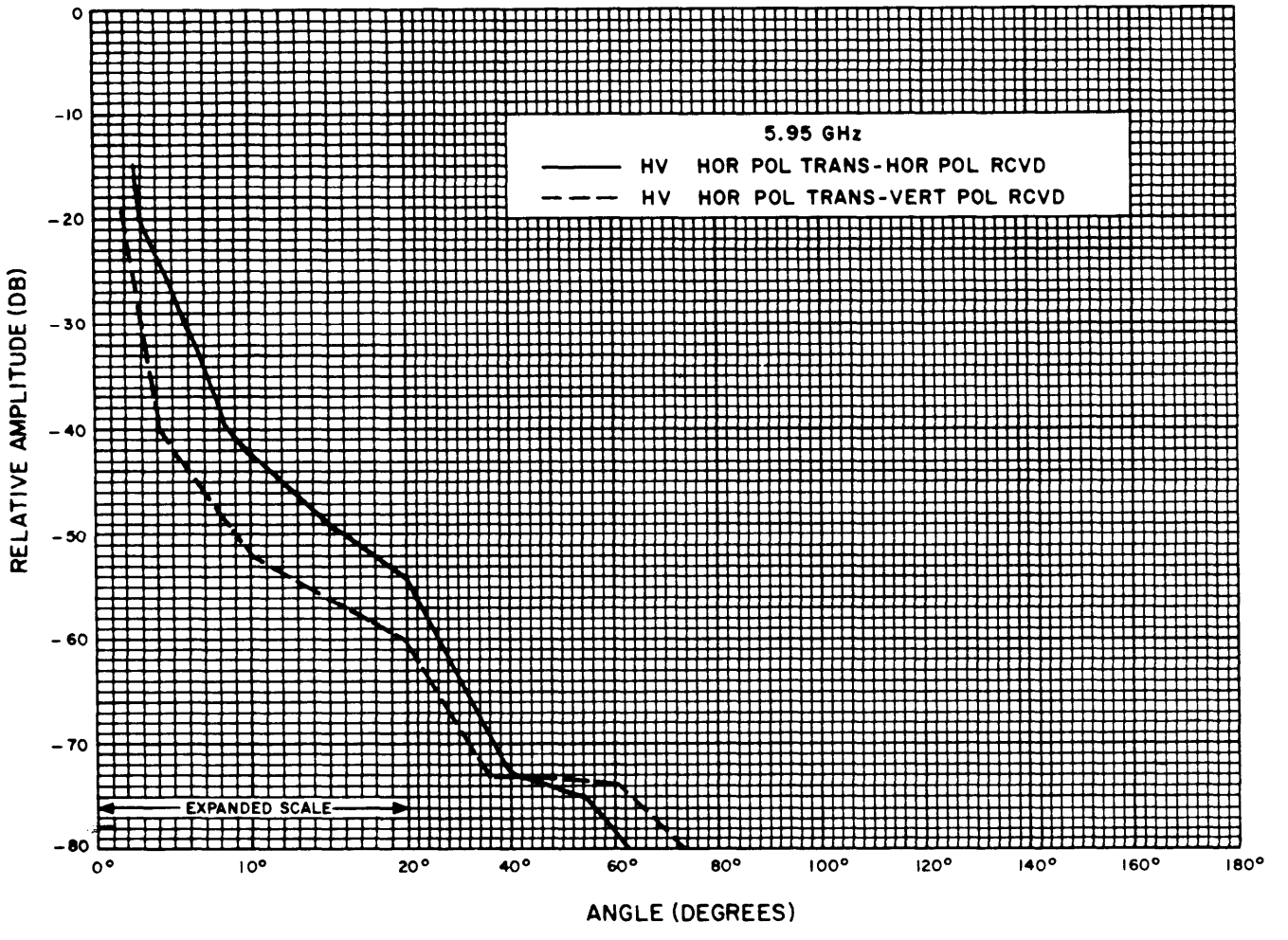

Fig. 6—KS-21972 Conical Antenna, 5.95 GHz, Horizontal Polarization Transmitted

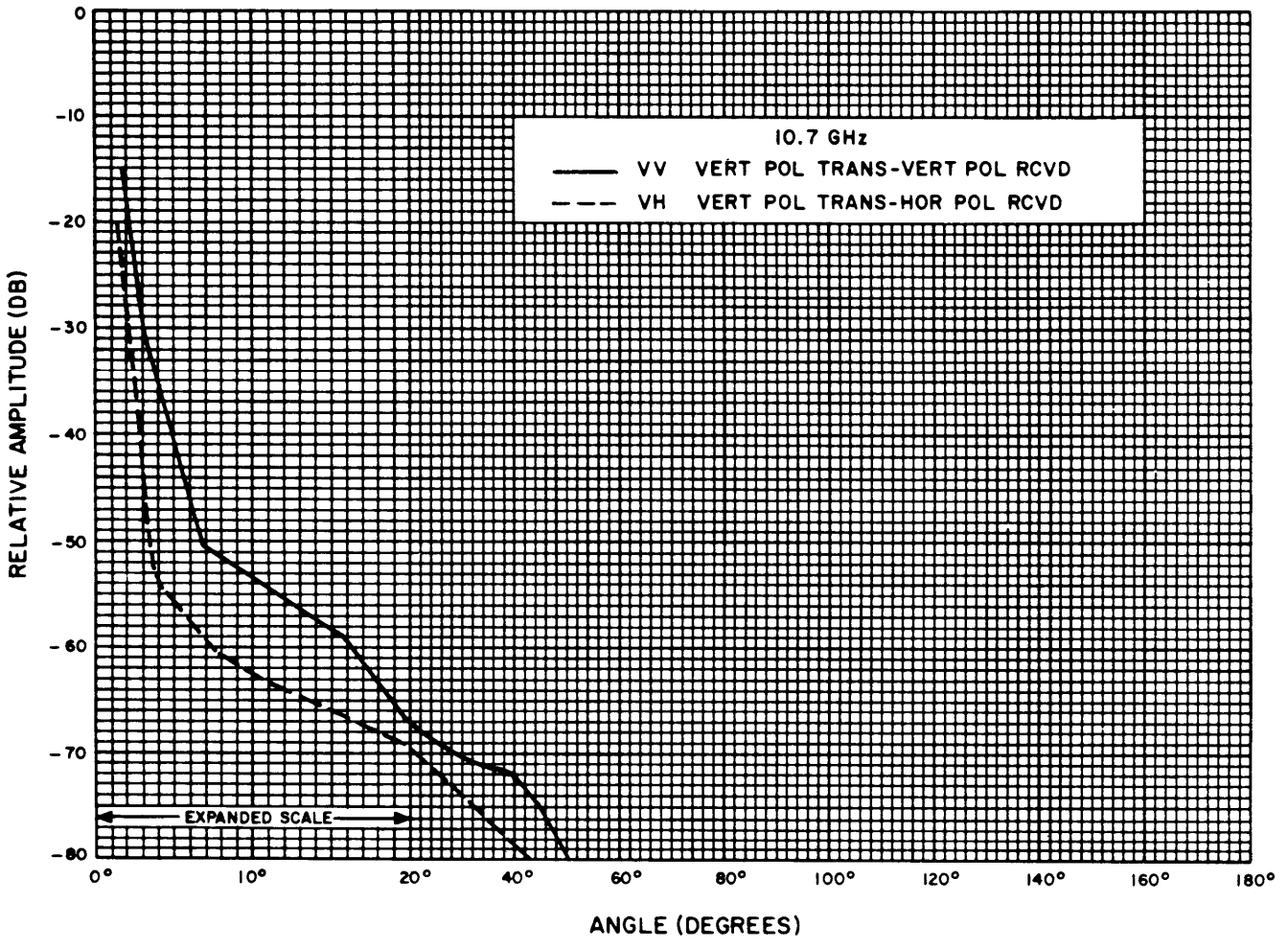

Fig. 7—KS-21972 Conical Antenna, 10.7 GHz, Vertical Polarization Transmitted

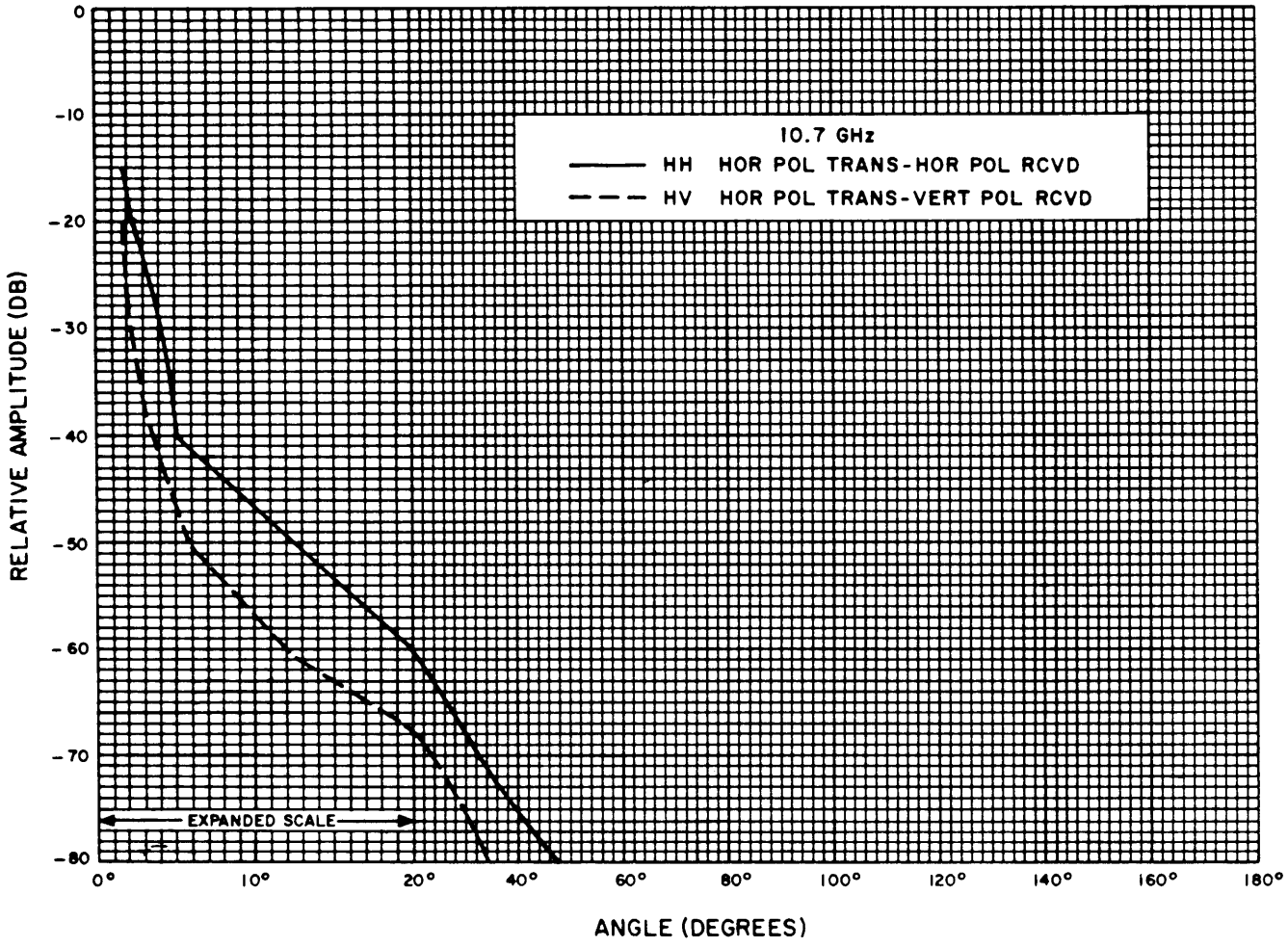

Fig. 8—KS-21972 Conical Antenna, 10.7 GHz, Horizontal Polarization Transmitted