

Overlay Graphs for the HP8414A/B Polar Display

by

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Introduction

The HP8414A/B polar display is used with the HP8407A and HP8410A/B/C vector network analyzers (VNA) for displaying the relative phase and magnitude of the signals from the VNA in polar form. It has an internal glass graticule with five concentric circular magnitude divisions and 36 radial ten-degree radial divisions for the direct measurement of S-parameters. The internal graticule is augmented with a set of 16 snap-in overlays which allow for the display and direct measurement of reflection coefficient, impedance, and return loss.

Eight of the overlays used a plastic film that reduce the parallax problems encountered when photographing the display. In addition, the HP8414A/B included an internal graticule illumination that eliminated the need for an ultraviolet light source in the camera, such as is included on the HP197A/B series cameras.

The Display Overlays

The overlays that were provided with the

HP8414A/B are listed below in Table 1. Each part number consists of two overlays, one being clear with black lines and the other being reverse field (opaque) which masks out the internal graticule so that only the overlay lines are visible.

The first two of these, 8414-009 and 8414-0010, are standard Smith Charts, which need little if any introduction. The next two, 8414-0011 and 8414-0012, are expanded Smith Charts which enlarge the centre of the standard Smith Chart to full scale so that the region close to 50 ohms can be analyzed in detail. When these expanded Smith Charts are installed, the gain of the VNA test channel amplifier must be increased by 14 dB to match the scale of the overlay. This is accomplished by first calibrating the VNA with the standard Smith Chart and then adjusting the test channel gain setting.

The next two sets of overlays, 8414-0021 and 8414-0022, are compressed Smith Charts which provide a display of the negative-real impedance region. When these compressed

HP Part #	Description
8414-0009	Standard Smith Chart (viewing)
8414-0010	Standard Smith Chart (photographing)
8414-0011	Expanded Smith Chart (viewing)
8414-0012	Expanded Smith Chart (photographing)
8414-0021	Compressed Smith Chart (viewing)
8414-0022	Compressed Smith Chart (photographing)
8414-0023	Return Loss (viewing)
8414-0024	Return Loss (photographing)

Table 1 - List of HP8414A/B overlays

Smith Charts are installed, the gain of the VNA test channel amplifier must be decreased by 10dB, which is accomplished in the same manner as for the expanded Smith Charts as described in the previous paragraph.

Finally, the last two sets of overlays, 8414-0023 and 8414-0024, are for directly measuring return loss. Gain may also be measured by adjusting the gain of test channel amplifier as desired and either adding or subtracting, as required, the difference from the overlay return loss circles.

Printing the Display Overlays

A full set of scanned images of the sixteen display overlays is supplied in the following pages. These may be conveniently printed on to clear film using a suitable laser printer and toner. Since some printers do not faithfully reproduce documents on a 1:1 scale, the user should first print them on paper and measure them to ensure that the following results are obtained:

Height - 4.625" (11.75cm)

Width - 4.250" (10.80cm)

Outer Ring Diameter - 3.950" (10.00cm)

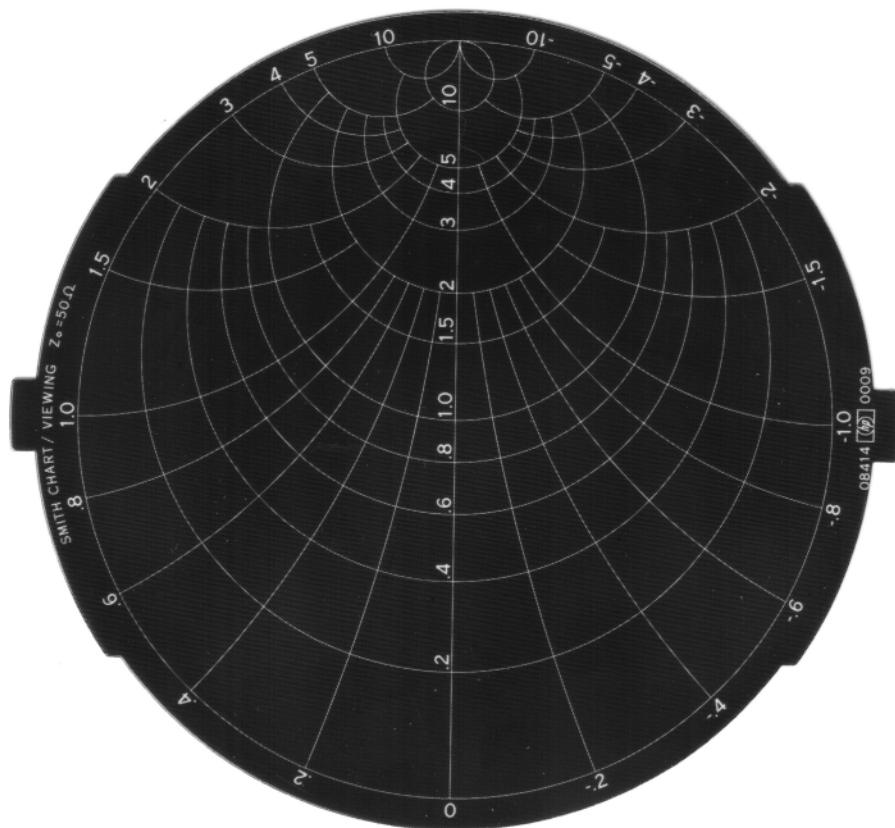
In addition, unless the user has access to a film that has the same parallax-reducing properties that was used by HP, then there is no need for printing the photographic overlays.

Acknowledgements

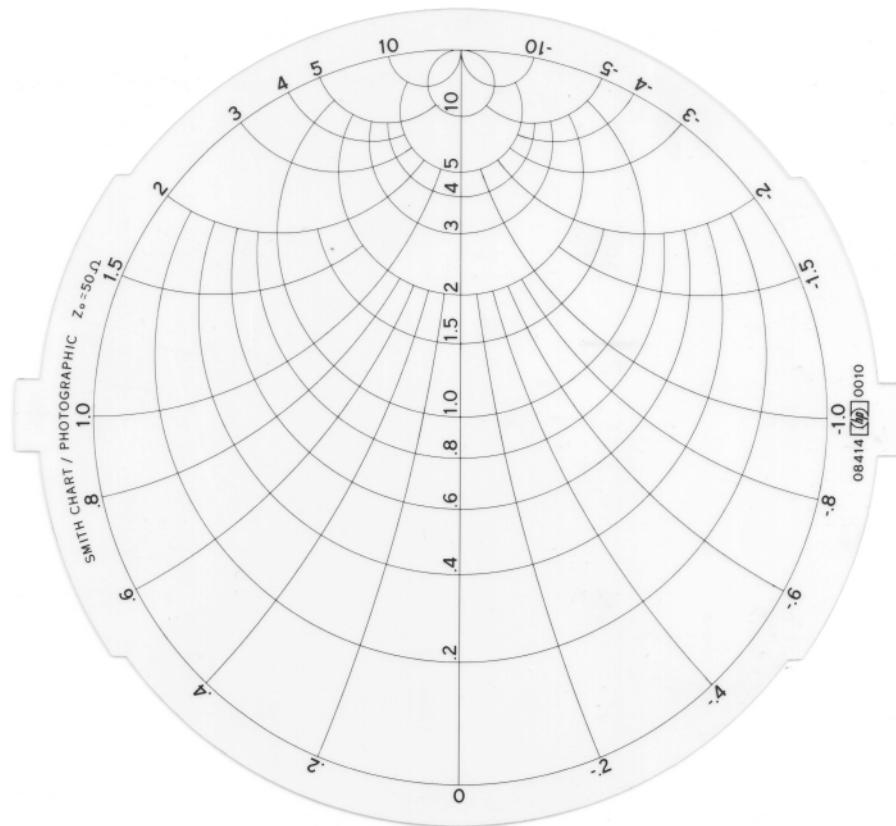
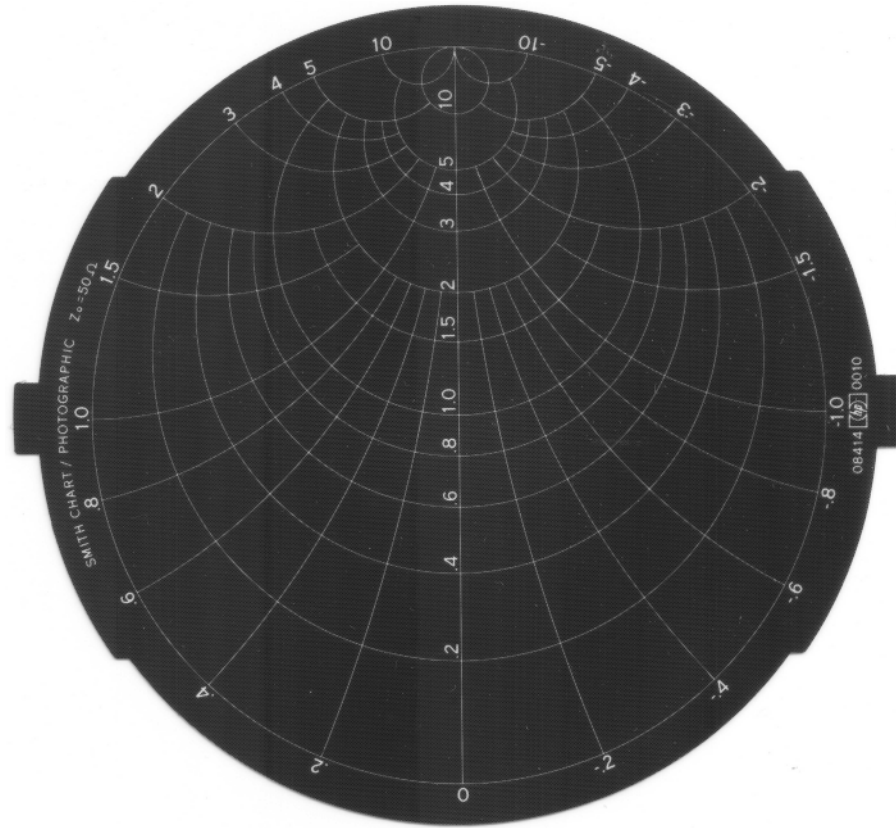
I'm most grateful to Antonio Amandio Sanches de Magalhaes, CT1TE, of Roriz, Santo Tirso, Portugal, who provided the scanned images that are reproduced here. Without his effort and diligence these images might not otherwise have been available.

References

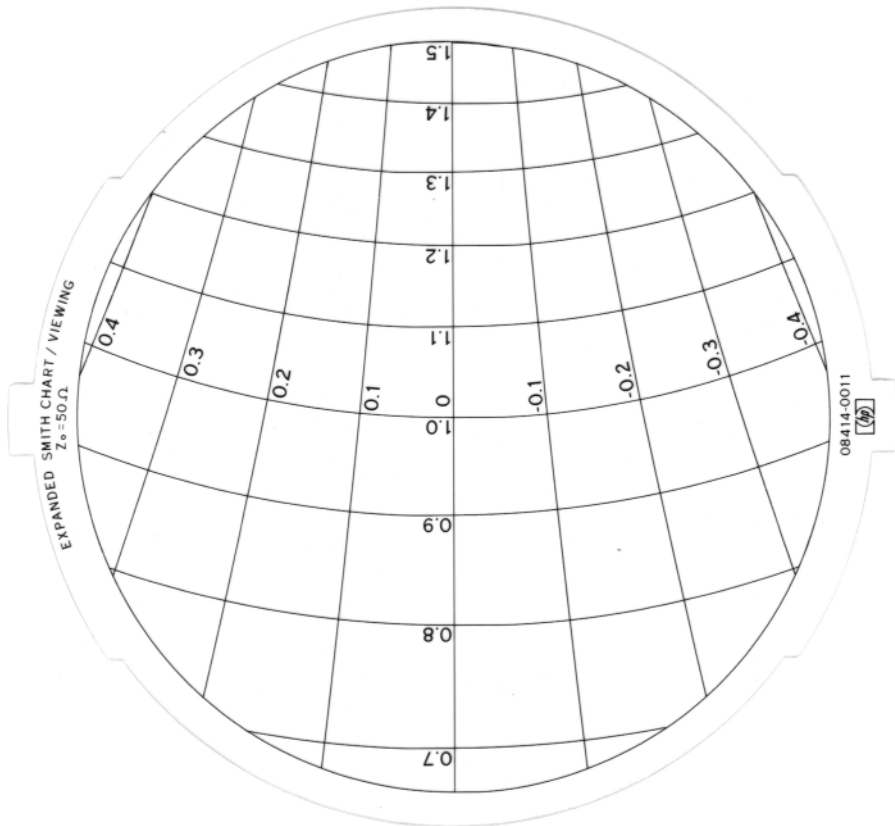
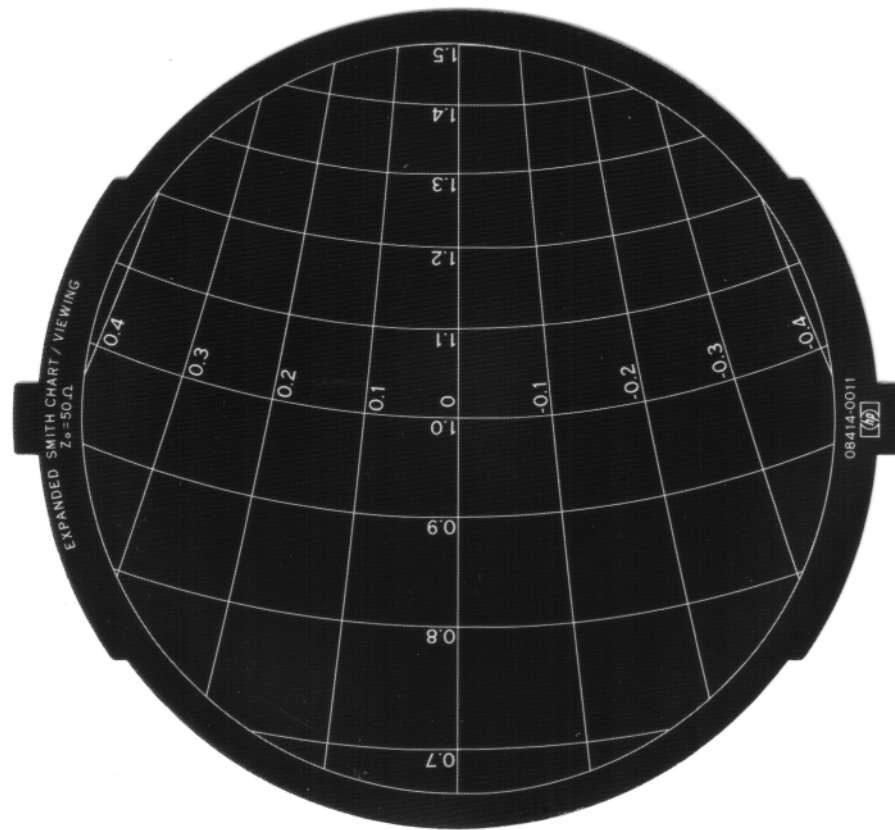
1. Hewlett-Packard, *8414A Polar Display Operating and Service Manual*, Part No. 08414-90016, Hewlett-Packard Company, Palo Alto, California, September 1973.
2. Smith, Phillip H., *Electronic Applications of the Smith Chart*, McGraw-Hill, 1969 (later republished by Noble Publishing, Atlanta, Georgia, 1995).



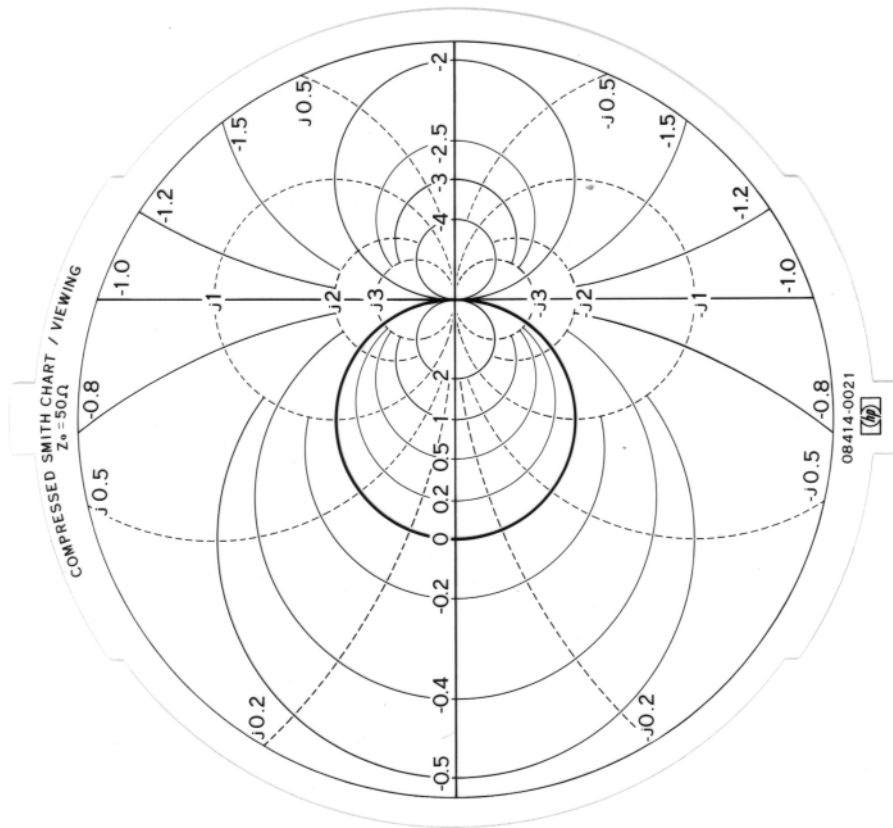
HP8414-009 Overlay (Standard Smith Chart, Viewing)



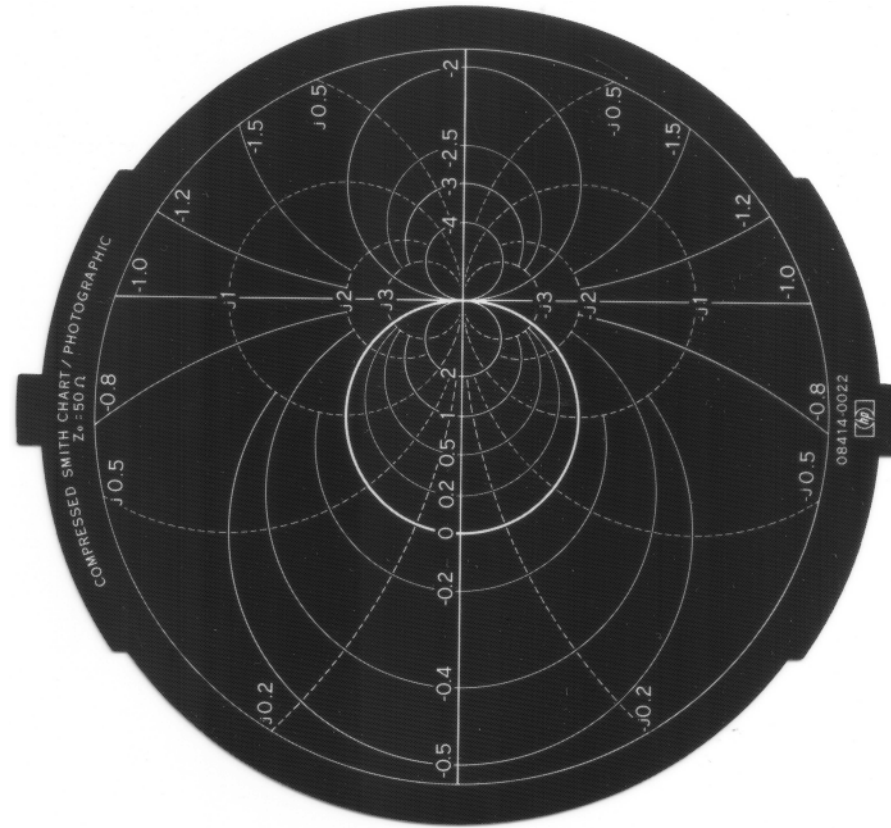
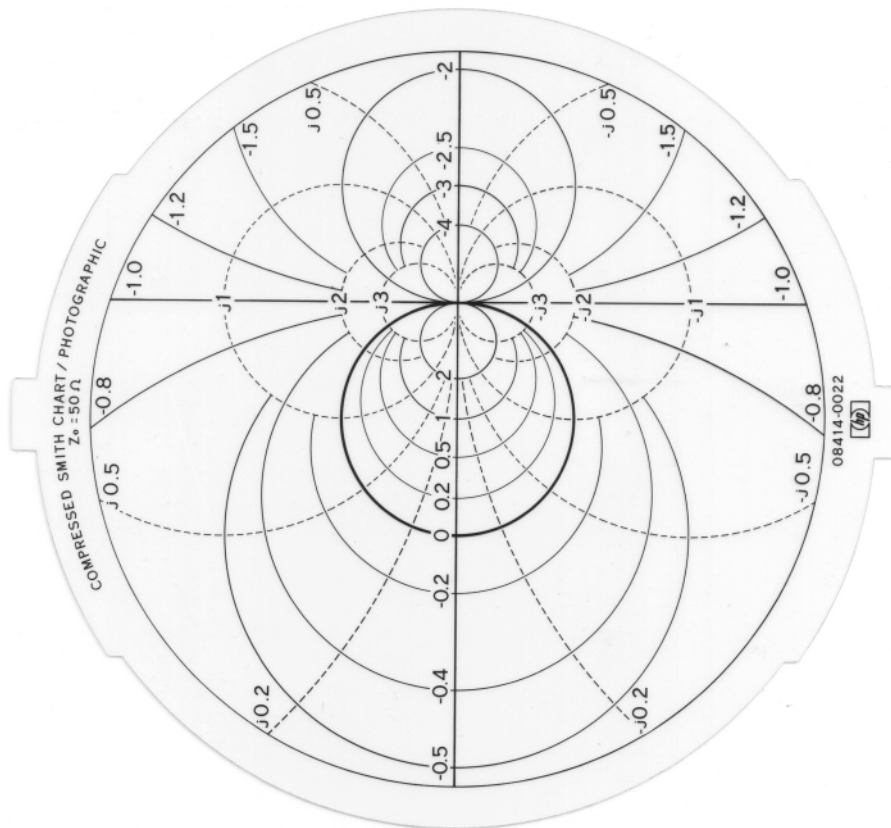
HP8414-010 Overlay (Standar Smith Chart, Photographing)



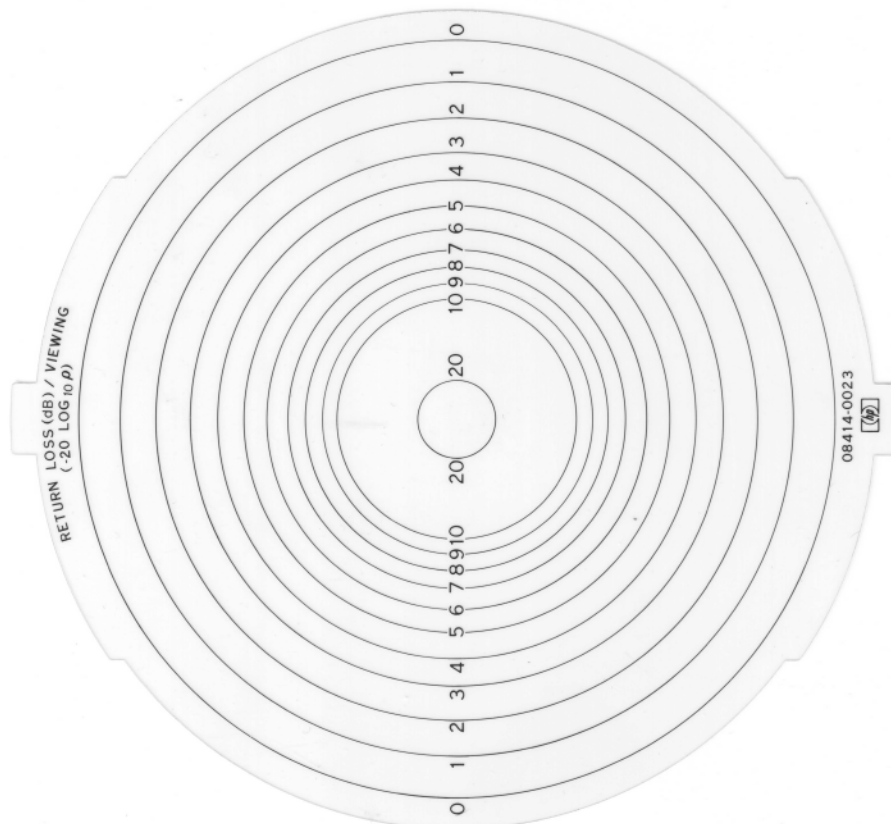
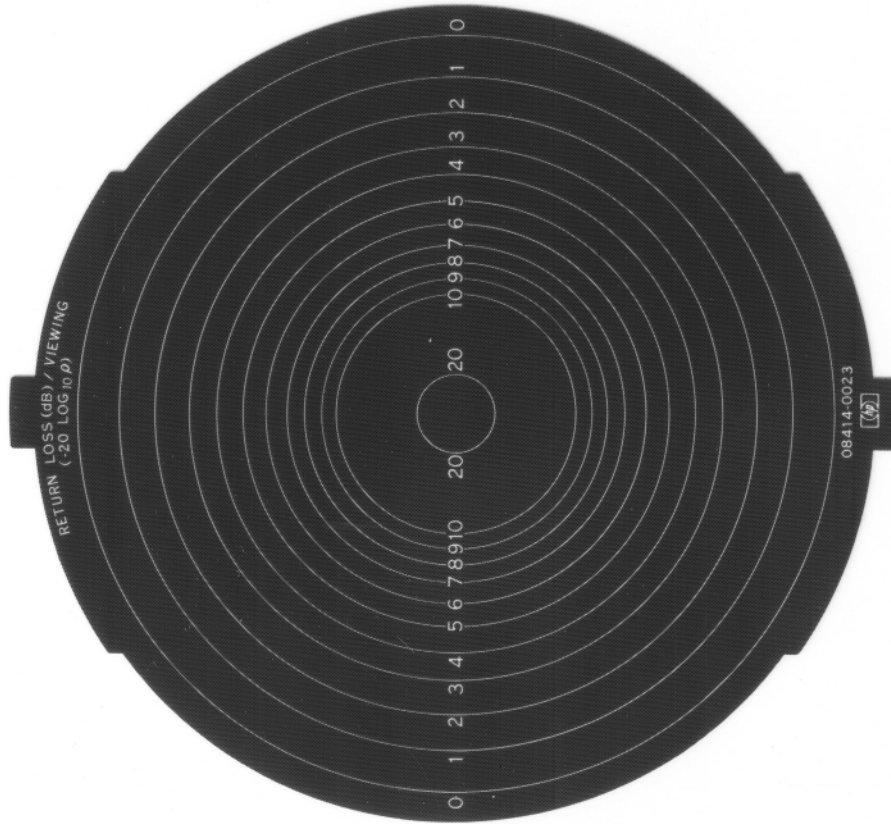
HP8414-011 Overlay (Expanded Smith Chart, Viewing)



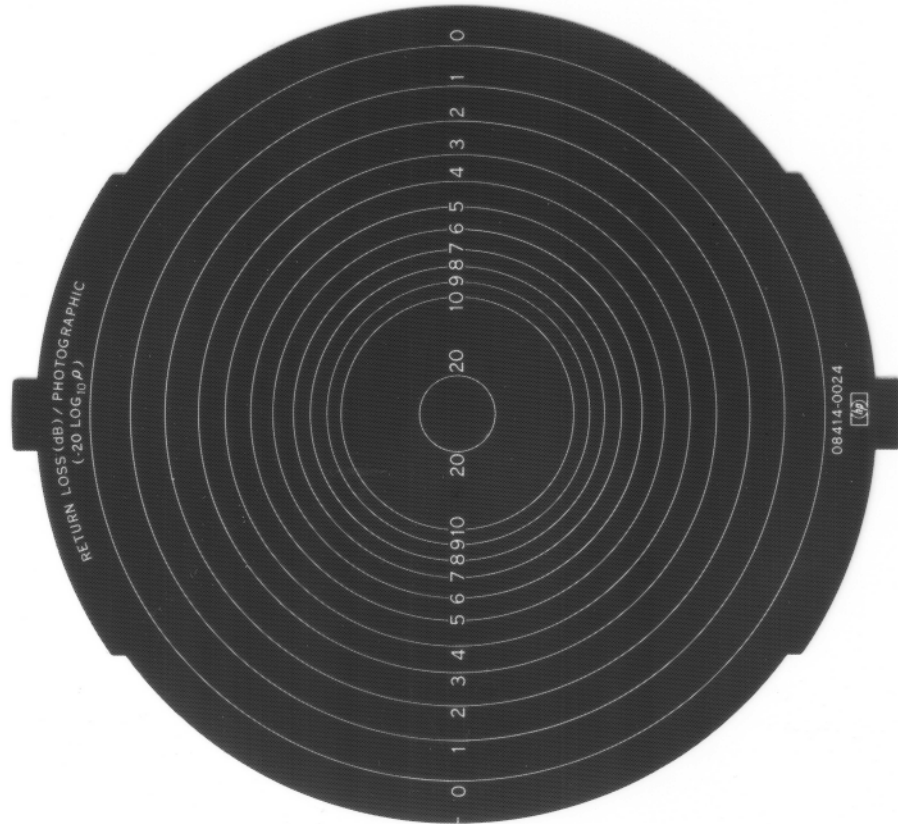
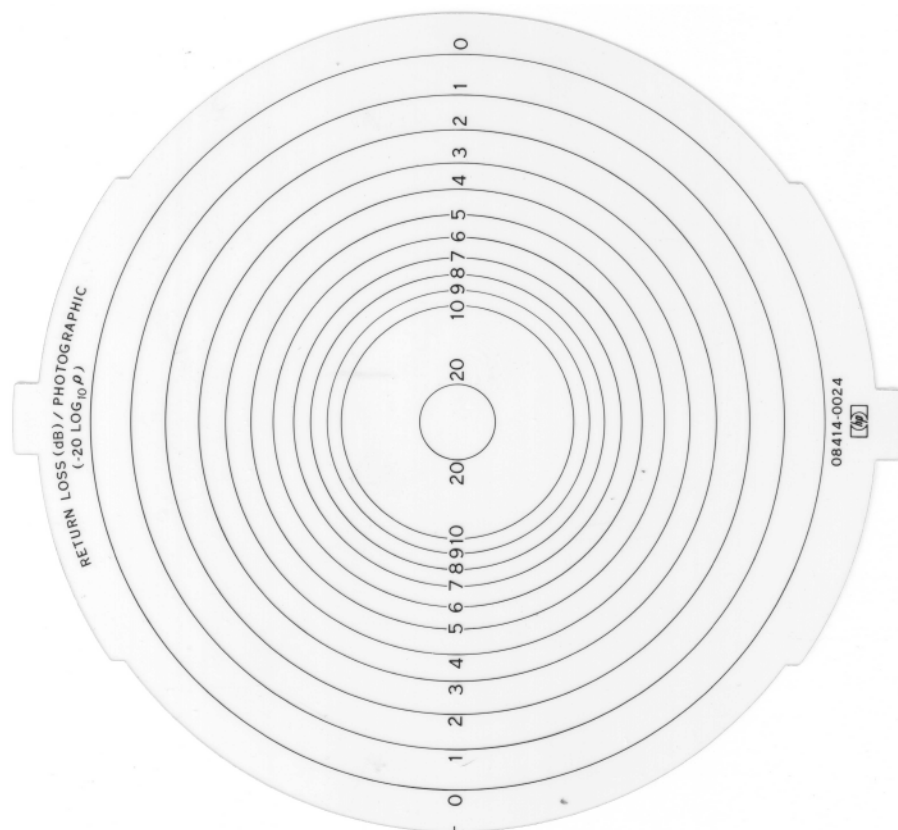
HP8414-021 Overlay (Compressed Smith Chart, Viewing)



HP8414-022 Overlay (Compressed Smith Chart, Photographic)



HP8414-023 Overlay (Return Loss Circles, Viewing)



HP8414-024 Overlay (Return Loss Circles, Photographing)