The Institute of Radio Engineers

REPORT

OF THE

COMMITTEE ON STANDARDIZATION

FOR

1915

DEFINITIONS OF TERMS
TESTS AND RATING
STANDARD GRAPHICAL SYMBOLS
DEFINITIONS OF TRADE NAMES

ONE HUNDRED AND ELEVEN BROADWAY
NEW YORK CITY

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HISTORICAL PREFACE

The early history of new branches of engineering always shows the discouraging spectacle of a confused and ill-defined nomenclature, together with widely different meanings assigned to graphical and literal symbols by the various investigators and authors. As a result, there arise many unfortunate misunderstandings and a considerable amount of needless labor on the part of the practicing engineer and students of engineering. It therefore becomes desirable for the chief engineering institute in the new field to bend its best efforts in the direction of remedying such confusion thru activities carefully carried on by a Committee on Standardization.

The field of radio engineering is far from having escaped the objectionable conditions mentioned, as may be easily seen on reading either theoretical papers in this field or by a study of the reports of patent lawsuits.

There was accordingly appointed in 1912, by Past-President of The Institute of Radio Engineers, Robert H. Marriott, a Committee on Standardization. This Committee, which was continued for 1913 by Past-President Greenleaf W. Pickard, was composed of the following members:

Robert H. Marriott, *Chairman*

Alfred N. Goldsmith, *Secretary*	A. E. Kennelly
John L. Hogan, Jr.	Roy A. Weagant

Greenleaf W. Pickard (*ex officio*)

A "Preliminary Report" of this Committee's work was issued on September 10, 1913, after approximately fifty meetings had been held.

This report embodied the first results of the study of the terms and symbols used in the radio art and science. It contained definitions of the terms which were adjudged of value, and described certain methods of testing and rating radio apparatus. It has been the aim of the present Committee on Standardization for 1915 to continue and amplify this work in somewhat the same directions.

A Committee on Standardization for 1914 was appointed by

Past-President Louis W. Austin. Its membership was the following:

John Stone Stone, *Chairman*

Guy Hill	Frederick A. Kolster
A. E. Kennelly	George W. Pierce
Ernest R. Cram	Emil E. Mayer
Greenleaf W. Pickard	Louis W. Austin (*ex officio*)

The Committee for 1914, however, issued no report.

The Committee on Standardization for 1915 was appointed by President John Stone Stone. Its membership is the following:

Alfred N. Goldsmith, *Chairman*

Louis W. Austin	Clyde S. McDowell
Louis Cohen	Greenleaf W. Pickard
James Erskine-Murray	George W. Pierce
John L. Hogan, Jr.	Emil J. Simon
Guy Hill	Charles H. Taylor
Lester L. Israel, *Secretary*	C. Tissot
A. E. Kennelly	Roy A. Weagant
Frederick A. Kolster	Jonathan Zenneck
Robert H. Marriott	John Stone Stone (*ex officio*)

As a result of sixteen regular meetings, and a number of less formal conferences, the Committee presents the present Report to the membership of the Institute and other workers in the radio field. It welcomes pertinent suggestions and criticisms of the present Report as well as the views of those interested as to the proper future scope of standardization. Communications dealing with these matters should be addressed to the Secretary of The Institute of Radio Engineers, 111 Broadway, New York City.

The Institute of Radio Engineers

REPORT OF THE COMMITTEE ON STANDARDIZATION

DEFINITION OF TERMS

NOTE: Terms are generally arranged alphabetically according to the *noun* referred to.

1. **Absorption, Atmospheric:** That portion of the total loss of radiated energy due to atmospheric conductivity.

2. **Ammeter** { **Hot Band:** / **Hot Wire:** } An ammeter dependent for its indications upon the change in dimensions of an element which is heated by a current thru it.

3. **Ammeter, Thermo:** An instrument for measuring current, depending for its indications on the voltage generated at the terminals of a thermo junction heated either directly or indirectly by the current to be measured.

4. **Amplifier** or **Amplifying Relay:** An instrument which modifies the effect of a local source of energy in accordance with the variations of received energy; and, in general, produces a larger indication than could be had from the incoming energy alone.

5. **Amplification, Coefficient of:** The ratio of the useful effect obtained by the employment of the amplifier to the useful effect obtained without that instrument.

6. **Antenna:** A system of conductors designed for radiating or absorbing the energy of electromagnetic waves.

7. **Antenna, Directive:** An antenna having the property of radiating a maximum of energy in one (or more) directions.

8. **Antenna, Flat Top:** An antenna having horizontal wires at the top covering a large area.

9. **Antenna, Harp:** An antenna having an approximately vertical section of large area and considerable width.

10. **Antenna, Inverted L:** A flat top antenna in which the leading down wires are taken from one end of the long narrow horizontal section.

11. **Antenna, Loop:** An antenna in which the wires form a closed circuit, part of which may be the ground.

12. **Antenna, Plain:** An approximately vertical single wire.

13. **Antenna, T:** A flat top antenna in which the horizontal section is long and narrow, the leading down wires being taken from the center.

14. **Antenna, Umbrella:** One whose conductors form the elements of a cone from the elevated apex of which the leading down wires are brought.

15. **Antenna Resistance:** An effective resistance which is numerically equal to the ratio of the power in the entire antenna circuit to the square of the R. M. S. current at a potential node (generally the ground).

Note: Antenna Resistance includes

Radiation resistance

Ground resistance

Radio frequency ohmic resistance of antenna and loading coil and shortening condensers.

Equivalent resistance due to corona, eddy currents, and insulator leakage.

16. **Arc:** The passage of an electric current of relatively high density thru a gas or vapor the conductivity of which is mainly due to the electron emission from the self-heated cathode. Under present practical conditions, the phenomena take place near atmospheric pressure.

17. **Arc Oscillator:** An arc used with an oscillating circuit for the conversion of direct to alternating or pulsating current. The oscillations generated are classified as follows:

Class (1). Those in which the amplitude of the oscillation circuit current produced is less than the direct current thru the arc.

Class (2). Those in which the amplitude of the oscillation circuit current is at least equal to the direct current, but in which the direction of the current thru the arc is never reversed.

Class (3). Those in which the amplitude of the initial portion of the oscillation circuit current is greater than the direct current passing thru the arc, and in which the direction of the current thru the arc is periodically reversed.

18. **Attenuation (Radio):** This is the decrease, with distance from the radiating source, of the amplitude of the electric and magnetic forces accompanying (and constituting) an electro-magnetic wave.

19. **Attenuation, Coefficient of (Radio):** The coefficient, which, when multiplied by the distance of transmission thru a uniform medium, gives the natural logarithm of the ratio of the amplitude of the electric or magnetic forces at that distance to the initial value of the corresponding quantities.

20. **Audibility:** The ratio of the telephone current variation producing the received signal, to that producing an audible signal. (An audible signal is one which permits the mere differentiation of dots and dashes.)

    The measurement of audibility is an arbitrary method for determining the relative loudness of telephone response in radio receivers, in which it is stated that a signal has an audibility of given value. The determination of the above ratio may be made by the non-inductive shunt-to-telephone method, except that a series resistance should be inserted to keep the main current constant, and that the shunt resistance should therefore be connected as a potentiometer.

21. **Brush** or **Coronal Losses:** Those due to leakage convection electric currents thru a gaseous medium.

22. **Cage Conductor:** A group of parallel wires arranged as the elements of a long cylinder.

    Note: Any conducting element of an antenna may be a cage conductor.

23. **Capacity, Effective, of an Antenna:** The effective capacity and effective inductance of an antenna at any oscillation frequency are the equivalent capacity and inductance values determined from the following fundamental equations:

$$\omega = \sqrt{\frac{1}{LC}} \quad . \quad . \quad . \quad . \quad . \quad (1)$$

where L = the total antenna inductance,
C = the total antenna capacity,
ω = the angular velocity of the free alternating currents in the antenna.

$$d = \pi R \sqrt{\frac{C}{L}} \quad . \quad . \quad . \quad . \quad . \quad . \qquad (2)$$

or $$d' = \pi R' \sqrt{\frac{C}{L}} \quad . \quad . \quad . \quad . \quad . \quad . \qquad (2a)$$

where R' = series resistance inserted at the base of the antenna and

d' = increased decrement resulting therefrom.

Solving (1) and (2a) for L and C, we have

$$L = \frac{\pi R'}{\omega d'} = \frac{R'}{6 \times 10^8 \times d'} \cdot \lambda \qquad (\lambda \text{ in meters})$$

$$C = \frac{d'}{R'} = \frac{d'}{6 \pi^2 \times 10^8 \times R'} \cdot \lambda \qquad (\lambda \text{ in meters})$$

Having the antenna inductance and capacity, the resistance R of the antenna can be determined from equation (2). This value of R satisfies the fundamental equation:

RI^2 = power absorbed by the antenna,

where I = current measured at the base of the antenna.

Note: The equation

$$I = \omega C E$$

$$\left(\text{and also } E = \frac{\pi R'}{d'} \cdot I\right)$$

defines an effective voltage E, which is the voltage approximately given by the equation,

Energy per spark $= C E^2$.

24. **Center of Capacity of an Antenna:** See Form Factor, Note 2.

25. **Changer, Frequency:** A device delivering alternating currents at a frequency which is some multiple of frequency of the supply current.

26. **Changer, Wave:** A transmitting device for rapidly and positively changing the wave length.

27. **Characteristic, Dynamic, of a Conductor:** (For a given frequency and between given extremes of impressed E. M. F. and resultant current thru the conductor): This is the relation given by the curve obtained when the impressed E. M. F.'s are plotted as ordinates against the resultant currents as abscissas, both E. M. F.'s and currents varying at the given frequency and between the given extremes.

28. **Characteristic, Static, of a Conductor:** This is the relation given by the curve plotted between the impressed electromotive force as ordinates and the resultant current thru the conductor as abscissas, for substantially stationary conditions.

29. **Coefficient, Attenuation, Radio:** See Attenuation.

30. **Coefficient of Amplification.** See Amplification.

31. **Coefficient of Coupling, Inductive:** The ratio of the effective mutual inductance of two circuits to the square root of the product of the effective self inductances of each of these circuits.

32. **Coherer:** A device sensitive to radio frequency energy, and characterized by (1) a normally high resistance to currents at low voltages, (2) a reduction in resistance on the application of an increasing electromotive force, this reduction persisting until eliminated by the application of a restoring or disturbing mechanical force, and (3) the substantial absence of thermo-electric or rectifying action.

33. **Communication, Radio:** The transmission of signals by means of electromagnetic waves originating in a constructed circuit.

34. **Compass, Radio:** A radio receiving device for determining the direction (or the direction and its opposite) in which maximum energy is received; or

    A radio transmitting device for determining the direction (or the direction and its opposite) of maximum radiation.

35. **Condenser, Air:** A condenser having air as its dielectric.

36. **Condenser, Compressed Gas:** A condenser having compressed gas as its dielectric.

37. **Conductor, Cage:** See Cage Conductor.

38. **Corona:** See Brush or Corona Losses.

39. **Counterpoise:** A system of electrical conductors forming one portion of a radiating oscillator the other portion of which is the antenna. In land stations, a counterpoise forms a capacitive connection to ground.

40. **Coupler:** An apparatus which is used to transfer radio frequency energy from one circuit to another by associating portions of these circuits.

41. **Coupler, Capacitive:** An apparatus which, by electric fields, joins portions of two radio frequency circuits; and which is used to transfer electrical energy between these circuits thru the action of electric forces.

42. **Coupler, Direct:** A coupler which magnetically joins two circuits having a common conductive portion.

43. **Coupler, Inductive:** An apparatus which by magnetic forces joins portions of two radio frequency circuits and is used to transfer electrical energy between these circuits thru the action of these magnetic forces.

44. **Coupling:** See Coefficient of Coupling (Inductive).

45. **Current, Damped Alternating:** An alternating current whose amplitude progressively diminishes. (Also called oscillating current.)

46. **Current, Forced Alternating:** A current, the frequency and damping of which are equal to the frequency and damping of the exciting electromotive force. See further Current, Free Alternating.

    Note 1: During the initial stages of excitation, both free and forced currents co-exist.

47. **Current, Free Alternating:** The current following any transient electromagnetic disturbance in a circuit having capacity, inductance, and *less* than the critical resistance. See further, Resistance, Critical.

48. **Curve, Distribution, of a Radio Transmitting Station for a given distance:** This is a polar curve the radii vectors of which are proportional to the field intensity of the radiation at that distance in corresponding directions. See also Compass, Radio.

    Note 1: The distribution curve depends, in general, not only on the form of the antenna, but also on the nature of the ground surrounding the station.

    Note 2: The distribution curve generally varies with the distance from the station.

49. **Curve, Resonance, Standard:** A curve the ordinates of which are the ratios of the square of the current at any frequency to the square of the resonant current, and the abscissas are the ratios of the corresponding wave length to the resonant wave length; the abscissas and ordinates having the same scale.

50. **Cyclogram:** See Characteristic, Dynamic.

51. **Cyclograph:** An instrument for the production of cyclograms.

52. **Decrement:** See Decrement, Linear, and Logarithmic.

53. **Decrement, Linear, of a Linearly Damped Alternating Current:** This is the difference of successive current amplitudes in the same direction divided by the larger of these amplitudes.

Note: Let I_n and I_{n+1} be successive current amplitudes in the same direction of a linearly damped alternating current.

Then, the linear decrement

$$b = \frac{I_n - I_{n+1}}{I_n}$$

Also: $I_t = I_o\ (1 - bft)$,

where I_o = initial current amplitude,

I_t = current amplitude at time t,

f = frequency of alternating current.

54. **Decrement, Logarithmic, of an exponentially damped alternating current:** This is the logarithm of the ratio of successive current amplitudes in the same direction.

Note: **Logarithmic decrements are standard for a complete period or cycle.**

Let I_n and I_{n+1} be successive current amplitudes in the same direction,

d = logarithmic decrement,

Then, $d = \log_{\varepsilon} \frac{I_n}{I_{n+1}}$, where $\varepsilon = 2.718+$.

55. **Decremeter:** An instrument for measuring the logarithmic decrement of a circuit or of a train of electromagnetic waves.

56. **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 energy into a form suitable for operation of the indicator. This translation may be effected either by the conversion of the radio frequency energy, or by means of the control of local energy by the energy received.

57. **Device, Acoustic Resonance:** A device which utilizes in its operation resonance to the audio frequency of the received signals.

58. **Diplex Reception:** The simultaneous reception of two signals by a single operating station.

59. **Diplex Transmission:** The simultaneous transmission of two signals by a single operating station.

60. **Duplex Signaling:** The simultaneous reception and transmission of signals.

61. **Excitation, Impulse:** A method of producing free alternating currents in an excited circuit in which the duration of the exciting current is short compared with the duration of the excited current.

Note: The condition of short duration implies that there can be no appreciable reaction between the circuits.

62. **Factor, Damping:** The product of the logarithmic decrement and the frequency of an exponentially damped alternating current.

Let I_o = initial amplitude,
I_t = amplitude at the time t,
ε = base of Napierian logarithms (2.718+),
a = damping factor,
Then, $I_t = I_o \varepsilon^{-at}$

63. **Factor, Form:** The form factor of a symmetrical antenna for a given wave length is the ratio of the algebraic average value of the R. M. S. currents measured at all heights to the greatest of these R. M. S. currents.

Note 1: For a given R. M. S. current at the base of the antenna, the field intensity at distant points is proportional to the form factor times the height of the antenna.

Note 2: The effective height (height of center of capacity) is equal to the form factor times the actual height of the antenna.

Note 3: The limiting values of the form factor for various types of antennas are as follows:

	Linear or Vertical Antenna	Flat Top Umbrella Antenna
Long Waves	Lower Limit, 1/2	Upper Limit, 1
Fundamental	Lower Limit, $2/\pi$	———————

Note 4: The form factor varies in a given antenna at various wave lengths due to variation of the current distribution

64. **Frequencies, Audio (abbreviated a. f.):** The frequencies corresponding to the normally audible vibrations. These are assumed to lie below 10,000 cycles per second.

65. **Frequencies, Radio (abbreviated r. f.):** The frequencies higher than those corresponding to the normally audible vibrations, which are generally taken as 10,000 cycles per second. See also Frequencies, Audio.

    Note: It is not implied that radiation cannot be secured at lower frequencies, and the distinction from audio frequencies is merely one of definition based on convenience.

66. **Frequency, Changer:** See Changer, Frequency.

67. **Frequency, Group:** The number per second of periodic changes of amplitude or frequency of an alternating current.

    Note 1: Where there is more than one periodically recurrent change of amplitude, or frequency, there is more than one group frequency present.

    Note 2: The term "group frequency" replaces the term "spark frequency."

68. **Frequency Transformer:** See Changer, Frequency.

69. **Fundamental of an Antenna:** This is the lowest frequency of free oscillations of the unloaded antenna. (No series inductance or capacity.)

70. **Fundamental Wave Length:** The wave length corresponding to the lowest free period of any oscillator.

71. **Gap, Micrometer:** A device for protecting any apparatus from excessive potentials, and consisting of a short gap designed for fine adjustment.

72. **Ground:** A conductive connection to the earth.

73. **Height, Effective, of an Antenna:** See Factor, Form; Note 2.

74. **Inductance, Effective of an Antenna:** See Capacity, Effective of an Antenna.

75. **Impulse Excitation:** See Excitation, Impulse.

76. **Interference, Wave (In Radio Communication):** The reinforcement or neutralization of waves arriving at a receiving point along different paths from a given sending station; (to be distinguished from ordinary or station interference, which is the simultaneous reception of signals from two or more stations).

77. **Key:** A switch arranged for rapidity of manual operation and normally used to form the code signals of a radiogram.

78. **Key, Relay:** See Relay Key.

79. **Length, Wave:** See Wave Length.

80. **Losses, Brush** or **Corona:** See Brush or Corona Losses.

81. **Meter, Wave:** See Wave Meter.

82. **Oscillations (In radio work):** See Current, Damped Alternating.

83. **Oscillator, Arc:** See Arc Oscillator.

84. **Potentiometer:** As commonly used for radio receiving apparatus, a device for securing a variable potential by utilizing the voltage drop across the variable portion of a current carrying resistance.

85. **Radiation, Sustained:** See Waves, Sustained.

86. **Radiogram:** A telegram sent by radio.

87. **To Radiograph (verb):** To send a radiogram.

88. **Radio Telephone:** An apparatus for the transmission of speech by radio.

89. **Radiophone (noun):** A telephone message sent by radio.

90. **To Radiophone (verb):** To send a radiophone.

91. **Rectifier, Electron:** A device for rectifying an alternating current by utilizing the approximately unilateral conductivity between a hot cathode and a relatively cold anode in so high a vacuum that a pure electron current flows between the electrodes.

92. **Rectifier, Gas:** An electron rectifier containing gas which modifies the internal action by the retardation of the electrons or the ionization of the gas atoms.

93. **Relay, Electron:** A device provided with means for modifying the pure electron current flowing between a hot cathode and a relatively cold anode placed in as nearly as possible a perfect vacuum.

These means may be, for example, an electric control of the pure electron current by variation of the potential of a grid interposed between the cathode and the anode.

94. **Relay, Gas:** An electron relay containing gas which modifies the internal action by the retardation of the electrons or the ionization of the gas atoms.

95. **Relay Key:** An electrically operated key. See further, Key.

96. **Resistance, Antenna:** See Antenna Resistance.

97. **Resistance, Critical, of a Circuit:** That resistance which determines the limiting condition at which the oscillatory discharge of a circuit passes into an aperiodic discharge.

98. **Resistance, Effective, of a Spark:** The ratio of the power dissipated by the spark to the mean square current.

99. **Resistance, Radiation:** This is the ratio of the total energy radiated (per second) by the antenna to the square of the R. M. S. current at a potential node (generally the ground connection). See further, Antenna Resistance.

100. **Resistance, Radio Frequency:** This is the ratio of the heat produced per second in watts to the square of the R. M. S. current (r. f.) in amperes in a conductor.

101. **Resonance:** Resonance of a circuit to a given exciting alternating E. M. F. is that condition due to variation of the inductance or capacity in which the resulting effective current (or voltage) in that circuit is a maximum.

Note 1: Instead of varying the inductance and capacity of a circuit the frequency of the exciting field may be varied. The condition of resonance is determined by the frequency at which the current (or voltage) is a maximum.

Note 2: The resonance frequency corresponds the more accurately to the frequency of the free oscillations of a circuit, the lower the damping of the exciting alternating field and of the excited circuit.

102. **Resonance, Acoustic Device:** See Device, Acoustic Resonance.

103. **Resonance, Sharpness of:** See Tuning, Sharpness of.

104. **Signaling, Duplex:** See Duplex Signaling.

105. **Sharpness of Tuning:** The measure of the rate of diminution of current in transmitters and receivers with detuning of the circuit which is varied.

If d_2 is the decrement of the free alternating current in the circuit and d_1 the decrement of the exciting E. M. F., then the sharpness of tuning is arbitrarily defined as $\frac{2\pi}{d_1+d_2}$.

106. **Spark:** An arc of short duration.

107. **Static:** Disturbances caused by atmospheric charging of the antenna.

Note: When it is definitely known that disturbances are due to atmospheric charging of the antenna, the word "Static" shall be used. In general, disturbances shall be called "Strays."

108. **Strays:** Electromagnetic disturbances set up by distant discharges.

109. **Telegraphy, Radio:** The art of sending and receiving radiograms.

110. **Telephony, Radio:** The art of sending and receiving radiophones.

111. **Train, Wave:** The waves emitted which correspond to a group of oscillations in the transmitter. See also, Frequency, Group.

112. **Transformer:** In present radio practice the term should be restricted to audio frequency transformers. See Frequency, Audio.

113. **Transmission, Diplex:** See Diplex Transmission.

114. **Tuning:** The process of securing the maximum indication by adjusting the time period of a driven element. See Resonance.

115. **Tuning; Sharpness of:** See Sharpness of Tuning.

116. **Vacuum Tube, Three Electrode:** As examples see Relays, Electron and Gas.

117. **Vacuum Tube, Two Electrode:** As examples see Rectifiers, Electron and Gas.

118. **Waves, Electromagnetic:** A periodic electromagnetic disturbance progressive thru space.

119. **Wave Length (of an Electromagnetic Wave):** The distance in meters between two consecutive maxima, of the same sign, of the electric and magnetic forces.

120. **Wave Length, Fundamental:** See Fundamental Wave Length.

121. **Wave Length, Natural:** In a loaded antenna (that is, with series inductance or capacity) the natural wave length corresponds to the lowest free oscillation.

122. **Wave Changer:** See Changer, Wave.

123. **Wave Meter:** A radio frequency measuring instrument calibrated to read wave lengths.

124. **Waves, Sustained:** Waves radiated from a conductor in which an alternating current flows.

125. **Wave Train:** See Train, Wave.

TESTS AND RATING

1001. **Radio frequency generators should be rated** according to their capacity at continuous load. The method of measuring output in operation is given in Sections 1011 and 1012 below. Unless otherwise specified, a continuous load shall correspond to a locked key test.

1002. **Radio transmitting sets should be rated** on the basis of their actual antenna input, not including in antenna input the losses in the antenna switch, and in antenna loading inductances or series capacities. The radio transmitting set starts therefore at the first piece of electrical equipment definitely a part thereof, comprises all further equipment, and includes the antenna switch and antenna loading inductances and series capacities (or any other apparatus placed in the antenna circuit which forms part of the transmitting equipment; e. g., an antenna relay for break system).

1003. The **over-all efficiency** of a radio transmitting set shall be the quotient of the actual power output measured in a standard antenna (either real or artificial) to the power input supplied to the first piece of electrical equipment which is definitely a part of the radio transmitter.

Examples of the application of this rule are the following:

1004. (a) **A ship station.** Direct current is supplied from the ship's mains to a motor generator set, which furnishes alternating current to the high tension transformer of the radio set. The ratio of power in the antenna to power supplied to the motor of the motor generator set and to the auxiliary radio equipment (e. g., blower motors, rotary gap motors) is the over-all efficiency.

1005. (b) **An auxiliary ship station.** Storage batteries are charged from the ship's mains, and operate a motor generator set or an induction coil. The over-all efficiency is the ratio of the kilowatt-hours supplied to the storage battery for a full charge to the kilowatt-hours delivered by the antenna circuit during the complete time of discharge. The energy ratio, rather than the power ratio, is here required, because of the method of storing energy in such batteries. It may be conveniently measured by the ratio of (kilowatt-hours on discharge of the storage battery to kilowatt-hours on charge) multiplied by the ratio of (power delivered in the antenna to power supplied by the storage battery to the radio equipment). This method is closely approximate.

1006. (c) **A land station.** High voltage alternating current (2,200 volts, for example) is supplied to the station from local power mains. This is stepped down to operate a motor generator set which supplies current of the definite type desired for the station. The over-all efficiency is the ratio of the power output of the antenna to the power supplied to the motor generator. If the step-down transformer feeds other electrical machinery or apparatus not a part of the radio equipment (e. g., lamps), the power supplied to such apparatus shall be subtracted from the total power supplied by the step-down transformer when calculating the over-all efficiency. If the motor generator in question is used to charge storage batteries which operate the station, an energy ratio, somewhat as in case (b) above, must be taken instead of the power ratio.

1007. (d) **A land station.** A large steam engine operates directly or indirectly an audio or radio frequency alternator which supplies current to the radio station exclusively. The over-all efficiency is the ratio of the power output in the antenna to the brake kilowatts of the engine driving the alternator.

1008. (e) **A land station.** A steam or gasoline engine drives a high voltage direct current generator which feeds directly or indirectly arcs or special gap dischargers in the station. The ratio of the antenna power to the brake kilowatts of the engine is the over-all efficiency (under similar conditions to those of (c) above).

1009. The **power output** shall be taken as the product of the total effective resistance of the antenna (not including the resistance of inductance coils, series antenna capacity, or switches and other equipment in the antenna), into the square of the current measured at a potential node.

1010. **Standard Antennas.** Two standard antennas are proposed; one for ships carrying sets of 2.5 kilowatts or under, and one for ships carrying sets of 2.5 kilowatts but not greater than 5 kilowatts.

1011. (a) SMALL ANTENNAS

Capacity = 0.001 microfarad Inductance = 50 microhenrys

Standard Test Wave Length = 600 meters

Test Wave Lengths	Antenna Resistance
*300 meters	8 ohms
600 meters	4 ohms
1200 meters	3 ohms
1800 meters	4 ohms

1012. (b) LARGE ANTENNAS

Capacity = 0.002 microfarad Inductance = 30 microhenrys

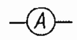
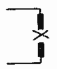
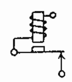
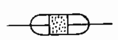
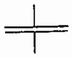
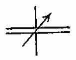
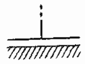
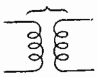
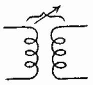
Standard Test Wave Length = 600 meters

Test Wave Length	Antenna Resistance
†600 meters	4 ohms
1200 meters	3 ohms
1800 meters	3 ohms
2400 meters	4 ohms
3000 meters	5 ohms

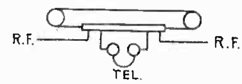
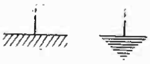
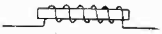
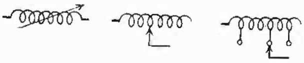
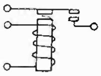
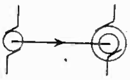
* At 300 meters a suitable series condenser will be inserted in the antenna circuit. The resistance of this condenser will not be included in the antenna resistance, since this condenser should be supplied with, and forms part of, the transmitting set.

† See note referring to 300 meters, above.

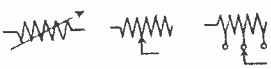
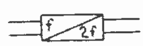
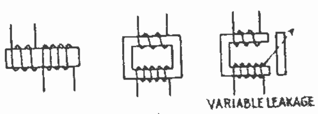
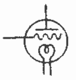
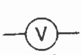
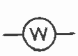
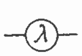
STANDARD GRAPHICAL SYMBOLS

Alternator	
Ammeter	
Antenna	
Arc	
"Audion"	*See Vacuum Tube, Three Electrode.*
Buzzer, Exciting	
Coherer	
Condenser, Audio Frequency	
Condenser, Compressed Gas	
Condenser, Radio Frequency	
Condenser, Variable	
Counterpoise	
Coupler, Inductive	
Coupler, Variable Inductive	
Decremeter	
Detector	

STANDARD GRAPHICAL SYMBOLS
(CONTINUED)

Detector, Magnetic	
Frequency Meter	
Gap, Non Synchronous	
Gap, Quenching	
Gap, Spark	
Gap, Synchronous	
Ground	
Inductance	
Inductance, Iron Core	
Inductance, Variable	
Insulator	
Key	
Key, Relay	
Microphone	
Motor Generator, D.C. to A.C.	
Mover, Prime	

STANDARD GRAPHICAL SYMBOLS
(CONTINUED)

Receivers, Telephone	
Relay	See Key, Relay
Resistance, Non-Inductive	
Resistance, Variable	
Telephone	See Receiver
Thermo Junction	
Tikker	
(Transformer,) Frequency Changer	
Transformer, Iron Core	
Transmitter, Telephone	
Vacuum Tube, Three Electrode "Audion"	
Vacuum Tube, Two Electrode "Valve"	
Voltmeter	
Wattmeter	
Wavemeter	

DEFINITIONS OF TRADE NAMES

The following terms are trade names and have been defined by the inventors or manufacturers of the corresponding apparatus. The Institute does not accept any responsibility for these definitions or sanction them in any way. They are given for the information of the membership.

It is requested that criticisms or other definitions of these terms be submitted to the Secretary of the Institute at an early date. Objections to the definitions should be entered before the intended standardization of these terms is effected.

2001. **Alternator, Alexanderson:** By General Electric Company.
The Alexanderson Alternator is an alternating current generator for radio frequency having a rotor of solid steel shaped as a disc for maximum strength and provided with inductor poles, and having stationary armatures with radial faces on both sides of the rotating disc.

2002. **Audion:** By De Forest Radio Telephone & Telegraph Company.
The Audion is a relay, operating by electrostatic control of currents flowing across a gaseous medium. In its present commercial form, it consists of three electrodes in an evacuated bulb, one of these eletrodes being a heated metal filament, the second a grid-like electrode, and the third a metal plate; an input circuit connected to the filament and the grid; and an output circuit connected to the filament and the plate, including a local source of energy and a telephone receiver.

2003. **Chopper:** By Federal Telegraph Company.
A transmitting device for repeatedly changing circuit connections at a uniform high rate of speed. The object of the above operation is to cause a continuous variation at audio frequency of the energy radiated at a fixed wave length from an antenna.

2004. **Gap, Quenched:** By the National Electric Signaling Company.

A spark gap provided with means for minimizing arcing and generally used under conditions which prevent the re-transfer of energy between the primary and secondary oscillation circuits.

2005. **Gap, Synchronous Rotary:** By the National Electric Signaling Company.

A rotary spark gap which produces discharges in synchronism with the supply of alternating E. M. F.

2006. **Heterodyne:** By the National Electric Signaling Company.

A receiver for radio frequency signals which operates by the production of interference beats between two radio frequency currents or voltages, the source of one of these radio frequencies being located at the receiving station.

2007. **Kenotron:** By General Electric Company.

Kenotron is a name applied to a general class of apparatus having an incandescent cathode and operating with a pure electron discharge in a vacuum so high that gas ionization plays no essential role. One of the uses of the kenotron is the rectification of alternating current, particularly of high voltage.

2008. **Pliotron:** By General Electric Company.

A Pliotron is a Kenotron provided with a member for electrostatically controlling the electron discharge.

2009. **Telegraphone:** By the Telegraphone Sales Company.

The Telegraphone is an instrument for recording and reproducing sounds by the impression of magnetic fluxes proportional in intensity and frequency to the sound waves, upon a moving steel mass. These magnetic fluxes are set up in the steel mass by a suitably placed electro-magnet in series with the telephone transmitter, and constitute the record. Passage of these fluxes across the poles of the electro-magnet in series with the telephone receiver, reproduces the sounds.

2010. **Tikker:** By the Federal Telegraph Company.

A receiving device for changing circuit connections in such a manner as to render the sustained radio frequency electrical energy stored in an oscillating circuit, available for operating a telephone receiver.

2011. **Ultraudion:** By De Forest Radio Telephone & Telegraph Company.

The Ultraudion is an Audion connected in a circuit having a type of energy coupling such that a powerful relay action, or even the production of sustained oscillations may be obtained. In one of its present commercial forms its elements are connected in two circuits so arranged that the energy coupling may be obtained thru a bridging condenser in its filament-plate circuit.