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Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary —

Part 4: General terms relating to radio communications

Technologies de l'information — Techniques automatiques d'identification et de saisie de données (AIDC) — Vocabulaire harmonisé —

Partie 4: Termes généraux relatifs aux communications radio

Reference number
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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

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ISO/IEC 19762-4 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 31, *Automatic identification and data capture techniques*.

ISO/IEC 19762 consists of the following parts, under the general title *Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary*:

— *Part 1: General terms relating to AIDC*

— *Part 2: Optically readable media (ORM)*

— *Part 3: Radio frequency identification (RFID)*

— *Part 4: General terms relating to radio communications*

— *Part 5: Locating systems*

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Introduction

ISO/IEC 19762 is intended to facilitate international communication in information technology, specifically in the area of automatic identification and data capture (AIDC) techniques. It provides a listing of terms and definitions used across multiple AIDC techniques.

Abbreviations used within each part of ISO/IEC 19762 and an index of all definitions used within each part of ISO/IEC 19762 are found at the end of the relevant part.

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Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary —

Part 4:
General terms relating to radio communications

1 Scope

This part of ISO/IEC 19762 provides general terms and definitions relating to radio communications in the area of automatic identification and data capture techniques. This glossary of terms enables the communication between non-specialist users and specialists in radio communications through a common understanding of basic and advanced concepts.

2 Classification of entries

The numbering system employed within ISO/IEC 19762 is in the format nn.nn.nnn, in which the first two numbers (***nn***.nn.nnn) represent the "Top Level" reflecting whether the term is related to 01 = common to all AIDC techniques, 02 = common to all optically readable media, 03 = linear bar code symbols, 04 = two-dimensional symbols, 05 = radio frequency identification, 06 = general terms relating to radio, 07 = real time locating systems, and 08 = MIIM. The second two numbers (nn.***nn***.nnn) represent the "Mid Level" reflecting whether the term is related to 01 = basic concepts/data, 02 = technical features, 03 symbology, 04 = hardware, and 05 = applications. The third two or three numbers (nn.nn.***nnn***) represent the "Fine" reflecting a sequence of terms.

The numbering in this part of ISO/IEC 19762 employs "Top Level" numbers (**nn**.nn.nnn) of 06.

3 Terms and definitions

06.01.01
radio frequency
frequency of a periodic radio wave or of the corresponding periodical electrical oscillation

NOTE This term and its abbreviation may qualify an electrical device for generating or collecting radiated waves.

[IEC 60050-713:1998, 713-06-02]

NOTE Radio Frequency (RF) (in RID). Radio frequency between 30 Hz and 3 GHz.

06.01.02
radio frequency data communication
RF/DC
system by which remote devices communicate with a host computer via a radio link

NOTE 1 Hand-held **readers** can send the **information** collected back to a controlling process without the need for fixed wiring for the **data** cables.

NOTE 2 One common use for RF/DC is on forklift trucks.

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06.01.03
electromagnetic field
field characterizing the electric and magnetic conditions of a material medium or of vacuum, defined by the following set of four vector quantities:

— E: electric field (vector)

— D: electric flux density (vector)

— H: magnetic field (vector)

— B: magnetic flux density (vector)

NOTE Adapted from IEC 50 (705):1995, 705-01-07.

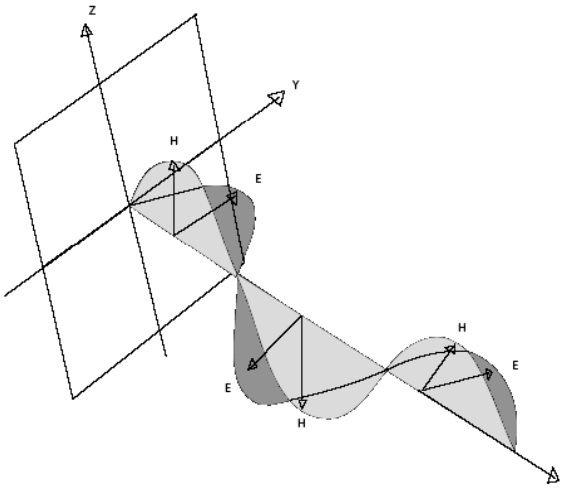

Figure 1 — Electromagnetic field

06.01.04
air interface
conductor-free medium, usually air, between a **transmitter** and the **receiver** through which communication, e.g. data and telemetry, is achieved by means of a modulated inductive or propagated **electromagnetic field**

[IEC 60050-702, 702-06-17]

06.01.05
electromagnetic spectrum
range or continuum of electromagnetic radiation, characterized in terms of frequency or wavelength

06.01.06
electromagnetic wave
wave characterized by the propagation of a time-varying electromagnetic field

NOTE An electromagnetic wave is produced by variations of electric charges or electric currents.

[IEC 50 (705):1995, 705-01-09]

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06.01.07
electric field
constituent of an electromagnetic field which is characterized by the electric field strength ***E*** together with the electric flux density ***D***

NOTE In French, the term “champ électrique” is also used for the quantity electric field strength.

[IEC 60050-121, 121-11-67]

06.01.08
far field region
region of an electromagnetic field of an antenna wherein the predominant components of the field are those which represent a propagation of energy and wherein the angular field distribution is essentially independent of the distance from the antenna

[IEC 50 (712):1992, 712-02-02]

NOTE 1 In the far field region, field distribution is unaffected by the **antenna** structure and the wave propagates as a plane wave.

cf. **radiating near field**

06.01.09
magnetic field
constituent of an electromagnetic field which is characterized by the magnetic field strength ***H*** together with the magnetic flux density ***B***

[221-01-01 MOD]

NOTE In French, the term “champ magnétique” is also used for the quantity magnetic field strength.

[IEC 60050-121, 121-11-69]

06.01.10
inductive coupling
process of transferring modulated data or energy from one system component to another, reader to **transponder** for example, by means of a varying magnetic field

NOTE An inductive coupled **tag** uses a coil to transfer data or power from the magnetic field output by an **interrogator**.

06.01.11
electromagnetic coupling
coupling through a **magnetic field**

NOTE Also referred to as inductive **coupling** or an **electric field**.

06.01.12
field strength
transmitter field intensity (deprecated)
magnitude of the electromagnetic field created at a given point by a radio transmitting system operating at a specified characteristic frequency with specified installation and modulation conditions

[IEC 50 (705):1995, 705-08-31]

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06.01.13
equivalent isotropically radiated power
EIRP
product of the net radiated **RF** power of a **transmitter** and the **gain** of an **antenna** system in one direction relative to an isotropic source

NOTE 1 The maximum power **gain** of a transmitting antenna in any direction multiplied by the net power accepted by the antenna from the connected transmitter.

EXAMPLE 36 dBm EIRP equals 4 W transmitted into an isotropic antenna, or 1 W transmitted into a 6 dB antenna.

NOTE 2 Also referred to as Effective Isotropically Radiated Power, Equivalent Isotropical Radiated Power, and Effective Isotropical Radiated Power.

06.01.14
effective radiated power
ERP
amount of power actually radiated by a transmitter and antenna combination (the applied power multiplied by the efficiency of the antenna)

cf. **EIRP**

NOTE To convert between ERP and EIRP, add 2,15 dB, as a dipole antenna has a gain of 2,15 dBi. For example, to convert the European Power output of 2 W ERP (which is +33 dBm) to EIRP, add 2,15 dB to get +35,15 dBm, which is very close to the FCC limit of 4 W EIRP (+36 dBm).

06.01.15
frequency
number of cycles a periodic signal executes in unit time

NOTE Usually expressed in hertz (cycles per second) or appropriate weighted units such as **kilohertz (kHz), megahertz (MHz) and gigahertz (GHz)**.

06.01.16
frequency band
continuous set of frequencies lying between two specified limiting frequencies

NOTE 1 A frequency band is characterized by two values which define its position in the frequency spectrum, for instance its lower and upper limiting frequencies, as opposed to the bandwidth which is characterized by one value.

NOTE 2 The nomenclature of the frequency and wavelength bands used in RFID are given in Table 1.

NOTE 3 Certain frequency ranges are sometimes designated by letter symbols consisting of capital letters which may be accompanied by a small letter as subscript.

NOTE 4 Adapted from IEC 60050-713.

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Table 1 — Nomenclature of frequency and wavelength bands

BAND NUMBER (NOTE 1)	ABBRE-VIATION	FREQUENCY RANGE (lower limit exclusive, upper limit exclusive)				METRIC QUALIFIER (NOTE 4)	METRIC ABBRE-VIATION of the band (NOTE 3)	WAVELENGTH RANGE (lower limit exclusive, upper limit exclusive)			
–1	(NOTE 2)	0,03	to	0,3	Hz	gigametric	B.Gm	1	to	1	Gm
0	(NOTE 2)	0,3	to	03	Hz	hectomegametric	B.hMm	100	to	1000	Mm
1	(NOTE 2)	3	to	30	Hz	decamegametric	B.daMm	10	to	100	Mm
2	(NOTE 2)	30	to	300	Hz	megametric	B.Mm	1	to	10	Mm
3	ULF	300	to	3000	Hz	hectokilometric	B.hkm	100	to	1000	km
4	VLF	3	to	30	kHz	myriametric	B.Mam	10	to	100	km
5	LF	30	to	300	kHz	kilometric	B.km	1	to	10	km
6	MF	300	to	3000	kHz	hectometric	B.hmm	100	to	1000	m
7	HF	3	to	30	MHz	decametric	B.dam	10	to	100	m
8	VHF	30	to	300	MHz	metric	B.m	1	to	10	m
9	UHF	300	to	3000	MHz	decimetric	B.dm	100	to	1000	mm
10	SHF	3	to	30	GHz	centimetric	B.cm	10	to	100	mm

NOTE 1 "Band number N" extends from $0,3 \times 10$ N to 3×10 N Hz

NOTE 2 The abbreviation ELF designates the set of bands –1 to 2.

NOTE 3 In French, abbreviations with letter O ("Ondes") are sometimes used (e.g. O.km "Ondes kilométriques") instead of abbreviations with letter B ("Bande") indicated in the column "metric abbreviation" of the table.

NOTE 4 Metric qualifiers and abbreviations are not names or symbols of unit, and so may use the combination of prefixes in some cases.

Adapted from IEC 60050-713.

06.01.17
kilohertz
kHz
measure of **frequency** equal to one thousand (1,000) cycles per second

06.01.18
megahertz
MHz
measure of **frequency** equal to one million (1,000,000) cycles per second

06.01.19
gigahertz
GHz
measure of **frequency** equal to one billion (1,000,000,000) cycles per second

06.01.20
continuous wave
typically sinusoidal wave at a given frequency, but more generally any interrogator waveform suitable for powering a passive tag without amplitude and/or phase modulation cover-coding method by which an interrogator obscures information that it is transmitting to a tag

NOTE To cover-code data or a password, an interrogator first requests a random number from the tag, then performs a bit-wise EXOR of the data or password with the received random number, and, finally, transmits the cover-coded (also called ciphertext) string to the tag; the tag uncovers the data or password by performing a bit-wise EXOR of the received cover-coded string with the original random number.

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06.01.21
modulation
process by which at least one characteristic quantity of a **carrier** is varied in accordance with a characteristic quantity of a signal to be transmitted

[ISO/IEC 2382-9:1995, 09.05.10]

NOTE 1 Generic forms of modulation include **amplitude modulation (AM**)**, phase modulation (PM) frequency modulation (FM)**, **pulse position modulation (PPM)**, and **pulse width modulation (PWM)**.

NOTE 2 Digital modulation methods principally feature **amplitude shift keying (ASK)**, **frequency shift keying (FSK)**, **phase shift keying (PSK)** or variants.

NOTE 3 See also amplitude, frequency and phase modulation, amplitude shift keying, frequency shift keying and phase shift keying.

06.01.22
amplitude modulation
modulation in which the amplitude of a periodic carrier is a given function, generally linear, of the instantaneous values of the modulating signal

06.01.23
phase modulation
PM
modulation in which data is contained in the changes in the phase of the **carrier** and in which the instantaneous phase deviation varies in accordance with a given function, generally linear, of the instantaneous value of the modulating signal

[IEC 60050-702, 702-06-36]

06.01.24
pulse position modulation
PPM
modulation in which data is contained in the position of pulses relative to a reference point

NOTE Pulse time modulation in which the positions in time of the pulses vary from their initial position in accordance with a given function of the value of the modulating signal.

[IEC 60050-702, 702-06-56]

06.01.25
pulse duration modulation(1)
PDM
pulse time modulation in which the pulse duration varies in accordance with a given function of the value of the modulating signal

[IEC 60050-702, 702-06-57]

06.01.26
pulse duration modulation(2)
PDM
data is contained in the duration of pulses, in which the pulse duration varies in accordance with a given function of the value of the modulating signal

[IEC 60050-702, 702-06-57]

06.01.27
pulse position modulation
PPM
data is contained in the position of pulses relative to a reference point

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06.01.28
pulse width modulation
PWM
See **pulse duration modulation**.

06.01.29
spread spectrum modulation
modulation in which the average power spectral density of the transmitted signal is spread in a random or quasi-random way over a bandwidth which is much wider than the bandwidth required for the information to be transmitted

NOTE Spread spectrum modulation permits multiple accesses to a communication path and increases immunity to noise and interference.

[IEC 60050-725, 725-14-30]

06.01.30
spreading sequence
pseudo-random sequence of **data coding** elements **chips** used to encode each logical bit

06.01.31
direct sequence spread spectrum modulation
DSSS
spread spectrum modulation in which each element of a digital information signal is transmitted as a pseudo-random sequence of digits having a digit-rate much higher than the bit rate of the information signal

NOTE The signal modulating the carrier is usually obtained by adding a pseudo-random digital signal to the information signal.

[IEC 60050-725, 725-14-31]

06.01.32
frequency hopping spread spectrum modulation
FHSS
form of spread spectrum modulation in which the carrier frequency is automatically changed at short intervals, selection being made in a pseudo-random way from a set of frequencies covering a frequency band much wider than the bandwidth required for the information to be transmitted

NOTE Adapted from IEC 50 (725), 725-14-32.

06.01.33
frequency hop rate
frequency at which a frequency hopping spread spectrum **(FHSS)** system moves between transmission frequencies, equal to the reciprocal of the dwell time at a FHSS centre frequency

06.01.34
hop rate
inverse of the dwell time at a given **FHSS** hopping frequency

06.01.35
frequency hop sequence
pseudo-random binary sequence **(PRBS)** determining the hopping frequencies used in frequency hopping spread spectrum **(FHSS)** systems

06.01.36
hop sequence
pseudo-randomly ordered list of hopping frequencies used by the **FHSS transmitter** to select an **FHSS channel**

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06.01.37
chip rate
frequency at which the spreading **sequence** modulates the **carrier**

06.01.38
chipping
process of moving from one chip to another in a spread **spectrum** transmission process, each chip being representative of a different spectral component or tone in the spread spectrum band

06.01.39
amplitude shift keying
ASK
modulation in which a modulating digital signal varies the amplitude of the output signal among a fixed number of predetermined values

06.01.40
frequency shift keying(1)
FSK
angle modulation in which each significant condition of a discretely timed modulating signal is represented by one of a specified set of discrete values of the frequency of the modulated signal

[IEC 60050-702, 702-06-47]

06.01.41
frequency shift keying(2)
FSK
modulation in which a modulating digital signal varies the frequency of the output signal among a fixed number of predetermined values

[ISO/IEC 2382-9, 09.05.13]

06.01.42
gaussian minimum shift keying
GMSK
gaussian pulse shaped **MSK**

06.01.43
binary phase shift keying
BPSK
modulation scheme of phase modulation where only two points in a constellation diagram are used

06.01.44
differential binary phase shift keying
DBPSK
binary phase shift keying before which the data is differential pre-processed

06.01.45
minimum shift keying
MSK
form of two-condition frequency shift keying with modulation index equal to 0,5, in which variations are continuous

[IEC 60050-702, 702-06-49]

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06.01.46
phase shift keying
PSK
angle modulation in which each significant condition in a discretely timed modulating signal is represented by a specified difference between the phase of the modulated signal and the phase of the carrier in the absence of modulation

[IEC 60050-702, 702-06-40]

06.01.47
absolute gain
isotropic gain
ratio, generally expressed in decibels, of the radiation intensity produced by an antenna in a given direction to the radiation intensity that would be obtained if the power accepted by the antenna were radiated equally in all directions

NOTE 1 If no direction is specified, the direction of maximum radiation intensity from the given antenna is implied.

NOTE 2 If the antenna is lossless its absolute gain is equal to its directivity in the same direction.

[IEC 50 (712):1992, 712-02-43]

06.01.48
acknowledgment signal
signal sent in one direction to acknowledge the receipt of a signal in the opposite direction

[IEC 50 (714), 714-07-22]

06.01.49
asynchronous transmission(1)
method of data transmission that does not require timing or clocking **information** in addition to data

NOTE Transmission is achieved by receiver reference to start and stop bits positioned at the beginning and end of each character or block of characters. A variable time interval can exist between characters or blocks of characters.

06.01.50
asynchronous transmission(2)
data transmission in which the start of each character or block of characters is arbitrary but, once started, signal elements are transmitted at a predetermined fixed rate

06.01.51
authentication
message exchange between two **elements**, which verifies that further communication between the two items is proper

06.01.52
bandwidth times time
product of bandwidth and time used for 1 bit, which implicitly specifies the occupied bandwidth for a given data rate

06.01.53
carrier
wave or oscillation whose characteristic quantities can be varied by signal

NOTE The wave or oscillation can be, for example, a sinusoidal wave or a pulse train. In modulation, it is an oscillation or wave, usually periodic, some characteristic of which follows by modulation the signal of another oscillation or wave.

[ISO/IEC 2382-9, 09.05.09] [IEC 60050-702, 702-06-03] [IEC 60050-704, 704-10-02]

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06.01.54
carrier frequency
analog signal of fixed amplitude and frequency

06.01.55
carrier signal
signal of chosen frequency generated to carry data, often used for long distance transmissions

NOTE A **carrier signal** does not convey any information until the data is added to the signal by **modulation**, then decoded on the receiving end by demodulation.

06.01.56
channel
transmission path
course taken by a signal during its transmission between two points

[IEC 60050-704, 704-04-01]

06.01.57
channel encoding
application of coding schemes to facilitate effective **channel** transmission of the source encoded data

cf. **source encoding**, **channel decoding**

06.01.58
channel decoding
process of operating upon a received transmission to separate the source-encoded data from the channel **encoded** form

cf. **source decoding**, **channel encoding**

06.01.59
source decoding
process of recovering the original or source **data** from a received source encoded bit stream

cf. **source encoding**

06.01.60
source encoding
process of operating upon original or source **data** to produce an encoded message for transmission

cf. **source decoding**

[IEC 60050-702, 702-04-40]

06.01.61
collision avoidance
multiple access protocol which allows for resolution of **collisions**

NOTE Examples include tree search **algorithms** and various **ALOHA** methods, including **CSMA**.

06.01.62
collision(1)
simultaneous communication by two or more **tags** in the field of view of an **interrogator**, which results in an error or lost transmission

NOTE Such communication may be inseparable without some means of anti-collision or contention management.

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06.01.63
collision(2)
condition that results from concurrent transmissions on the transmission medium

NOTE In hashing, the occurrence of the same hash value for two or more different keys.

06.01.64
Carrier Sense Multiple Access(1)
CSMA
multiple access protocol that allows the **tag** to "sense" whether another tag is using the **channel** prior to transmitting itself

06.01.65
Carrier Sense Multiple Access(2)
CSMA
multiple access technique where data stations mediate their own use of the common resource based upon presence or absence of a **carrier** from another user

06.01.66
Carrier Sense Multiple Access with Collision Detection
CSMA/CD
multiple access protocol that allows the **tag** to "sense" whether another tag is using the **channel** prior to transmitting itself; and to detect a **collision**, if one occurs

06.01.67
code division multiple access(1)
CDMA
technique that breaks each transmission into **packets** and assigns a unique code to each

NOTE All coded packets are then combined mathematically into one signal and each intended receiver extracts only its data packets depending on the assigned code.

06.01.68
code division multiple access(2)
CDMA
multiple access that depends upon the use of independently coded **modulations** within a single channel

06.01.69
ALOHA random
multiple access protocol in which **tags** respond to the **interrogator** after a random time interval

06.01.70
ALOHA slotted
multiple access protocol in which tags respond to the interrogator after selecting a random time slot

06.01.71
directivity
ratio, generally expressed in decibels, of the radiation intensity produced by an antenna in a given direction, to the value of the radiation intensities averaged in all directions in space

NOTE 1 If no direction is specified, the direction of maximum radiation intensity from the given antenna is implied.

NOTE 2 The directivity is independent of antenna losses and equal to the absolute gain in the same direction if the antenna is lossless.

[IEC 50 (712):1992, 712-02-42]

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06.01.72
down-link
radio link between a transmitting space station and receiving earth station

[IEC 60050-725, 725-12-24]

06.01.73
duplex transmission
data transmission in both directions at the same time

[ISO/IEC 2382-9:1995, 09.03.07]

06.01.74
full-duplex transmission(1)
communication of **data** while the **transceiver** transmits the activation field

06.01.75
interlaced half duplex
full duplex transmissions by the **interrogator**; **half duplex** operation by the **tag**

06.01.76
emission
radio waves or signals produced by a radio transmitting station

NOTE 1 In radio communication, the term “emission” is not used in the more general sense of “radio frequency emission”. For example, that part of electromagnetic energy from the local oscillator of a radio receiver transferred to external space is a radiation and not an emission.

NOTE 2 In radio communication, the French term “émission” applies only to intentional radiation.

[IEC 60050-702, 702-02-05]

06.01.77
electromagnetic interference
EMI
degradation in the performance of an equipment transmission channel or system caused by an electromagnetic disturbance

[IEC 600500-161-01-06 (702-08-29]

06.01.78
electromagnetic noise
time-varying electromagnetic phenomenon apparently not conveying information and which may be superimposed on or combined with a wanted signal

[IEC 60050-161, 161-01-02]

06.01.79
immunity
ability of a device, equipment or system to perform without degradation in the presence of an electromagnetic disturbance

[IEC 60050-161, 161-01-20]

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06.01.80
radio frequency disturbance
electromagnetic phenomenon having components in the radio frequency range, which may degrade the performance of a device, equipment or system, or adversely affect living or inert matter

NOTE A radio frequency disturbance may be a **radio frequency noise**, an unwanted signal or a change in the propagation medium itself.

[IEC 60050-713:1998, 713-11-04]

06.01.81
radio frequency interference
RFI
degradation of the reception of a wanted signal caused by a radio frequency disturbance

[IEC 60050-713:1998, 713-11-05]

NOTE Unwanted electromagnetic signals, where encountered within the environment of a **radio frequency identification** system, that cause disturbance in its normal operation, possibly resulting in bit errors, and degrading system performance.

06.01.82
radio frequency noise
time-varying electromagnetic phenomenon having components in the radio frequency range, apparently not conveying information and which may be superimposed on, or combined with, a wanted signal

[IEC 60050-713:1998, 713-11-03]

06.01.83
de-tuning
effect of a change of the resonance frequency of an RF tag and/or **readers/interrogators** caused by the close **proximity** of metal or a dielectric material, thus causing a reduction in performance of **transponders**

06.01.84
ETR
European Telecommunications Report
ETSI document created as an output of a work Item in the ETSI work program

NOTE An ETR has a lower stature than an **ETS**.

06.01.85
ETS
European Telecommunications Standard
ETSI document created as an output of a work item in the ETSI work programme, and having the status of a European standard

06.01.86
ETSI
European Telecommunications Standards Institute
European standards organization responsible for standardization in telecommunications

06.01.87
harmonics
power output at integer multiples of the primary frequency of a **transmitter** invariably exhibiting lower amplitudes

NOTE Harmonics can be generated as a result of circuit non-linearities associated with radio transmissions resulting in harmonic distortion.

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06.01.88
isotropic radiator
hypothetical antenna, without loss, having equal radiation intensities in all directions and serving as a convenient reference for expressing the directional properties of actual antennas

[IEC 50(712), 712-03-01]

06.01.89
non interference
RFID condition that exists where standard compliant components of various types or of different vendor origins co-exist within the same space without serious detrimental effect on one another's performance

NOTE Components are not required to communicate with one another as part of a common infrastructure, but only to peacefully co-exist.

06.01.90
penetration
ability of **electromagnetic waves** to propagate into or through materials

NOTE 1 Non-conducting materials are essentially transparent to electromagnetic waves, but absorption mechanisms, particularly at higher frequencies, reduce the amount of energy propagating through the material.

NOTE 2 Metals constitute good reflectors for freely propagating electromagnetic waves, with very little of an incident wave being able to propagate into the metal surface.

NOTE 3 Low-frequency tagging systems are said to have good penetrative properties as their **tag** can be read when behind or encased in other materials.

NOTE 4 Microwave tagging systems, while having greater ranges, are less capable of penetration of materials.

06.01.91
polarization
attribute of an electromagnetic wave characterized by the curve described with time by the extremity of the electric flux density vector at a fixed point, and by the direction of this curve

[IEC 50(705), 705-01-13]

06.01.92
polarization summary
polarization of a propagating wave is determined by the locus or path described by the electric field **vector** with respect to time

NOTE Polarization is a term that often arises in the literature and when considering radio frequency communication and RFID. If we ascribe an x, y, z co-ordinate system to a propagating wave as illustrated below, with the direction of propagation being in the z direction, the electric field vector E will be in the x, y plane. If E remains in the same orientation with respect to time, so that its locus describes a straight line, the wave is said to be linearly polarized. However, if the locus describes a circular motion with respect to time the wave is said to be circularly polarized. Where the locus describes an elliptical path, the wave is said to be elliptically polarized.

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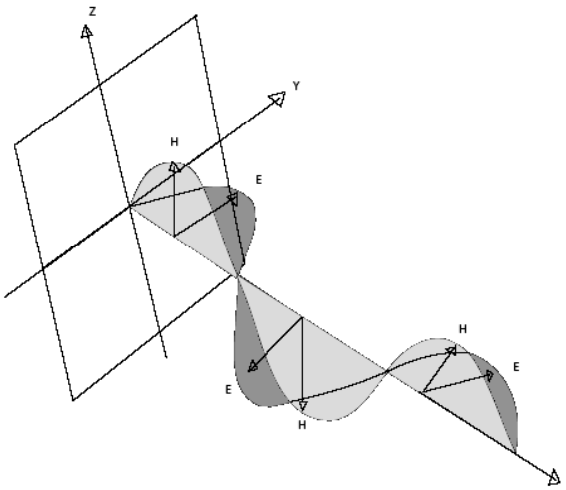

Figure 2 — Electromagnetic field

Circular polarization is often used in communication systems since the orientation of the transmitting and receiving **antenna** is less important than it is with linearly polarized waves. The magnetic vector, H, always remains perpendicular to the E vector. Using an IEEE convention, a clockwise circular rotating wavefront approaching a receiver is defined as being left-hand circular (LHC) polarized. The power in the wavefront is expressed in the form of the Poynting vector, P:

$$P = (E \times H) = E \times H \sin \theta,$$

where θ is the phase angle between E and H.

06.01.93
alignment
orientation of the **tag** relative to the reader **antennas,** in terms of the variation of the tag's x, y and z positions

06.01.94
antenna polarization
⟨**antenna** system⟩ focus of the tip of the **vector** of the electrical **field strength** in a plane perpendicular to the transmission vector

06.01.95
polling
process whereby data stations are invited one at a time to transmit

NOTE While generally used on a multipoint connection, polling can be used on a point-to-point connection.

[ISO/IEC 2382-9, 09.06.24]

06.01.96
power flux density
power passing through an element of surface normal to the direction of propagation of energy of an electromagnetic wave divided by the area of the element

[IEC 50(705), 705-02-03]

06.01.97
power gain
in a given direction, the field intensity radiated by a transmitting **antenna** referenced to the field intensity that would be radiated by an isotropic antenna provided the same input power

NOTE 1 Power gain includes dissipative loss, in contrast to directive **gain**.

NOTE 2 Power gain does not include losses resulting from **polarization** mismatch.

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06.01.98
programmability
ability to enter data and to change data and functions stored in a **transponder**

06.01.99
programming
act of entering or changing data stored in a **transponder**

06.01.100
projected life
estimated lifetime for a **transponder** often expressed in terms of read and/or **write** cycles or, for active **transponders**, years, based upon battery life expectancy and, as appropriate, **read/write** activity

06.01.101
pulse dispersion
spread in width or duration of a pulse during transmission through a practical transmission system, due to the influence of distributed reactive components

06.01.102
Q factor
quality factor
ratio of the centre frequency to the **bandwidth**

06.01.103
radiating near field
region of space between the reactive near field region and the far field region, wherein the predominant components of the electromagnetic field are those which represent a propagation of energy, and wherein the angular field distribution is dependent upon the distance from the antenna

NOTE If the antenna has a maximum overall dimension which is not large compared to the wavelength, the radiating near field region may not be identifiable in practice.

[IEC 50(712), 712-02-04]

06.01.104
radiation
phenomena by which energy in the form of electromagnetic waves emanates from a source into space

NOTE Associated term: to radiate.

[IEC 50(705), 705-02-01]

06.01.105
radiation efficiency
ratio of the total power radiated by an antenna to the net power accepted by the antenna

[IEC 50(712), 712-02-50]

06.01.106
antenna efficiency
〈aperture-type antenna with a specified aperture illumination〉 ratio of the maximum total effective area to the geometric area of the aperture

[IEC 50(712), 712-05-06]

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06.01.107
radiation pattern
radiation diagram
graphical representation of the distribution in space of a quantity which characterizes the electromagnetic field produced by an antenna

NOTE For example, a radiation pattern may be a plot of the magnitude of a far field component, or alternatively contours of equal value of a far field component, at a given distance from the antenna, as a function of the direction.

[IEC 50(712), 712-02-15]

06.01.108
range
distance (minimum and maximum) between interrogator antenna and tag(s)

NOTE For multiple tags, the range will be measured to the geometric centroid of the tag population.

06.01.109
read/write
ability to both read data from a **transponder** and to change data (**write** process) using a suitable **programming** device

cf. **reader/interrogator**

06.01.110
receiving signal strength indicator
RSSI
value of the received input power, which can be represented as **digital** data or analog voltage depending on the hardware implementation

06.01.111
screening
process of masking **RF** transmissions to avoid unwanted operation of **tags** outside the desired field of view

NOTE The process of avoiding or minimizing electromagnetic **interference** by use of electromagnetic reflective and absorptive materials suitably structured or positioned to reduce interaction between the source of potential **interference** and the circuit being protected.

06.01.112
signal element
part of a discretely timed signal distinguished from the others by one or more characteristics such as its duration, its relative position, its waveform, its magnitude

[IEC 60050-702, 702-05-01]

NOTE Each of the parts constituting a discrete signal and distinguished from the others by one or more characteristic quantities.

NOTE Examples of characteristic quantities are amplitude, waveform, duration, and position in time.

[ISO/IEC 2382-9, 09.02.05]

06.01.113
signal to noise & distortion
SINAD
abbreviation for signal-plus-noise-plus-distortion to noise-plus-distortion ratio, usually expressed in decibels (dB)

NOTE SINAD is calculated as the ratio of total received power, i.e. the received signal-plus-noise-plus-distortion power, to the received noise-plus-distortion power signal-to-noise ratio.

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06.01.114
signal/noise ratio
S/N
ratio, generally expressed in decibels, of the power of wanted signal to that of the coexistent noise at a specified point in a transmission channel, usually at the receiver output, under specified conditions

NOTE 1 The signal cannot generally be separated from noise, and in practice the ratio (signal noise) to noise is measured.

NOTE 2 The specified conditions comprise, among others, the nature and characteristics of the wanted signal, the nature and characteristics of the noise, the receiver and antenna characteristics such as the bandwidth.

[IEC 60050-713:1998, 713-11-19]

06.01.115
sinusoidal carrier
fundamental waveform, characterized by a single frequency and wavelength, used to carry data or information by modulating some feature of the waveform

cf. **modulation**

06.01.116
spectrum-mask
maximum power density of a transmission expressed as a function of frequency

06.01.117
time division duplexing
TDD
application of **time-division multiplexing** which specifies how the physical time is handled

EXAMPLE Interrogator and tag are not operated at the same time.

06.01.118
time division multiplexing
TDM
multiplexing in which several independent signals are allocated separate periodic time intervals for transmission over a common channel

[IEC 60050-704, 704-08-07]

06.01.119
up-link
radio link between a transmitting earth station and receiving space station

[IEC 60050-725, 725-12-23]

06.01.120
transmission channel
means of transmission of signals in one direction between two points

NOTE Several channels may share a common path: for example, where each channel is allocated a particular frequency band or a particular time-slot. In some countries, the term “communication channel” or its abbreviation “**channel**” is also used to mean “telecommunication circuit”, i.e. to encompass the two directions of transmission. This usage is deprecated. A transmission channel may be qualified by the nature of the transmitted signals, or its bandwidth or its digit rate: for example: telephone channel, telegraph channel, data channel. 10 MHz channel. 34 Mbit/s channel.

[IEC 60050-704, 704-04-02]

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06.01.121
open field
path from transmitter to receiver is LOS (Line Of Sight)

06.01.122
operating environment
region within which an interrogator's RF transmissions are attenuated by less than 90 dB

NOTE In free space, the operating environment is a sphere whose radius is approximately 1000 m, with the interrogator located at the centre; in a building or other enclosure, the size and shape of the operating environment depends on factors such as the material properties and shape of the building, and may be less than 1000 m in certain directions and greater than 1000 m in other directions.

06.01.123
operating procedure
set of functions and commands used by an interrogator to identify and modify tags (also known as the tag-identification layer)

06.01.124
session
inventory process comprised of an interrogator and an associated tag population

EXAMPLE An interrogator chooses one of four sessions and inventories tags within that session; the interrogator and associated tag population operate in one and only one session for the duration of an inventory round (defined above); for each session, tags maintain a corresponding inventoried flag; sessions allow tags to keep track of their inventoried status separately for each of four possible time-interleaved inventory processes, using an independent inventoried flag for each process.

06.01.125
command set
set of commands used to explore and modify a tag population

06.01.126
automatic repeat request
ARQ
protocol consisting of error detection and following repetition of the transmission for correcting if necessary

NOTE The frequency used to carry data by appropriate modulation of the carrier waveform, typically in a radio frequency identification system by amplitude shift keying (ASK), frequency shift keying (FSK), phase shift keying (PSK) or associated variants. A carrier signal does not convey any information until the data is added to the signal by modulation.

06.01.127
compatibility
suitability of products, processes or services for use together under specific conditions to fulfil relevant requirements without causing unacceptable interactions

NOTE Interchangeability, interoperability, and non-interference are differing levels (or degrees) of compatibility.

06.01.128
frequency range
⟨equipment⟩ set of frequencies over which the equipment can be adjusted to operate satisfactorily

NOTE The frequency range of equipment can be subdivided into switched sub-ranges which may or may not be contiguous.

[IEC 60050-702, 702-09-68]

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06.01.129
interchangeability
condition that exists between devices or systems that exhibit equivalent functionality, interface features and performance to allow one to be exchanged for another, without alteration, and achieve the same operational service

06.01.130
SRD
short range device
radio transmitters which will provide both unidirectional and bi-directional communication and which have low capability of causing interference to other radio equipment

NOTE The following categories are amongst those covered as an SRD:

- telecommand and telecontrol;
- telemetry;
- alarms;
- speech and video.

06.01.131
technical basis for regulation
TBR
subset of **ETSs** (specifications and tests) developed by ETSI, which serve as the basis for the common technical regulations (CTR)

06.01.132
chip
⟨digital radio communications⟩ time part of the signal which represents one character, transmitted with characteristics which are distinct from those of the other parts of the same signal, in accordance with a specified rule

NOTE Adapted from IEC 60050-713, 713-07-04.

06.01.133
capture field/area/zone
region of the **electromagnetic field**, determined by the **reader/interrogator antenna**, in which the **transponders** are signalled to deliver a response

06.01.134
anti-clash
property whereby contention is avoided at the **reader/interrogator** receiver for responses arising from **transponders** simultaneously present within the read or **interrogation zone** of a **radio frequency identification** system and competing for attention at the same time without producing an error report or blocking transaction

NOTE Also referred to as anti-contention and anti-collision.

06.01.135
field of view
FoV
capture field/area/zone
zone surrounding a reader/interrogator in which the reader/interrogator is capable of communicating with a transponder

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06.01.136
forward link
communications from **reader/interrogator** to **transponder**

NOTE Alternatively known as **down-link**.

cf. **up-link**

06.04.01
antenna
aerial (deprecated)
part of a radio transmitting or receiving system which is designed to provide the required coupling between a transmitter or a receiver and the medium in which radio wave propagates

[IEC 50 (712), 712-01-01]

NOTE 1 Antenna structures, often encountered in **radio frequency identification** systems, may be used to both transmit and receive electromagnetic energy, particularly data modulated electromagnetic energy.

NOTE 2 See also **dipole antenna**.

06.04.02
dipole antenna
symmetrical antenna composed of conductors usually rectilinear and energized by a balanced feed

NOTE 1 The word “dipole” is sometimes used to describe antennas which do not conform in all respects to the above definition. In such cases, the word should be qualified, for example: “asymmetrical dipole”.

[IEC 50 (712), 712-04-23]

NOTE 2 Dipole antennas comprising a single conductor of length approximately equal to half the wavelength of the **carrier** wave.

NOTE 3 Dipole antennas provide the basis for a range of other more complex forms of **antenna**.

06.04.03
exciter
electronic circuits used to drive an antenna

NOTE The combination of exciter and antenna is often referred to as the transmitter or scanner.

06.04.04
memory card(1)
read/write or re-programmable **tag** credit card sized

NOTE Data may be accessed via direct contact, through a microprocessor (smart card) or via a radio link (non-contact).

06.04.05
memory card(2)
deprecated synonym for flash memory card

[IEC 60050-713:1998, 713-06-03]

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06.04.06
transponder
combination of radio transmitter and radio receiver, which transmits a signal automatically in response to an appropriate triggering signal

NOTE The signal transmitted in response is in part predetermined and is generally different from the response to an appropriate triggering signal.

[IEC 60050-713, 713-08-04]

06.04.07
on-board equipment
OBE
on-board transponders
transponders fitted to a vehicle or item to be identified and containing the unique or unambiguous positive identification and associated data

06.04.08
planar array
flat panel antenna
array in which corresponding points of the radiating elements lie in a plane

[IEC 50(712), 712-01-07]

NOTE May be characterized as flat, conductive sheet **antennas**, usually made of metal plate or foil.

06.04.09
programmer
electronic device for entering or changing programming data in a **transponder**, usually via a close **proximity**, inductively coupled data transfer link

06.04.10
sensor
electronic device that senses a physical condition or chemical compound and delivers an electronic signal proportional to the observed characteristic

06.04.11
transceiver
transmitter-receiver
combination in a single unit of a radio transmitter and radio receiver employing common circuit components and usually the same antenna for both transmitting and receiving

[IEC 60050-713:1998 713-08-02]

06.04.12
transmitter
electronic device for creating an **electromagnetic wave** and delivering an **electromagnetic field** via an antenna for the purpose of transmitting energy and/or communicating by a modulated data information to a tag

NOTE Often considered separately from the **antenna**, as the means whereby the antenna is energized. In this respect it is also referred to as an exciter.

06.04.13
surface acoustic wave
SAW
technology used for automatic identification in which low power microwave **radio frequency** signals are converted to ultrasonic acoustic signals by a piezoelectric crystalline material in the **tag**

NOTE Variations in phase shift in the reflected signal can be used to provide a unique identity.

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4 Abbreviations

OBE	on-board equipment
TBR	technical basis for regulation
SRD	short range device
PWM	pulse width modulation
PDM	pulse duration modulation
PSK	pulse shift keying
MSK	minimum shift keying
GMSK	gaussian minimum shift keying
FSK	frequency shift keying
FHSS	Frequency Hopping Spread Spectrum modulation
DSSS	direct sequence spread spectrum modulation
DBPSK	differential binary phase shift keying
BPSK	binary phase shift keying
ARQ	automatic repeat request
ASK	amplitude shift keying
TDM	time division multiplexing
TDD	time division duplexing
S/N	signal/noise ratio
SINAD	signal to noise & distortion
RSSI	receiving signal strength indicator
RFI	radio-frequency interference
RF/DC	radio frequency data communication
PPM	pulse position modulation
PM	phase modulation
MHz	megahertz
kHz	kilohertz
GHz	gigahertz
ETSI	European Telecommunications Standards Institute
ETS	European Telecommunications Standard
ETR	European Telecommunications Report
EIRP	effective radiated power
EMI	electromagnetic interference
CDMA	code division multiple access(2)
CSMA/CD	Carrier Sense Multiple Access with Collision Detection
CSMA	Carrier Sense Multiple Access(2)
SAW	surface acoustical wave

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