The Institute of Radio Engineers

REPORT

OF THE

COMMITTEE ON STANDARDIZATION

FOR

1926

DEFINITIONS OF TERMS
STANDARD GRAPHICAL SYMBOLS
USED IN RADIO ENGINEERING

37 WEST 39TH STREET
NEW YORK CITY

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Supplement to February, 1926, PROCEEDINGS

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PREFACE

The first standardization report of the Institute of Radio Engineers was issued in 1913. This was succeeded by revised reports issued in 1915 and 1922. Since the publication of the Report of the Committee on Standardization for 1922, the Committee has been engaged in a complete revision of that report which it now presents to the membership of the Institute of Radio Engineers and others concerned with the subject. This report was adopted by the Board of Direction of the Institute on December 1, 1925.

The membership of the Committee on Standardization during the last three years has been as follows:

1923

Donald McNicol, *Chairman*

E. F. W. Alexanderson
O. B. Blackwell
L. W. Chubb
J. H. Dellinger
E. D. Forbes
A. N. Goldsmith
J. V. L. Hogan
H. W. Nichols
A. E. Reoch
M. B. Sleeper
Bowden Washington
L. E. Whittemore

1924

Donald McNicol, *Chairman*

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A. N. Goldsmith
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L. A. Hazeltine
Guy Hill
J. V. L. Hogan
C. A. Hoxie
F. H. Kroger
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H. W. Nichols
R. H. Langley
A. E. Reoch
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R. A. Heising	Bowden Washington
J. V. L. Hogan	W. C. White
C. A. Hoxie	L. E. Whittemore
C. B. Jolliffe	C. A. Wright

During 1924 and 1925, the Committee organized several sub-committees each of which prepared drafts of definitions for terms employed in a certain specialized part of the radio field. The names of these sub-committees and their chairmen are as follows:

A. E. Reoch, *Chairman Sub-committee on Radio Telegraph Transmitter Terminology.*

R. H. Langley, *Chairman Sub-committee on Radio Telegraph Receiver Terminology.*

H. W. Nichols, Lloyd Espenschied } *Joint Chairmen Sub-committee on Radio Telephone Transmitter and Receiver Terminology.*

L. A. Hazeltine, *Chairman Sub-committee on Vacuum Tube Terminology.*

C. H. Taylor, *Chairman Sub-committee on Antenna Terminology.*

L. E. Whittemore, *Chairman Sub-committee on Direction Finding Terminology*

In preparing this report the Committee has recognized the growth in the use of radio by including many terms which were not included in previous reports, but which have either come recently into general use or have become a recognized part of the nomenclature in specialized parts of the radio field. It is hoped, therefore, that this report will be helpful to radio engineers and others by giving such terms and definitions as have gained recognized standing in special branches of radio engineering as well as by indicating what is considered to be good usage of terms in radio literature generally. Trade names have not been included.

The list of terms and definitions has been divided into seven groups in order to facilitate reference to terms which are related to one another in meaning or in use. An alphabetical index is appended.

It was found unnecessary to make any extensive revision of the section giving standard graphical symbols, though a few modifications which were felt to be desirable have been incorporated.

It has been the aim of the Committee to make the report descriptive and explanatory rather than to make the definitions rigorously exact in their phraseology.

The Institute will welcome comments and criticisms which will be helpful in the preparation of revised report in the course of the next two years.

Communications dealing with this work as well as with other Institute matters should be addressed to the Secretary of the Institute of Radio Engineers, 37 West 39th Street, New York City.

DEFINITION OF TERMS USED IN RADIO ENGINEERING

SECTION 1—WAVES AND WAVE PROPAGATION

1001. Wave—(a) A propagated disturbance, usually periodic; as, an electric wave or a sound wave.

(b) A single cycle of such a disturbance.

(c) A periodic variation as represented by a graph.

1002. Wavelength—The distance traveled in one period or cycle by a periodic disturbance. The distance between corresponding phases of two consecutive waves of a wave train. The quotient of velocity by frequency.

1003. Continuous Waves—Alternating electric waves in space, of constant amplitude and frequency. (Abbreviation—cw.)

1004. Modulated Continuous Waves—Continuous waves of which the amplitude or frequency is repeatedly varied in accordance with a signal wave.

1005. Key-Modulated Continuous Waves—Continuous waves of which the amplitude or frequency is varied by the operation of a transmitting key in accordance with the characters of a communicating code.

1006. Interrupted Continuous Waves—Waves obtained by the interruption at audio frequency in a periodic manner of an otherwise continuous wave. (Abbreviation—icw.)

1007. Damped Waves—Electromagnetic waves proceeding in wave trains in each of which the amplitude progressively diminishes in successive cycles.

1008. Signal—The intelligence, message, or effect conveyed in communication.

1009. Signal Wave—A wave, the form of which conveys a signal.

1010. Carrier Wave—The component of a modulated wave which has the same frequency as the original unmodulated wave. (See 2005, Carrier Current.)

1011. Radio Field Intensity—The root-mean-square value of the electric or magnetic field intensity at a point due to

the passage of radio waves. It is often expressed in microvolts per meter.

1012. Radio Noise Field Intensity—A measure of the field intensity, at a point (as a radio receiving station), of electromagnetic waves of an interfering character. In practice the quantity measured is not the field intensity of the interfering waves, but some quantity which is proportional to or bears a known relation to the field intensity.

1013. Signal-Noise Ratio—The ratio at a point of the field intensity of the radio wave to the radio noise field intensity.

1014. Strays—Electromagnetic disturbances in radio reception other than those produced by radio transmitting systems.

1015. Static—Conduction or charging current in an antenna resulting from physical contact between the antenna and charged bodies or masses of gas.

In the United States this term has come to be used quite generally as a synonym for atmospherics.

1016. Atmospherics—Strays produced by atmospheric conditions.

1017. Atmospheric Absorption—A loss of power in transmission of radio waves due to a dissipation in the atmosphere.

1018. Transmission Loss—The loss of power suffered by a transmitted wave in passing along a transmission path or through a circuit device. (See 5076, Transmission—Frequency Characteristic.)

1019. Attenuation—The reduction in power of a wave or a current with increasing distance from the source of transmission.

1020. Fading—The variation of the signal intensity received at a given location from a radio transmitting station as a result of changes in the transmission path. (See 5077, Distortion.)

1021. Swinging—The variation in intensity of a received radio signal resulting from changes in the frequency of the transmitted waves.

SECTION 2—TRANSMITTING

2001. Radio Communication—The transmission of signals by means of radiated electromagnetic waves originating in a constructed circuit.

2002. Broadcasting—The transmission of music, news, entertainment or other intelligence intended for general reception.

2003. Radiate—To emit electromagnetic waves into space.

2004. Radiation—The process of emitting electromagnetic waves into space.

2005. Carrier Current—An alternating current which is modulated by a signal. Ordinarily refers to wire transmission of high-frequency currents. (See 10101, Carrier Wave.)

2006. Carrier Frequency—Frequency of a carrier wave or a carrier current.

2007. Carrier Suppression—That method of operation in which the carrier wave or carrier current is not transmitted.

2008. Band of Frequencies—A continuous range of frequencies extending between two definite frequencies. (See 2012, Radio Channel and 5002, Frequency.)

2009. Side Bands—The bands of frequencies, one on either side of the carrier frequency, produced by the process of modulation.

2010. Side Frequencies—The frequency on either side of the carrier frequency produced by the process of single frequency modulation.

2011. Single-Side-Band Transmission—That method of operation in which one side band is transmitted, and the other side band is suppressed. The carrier wave may be either transmitted or suppressed.

2012. Radio Channel—A band of frequencies or wave lengths of a width sufficient to permit of its use for radio communication. The width of a channel depends upon the type of transmission. (See 2008, Band of Frequencies.)

2013. Radio Transmitting Set (Transmitter)—A device for producing radio-frequency power and modifying it in accordance with a signal.

2014. Vacuum Tube Transmitter—A radio transmitter in which vacuum tubes are utilized to convert the applied electric power into radio-frequency power.

2015. Oscillator—A non-rotating device for producing alternating current, the output frequency of which is determined by the characteristics of the device. (See 2018, Radio-Frequency Alternator.)

2016. Master Oscillator—An oscillator of comparatively low power so arranged as to control the frequency of the output of an amplifier.

2017. Tank Circuit—An intermediate oscillatory circuit associated with the output circuit of a vacuum tube transmitter which absorbs the output of the vacuum tube transmitter in the form of energy impulses of high value and short duration and delivers the power to the load in substantially sinusoidal form.

2018. Alternator Transmitter—A radio transmitter which utilizes radio-frequency currents generated by a radio-frequency alternator.

2019. Radio-Frequency Alternator—A rotating-type alternating-current generator which generates radio-frequency currents. (See 2014, Oscillator.)

2020. Load Compensator—Part of a radio-frequency alternator speed regulator consisting of a device to vary the torque of the motor driving a radio-frequency alternator approximately in accordance with variations of the load on the motor.

2021. Arc Converter—A form of oscillator comprising an electric arc used for the conversion of direct to alternating or pulsating current.

2022. Spark Transmitter—A radio transmitter which utilizes the oscillatory discharge of a condenser through an inductance and a spark gap as the source of its radio-frequency power.

2023. Plain Antenna Transmitter—A spark transmitter in which the spark gap is connected directly in the antenna circuit.

2024. Spark Gap—An arrangement of electrodes, used for closing a circuit (usually oscillatory) at a predetermined voltage. The several types of spark gaps are:

(a) **Plain Gap**—A spark gap between two fixed metal electrodes.

(b) **Rotary Gap**—Spark gap in which one of the electrodes is a rotating element which causes a regular change in gap

length thereby timing the beginning of the discharge and modifying its duration.

(c) **Synchronous Rotary Gap**—A rotary gap in which the speed of rotation is such that the discharge is synchronous with the alternating voltage applied.

(d) **Quenched Gap**—A spark gap in which the strongly damped discharge current is quickly stopped by the quenching or extinction of the spark.

2025. Impulse Excitation—A method of producing damped oscillatory current in a circuit in which the duration of the impressed voltage is short compared with the duration of the current produced.

2026. Frequency Changer—A device delivering alternating current at a frequency which differs from the frequency of the supply current.

2027. Frequency Multiplier—A frequency changer used to multiply by an integer the frequency of an alternating current.

2028. Telephone Transmitter—A sound operated device designed to produce an alternating current the form of which corresponds to that of the sound wave actuating it.

2029. Microphone—A telephone transmitter comprising a contact device designed to have its electrical resistance directly and materially altered by slight differences in mechanical pressure.

2030. Condenser Transmitter—A telephone transmitter, the operation of which involves a variation in electrostatic capacity produced by a sound wave.

2031. Modulation—The process whereby the frequency or amplitude of a wave is varied in accordance with a signal wave.

2032. Double Modulation—The process of modulation in which a carrier wave of one frequency is first modulated by the signal wave and is then made to modulate a second carrier wave of another frequency.

2033. Percentage Modulation—The variation in amplitude of a modulated wave from its mean value expressed in per cent. of the mean value.

2034. Modulator—A device to effect the process of modulation. It may be operated by virtue of some non-linear characteristic or by a controlled variation of some circuit quantity.

2035. Magnetic Modulator (Ferromagnetic Modulator)—A magnetic device employed as a modulator and functioning by virtue of its non-linear magnetization characteristic.

2036. Vacuum Tube Modulator—A modulator employing a vacuum tube as a modulating element.

2037. Duplex Operation—The operation of associated radio transmitting and radio receiving channels in which transmission and reception are simultaneous.

SECTION 3—RECEIVING

3001. Receiving Set (Receiver)—A device for converting radio waves into perceptible signals.

3002. Monitoring Receiver—A receiver arranged to enable an operator to check the operation of a transmitting set.

3003. Heterodyne Reception—The process of receiving radio waves by combining the received current with locally generated alternating current. The locally generated frequency is commonly different from the frequency of the received current, thus producing beats. This is called beat reception.

3004. Self-Heterodyne Reception (Autodyne Reception)—A system of heterodyne reception through the use of a device which is both an oscillator and a detector.

3005. Homodyne Reception—The process of detecting a wave by the aid of a locally generated wave of carrier frequency. (Sometimes called zero-beat reception.)

3006. Super-Heterodyne Reception—A method of reception in which the received current is combined with the current from a local oscillator and converted into current of an intermediete frequency which is then amplified and detected to reproduce the original signal wave.

3007. Intermediate Frequency—A frequency of a magnitude between that of the carrier employed in radio transmission and the frequency of modulation, and to which the carrier is converted in the super-heterodyne process of reception.

3008. Reflex Circuit—An arrangement in which one or more amplifiers are used, each to amplify the signal both before and after detection.

3009. Tuning—Primarily, the adjustment of a circuit or circuits to resonance. Use also to mean the adjustment of a circuit or system to secure maximum transmission of a desired signal.

3010. Sensitivity—The degree to which a radio receiving set responds to signals of the frequency to which it is tuned.

3011—Selectivity—The degree to which a radio receiving set is capable of differentiating between signals of different frequencies.

3012. Detector—That portion of the receiving apparatus which, connected to a circuit carrying currents of radio frequency, and in conjunction with a self-contained or separate indicator, translates the radio-frequency power into a form suitable

for operation of the indicator. This translation may be effected either by the conversion of the radio-frequency power, or by means of the control of local power. The indicator may be a telephone receiver, relaying device, tape recorder, and so on.

The most common type of detector is a vacuum tube operated on a non-linear portion of its characteristic curve, thereby converting a modulated radio-frequency current into a modulated direct current.

A tube which operates similarly to a detector tube, but the output of which does not operate an indicator, may properly be called a frequency converting tube. (See 5062, Rectifier.)

3013. Detection Coefficient—The quotient of the direct current in a radio detector with no external resistance, due to an impressed alternating voltage, divided by the square of the r.m.s. alternating voltage. As most precisely used, the term refers to a voltage so small that its value is independent of the magnitude of the voltage, in which case it is expressed by the equation.

$$\text{Detection Coefficient} = \frac{1}{2}\frac{d^2 i}{d e^2}$$

where e and i are respectively the voltage and current as taken from the characteristic curve of the detector with no external resistance. (See 4015, Grid Detection Coefficient and 4039, Mutual Detection Coefficient.)

3014. Telephone Receiver—An electrically operated device designed to produce sound waves which correspond to the signal current actuating it.

3015. Loud Speaker—A telephone receiver designed to produce sound of sufficiently large volume to be heard at a substantial distance.

3016. Interference—Confusion of reception due to strays, undesired signals or other causes; also that which produces the confusion.

SECTION 4—VACUUM TUBES

4001. Vacuum Tube—A device consisting of a number of electrodes contained within an enclosure evacuated to a low pressure. This term is also commonly used less broadly in referring to the type of vacuum tube having grid, plate and filament (triode).

4002. Diode—A type of vacuum tube containing two electrodes which passes current wholly or predominantly in one direction.

Note—A vacuum tube having a single cathode and two anodes which operate alternately may properly be called a **double diode.**

4003. Triode—A type of vacuum tube containing an anode, a cathode and a third electrode, in which the current flowing between the anode and the cathode is controlled by the relative potential of the third or control electrode.

4004. Cathode—The electrode to which the current flows through the vacuous space. The cathode is usually the source of the electron emission which constitutes this current. (See 4005, Filament.)

4005. Filament—The cathode in the common type of vacuum tube (triode).

4006. Filament Voltage—The voltage between the terminals of the filament.

4007. Filament Current—The current supplied to the filament to heat it.

Note—When the filament is heated by direct current which is not large in comparison with the plate current, the filament current is ordinarily measured at that filament terminal where it is the larger.

4008. Control Electrode—The electrode, the relative potential of which controls the current flowing between the anode and the cathode. (See 4009, Grid.)

4009. Grid—The common name for the control electrode in a vacuum tube.

4010. Grid Potential—The electric potential of the grid relative to the cathode. (See note under 4020, Plate Potential.)

4011. Grid Current—The conduction current passing from the grid through the vacuous space.

4012. Reversed Grid Current—The conduction current passing to the grid through the vacuous space.

4013. Grid Conductance—The quotient of the change in grid current divided by the change in grid potential producing it, under the condition of constant plate potential. As most precisely used, the term refers to infinitesimal changes, as indicated in the defining equation

$$\text{Grid conductance, } g_g = \frac{d\,i_g}{d\,e_g}, \quad e_p = \text{const.}$$

Note—The grid conductance is the resistive component of the input admittance of the vacuum tube.
(See 4024, Plate Conductance.)

4014. Grid Characteristic Curve—The curve plotted between grid potential as abscissa and grid current as ordinate. (See 4026, Plate Characteristic Curve; 4040, Mutual Characteristic Curve and 4043, Emission Characteristic Curve.)

4015. Grid Detection Coefficient—The quotient of the change in the direct grid current produced in a vacuum tube with no external grid or plate resistance, due to an impressed alternating grid voltage, divided by the square of the r.m.s. alternating voltage. As most precisely used, the term refers to a grid voltage so small that its value is independent of the magnitude of the voltage, in which case it is expressed by the equation

$$\text{Grid detection coefficient} = \frac{1}{2}\frac{d^2\,i_g}{d\,e^2_g}, \quad e_p = \text{const.}$$

where e_g and i_g are respectively the grid potential and the grid current.
(See 3013, Detection Coefficient and 4039, Mutual Detection Coefficient.)

4016. Grid Condenser—A condenser connected in series in the grid or control circuit of a vacuum tube.

4017. Grid Leak—A resistor usually of very high resistance, used in association with a condenser and connected directly or indirectly between the cathode and the grid of a vacuum tube.

4018. Anode—The electrode from which the current flows through the vacuous space. (See 4019, Plate.)

4019. Plate—The common name for the anode in a vacuum tube.

4020. Plate Potential—The electric potential of the plate relative to the cathode.

Note—If the cathode is a filament heated by direct

current, its negative terminal is ordinarily taken as the datum of potential; if heated by alternating current, its mid-point is taken as the datum.

4021. Plate Current—The conduction current passing from the plate through the vacuous space.

4022. Amplification Factor—A measure of the effectiveness of the grid potential relative to that of the plate potential in affecting the plate current; it is the quotient of the change in plate potential divided by the negative change in grid potential, under the condition that the plate current remains unchanged. As most precisely used, the term refers to infinitesimal changes in the potentials as indicated in the defining equation

$$\text{Amplification factor } \mu = -\frac{d\,e_p}{d\,e_g},\quad i_p = \text{const.}$$

(See 5044, Voltage Amplification.)

4023. Mutual Conductance—The quotient of the change in plate current divided by the change in grid potential producing it, under the condition of constant plate potential. As most precisely used, the term refers to infinitesimal changes, as indicated in the defining equation

$$\text{Mutual conductanc, } g_m = \frac{d\,i_p}{d\,e_g},\quad e_p = \text{const.}$$

The unit ordinarily used is the micromho.

Note—In rare cases, when the dependence of the grid current on the plate potential is to be considered, the following terms and symbols may be employed:
Inverse amplification factor

$$\mu_n = -\frac{d\,e_g}{d\,e_p},\quad i_g = \text{const.}$$

Inverse mutual conductance,

$$g_n = \frac{d\,i_g}{d\,e_p},\quad e_g = \text{const.}$$

(See 4040, Mutual Characteristic Curve.)

4024. Plate Conductance—The quotient of the change in plate current divided by the change in plate potential producing it, under the condition of constant grid potential. As most precisely used, the term refers to infinitesimal changes, as indicated in the defining equation

Plate conductance, $g_p = \frac{d\,i_p}{d\,e_p}$, $e_g = \text{const.}$

Note—The plate conductance is the resistive component of the internal output admittance of a vacuum tube. (See 4013, Grid Conductance.)

4025. Plate Resistance—The reciprocal of the plate conductance.

$$r_p = \frac{1}{g_p} = \frac{d\,e_p}{d\,i_p}, \quad e_g = \text{const.}$$

Note—The following relations exist between the terms numbered 4022, 4023, 4024 and 4025.

$$g_m = \mu\, g_p = \frac{\mu}{r_p}$$

4026. Plate Characteristic Curve—The curve plotted between plate potential as abscissa and plate current as ordinate. (See 4014, Grid Characteristic Curve; 4040, Mutual Characteristic Curve and 4043, Emission Characteristic Curve.)

4027. Plate Choke Coil—A coil of relatively high inductance inserted in the anode supply circuit of a vacuum tube amplifier, modulator, or oscillator to maintain substantially constant current in this circuit throughout a cycle of the amplified or generated current.

4028. Filament Capacity (C_f)—The sum of the direct capacities between the filament and all other conductors of a vacuum tube.

4029. Grid Capacity (C_g)—The sum of the direct capacities between the grid and all other conductors of a vacuum tube.

4030. Plate Capacity (C_p)—The sum of the direct capacities between the plate and all other conductors of a vacuum tube.

4031. Direct Capacity (C)—between two conductors—The quotient of the charge produced on one conductor by the voltage between it an the other conductor divided by this voltage, all other conductors in the neighborhood being at the potential of the first conductor.

4032. Grid-Plate Capacity (C_{gp})—The direct capacity between the grid and the plate.

4033. Grid-Filament Capacity (C_{gf})—The direct capacity between the grid and the filament (See 4032, Grid-Plate Capacity.)

4034. Plate-Filament Capacity (C_{pf})—The direct capacity between the plate and the filament. (See 4032, Grid-Plate Capacity.)

Note—All capacities are ordinarily understood to be taken with the vacuum tube in its completed form but not in its socket or other holder.

Note—The capacities C_{pf}, C_{gf} and C_{gp} are not those ordinarily directly measured, but are computed from the direct capacities which can be directly measured, in accordance with the following equations:

$$C_f = C_{gf} + C_{pf};\ C_p = C_{pf} + C_{gp};\ C_g = C_{gf} + C_{gp};$$

$$C_{pf} = \frac{C_p + C_f - C_g}{2};\ C_{gf} = \frac{C_g + C_f - C_p}{2};\ C_{gp} = \frac{C_g + C_p - C_f}{2}$$

4035. Internal Output Impedance (of any electrical device having output terminals)—The quotient of the alternating voltage impressed on the output terminals divided by the alternating current thereby produced at these terminals, in the absence of impressed alternating voltages at other points.

Note—This is sometimes called simply "output impedance," but the prefix "internal" is preferred in order more surely to distinguish it from the impedance of the external output circuit.

4036. Internal Output Admittance—The reciprocal of internal output impedance.

4037. Input Impedance (of any electrical device)—The quotient of the alternating voltage impressed on the input terminals of the device divided by the alternating current thereby produced at these terminals, in the absence of impressed alternating voltages at other points.

4038. Input Admittance—The reciprocal of input impedance.

4039. Mutual Detection Coefficient of a vacuum tube—The quotient of the change in the direct place current produced in a triode with no external grid or plate resistance, due to an impressed alternating grid voltage, divided by the square of the r.m.s. alternating voltage. As most precisely used, the term refers to a grid voltage so small that its value is independent of the magnitude of the voltage, in which case it is expressed by the equation

$$\text{Mutual detection coefficient} = \frac{1}{2}\frac{d^2 i_p}{d e^2_g},\ e_p = \text{const.}$$

(See 3013, Detection Coefficient and 4015, Grid Detection Coefficient.)

4040. Mutual Characteristic Curve (Grid-Plate Characteristic Curve)—The curve plotted between the grid voltage as abscissa and the plate current as ordinate. (See 4014, Grid Characteristic Curve; 4023, Mutual Conductance; 4026, Plate Characteristic Curve and 4043, Emission Characteristic Curve.)

4041. Electron Emission—The phenomenon of the liberation of electrons from the surface of a body into the surrounding space, usually under the influence of heat, ultra-violet rays, x-rays, impact excitation, or chemical disintegration.

4042. Emission Current—The value of the current carried by electrons emitted from a cathode under the influence of a voltage such as will draw away all the electrons emitted.

4043. Emission Characteristic Curve—The curve plotted between a factor controlling electron emission (such as the temperature, voltage or current of the cathode or filament) as abscissa and the emission current from the cathode or filament as ordinate. (See 4014, Grid Characteristic Curve; 4026, Plate Characteristic Curve and 4040, Mutual Characteristic Curve.)

4044. Thermionic—Relating to electron emission under the influence of heat.

SECTION 5—CIRCUIT ELEMENTS AND PROPERTIES

5001. Cycle—One complete set of positive and negative values of an alternating current.

5002. Frequency—The number of cycles per second. (See 2008, Band of Frequencies.)

5003. Kilocycle (strictly kilocycle per second or cycle per millisecond)—A thousand cycles per second.

5004. Megacycle (strictly megacycle per second or cycle per microsecond)—A million cycles per second.

5005. Audio Frequencies—The frequencies corresponding to normally audible sound waves. The upper limit ordinarily lies between 10,000 and 20,000 cycles.

5006. Radio Frequencies—The frequencies higher than those corresponding to normally audible sound waves. (See 5005, Audio Frequencies.)

Note—It is not implied that radiation cannot be secured at lower frequencies, nor that radio frequencies are necessarily above the limit of audibility.

5007. Group Frequency—The number of trains of damped waves or current per second.

Note—The term "group frequency" has replaced the term "spark frequency."

5008. Resonance Frequency (of a circuit)—The frequency at which the supply current and supply voltage of the circuit are in phase.

5009. Frequency Meter—An instrument for measuring frequency. (Frequency meters used in radio work are sometimes called wavemeters.)

5010. Fundamental Frequency—That frequency of which all component frequencies are integral multiples.

5011. Fundamental Wavelength—The wavelength corresponding to fundamental frequency.

5012. Harmonic—A component of a periodic quantity having a frequency which is an integral multiple of the fundamental wave frequency. For example, a component, the frequency of which is twice the fundamental frequency, is called the second harmonic.

5013. Periodic Current—Periodically reversing current the frequency of which is determined by the electrical constants of the circuits in which it flows. It may be either damped or continuous.

5014. Oscillatory Circuit—A relatively low resistance circuit containing both inductance and capacity, such that a voltage impulse will produce a current which periodically reverses.

5015. Beating—A phenomenon in which two or more periodic quantities of not greatly different frequencies react with each other to produce a resultant having pulsations of amplitude.

5016. Beat—A complete cycle of such pulsations.

5017. Beat Frequency—The number of beats per unit of time. This frequency is equal to the difference between the frequencies of the combining waves.

5018. Series Resonance—A condition which exists in a circuit having inductance and capacity connected in series, when the supply current and supply voltage are in phase.

5019. Parallel Resonance—A condition which exists in a circuit having inductance and capacity connected in parallel, when the supply current and supply voltage are in phase.

5020. Acceptor—A circuit having inductance and capacity so arranged and tuned as to offer low impedance to currents of a given frequency, and high impedance to currents of any other frequency. (See 5021, Rejector.)

5021. Rejector—A circuit having inductance and capacity so arranged and tuned as to offer high impedance to the flow of currents of a given frequency and low impedance to currents of all other frequencies. (See 5020, Acceptor.)

5022. Coupling—The association of two circuits in such a way that energy may be transferred from one to the other.

5023. Coupling Coefficient—The ratio of the mutual or common impedance component of two circuits to the square root of the product of the total impedance components of the same kind in the two circuits. (Impedance components may consist of inductance, capacity or resistance.)

5024. Direct Coupling—Association of two radio circuits by having an indicator, a condenser, or a resistor, common to both circuits.

5025. Inductive Coupling—The association of one circuit with another by means of inductance common or mutual to both. (This term when used without modifying words is commonly used for coupling by means of mutual inductance, whereas coupling by means of self-inductance common to both circuits is called "direct inductive coupling.")

5026. Capacity Coupling—The association of one circuit with another by means of capacity common or mutual to both.

5027. Resistance Coupling—The association of one circuit with another by means of resistance common to both.

5028. Coupler—An apparatus which is used to transfer radio-frequency power from one circuit to another by associating together portions of these circuits. Couplers are of the same types as the types of coupling—inductive, capacity, and resistance.

5029. Coupling Coil—An inductance coil used as a coupler.

5030. Coupling Condenser—A condenser used to produce coupling between two circuits.

5031. Decremeter—An instrument for measuring the logarithmic decrement of a train of waves.

5032. Logarithmic Decrement—The Napierian logarithm of the ratio of the first to the second of two successive amplitudes in the same direction, for an exponentially damped alternating current. The logarithmic decrement can also be considered as a constant of a simple radio circuit, being π times the product of the resistance by the square root of the ratio of the capacity to the inductance of the circuit.

5033. Damping Constant—The Napierian logarithm of the ratio of two values of an exponentially decreasing quantity separated by unit time. (This is preferred to the term "damping factor.")

The coefficient "a" appearing in the exponent of the damping factor, ε^{-at}, which occurs in expressions of the following forms for damped currents.

$$i = I_o \varepsilon^{-at}$$

$$i = I_o \epsilon^{-at} \cos 2\pi f_n t$$

In an oscillatory circuit containing resistance, inductance, and capacity in series, $a = R/2L$.

5034. Alternating Current—A current, the direction of which reverses at regularly recurring intervals, the algebraic average value being below zero.

5035. Damped Alternating Current—A current passing through successive cycles with progressively diminishing amplitude.

5036. Free Alternating Current—The damped alternating current which flows in a circuit following the cessation of an impressed voltage.

5037. Forced Alternating Current—The alternating current which flows in a circuit as the result of an impressed alternating voltage and which has the same frequency.

5038. Pulsating Current—A periodic current (that is, current passing through successive cycles), the algebraic average value of which is not zero. A pulsating current is equivalent to the sum of an alternating and a constant amplitude direct current.

5039. Direct Current—A unidirectional current. As ordinarily used, the term designates a practically non-pulsating current.

5040. Hot-Wire Ammeter—(Extension type)—An ammeter dependent for its indications on a change in dimensions of an element which is heated by a current through it.

5041. Thermocouple Ammeter—An ammeter dependent for its indications on the change in thermo electromotive force set up in a thermo electric couple which is heated by the current to be measured.

5042. Vacuum Tube Voltmeter—A device for measuring small voltages consisting of a vacuum tube having an ammeter in its output circuit. The scale deflections are calibrated in terms of the voltage applied to the grid circuit.

5043. Amplifier—A device for increasing the amplitude of electric current or voltage, through the control by the input power of a larger amount of power supplied by a local source to the output circuit.

5044. Voltage Amplification—The ratio of the alternating voltage produced at the output terminals of an amplifier to the alternating voltage impressed at the input terminals. (This term should not be used to describe a process). (See 4022, Amplification Factor).

5045. Current Amplification (of an amplifier)—The ratio of the alternating current produced in the output circuit to the alternating current supplied to the input circuit.

5046. Power Amplification (of an amplifier)—The ratio of the alternating-current power produced in the output circuit to the alternating-current power supplied to the input circuit.

5047. Power Amplifier—An amplifier which is capable of producing relatively large power in an output circuit.

5048. Relay—A device in which the input power is used to control a local source of power in the output circuit.

5049. Regeneration—The process by which a part of the output

power of an amplifying device reacts upon the input circuit in such a manner as to reinforce the initial power, thereby increasing the amplification. (Sometimes called "feed back.")

5050. Attenuation Equalizer—A device for altering the attenuation of a circuit for various frequencies in order to make substantially equal the total attenuation for all frequencies within a certain range.

5051. Transmission Level—The radio field intensity or the signaling power amplitude at any point in a communication system, expressed either in some absolute unit or with reference to an arbitrary base value.

5052. Transmission Unit (Abbreviation TU)—A unit of power ratio used for expressing transmission loss or transmission gain (amplification). Two amounts of power differ by one transmission unit when they are in the ratio of $10^{0.1}$. Two amounts of power differ by N transmission units when they are in the ratio of $10^{(0.1)N}$. The number of transmission units is ten times the common logarithm of the power ratio to be expressed; i. e., $10\,log_{10}\frac{P_1}{P_2}$.

Power Ratio		TU	
1	$(= 10^0)$	0	$(= 10\,log_{10}\,1)$
1.259	$(= 10^{0\,1})$	1	$(= 10\,log_{10}\,1.259)$
10	$(= 10^1)$	10	$(= 10\,log_{10}\,10)$
100	$(= 10^2)$	20	$(= 10\,log_{10}\,100)$
1000	$(= 10^3)$	30	$(= 10\,log_{10}\,1000)$

For current ratios, the number of transmission units is equal to 20 times the common logarithm of the current ratio (with constant impedance) to be expressed; i. e., $20\,log_{10}\frac{I_1}{I_2}$.

Current Ratio	TU
0.001	— 60.00
0.005	— 46.02
0.01	— 40.00
0.05	— 26.02
0.1	— 20.00
0.2	— 13.98
0.5	— 6.02
1.0	0.00
1.5	3.52

Current Ratio	TU
2	6.02
5	13.98
10	20.00
20	26.02
50	33.98
100	40.00
500	53.98
1000	60.00

5053. Loading Coil—An inductance coil, usually not inductively coupled to any other circuit, for connection in a tuned circuit to decrease its resonant frequency.

5054. Choke Coil—An inductance coil inserted in a circuit to offer reactance to the flow of alternating current components while allowing direct current to pass.

5055. Banked Winding—A form of coil winding in which single turns are wound successively in each of two or more layers, the winding proceeding from one end of the coil to the other, without return.

5056. By-Pass Condenser—A condenser used to provide a path of comparatively low impedance around some circuit element.

5057. Stopping Condenser—A condenser used to insert a comparatively high impedance in some branch of a circuit for the purpose of limiting the flow of low frequency alternating current or direct current without materially affecting the flow of high frequency alternating current.

5058. Filter—A selective circuit network designed to transmit alternating-currents within a continuous band or bands of frequencies and attenuate currents of all frequencies outside the transmission band or bands.

5059. Low-Pass Filter—A filter designed to transmit currents of all frequencies below a critical or cut-off frequency and attenuate currents of all frequencies above this critical frequency.

5060. High-Pass Filter—A filter designed to transmit currents of all frequencies above a critical or cut-off frequency and attenuate currents of all frequencies below this critical frequency.

5061. Band-Pass Filter—A filter designed to transmit currents of frequencies within a continuous band limited by an upper

and a lower critical or cut-off frequency and attenuate currents of all frequencies outside of that band.

5062. Rectifier—A device whose resistance for currents in one direction differs from its resistance for currents in the other direction and which is used to convert an alternating-current wave into a unidirectional wave.

Note—In dealing with rectification in the reception of radio signals the term "detector" or "converter" is preferred to "rectifier." (See 3012, Detector.)

5063. Half-Wave Rectifier—A rectifier which changes alternating current into pulsating, unidirectional current, utilizing only one-half of each cycle.

5064. Full-Wave Rectifier—A double rectifier arranged so that current is allowed to pass in the same direction to the load circuit during each half cycles of the alternating-current supply, one element functioning during one-half cycle and the other during the next half cycle, and so on.

5065. Vacuum Tube Rectifier—A device for rectifying an alternating current by utilizing the electron flow between two electrodes in a vacuum or in a gas.

5066. Resonance Transformer—A transformer with condenser load, whose circuits are adjusted as a whole to have the same frequency as that of the alternating current supplied to the primary, thereby causing the secondary voltage to build up to higher values than would otherwise be attained.

5067. Radio-Frequency Transformer—A transformer for use with radio-frequency currents.

5068. Audio-Frequency Transformer—A transformer for use with audio-frequency currents.

5069. Rheostat—A resistor which is provided with means for readily varying its resistance.

5070. Potentiometer—A device consisting of a resistor provided with a movable or sliding contact in addition to its terminal contacts. It is used as a voltage divider. The current is passed between the terminal contacts and the desired difference of potential is obtained between one terminal contact and the movable contact. ("Voltage divider" is a preferred term.)

5071. "A" Battery—A battery which provides heating current for the filament of a vacuum tube.

5072. "B" Battery—A battery connected in the plate circuit

of a vacuum tube, for the purpose of supplying power to the plate circuit.

5073. "C" Battery—A battery connected in the circuit between the filament and grid of a vacuum tube so as to apply a potential to the grid.

5074. Protective Device—A device for keeping currents or voltages of undesirably large magnitude out of a given part of an electrical circuit. For example, fuse, lightning arrestor.

5075. Quality—(In broadcasting)—The degree to which sound is faithfully reproduced.

5076. Transmission-Frequency Characteristic—The variation with frequency of the transmission efficiency of a circuit or transmission path. (See 1018, Transmission Loss).

5077. Distortion—A change in wave form as in passing through a circuit or transmission medium. A wave form may be distorted by:

(a) The presence in the output of components having frequencies not present in the original wave due to circuit elements having non-linear characteristics.

(b) A change in the relative amplitude of the component frequencies due to variation in the transmission efficiency over the frequency range involved.

(c) A change in the relative phase of the component frequencies. (Not a cause of distortion when presnent in audio-frequency waves).

Two or more of these forms of distortion may exist simultaneously. (See 1020, Fading).

SECTION 6—ANTENNAS

6001. Antenna—A device for radiating or absorbing radio waves.

6002. Aerial—The elevated conductor portion of a condenser antenna.

6003. Beam Antenna—A unilateral directive antenna such that its radiation is substantially confined to a narrow beam.

6004. Unilateral Antenna—An antenna having the property of radiating or receiving radio waves in larger proportion in some one angular region than in all other directions.

6005. Bi-Lateral Antenna—An antenna having the property of radiating or receiving radio waves in larger proportion in angular regions 180 degrees apart than in all other directions.

6006. Cage Antenna—An antenna having conductors which consist of groups of parallel wires arranged as the elements of a cylinder.

6007. Coil Antenna—An antenna consisting of one or more conplete turns of wire.

6008. Condenser Antenna—An antenna consisting of two capacity areas.

6009. Directive Antenna—An antenna having the property of radiating radio waves in larger proportion along some directions than others.

6010. Directional Antenna—An antenna having the property of radiating or receiving radio waves in larger proportion along some directions than others.

6011. Flat Top Antenna—An antenna having approximately horizontal conductors at the top.

6012. Harp Antenna—An antenna composed of vertical, or approximately vertical conductors, all in one plane.

6013. Inverted Antenna—A flat top antenna in which the lead-in is taken from one end of the horizontal portion.

6014. Multiple Tuned Antenna—An antenna with connections to ground through inductances at more than one point, the inductances being so determined that their reactances in parallel present a total reactance equal to that necessary to give the antenna the desired natural frequency.

6015. Feed Ratio (of a multiple tuned antenna)—The value obtained by dividing the sum of the currents at all the antinodes by the current in the line feeding the antenna.

6016. Series or Feed Resistance (of a multiple tuned antenna)—The quotient of the power delivered to the antenna by the square of the current in the line feeding the antenna.

6017. T Antenna—A flat top antenna in which the lead-in is taken from the center of the horizontal portion.

6018. Umbrella Antenna—An antenna, the conductors of which form elements of a cone with the apex at the top to which the lead-in is connected.

6019. Wave Antenna—A horizontal aerial the physical length of which is of the same order of magnitude as that of the signaling waves to be received, and which is so used as to be strongly directional.

6020. Antenna Resistance—An effective resistance which is numerically equal to the quotient of the average power in the entire antenna circuit by the square of the effective current at the point of maximum current.

Note: Antenna resistance includes: Radiation resistance, ground resistance, radio-frequency resistance of conductors in antenna circuit, equivalent resistance due to corona, eddy currents, insulator leakage, dielectric loss, and so on.

6021. Effective Height of an Antenna—The height of an equivalent ideal antenna producing the same radiated field. As ordinarily defined, this ideal antenna is a vertical conductor carrying a uniform current equal to the maximum current existing at any point in the actual antenna.

6022. Meter Amperes—The product of the antenna current in amperes at the point of maximum current and the antenna effective height in meters for any radio transmitting station. It constitutes a factor for indicating the radiating strength of radio transmitting stations.

6023. Antenna Form Factor—The ratio of the effective height of an antenna to its actual physical height.

6024. Radiation Resistance—The quotient of the total power radiated by an antenna by the square of the effective current at the point of maximum current.

6025. Radiation Efficiency—The radiation efficiency of an antenna is the ratio of power radiated to the total power delivered to the antenna, at a given frequency.

6026. Fundamental or Natural Frequency (of an antenna)—The lowest resonant frequency of an unloaded antenna. (Unloaded, i. e., without added inductance or capacity.)

6027 Lead-In—That portion of an antenna system which completes the electrical connection between the elevated outdoor portion and the instruments or disconnecting switches inside the building.

6028. Antenna Loading Coil—A coil, inserted to increase the inductance of the antenna circuit.

6029. Counterpoise—A system of wires or other conductors, forming the lower capacity area of a condenser antenna elevated above and insulated from the ground and substantially as extensive as the aerial.

6030. Ground System (of an antenna)—That portion of the antenna system below the antenna loading devices or generating apparatus most closely associated with the ground and including the ground itself.

6031. Ground Wire—A conductive connection to the earth.

6032. Ground Equalizer Inductors—Coils of relatively low inductance placed in the circuit connected to one or more of the grounding points of an antenna ground system, to divide the current between the various points in any desired way.

SECTION 7—DIRECTION FINDING

7001. Direction Finder (Radio Compass or Goniometer)—A radio receiving device which permits determination of the line of travel of waves as received from transmitting station.

7002. Direction Finder Calibration—The determination of the direction and amount of local wave front distortion to the end that the true bearing may be determined from the apparent bearing given by the direction finder.

7003. Radio Wave Front Distortion—A change in the direction of advance of radio waves.

7004. Unidirectional Radio Direction Finder (Sense Radio Direction Finder)—A radio receiving device which permits determination of the direction (without 180° ambiguity) of waves as received from a transmitting station.

7005. Radio Beacon—A radio transmitting station in a fixed geographic location which emits a distinctive or characteristic signal for enabling mobile receiving stations to determine bearings.

7006. Equisignal Radio Beacon—A radio beacon which transmits two distinctive signals which may be received with equal intensity only in certain directions.

7007. Equisignal Zone—The region in which the two distinctive signals from an equisignal radio beacon are received with equal intensity.

7008. Observed Radio Bearing—The angular deviation from an arbitrary fixed line, such as the earth's geographical meridian or the fore and aft line of a ship, of the direction of the incoming wave as determined by a radio direction finder (without calibration correction).

7009. Corrected Radio Bearing—An observed radio bearing to which the calibration correction has been applied.

7010. True Radio Bearing—The angular deviation from true North, at the point of observation, of the chord of the great circle passing from the observer, to a given transmitting station.

7011. Fix—The intersection of the lines of direction of two or more bearings.

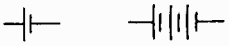
7012. Balancing Condenser—A condenser used for equalizing the potentials at the terminals of a direction finder coil when set in the position of minimum signal.

STANDARD GRAPHICAL SYMBOLS

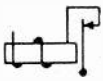
Ammeter 

Antenna or Aerial 

Arc 

Battery 

Battery (polarity indicated) 

Buzzer 

Coil Antenna 

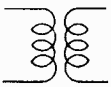
Condenser, Fixed 

Condenser, Shielded 

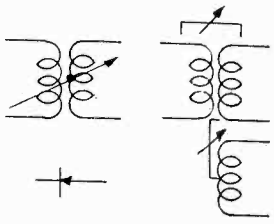
Condenser, Variable 

Condenser, Variable (with moving plate indicated) 

Counterpoise 

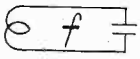
Coupler, Inductive (Mutual inductor) 

Coupler, Inductive (with variable coupling)

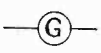


Crystal Detector

Frequency Meter (Wavemeter)

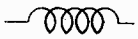


Galvanometer



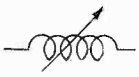
Ground

Inductor

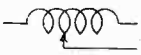


Inductor, Iron Core

Inductor, Variable



Inductor, Adjustable



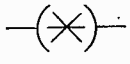
Jack

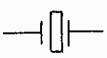
Key

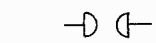
Lightning Arrester

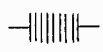
Resistor

Resistor, Variable

Spark Gap, Non Synchronous 

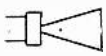
Piezoelectric Crystal 

Spark Gap, Plain 

Spark Gap, Quenched 

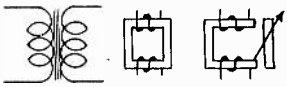
Spark Gap, Synchronous 

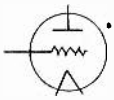
Telephone Receiver 

Loud Speaker 

Telephone Transmitter (Microphone) 

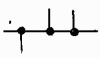
Thermoelement 

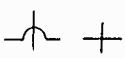
Transformer 

Vacuum Tube, Triode 

Vacuum Tube, Diode 

Voltmeter 

Wires, Joined 

Wires, Crossed not joined 

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