

IEEE
Std 145-1973

Revision of
IEEE Std 145-1969

IEEE STANDARDS
ARCHIVES
DO NOT REMOVE

IEEE Standard Definitions of Terms for Antennas

Aug. 2, 1973

SH01453



PUBLISHED BY
THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, Inc.
345 EAST 47 STREET, NEW YORK, N. Y. 10017



Documents

Document Sharing Hub

Authorized licensed use limited to: Tsinghua University. Downloaded on February 24, 2026 at 15:50:48 UTC from IEEE Xplore. Restrictions apply.

IEEE Standard Definitions of Terms for Antennas

Sponsor
**Antenna Standards Committee
of the
IEEE Antennas and Propagation Group**

© Copyright 1973 by

The Institute of Electrical and Electronics Engineers, Inc.

*No part of this publication may be reproduced in any form,
in an electronic retrieval system or otherwise,
without the prior written permission of the publisher.*

Approved September 20, 1972
IEEE Standards Committee

J. Forster, *Chairman*

B. O. Weinschel, *Vice Chairman*

S. I. Sherr, *Secretary*

**S. J. Angello
Saul Aronow
Jack Avins
B. B. Barrow
F. K. Becker
Richard Brereton
W. H. Cook
Louis Costrell**

**G. E. Hertig
J. L. Koepfinger
W. R. Kreusi
Harvey Lance
B. J. Leon
D. T. Michael
J. D. M. Phelps
R. H. Rose, II**

**S. W. Rosenthal
Gustave Shapiro
R. M. Showers
P. H. Smith
F. G. Timmel
L. van Rooij
R. V. Wachter
W. T. Wintringham**



Documents

Document Sharing Hub

Foreword

(This Foreword is not a part of IEEE Std 145-1973, Standard Definitions of Terms for Antennas.)

In 1969, IEEE Standard 145 was published as a list of basic terms of antenna theory and practice. That document treated antenna gain as a fundamental property, with impedance and polarization as independent properties. The definitions of gain, directivity, impedance, and polarization were worded to emphasize this independence. Various other significant groups of terms were also defined, such as the regions of the electromagnetic field of an antenna, the terms relating to cross section, the tracking antenna techniques, and the idealized radiators.

After the list of basic terms had been published, the Antenna Standards Committee turned its attention to three areas. The first of these is the definition of additional antenna terms and types of antennas. The second is a set of polarization terms, and the third topic is the definition of terms related to antennas in physical media. The results are presented in this document.

Reconsideration of the independence of gain, impedance, and polarization led to the definition of two terms that interrelate these quantities. These are the terms *realized gain* and *power gain referred to a specified polarization*. The basic gain, impedance, and polarization terms remain as independent fundamental properties. The group of terms relating to array antennas has been substantially expanded. The arrangement of elements, the impedance, and the radiation properties are now covered by definitions.

The polarization terms provide a consistent and comprehensive description of polarization properties that are of concern to antenna specialists. The other category of new definitions is a list of terms for antennas in physical media. It has become clear to the Antenna Standards Committee that definitions of antenna terms pertaining to increasingly complex media require a considerable number of restrictions and qualifications for the particular properties of the medium. At present, consistent notation and usage have not yet evolved, and this subject area is still under active study.

Members of the Antenna Standards Committee of the IEEE Antennas and Propagation Group who have contributed to this document were:

W. V. Tilston and H. V. Cottony, *Chairmen*

C. C. Allen	P. W. Hannan	L. J. Ricardi
J. L. Allen	R. C. Hansen	A. C. Schell
K. G. Balmain	W. K. Kahn	C. J. Sletten
P. A. Burgmyer	E. H. Kennaugh	P. H. Smith
H. V. Cottony	W. H. Kummer	W. V. Tilston
G. A. Deschamps	D. J. LeVine	M. S. Wheeler
	D. C. Ports	

Members of the Subcommittee on Antenna Terms 2.6 who contributed to this document were:

A. C. Schell, *Chairman* C. J. Sletten, *Past Chairman*

C. C. Allen	L. J. Ricardi
J. L. Allen	P. H. Smith
D. J. LeVine	

The polarization terms are a modified version of a set of terms originally prepared by G. A. Deschamps and P. E. Mayes.

Members of the Subcommittee on Antennas in Physical Media 2.8 who contributed to this document were:

K. G. Balmain, *Chairman*

R. E. Collin	W. V. Tilston
R. E. Haskell	B. R. Tripp
K. Iizuka	

IEEE Standard

Definitions of Terms for Antennas

1. Scope

This standard is a comprehensive revision and extension of the previous Standard Definitions of Terms of Antennas.

It is assumed in this standard that an antenna is a passive linear reciprocal device. Thus, where a definition implies the use of an antenna in a transmitting situation, its use in a receiving situation is also implicit unless specifically stated otherwise.

When an antenna or group of antennas is combined with circuit elements that are active, nonlinear, or nonreciprocal, the combination is regarded as a system which includes an antenna. Examples of such cases are an adaptive antenna system and a signal-processing antenna system; the complete conical-scanning, monopulse, and compound interferometer systems also fall in this category.

For terms that are quantitative it is understood that frequency must be specified. Those terms in which phase or polarization is a significant part of the definition imply a coherent source of power. Whenever a term is commonly used in other fields but has specialized significance in the field of antennas, this is noted in the title.

2. Categories of Terms

This standard consists of three sets of terms relating to antennas. The first is a collection of definitions of types of antennas and basic terms of antenna theory and practice. The second set of terms deals with polarization, and the third set is pertinent to antennas located within physical media. The terms are arranged alphabetically in the following section.

The viewpoint about polarization is that this term can be used in three related meanings. It can apply (1) to a field vector at some point in space, (2) to a plane wave, and (3) to an antenna. The *polarization of a field vector*

specifies the shape, orientation and sense of the ellipse that the extremity of the field vector describes as a function of time. This applies to any field vector: electric field, magnetic field, velocity field in a plasma, displacement field in a solid, etc. In a single-frequency plane wave a specified field vector has the same polarization at every point in space. This is taken as the *polarization of the plane wave*. Conventionally in electromagnetics the electric field is considered rather than the magnetic field. However, in a non-isotropic medium the polarization state of the plane wave requires consideration of all its vector components. The third application of the term polarization is to antennas. The *polarization of an antenna* in a given direction is that of the plane wave it radiates at large distances in that direction. By reciprocity it is also the polarization of the plane wave coming from that direction which, for a given power density, produces the maximum response. For best understanding, the three related definitions of polarization should be read in the above order.

Some departures from previous usage should be noted. It is recommended to use the expression *linearly polarized* instead of *plane polarized*. The plane of polarization is taken as that of the polarization ellipse rather than one which contains a propagation vector. This was done for two reasons: first, a name is needed to designate the plane of the polarization ellipse of a field vector; second, according to the former usage the plane would become complex for elliptically polarized waves and this is of little practical use.

In general, it is assumed that the antenna is not located in a medium such as a plasma, salt water, or the earth. In certain instances, some of the terms may be applicable to such locations, but careful evaluation is necessary to determine their applicability. The term *physical media* refers to antennas located in isotropic homogeneous media with no spatial dispersion, and is added to the titles of those definitions specifically intended to be pertinent to antennas in physical media.

3. Definitions

adaptive antenna system. An antenna system having circuit elements associated with its radiating elements such that one or more of the antenna properties are controlled by the received signal.

Adcock antenna. A pair of vertical antennas separated by a distance of one-half wavelength or less, and connected in phase opposition to produce a radiation pattern having the shape of the figure eight in all planes containing the centers of the two antennas.

aerial. See **antenna**.

Alford loop antenna. A multielement antenna having approximately equal amplitude currents which are in phase and uniformly distributed along each of its peripheral elements producing a substantially circular radiation pattern in the plane of polarization (originally developed as a four-element horizontally polarized UHF loop antenna).

angle tracking. See **tracking**.

annular slot antenna. A slot antenna with the radiating slot having the shape of an annulus (ring).

antenna (aerial). A means for radiating or receiving radio waves.

antenna effect. In a loop antenna, any spurious radiation effect resulting from the capacitance of the loop to ground.

antenna efficiency of an aperture-type antenna. For an antenna with a specified planar aperture, the ratio of the maximum effective area of the antenna to the aperture area.

antenna pattern. See **radiation pattern**.

antenna resistance. The real part of the input impedance of an antenna.

aperture of an antenna. A surface, near or on an antenna, on which it is convenient to make assumptions regarding the field values for the purpose of computing fields at external points.

NOTE: The aperture is often taken as that portion of a plane surface near the antenna, perpendicular to the direction of maximum radiation, through which the major part of the radiation passes.

aperture blockage. A blocking of or interfering with the radiation from the feed or secondary

radiator by obstacles such as the feed itself or support struts.

aperture illumination. The field over the aperture as described by amplitude, phase, and polarization distributions.

aperture illumination efficiency. For a planar antenna aperture, the ratio of its directivity to the directivity obtained when the aperture illumination is uniform.

area. See **effective area of an antenna; equivalent flat plate area of a scattering object**.

array antenna. An antenna comprising a number of radiating elements, generally similar, which are arranged and excited to obtain directional radiation patterns.

array element. In an array antenna, a single radiating element or a convenient grouping of radiating elements that have a fixed relative excitation.

array factor. The radiation pattern of an array antenna when the pattern of each array element is considered to be isotropic.

artificial dielectric. A medium containing metallic conductors in an arrangement which appears as a dielectric to electromagnetic waves.

NOTE: The metallic conductors are usually small compared to a wavelength and embedded in a dielectric material of low effective permittivity and density.

attenuation vector in physical media. The real part of the propagation vector.

axial ratio. The ratio of the axes of the polarization ellipse.

NOTE: See Note (3) under **polarization** of a field vector.

backfire antenna. An antenna consisting of a radiating feed, a reflector element, and a reflecting surface such that the antenna functions as an open resonator, with radiation from the open end of the resonator.

back-scattering cross section (monostatic cross section). The scattering cross section in the direction toward the source. Cf **radar cross section**.

bandwidth of an antenna. The range of frequencies within which the performance of the antenna, with respect to some characteristic, conforms to a specified standard.