Standards on Pulses: Definitions of Terms, Part II, 1952*

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I. INTRODUCTION

THE MEANINGS of commonly used terms in pulse work have often been a matter of disagreement. The IRE Standards Committee, faced with the fact that different technical committees proposed different definitions for the same term, and wishing to try to introduce uniformity where little has existed, set up a special task group with wide representation of special interests to propose standard definitions of terms concerned with pulses. Months of work by the task group and intensive critical review by the Standards Committee has led to results, the second half of which are given below. These are necessarily compromises. The Standards Committee urges IRE members (a) to try to use the terms according to the definitions below so that reasonable uniformity may be achieved, and (b) to take into account that in this particularly controversial region many compromises have been necessary so that favorite meanings and uses may appear not to have been considered, whereas in actuality it is unlikely that the very thorough review of the field has failed to unearth them for the Committee's consideration.

Since many pulse shapes are possible, and a clear concept of the ones under discussion is desirable, it may be helpful to use drawings of pulse shapes, pulse times, magnitudes, durations, and the like to show how these quantities apply.

In these definitions, linear superposition of pulses and possibly other waveforms is understood. Since it is possible to generate pulses whose characteristics may not seem to be adequately covered by the definition, it has been assumed that complex pulses can be analyzed in terms of more fundamental pulses and waveforms somewhat as a complex periodic wave can be considered as the sum of a fundamental and harmonics.

* Reprints of this Standard, **52 IRE 20 S1**, may be purchased while available from The Institute of Radio Engineers, 1 East 79 Street, New York 21, N. Y., at $0.50 per copy. A 20-per cent discount will be allowed for 100 or more copies mailed to one address.

Part I of these definitions, constituting the first half, was published in PROC. I.R.E., vol. 39, p. 624; June, 1951, as Standard **51 IRE 20 S1**.

II. DEFINITIONS

Note—Terms in italics are defined elsewhere in the Standards on Pulses: Definitions of Terms, Parts I and II.

Bidirectional Pulse. A *pulse* in which the variation from the normally constant value occurs in both directions.

Bidirectional Pulse Train. A *pulse train*, some *pulses* of which rise in one direction and the remainder in the other direction.

Carrier-Frequency Pulse. A carrier, amplitude modulated by a *pulse*. The amplitude of the modulated carrier is zero before and after the *pulse*.

Note—Coherence of the carrier (with itself) is not implied.

Equalizing Pulses (Television). *Pulse trains* in which the *pulse-repetition frequency* is twice the line frequency and which occur just before and just after a vertical synchronizing pulse.

Note—The equalizing pulses minimize the effect of line-frequency pulses on the interlace.

Fruit Pulse (Fruit[1]). A *pulse reply* received as the result of interrogation of a transponder by interrogators not associated with the responsor in question.

Main Bang. Transmitted *pulse*, within a radar system.

Oscillator Starting Time, Pulsed. See *Pulsed Oscillator Starting Time.*

Peak Pulse Power. The power at the maximum of a *pulse* of power, excluding *spikes*.

Peak Pulse Power, Carrier-Frequency. The power averaged over that carrier-frequency cycle which occurs at the maximum of the pulse of power (usually one half the maximum instantaneous power).

Periodic Pulse Train. A *pulse train* made up of identical groups of *pulses*, the groups repeating at regular intervals.

Power, Carrier-Frequency, Peak Pulse. See *Peak Pulse Power, Carrier-Frequency.*

Power, Peak Pulse. See *Peak Pulse Power.*

Pulse, Bidirectional. See *Bidirectional Pulse.*

Pulse, Carrier-Frequency. See *Carrier-Frequency Pulse.*

Pulse Code.

(1) A *pulse train* modulated so as to represent information.

(2) Loosely, a code consisting of *pulses*, such as Morse code, Baudot code, binary code.

Pulse-Code Modulation (PCM). Modulation which involves a *pulse code.*

Note—This is a generic term, and additional specification is required for a specific purpose.

[1] Deprecated.

Pulse Delay, Receiver. See *Transducer Pulse Delay.*

Pulse Delay, Transducer. See *Transducer Pulse Delay.*

Pulse Delay, Transmitter. See *Transducer Pulse Delay.*

Pulse Droop. A distortion of an otherwise essentially flat-topped rectangular *pulse* characterized by a decline of the *pulse* top.

Pulse Frequency Modulation (PFM). A form of *pulse time modulation* in which the *pulse repetition rate* is the characteristic varied.

Note—A more precise term for "pulse frequency modulation" would be "*pulse repetition-rate* modulation."

Pulse Interrogation. The triggering of a transponder by a *pulse* or *pulse mode.*

Note—Interrogations by means of *pulse modes* may be employed to trigger a particular transponder or group of transponders.

Pulse Jitter. A relatively small variation of the *pulse spacing* in a *pulse train.*

Note—The jitter may be random or systematic, depending on its origin, and is generally not coherent with any *pulse modulation* imposed.

Pulse Mode.

(1) A finite sequence of *pulses* in a prearranged pattern used for selecting and isolating a communication channel.

(2) The prearranged pattern.

Pulse-Mode Multiplex. A process or device for selecting channels by means of *pulse modes.*

Note—This process permits two or more channels to use the same carrier frequency.

Pulse Mode, Spurious. See *Spurious Pulse Mode.*

Pulse Modulation.

(1) Modulation of a carrier by a *pulse train.*

Note—In this sense, the term is used to describe the process of generating *carrier-frequency pulses.*

(2) Modulation of one or more characteristics of a *pulse carrier.*

Note—In this sense, the term is used to describe methods of transmitting information on a *pulse carrier.*

Pulse Multiplex. Deprecated. See *Pulse-Mode Multiplex.*

Pulse Phase Modulation (PPM). See *Pulse Position Modulation (PPM).*[2]

Pulse Power, Carrier-Frequency, Peak. See *Peak Pulse Power, Carrier-Frequency.*

Pulse Power, Peak. See *Peak Pulse Power.*

[2] "Standards on Pulses: Definitions of Terms, Part I," vol. 39, pp. 624–626; June, 1951.

Pulse Reply. The transmission of a *pulse* or *pulse mode* by a transponder as the result of an interrogation.

Pulse Separation. The interval between the *trailing-edge pulse-time* of one *pulse* and the *leading-edge pulse-time* of the succeeding *pulse.*

Pulse Shaper. Any transducer used for changing one or more characteristics of a *pulse.*

Note—This term includes *pulse* regenerators.

Pulse Shaping. Intentionally changing the shape of a *pulse.*

Pulse, Single-Polarity. See *Unidirectional Pulse.*[2]

Pulse Spike Amplitude. The *peak pulse amplitude* of the *pulse spike.*

Pulse Tilt. A distortion in an otherwise essentially flat-topped rectangular *pulse* characterized by either a decline or a rise of the *pulse* top.

Pulse Train, Bidirectional. See *Bidirectional Pulse Train.*

Pulse Train, Periodic. See *Periodic Pulse Train.*

Pulse-Train Spectrum (Pulse-Train Frequency-Spectrum). The frequency distribution of the sinusoidal components of the *pulse-train* in amplitude and in phase angle.

Pulse Train, Unidirectional. See *Unidirectional Pulse Train.*

Pulse Valley. The part of the *pulse* between two specified maxima.

Note—Unless otherwise specified, it is to be understood that the maxima are the first and the last.

Pulse Width. See *Pulse Duration.*[2]

Pulsed Oscillator. An oscillator which generates a *carrier-frequency pulse* or a train of *carrier-frequency pulses.*

Note—These *carrier-frequency pulses* may occur as the result of self-generated or externally applied *pulses.*

Pulsed-Oscillator Starting Time. The interval between the *leading-edge pulse-time* of the *pulse* at the oscillator control terminals and the *leading-edge pulse-time* of the related output *pulse.*

Pulses, Equalizing. See *Equalizing Pulses.*

Receiver Pulse Delay. See *Transducer Pulse Delay.*

Single-Polarity Pulse. See *Unidirectional Pulse.*[2]

Spurious Pulse Mode. An unwanted *pulse mode,* formed by the chance combination of two or more *pulse modes,* which is indistinguishable from a *pulse interrogation* or *pulse reply.*

Transducer Pulse Delay. The interval of time between a specified point on the input *pulse* and a specified point on the related output *pulse.*

Note 1—This is a general term which applies to the *pulse delay* in any transducer, such as receiver, transmitter, amplifier, oscillator, and the like.

Note 2—Specifications may require illustrations.

Transmitter Pulse Delay. See *Transducer Pulse Delay.*

Unidirectional Pulse Train. A *pulse train* in which all *pulses* rise in the same direction.

Note—A *unidirectional pulse train* may contain *bidirectional pulses.*

Average Radio-Ray Refraction in the Lower Atmosphere*

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Summary—**Existing corrections for atmospheric refraction in radio-field intensity computations are reviewed with respect to their application to computation of ray bending. A practical scheme is presented for calculating atmospheric refraction of radio-frequency rays numerically from radiosonde data. Ray-bending computations are made for a range of climatological conditions for rays passing entirely through the atmosphere and arriving or departing tangentially at the earth's surface. Some discussion is included regarding the uncertainty in refractive-index computations from meteorological sounding data.**

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The "lower atmosphere" means, arbitrarily, that portion of the atmosphere up to about 18 km. However, an estimate is made in this study of the contribution of the refraction of the atmosphere above this elevation, excluding any ionospheric effects. Measurements of ionospheric effects on radio-ray refraction have been made by R. Payne-Scott and L. L. McCready. "Ionospheric effects noted during dawn observations on solar noise," *Terr. Mag. Atmo. Elec.*, vol. 53, pp. 429–432; December, 1948; and the correction in the *Jour. Geophys. Res.*, vol. 53, p. 98; March, 1949.

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I. Introduction

THE PROBLEM of radio-ray tracing is closely connected with the problem of astronomical refraction. The principal difference between optical-