



Glossary of Terminology & Acronyms

RFID | Radio Frequency Identification

Accelerometer: A device that measures acceleration (the rate of change of velocity). An accelerometer inherently measures its own motion (locomotion), as opposed to a device based on remote sensing.

Active tag: An RFID tag that has a transmitter to send back information, rather than reflecting back a signal from the reader, as a passive tag does. Most active tags use a battery to transmit a signal to a reader. However, some tags can gather energy from other sources. Active tags can be read from 300 feet (100 meters) or more, but they're expensive (typically more than US\$20 each). They're used for tracking expensive items over long ranges. For instance, the U.S. military uses active tags to track containers of supplies arriving in ports.

Active transponder: see Active tag.

Addressability: The ability to write data to different fields, or blocks of memory, in the microchip in an RFID tag.

Agile reader: A generic term that usually refers to an RFID reader that can read tags operating at different frequencies or using different methods of communication between the tags and readers.

Air interface: The conductor free medium, usually air, between a **transponder** and a **reader/interrogator** through which data communication is achieved by means of a modulated inductive or propagated electromagnetic field.

AIM: The industry association for Automatic Identification and Mobility.

Alignment: A term to express the orientation of a **transponder** relative to the **reader/interrogator** antenna. Alignment can influence the degree of coupling between transponder and reader, separation being a further influence.

Alphanumeric: Strictly data comprising both alphabetical and numeric characters. For example, A1234C9 as an alphanumeric string. The term is often used to include other printable characters such as punctuation marks.

Amplitude: The maximum absolute value of a periodic curve measured along its vertical axis (the height of a wave, in layman's terms).

Amplitude modulation: Changing the amplitude of a radio wave. A higher wave is interpreted as a 1 and a normal wave is interpreted as a zero. By changing the wave, the RFID tag can communicate a string of binary digits to the reader. Computers can interpret these digits as digital information. The method of changing the amplitude is known as amplitude shift keying, or ASK.

Amplitude shift keying: Changing the amplitude of the wave to communicate data stored on a tag.

ANSI (American National Standards Institute): An American technical standards body and the representative of the United States to the International Organization for Standardization.

Antenna: The **tag antenna** is the conductive element that enables the tag to send and receive data. Passive, low- (135 kHz) and high-frequency (13.56 MHz) tags usually have a coiled antenna that couples with the coiled antenna of the reader to form a magnetic field. UHF tag antennas can be a variety of shapes. Readers also have antennas which are used to emit radio waves. The RF energy from the **reader antenna** is "harvested" by the antenna and used to power up the microchip, which then changes the electrical load on the antenna to reflect back its own signals.

Anti-collision: A general term used to cover methods of preventing radio waves from one device from interfering with radio waves from another. Anti-collision algorithms are also used to read more than one tag in the same reader's field.

API: A source-code interface provided by a computer system or program library to support a computer program's requests for services. Unlike an application binary interface, an API is specified in terms of a programming language that can be compiled when an application is built, rather than an explicit low-level description of how data is laid out in memory.

Applet: A software component designed to run in the context of another program, such as a Web browser.

Application Programming Interface: A source-code interface provided by a computer system or program library to support a computer program's requests for services. Unlike an application binary interface, an API is specified in terms of a programming language that can be compiled when an application is built, rather than an explicit low-level description of how data is laid out in memory.

Application-Specific Integrated Circuit (ASIC): An integrated circuit (IC) customized for a particular use (such as a chip designed solely to run a cell phone) rather than general use.

Asset Tracking: One of the most common applications for RFID. Placing RFID transponders on or in high-value assets and returnable transport containers enables companies to gather data on their location quickly and with little or no manual intervention. Tagging assets allows companies to increase asset utilization, identify the last known user of assets, automate maintenance routines and reduce lost items.

Attenuation: The reduction of energy.

Attenuator: A device that attaches to a transmission line (a coaxial cable) that reduces the power of the RF signal as the signal travels through the cable from the reader to the antenna. Attenuators usually work by dissipating the RF energy as heat.

Authentication: The verification of the identity of a person, object or process. In RFID, the term is used in two ways. For contactless smart cards and other payments systems, the reader must make sure the transponder is a valid device within the system. That is, someone is not using an unauthorized device to commit fraud. There is also some talk of using EPC technology to authenticate products as a way of reducing counterfeiting.

Automatic Identification: A broad term that covers methods of collecting data and entering it directly into computer systems without human involvement. Technologies normally considered part of auto-ID include bar codes, biometrics, RFID and voice recognition.

Automatic identification and data capture: A broad term that covers methods of identifying objects, capturing information about them and entering it directly into computer systems without human involvement. Technologies normally considered part of auto-ID include bar codes, biometrics, RFID and voice recognition.

Awake: The condition of a **transponder** when it is able to respond to **interrogation**.

B

Backscatter: A method of communication between passive tags (ones that do not use batteries to broadcast a signal) and readers. RFID tags using backscatter technology reflect back to the reader radio waves from a reader, usually at the same carrier frequency. The reflected signal is modulated to transmit data.

Bandwidth: The range or band of frequencies, defined within the **electromagnetic spectrum**, that a system is capable of receiving or delivering.

Bar code: A standard method of identifying the manufacturer and product category of a particular item. The bar code was adopted in the 1970s because the bars were easier for machines to read than optical characters. Bar codes' main drawbacks are they don't identify unique items and scanners have to have line of sight to read them.

Base station: An RFID reader that is connected to a host system.

Batch reading: The process or capability of a radio frequency identification reader/interrogator to read a number of transponders present within the system's **interrogation zone** at the same time. Alternative term for **Multiple Reading**.

Battery-assisted tag: These are RFID tags with batteries, but they communicate using the same backscatter technique as passive tags (tags with no battery). They use the battery to run the circuitry on the microchip and sometimes an onboard sensor. They have a longer read range than a regular passive tag because all of the energy gathered from the reader can be reflected back to the reader. They are sometimes called "semi-passive RFID tags."

Beacon: An active or semi-active RFID tag that is programmed to wake up and broadcast its signal at a set intervals.

Bistatic: A bistatic RFID interrogator, or reader, uses one antenna to transmit RF energy to the RFID tag and a different antenna to receive energy reflected back from the tag.

Block check character (BCC): A parity error checking character added to data for the purposes of detecting transmission errors.

Words deleted: all references to binary number system, bits and bytes

C

Capacitor: An electric circuit element used to store a charge temporarily. A capacitor usually consists of two metallic plates separated and insulated from each other by a dielectric substance.

Capacity – Channel: A measure of the transmission capability of a communication channel expressed in bits.s⁻¹ and related to channel bandwidth and signal to noise ratio by the Shannon equation; Capacity, $C = B \log_2 (1 + S/N)$, where B is the bandwidth and S/N the signal to noise ratio.
Compare Capacity - Data

Capacity – Data: A measure of the data, expressed in bits or bytes, that can be stored in a transponder. The measure may relate simply to the bits that are accessible to the user or to the total assembly of bits,

including data identifier and error control bits.
Compare Capacity – Channel

Capture Field/Area/Zone (also Interrogation Zone/ Area/Volume): The region of the electromagnetic field, determined by the reader/interrogator antenna, in which the transponders are signaled to deliver a response.

Card operating system: The software program stored in the smart card IC, which manages the basic functions of the card, such as communication with the terminal, security management and data management in the smart card file system.

Carrier: Abbreviated term for Carrier Frequency.

Carrier Frequency: 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.
See also Tolerance.

CEPT (Conférence Européenne des Administrations des Postes et Télécommunications): The body responsible for European efficient utilisation of Spectrum and related regulatory matters.

Channel: A medium or medium associated allocation, such as carrier frequency, for electronic communication.

Channel encoding: The application of coding schemes to facilitate effective channel transmission of the source encoded data.
Compare Source encoding. See also Channel decoding.

Channel decoding: The process of operating upon a received transmission to separate the source-encoded data from the channel encoded form.
Compare Source decoding. See also Channel encoding.

Character set: A set of characters assembled to satisfy a general or application requirement.

Checksum: A code added to the contents of a block of data stored on an RFID microchip that can be checked before and after data is transmitted from the tag to the reader to determine whether the data has been corrupted or lost. The cyclic redundancy check is one form of checksum.

Chip: In data communication terms, the smallest duration of a pseudo-random code sequence used in spread spectrum communication systems.

Chipless RFID tag: An RFID tag that doesn't depend on a silicon microchip. Some chipless tags use plastic or conductive polymers instead of silicon-based microchips. Other chipless tags use materials that reflect back a portion of the radio waves beamed at them. A computer takes a snapshot of the waves beamed back and uses it like a fingerprint to identify the object with the tag. Companies are experimenting with embedding RF reflecting fibers in paper to prevent unauthorized photocopying of certain documents. Chipless tags that use embedded fibers have one drawback for supply chain uses—only one tag can be read at a time.

Chipping: The 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.
See also Frequency Hopping Spread Spectrum.

Circular-polarized antenna: A UHF reader antenna that emits radio waves in a circular pattern. These antennas are used in situations where the orientation of the tag to the reader cannot be controlled. Since the waves are moving in a circular pattern, they have a better chance of hitting the antenna, but circular-polarized antennas have a shorter read range than linear-polarized antennas.

Clocking information: Timing signals or pulses used to synchronize the transfer of data from a source to a host destination.

Closed Systems (closed loop systems): Within the context of radio frequency identification, they are systems in which data handling, including capture, storage, and communication are under the control of the organization to which the system belongs.
Compare with Open Systems.

Code Plate: An alternative colloquial term for transponder or tag.

Collision: A term to denote an event in which two or more data communication sources compete for attention at the same time and cause a clash of data, inseparable without some means of anti-collision or contention management.

Collision avoidance: A means of avoiding collisions or clashes of data from different sources competing for attention at the same time.
See also Anti-clash (Anti-contention)

Commissioning a tag: This term is sometime used to refer to the process of writing a serial number to a tag (or programming a tag) and associating that number with the product it is put on in a database.

Compatibility: The 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. An alternative term for Interchangeability.
Compare Interoperability.

Compliance Labeling: Many industries, including the auto, technology and aerospace industries, have established label standards for products and goods moving through the supply chain. These standards specify the use of mandatory data fields, acceptable bar code symbologies, print quality minimums and environmental considerations. Compliance labeling standards ensure that everyone practices a similar labeling approach that clearly defines the label format, usage, and the information to include on the label. There are no compliance labeling standards yet for RFID, but some consider bar-code labels with embedded UHF EPC tags as compliance labels.

Concatenation: The facility to link together specific items of data, held in data carriers, to form a single file or field of data.

Concentrator: A means of connecting a number of data communication devices and concentrating packets of data at a local point before onward transmission on a single link to a central data processor or information management system. In contrast to multiplexors concentrators usually have a buffering capability to 'queue' inputs that would otherwise exceed transmission capacity.
See also Multiplexor.

Conductive Ink: A type of ink able to conduct a signal, usually containing powdered silver and carbon. With conductive ink, companies can draw or print circuits on a variety of materials. Conductive ink provides a cheap method for printing circuit boards on paper, for instance.

Conductor: A material, such as aluminum and copper, which readily conducts electricity. Conductors have a significant impact on the performance of RFID tags. Conductors near tags can reflect RF energy in a way that reduces tag performance, and they can also detune the tag.

Contactless smart card: An awkward name for a credit card or loyalty card that contains an RFID chip to transmit information to a reader without having to be swiped through a reader. Such cards can speed checkout, providing consumers with more convenience.

Contention (Clash): Term denoting simultaneous transponder responses capable of causing potential confusion, and misreading, within a reader/interrogator system unequipped with anti-contention facilities.

Continuous reporting: A mode of reader/interrogator operation wherein the identification of a transponder is reported or communicated continuously while the transponder remains within the interrogation field. See also In-field Reporting.

Continuous Wave Modulation (CW): A data modulation scheme in which the data is represented by the carrier signal being switched on and off. The scheme is identical to amplitude shift keying (ASK) with 100% depth of modulation – known as on-off keying (OOK).

Corruption-data: In data terms, the manifestations of errors within a transmitted data stream due to noise, interference or distortion.

Cryptographic coprocessor: Special circuitry that perform cryptographic calculations, such as modular arithmetic and large integer calculations. These circuits are added to a standard processor core and therefore are called coprocessors.

Cyclic Redundancy Check (CRC): An error detection algorithm which exploits the attributes of modulo-2 arithmetic to generate, through the use of a generator polynomial, a transmission polynomial, comprising the message polynomial and a parity polynomial.

Data: Representations, in the form of numbers and characters for example, to which meaning may be ascribed.
Compare with Information.

Data carrier: A medium that holds machine-readable data. Bar codes and RFID tags are types of data carriers. The term is also applied to a carrier frequency used to transmit data.

Data Rate (Data Transfer Rate): In a radio frequency identification system, the rate at which data is communicated between transponder and the reader/interrogator, expressed in baud, bits.s⁻¹ or bytes.s⁻¹

Data Field: A defined area of memory assigned to a particular item or items of data.

Data Field Protection: The facility to control access to and operations upon items or fields of data stored within the transponder.

Data Identifier: A specific character, or string of characters, that denotes the nature or intended use of the data that follows.

Data retention: The ability of a microchip to maintain the information stored in EEPROM. RFID tags and other microchips can typically retain data for 10 years or more, but data retention depends on temperature, humidity and other factors.

Data transfer: The process of transferring data from a data holding source to a destination.

Demodulation: Process of recovering channel encoded data from a modulated carrier waveform.
Compare Modulation.

De-tuning: The reduction in performance of transponders and readers/interrogators caused by the close proximity of metal influencing the resonance of an electronic tuned circuit.

Die: The silicon block onto which circuits have been etched to create a microchip.

Dielectric: Unable to conduct direct electric current. Dielectric substances are used as insulators.

Dielectric constant: The measure of a material's ability to store a charge when an electric field is applied, or its "capacitance." If a material has a high dielectric constant, it reflects more RF energy and detunes the antenna more, which makes it harder to tag. Examples of materials with a low dielectric constant are dry paper (2), plastics (most are between 2 and 4), and glass (between 5 and 10). Water's dielectric constant changes: At room temperature it is 80; near boiling it is 55; and when frozen it is 3.2.

Digital certificate: A digital message that contains the identity of an company or organization, its public key combined and a signature of this data from a certificate authority (Trust Center) proving the correctness of this data.

Dipole (antenna): A fundamental form of antenna, comprising a single conductor of length approximately equal to half the wavelength of the carrier wave. Provides the basis for a range of other more complex forms of antenna.

Directivity-antenna: The ability of an antenna to concentrate radiated energy in a preferred direction, when considered in a transmitter mode. Alternatively, the ability to reject signals that are off-axis to the normal of the antenna, when considered in the receiver mode. May be expressed as a ratio of power radiated per unit solid angle in a defined direction to the total power radiated by the antenna. See also Efficiency – antenna.

Direct Sequence Spread Spectrum (DSSS): A category of spread spectrum modulation in which the source base-band bit stream is multiplied by a fast pseudorandom binary sequence to produce a signal that exhibits broad-band characteristics. Alternatively, the pseudorandom sequence and its inverse are used to represent logic 1 and 0. See also Frequency Hopping Spread Spectrum

Dispersion – pulse: The spread in duration and form experienced by a pulse in transmission through a communication channel. See also Intersymbol Interference.

Distortion: Any disturbance that causes an unwarranted change in the form or intelligibility of a signal. The distortion exhibits a noise-like effect that can be quantified as the ratio of the magnitude of the distortion component to the magnitude of the undistorted signal, usually expressed as a percentage. See also Signal to Noise Ratio and Signal to Noise and Distortion Ratio.

Downlink: Term which defines the direction of communications as being from reader/interrogator to transponder. Alternative term for Forward Link. Compare Uplink

Duplex: A channel capable of transmitting data in both directions at the same time. (Half duplex is a channel capable of transmitting data in both directions, but not simultaneously.)

Duty cycle: The length of time the reader can be emitting energy. Regulations in the European Union say readers can be on only 10 percent of the time.

E-seal: A method of sealing a digital document in a manner similar to that used for electronic signatures. Electronic seals enable computers to authenticate that documents or electronic messages have not been altered, providing a level of security in digital communications.

Edge server: A computer for running middleware or applications that is close to the edge of the network, where the digital world meets the real world. Edge servers are put in warehouses, distribution centers and factories, as opposed to corporate headquarters.

Effective Isotropic Radiated Power (EIRP): The product of the input power to an antenna and the gain relative to an isotropic source.

Effective Aperture: A term denoting the reception capability of a practical antenna expressed as the product of actual aperture and antenna efficiency.
See 'Propagation' summary box.

Efficiency-antenna: Two components distinguishable, radiation efficiency and aperture efficiency. Radiation efficiency is expressed as the ratio of total power radiated by the antenna to total power accepted by the antenna from source – for the transmission mode. Aperture efficiency is expressed as the ratio of effective antenna area to the real area of the antenna.

Electrically Erasable Programmable Read-Only Memory: A method of storing data on microchips. Usually bytes can be erased and reprogrammed individually. RFID tags that use EEPROM are more expensive than factory programmed tags, where the number is written into the silicon when the chip is made, but they offer more flexibility because the end user can write an ID number to the tag at the time the tag is going to be used.

Electromagnetic Coupling: A process of transferring modulated data or energy from one system component to another, reader to transponder for example, by means of an electromagnetic field.

Electromagnetic energy: A process of transferring modulated data or energy from one system component to another, reader to transponder for example, by means of an electromagnetic field.

Electromagnetic Field: The spatial and temporal manifestation of an electromagnetic source in which magnetic and electric components of intensity can be distinguished and plotted as contours, like contour lines on a map, the planes of the electric and magnetic contours being at right angles to one another. Where the source is varying in time so too the field components vary with time. Where the source launches an electromagnetic wave the field may be considered to be propagating.

Electromagnetic interference: Interference caused when the radio waves of one device distort the waves of another. Cell phones, wireless computers and even robots in factories can produce radio waves that interfere with RFID tags.

Electromagnetic spectrum: The range or continuum of electromagnetic radiation, characterised in terms of frequency or wavelength.

Electromagnetic wave: A sinusoidal wave in which electric E and magnetic H components or vectors can be distinguished at right angles to one another, and propagating in a direction that is at right angles to both the E and H vectors. The energy contained within the wave also propagates in the direction at right angles to the E and H vectors. The power delivered in the wave is the vector product of E and H (Poynting Vector).

Electronic article surveillance: Simple electronic tags that can be turned on or off. When an item is purchased (or borrowed from a library), the tag is turned off. When someone passes a gate area holding an item with a tag that hasn't been turned off, an alarm sounds. EAS tags are embedded in the packaging of most pharmaceuticals. They can be RF-based, or acousto-magnetic.

Electronic Data Interchange (EDI): Communication of a data message, or messages, automatically between computers or information management systems, usually for the purposes of business transactions.

Electronic Data Transfer (EDT): The transfer of data by electronic communication means from one data handling system to another.

Electronic Label: An alternative colloquial term for a transponder.

Electronic pedigree: A secure file that stores data about each move a product makes through the supply chain. Pedigrees can help to reduce counterfeiting of drugs and other products.

Electronic Product Code: A serial, created by the Auto-ID Center, which will complement barcodes. The EPC has digits to identify the manufacturer, product category and the individual item.

Electronic Seal: A method of sealing a digital document in a manner similar to that used for electronic signatures. Electronic seals enable computers to authenticate that documents or electronic messages have not been altered, providing a level of security in digital communications.

Encryption: A means of securing data, often applied to a plain or clear text, by converting it to a form that is unintelligible in the absence of an appropriate decryption key.
See also Scrambling.

Environmental Parameters: Parameters, such as temperature, pressure, humidity, noise that can have a bearing or impact upon system performance.

Error: In digital data terms, a result of capture, storage, processing or communication of data in which a bit or bits assume the wrong values, or bits are missing from a data stream.

Error burst: A group of bits in which two successive erroneous bits are always separated by less than a given number of correct bits.

Error control: Collective term to accommodate error detection and correction schemes applied to handle errors arising within a data capture or handling system.
See also Redundancy.

Error detection: A term to denote a scheme or action to determine the presence of errors in a data stream.

Error correction: A term to denote a scheme or action for correcting an error detected in a data stream.

Error correcting code (ECC): Supplemental bits introduced or source encoded into a data stream to allow automatic correction of erroneous bits and/or derivation of missing bits, in accordance with a specific computational algorithm.

Error correcting mode: Mode defined for a data communication or handling process in which missing or erroneous bits are automatically corrected.

Error correcting protocol: The rules by which an error correcting mode operates.

Error management: Techniques used to identify and/or correct errors within a data capture and handling system with the objective of assuring the accuracy of data presented to the system user.

ETSI (European Telecommunications Standards Institute): The European standards organization responsible for standardization in telecommunications.

European Article Number: A system for identifying products developed by EAN International, the bar code standards body in Europe. There are several types of bar codes that use EANs, including EAN-8, EAN-13 and EAN-14.

Event data: Information related to a transaction or incident with significance to the business. If a tag on a pallet is read as the pallet leaves a dock door, an event is recorded (the pallet was shipped). If a reader reads a tag on a pallet in a storage bay 100 times per minute but the pallet never moves, data is generated, but there is no event.

Exciter: The electronic circuits used to drive an antenna. The combination of exciter and antenna is often referred to as the transmitter or scanner.

Extended Binary Coded Data Interchange Code (EBCDIC): An eight-bit binary code set, sometimes referred to as extended ASCII, wherein the 128 character set of ASCII are accommodated, together with other characters and control functions, making up a total set of 256 characters.

F

Factory Programming: The entering of data into a transponder as part of the manufacturing process, resulting in a read-only tag.
Compare Field Programming.

False Activation: The result of a 'foreign' or non-assigned transponder entering the interrogation zone of a radio frequency identification system and affecting a response, erroneous or otherwise.

Far Field: The region of an electromagnetic radiation field at a distance from the antenna in which the field distribution is unaffected by the antenna structure and the wave propagates as a plane wave.
Compare Near Field.

Field of View: The zone surrounding a reader/interrogator in which the reader/interrogator is capable of communicating with a transponder.

Field Programming: Entry of data by an original equipment manufacturer (OEM) or user into a transponder by means of a proprietary programming system, usually undertaken before the device is attached to the item to be identified or accompanied. This facility is usually associated with Write Once Read Many (WORM) and read/write (RW) devices.

The data entered into a transponder may be by a combination of factory and field programming.
Compare In-use Programming.

Field Strength: The intensity of a field measured in units appropriate to the field concerned. Electric field strengths are measured in volts per meter ($V.m^{-1}$) and magnetic field strengths in amperes per meter ($A.m^{-1}$).

File: A set of data stored within a computer, portable data terminal or information management system.

Filler Character: A redundant character inserted into a data field simply to achieve a desired field length. Also known as a pad character.

Firmware: Coded instructions that are stored permanently in read-only memory. When upgrading a reader to read a new protocol, the firmware usually has to be changed. Some newer readers can be upgraded remotely over a network.

Form factor: The packaging in which a transponder can be put. These include thermal transfer labels, plastic cards, key fobs and so on.

Forward Link: Communications from reader/interrogator to transponder. Alternatively known as Downlink.
Compare Uplink.

Frequency: The number of cycles a periodic signal executes in unit time. Usually expressed in Hertz (cycles per second) or appropriate weighted units such as kilohertz (kHz), Megahertz (MHz) and Gigahertz (GHz).

Frequency Hop Rate: The frequency at which a frequency hopping spread spectrum (FHSS) system moves between transmission frequencies. It is equal to the reciprocal of the dwell time at a FHSS centre frequency.

Frequency Hop Sequence: A pseudorandom binary sequence (PRBS) determining the hopping frequencies used in frequency hopping spread spectrum (FHSS) systems.

Frequency Hopping Spread Spectrum (FHSS): A category of spread spectrum modulation in which each bit of data is divided into chips and each chip is represented by a different spectral component or tone in the spread spectrum band using a pseudorandom sequence to assign tones. Modulated in this way the transmissions hop from frequency to frequency within the band, requiring a receiver synchronized to the pseudorandom chipping sequence to recover the data.
See also Direct Sequence Spread Spectrum.

Frequency Modulation (FM): Representation of data or signal states by using different transmission frequencies. Where data is in binary form, the modulation constitutes two transmission frequencies and is referred to as Frequency Shift Keying (FSK).

Frequency Shift Keying (FSK): Representation of binary data by switching between two different transmission frequencies.

Full Duplex (FDX): A channel communications protocol that allows a channel to transmit data in both directions at the same time. In RFID, the method of information exchange in which the information is communicated while the transceiver transmits the activation field.
Compare Half Duplex.

G

Global Commerce Initiative: A user group founded in October 1999 by manufacturers, retailers and trade industry associations, to improve the performance of the international supply chain for consumer goods through the collaborative development and endorsement of recommended voluntary standards and best practices. Its charter is to drive the implementation of EAN•UCC standards and best practices, including use of EPC.

Global data synchronization: A term that generally refers to the process of ensuring that a manufacturer's master files with product information match those of retailers. GDS is an important prerequisite to deploying RFID in open supply chains because companies need to ensure that RFID serial numbers refer to the right product information in a database.

Global Location Number: A numbering scheme created by EAN International and the Uniform Code Council to as a means to identify virtually limitless numbers of legal entities, trading parties and locations to support the requirements of electronic commerce (B2B and B2C). Parties and locations that can be identified with GLNs include functional entities (e.g., a purchasing, accounting or returns department), physical entities (e.g., a particular room in a building, warehouse, loading dock, delivery point) and legal entities or trading partners (e.g. buyers, sellers, whole companies, subsidiaries or divisions such as suppliers, customers, financial services companies, or freight forwarders).

Global Positioning System: Developed for and managed by the United States military, GPS is a satellite navigation system. It consists of 24 satellites above the earth. They transmit radio signals to receivers placed on ships, trucks or other large assets that need to be tracked. The receivers compute longitude and latitude and velocity by calculating the difference in the time signals are received from four different satellites. Some companies are integrating RFID and GPS systems to track assets in transit.

Global System for Mobiles (GSM): The digital cellular telephone system, widely used in Europe, Asia and Australia.

Global Trade Item Number (GTIN): A standardized system of identifying products and services created by the Uniform Code Council and EAN International. Product identification numbers, such as EAN/UCC-8, UCC-12, EAN/UCC-13, and EAN/UCC-14, are based on the GTIN.

H

Half Duplex (HDX): A channel communications protocol that allows a channel to transmit data in both directions but not at the same time. In RFID, the method of information exchange in which the information is communicated after the transceiver has stopped transmitting the activation field. Compare Full Duplex.

Handshaking: A protocol or sequence of signals for controlling the flow of data between devices, which can be hardware implemented or software implemented.

Harmonics: Multiples of a principal frequency, invariably exhibiting lower amplitudes. Harmonics can be generated as a result of circuit non-linearities associated with radio transmissions resulting in harmonic distortion.
See also Spurious emissions.

Hexadecimal (Hex): A column placing method of representing data to the base of 16, using digits 0-9 and letters A to F for decimal values 10 - 15. For example, 1010 = A16 and 2210 = 6F16 Used as a convenient short hand notation for representing 16 and 32 bit memory addresses.

High-frequency: This is generally considered to be from 3 MHz to 30 MHz. HF RFID tags typically operate at 13.56 MHz. They can be read from less than 3 feet away and transmit data faster than low-frequency tags. But they consume more power than low-frequency tags.

Host system: A computer on a network, which provides services to users or other computers on that network.

Hybrid card: A smart card that has both a contactless IC and a contact IC. Unlike a dual interface card, a hybrid card acts as two separate cards.

Hysteresis: A retardation of an effect when the forces acting upon a body are changed. When corrugated boxes and other materials absorb water and then dry, they are never as RF-friendly as they were before they became moist.

I

ID Filter: A software facility that compares a newly read identification (ID) with those within a database or set, with a view to establishing a match.

Impact: Any influence upon a system, environmental or otherwise, that can influence its operational performance.

Incorrect Read: The failure to read correctly all or part of the data set intended to be retrieved from a transponder during read or interrogation process. Alternative term for Misread.

In-Field Reporting: A mode of operation in which a reader/interrogator reports a transponder ID on entering the interrogation zone and then refrains from any further reports until a prescribed interval of time has elapsed.

See also Out of Field Reporting.

In-Use Programming: The ability to read from and write to a transponder while it is attached to the object or item for which it is being used.

Compare Factory Programming, Field Programming.

Inductive coupling: A 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.

Interface: A physical or electrical interconnection between communicating devices.

See also RS232, RS422 and RS485.

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

Interchangeability: The 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. An alternative term for compatibility.

Compare Interoperability.

Intelligent reader: A generic term that is sometimes used to describe a reader that has the ability to filter data, execute commands and generally perform functions similar to a personal computer.

Intentional radiator: A device that produces a RF signal for the purpose of data communications.

Examples. Include garage door openers, cordless phones, RFID transmitter and so on.

International Organization for Standardization: A non-governmental organization made up of the national standards institutes of 146 countries. Each member country has one representative and the organization maintains a Central Secretariat in Geneva, Switzerland, that coordinates the system.

Interoperability: The ability of systems, from different vendors, to execute bi-directional data exchange functions, in a manner that allows them to operate effectively together.

Interrogation: The process of communicating with, and reading a transponder

Interrogator: A fixed or mobile data capture and identification device using a radio frequency electromagnetic field to stimulate and effect a modulated data response from a transponder or group of transponders present in the interrogation zone. Often used as an alternative term to Reader.

See also Reader.

Interrogation zone: The region in which a transponder or group of transponders can be effectively read by an associated radio frequency identification reader/interrogator.

Intersymbol Interference: Interference arising within a serial bit stream as a result of pulse dispersion and consequential overlapping pulse edges, leading possibly to decoding errors at the receiver.

ISO 10536: The international standard for proximity cards

ISO 11784: The international standard defining frequencies, baud rate, bit coding and data structures of the transponders used for animal identification.

ISO 14443: A set of international standards covering proximity smart cards.

ISO 15693: The international standard for vicinity smart cards.

ISO 18000: A series of international standards for the air interface protocol used in RFID systems for tagging goods within the supply chain.

ISO 7816: A set of international standards covering the basic characteristics of smart cards, such as physical and electrical characteristics, communication protocols and others.

Isotropic source: An ideal electromagnetic source or radiator exhibiting a perfect spherical energy radiation pattern.

Item-level: A term used to describe the tagging of individual products, as opposed to case-level and pallet-level tagging.

L

Label applicator: A device that applies labels to cases or other items. Some label applicators can print bar codes on and encode RFID transponders in labels before applying the labels.

License plate: This term generally applies to a simple RFID that has only a serial number that is associated with information in a database. The Auto-ID Center promoted the concept as a way to simplify the tag and reduce the cost.

Lifetime: The period of time during which an item of equipment exists and functions according to specification.

See also Mean time between failures and Mean Time to Repair.

Linear-polarized antenna: An antenna that focuses the radio energy from the reader in one orientation or polarity. This increases the read distance possible and can provide greater penetration through dense materials. Tags designed to be used with a linear polarized reader antenna must be aligned with the reader antenna in order to be read. (See circular-polarized antenna.)

Low-frequency: From 30 kHz to 300 kHz. Low-frequency tags typical operate at 125 kHz or 134 kHz. The main disadvantages of low-frequency tags are they have to be read from within three feet and the rate of data transfer is slow. But they are less subject to interference than UHF tags.

M

Manchester coding: A bi-phase code format in which each bit in the source encoded form is represented by two bits in the derived or channel encoded form. The transformation rule ascribes 01 to represent 0 and 10 to represent 1.

Manufacturers Tag ID (MfrTagID): A reference number which uniquely identifies the tag.

Mean time between failures (MTBF): The average or mean time interval between failures, often expressed as the reciprocal of the constant failure rate.

Mean time to repair: The length of time that a system is non-operational between failure and repair.

Memory: A means of storing data in electronic form. A variety of random access (RAM), read-only (ROM), Write Once-Read Many (WORM) and read/write (RW) memory devices can be distinguished. In RFID terms, it's the amount of data that can be stored on the microchip in an RFID tag. It can range from 64 bits to 2 kilobytes or more on passive tags.

Memory block: Memory on the microchip in an RFID tag is usually divided into sections, which can be read or written to individually. Some blocks might be locked, so data can't be overwritten, while others are not.

Memory Modules: Colloquial term for a read/write or re-programmable transponder.

Microcontroller: A complete microprocessor on a chip. A microcontroller includes a central processing unit, RAM or EPROM, clock and control circuits, and serial and parallel I/O ports.

Microprocessor: The silicon chip that is the heart of a computing system. It includes a central processing unit, internal registers, control logic and bus interfaces to external memory and input-output ports. Some advanced systems also include floating point processors and some memory.

Microwave: A high-frequency electromagnetic wave, one millimeter to one meter in wavelength.

Microwave tags: A term that is sometimes used to refer to RFID tags that operate at 5.8 GHz. They have very high transfer rates and can be read from as far as 30 feet away, but they use a lot of power and are expensive. (Some people refer to any tag that operates above about 415 MHz as a microwave tag.)

Middleware: In the RFID world, this term is generally used to refer to software that resides on a server between readers and enterprise applications. The middleware is used to filter data and pass on only useful information to enterprise applications. Some middleware can also be used to manage readers on a network.

Misread: A condition that exists when the data retrieved by the reader/interrogator is different from the corresponding data within the transponder.

Modulation: A term to denote the process of superimposing (modulating) channel encoded data or signals onto a radio frequency carrier to enable the data to be effectively coupled or propagated across an air interface. Also used as an associative term for methods used to modulate carrier waves. Methods generally rely on the variation of key parameter values of amplitude, frequency or phase. Digital modulation methods principally feature amplitude shift keying (ASK), frequency shift keying (FSK), phase shift keying (PSK) or variants. See also Amplitude, Frequency and Phase Modulation, Amplitude Shift Keying, Frequency Shift Keying and Phase Shift Keying.

Modulation Index: The size of variation of the modulation parameter (amplitude, frequency or phase) exhibited in the modulation waveform.

Multiple Reading: The process or capability of a radio frequency identification reader/interrogator to read a number of transponders present within the system's interrogation zone at the same time. Alternative term for Batch Reading.

Multiplexor (Multiplexer): A device for connecting a number of data communication channels and combining the separate channel signals into one composite stream for onward transmission through a single link to a central data processor or information management system. At its destination the multiplexed stream is de-multiplexed to separate the constituent signals. Multiplexors are similar to concentrators in many respects, a distinction being that concentrators usually have a buffering capability to 'queue' inputs that would otherwise exceed transmission capacity. See also Concentrator.

N

National Institute for Standards and Technology (NIST): An American standards body that establishes standards for information-processing technology, particularly IT used by the Federal government.

Near-field communication: RFID reader antennas emit electromagnetic radiation (radio waves). If an RFID tag is within full wavelength of the reader, it is sometimes said to be in the "near field" (as with many RFID terms, definitions are not precise). If it is more than the distance of one full wavelength away, it is said to be in the "far field." The near field signal decays as the cube of distance from the antenna, while the far field signal decays as the square of the distance from the antenna. So passive RFID systems that rely on near-field communication (typically low- and high-frequency systems) have a shorter read range than those that use far field communication (UHF and microwave systems)

Noise: Unwanted extraneous electromagnetic signals encountered within the environment, usually exhibiting random or wide band characteristics, and viewed as a possible source of errors through influence upon system performance.
Compare Interference.

Noise immunity: A measure of the extent or capability of a system to operate effectively in the presence of noise.

O

Omnidirectional: A description of a transponder's ability to be read in any orientation.

On-off Keying (OOK): A special case of amplitude shift keying (ASK) in which the carrier is switched between full carrier amplitude and zero or absence of carrier amplitude, according to data value (1 or 0).

Open Systems: Within the context of radio frequency identification, they are systems in which data handling, including capture, storage and communication, is determined by agreed standards, so allowing various and different users to operate without reference to a central control facility.
Compare with Closed System.

Orientation: The attitude of a transponder with respect to the antenna, expressed in three dimensional angular terms, with range of variation expressed in terms of skew, pitch and roll.

Orientation Sensitivity: The sensitivity of response for a transponder expressed as a function of angular variation or orientation.

Out of Field Reporting: A mode of operation in which the identification of a transponder is reported as or once the transponder leaves the reader interrogation zone.

Parity: A simple error detecting technique, used to detect data transmission errors, in which an extra bit (0 or 1) is added to each binary represented character to achieve an even number of 1 bits (even parity) or an odd number of 1 bits (odd parity). By checking the parity of the characters received a single errors can be detected. The same principle can be applied to blocks of binary data.

Passive Transponder (Tag): A battery-free data carrying device that reacts to a specific, reader produced, inductively coupled or radiated electromagnetic field, by delivering a data modulated radio frequency response. Having no internal power source, passive transponders derive the power they require to respond from the reader/interrogator's electromagnetic field.
Compare Active Transponders (Tags).

Penetration: Term used to indicate the ability of electromagnetic waves to propagate into or through materials. 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. Metals constitute good reflectors for freely propagating electromagnetic waves, with very little of an incident wave being able to propagate into the metal surface.

Phase Modulation (PM): Representation of data or signal states by the phase of a fixed frequency sinusoidal carrier wave. Where data is in binary form the modulation involves a phase difference of 180° between the binary states and is referred to as Phase Shift Keying (PSK).

Phase Shift Keying (PSK): Representation of binary data states, 0 and 1, by the phase of a fixed frequency sinusoidal carrier wave, a difference of 180° being used to represent the respective values.

Polar Field Diagram: A graphical representation of the electric or magnetic field intensity components of an electromagnetic field, expressed on a polar co-ordinate system (distance v angle, through 360°). Typically used to illustrate the field characteristics of an antenna.

Polarisation: The locus or path described by the electric field vector of an electromagnetic wave, with respect to time.

Port Concentrator: A device that accepts the outputs from a number of data communication interfaces for onward transmission into a communications network.

Power-levels and flux density: The vector product of electric and magnetic field strengths within an electromagnetic wave, expressed as levels in watts and as a power flux density, measured at a distance from the source, in watts per square meter (W.m⁻²). Low power radio frequency transmissions are generally expressed in milli- or microwatts.

It is usual to express the levels and flux densities in terms of decibels, whereby the power level is referenced to an appropriate level, such as a watt or a milliwatt. Using this approach levels are distinguished in dBW (reference to 1 watt) and dBm (referenced to 1mW) and power flux densities in terms of dBW.m⁻².

Note: Power level (dB) = 10 log₁₀ Pr/Pref where Pr is the measured power and Pref the reference power level.

Programmability: The ability to enter data and to change data stored in a transponder.

Programmer: An electronic device for entering or changing (programming) data in a transponder, usually via a close proximity, inductively coupled data transfer link.

Programming: The act of entering or changing data stored in a transponder.

Projected lifetime: The 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.

Protocol: A set of rules governing a particular function, such as the flow of data/information in a communication system.

Proximity: Term often used to indicate closeness of one system component with respect to another, such as that of a transponder with respect to a reader.

Proximity sensor: An electronic device that detects and signals the presence of a selected object. When used in association with a radio frequency identification system the sensor is set up to sense the presence of a tagged or transponder carrying object when it enters the vicinity of the reader/interrogator so that the reader can then be activated to effect a read.

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

Radio frequency identification system: An automatic identification and data capture system comprised of one or more reader/interrogators and one or more transponders in which data transfer is achieved by means of suitably modulated inductive or radiating electromagnetic carriers.

Radio Frequency Tag: Alternative term for a transponder.

Range – Read: The maximum distance between the antenna of a reader/interrogator and a transponder over which the read function can be effectively performed. The distance will be influenced by orientation and angle with respect to the antenna, and possibly by environmental conditions.

Range – Programming: The maximum distance between the antenna of a reader/interrogator and a transponder over which a programming function can be effectively performed. Usually shorter than the read range, but may be influenced by orientation and angle with respect to the antenna, and possibly by environmental conditions.

Read: The process of retrieving data from a transponder and, as appropriate, the contention and error control management, and channel and source decoding required to recover and communicate the data entered at source.

Readability: The ability to retrieve data under specified conditions.

Reader/Interrogator or Reader/Writer: An electronic device for performing the process of retrieving data from a transponder and, as appropriate, the contention and error control management, and channel and source decoding required to recover and communicate the data entered at source. The device may also interface with an integral display and/or provide a parallel or serial communications interface to a host computer or industrial controller.

Read Only: Term applied to a transponder in which the data is stored in an unchangeable manner and can therefore only be read.

Read Rate: The maximum rate at which data can be communicated between transponder and reader/interrogator, usually expressed in bits per second (bps or bits.s⁻¹).

Read/Write: Applied to a radio frequency identification system, it is the ability to both read data from a transponder and to change data (write process) using a suitable programming device.
See Reader/Interrogator

Redundancy: In information terms it is a term to describe the additional bits, such as those for error control or repeated data, over and above those required for transmitting the information message.

Reprogrammability: The ability to change the data content of a transponder using a suitable programming device.

RF Tag: Alternative, short hand term for a transponder.

RS232: A common physical interface standard specified by the EIA for the interconnection of devices. The standard allows for a single device to be connected (point-to-point) at baud values up to 9600 bps, at distances up to 15 meters. More recent implementations of the standard may allow higher baud values and greater distances.

RS422: A balanced interface standard similar to RS232, but using differential voltages across twisted pair cables. Exhibits greater noise immunity than RS232 and can be used to connect single or multiple devices to a master unit, at distances up to 3000 meters.

RS485: An enhanced version of RS422, which permits multiple devices (typically 32) to be attached to a two wire BUS at distances of over one kilometer.

S

SAW (Surface Acoustic Wave) devices: Devices using a transponder technology in which low power microwave signals are converted to ultrasonic waves by and on the surface of a piezoelectric crystal material forming the tag. Surface applied 'finger' transducers determine the form and data content of the reflected return signal.

Scrambling: The rearrangement or transposition of data to enhance security of stored data or the effectiveness of error control schemes.

Scanner: The combination of antenna, transmitter (or exciter), and receiver into a single unit is often referred to as a scanner. With the addition of electronics to perform the necessary decoding and management functions to deliver the source data, the unit becomes a reader.

Screening: 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.

Sensor: An electronic device that senses a physical entity and delivers an electronic signal that can be used for control purposes.

Separation: A term used to denote the operational distance between two transponders.

Signal to Noise (S/N): The ratio of signal level to the level of noise present in a system, usually expressed in decibels.

Signal to Noise & Distortion (SINAD): The ratio of combined signal, noise and distortion levels to the combined level of noise and distortion present in a system.

Sinusoidal carrier: A fundamental waveform, characterized by a single frequency and wavelength, used to carry data or information by modulating some feature of the waveform.
See also Modulation.

Source Decoding: The process of recovering the original or source data from a received source encoded bit stream.
Compare Source Encoding. See also Data Flow Model.

Source Encoding: The process of operating upon original or source data to produce an encoded message for transmission.

Spectrum – electromagnetic: The continuum of electromagnetic waves, distinguished by frequency components and bands that exhibit particular features or have been used for particular applications, including radio, microwave, ultraviolet, visual, infrared, X-rays and gamma rays.

Spectrum–signal: Expression used to denote the make-up of a signal or waveform in terms of sinusoidal components of different frequency and phase relationship (spectral components).

Spectrum Mask: The maximum power density of a transmission expressed as a function of frequency.

Spurious Emissions: Usually denotes unwanted electromagnetic harmonics. Type Approval testing includes measurement of harmonic emissions arising from the reader, to ensure they are within specified limits.

Spread Spectrum: Techniques for uniformly distributing or spreading the information content of a data carrying signal over a frequency range considerably larger than required for narrow band communication, allowing data to be recoverable under conditions of strong interference and noise.

SRD (Short range Device): A tag that is used at short range (less than 100mm)

Synchronization: The process of controlling the transmission of data using a separate or derived clocking signal.

Synchronous transmission: A method of data transmission that requires timing or clocking information in addition to data.

T

Tag: Colloquial term for a transponder. Commonly used and the term preferred by AIM for general usage.

Tolerance: The maximum permissible deviation of a system parameter value, caused by any system or environmental influence or impact. Usually expressed in parts per million (ppm). Tolerances are specified for a number of radio frequency parameters, including carrier frequencies, sub-carriers, bit clocks and symbol clocks.

Transceiver: A TRANSmitter/reCEIVER device used to both receive and transmit data.
See also Transmitter. Compare Transponder

Transmitter (Exciter): An electronic device for launching an electromagnetic wave or delivering an electromagnetic field for the purpose of transmitting or communicating energy or modulated data/information. 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.

Transponder: An electronic TRANSmitter/resPONDER, commonly referred to as a Tag.

U

Unifised active tag: An active tag or transponder in which the batteries are replaceable or sealed within the device.

Uplink: Term which defines the direction of communications as being from transponder to reader/interrogator.
Compare Downlink

V

Vector: A quantitative component that exhibits magnitude, direction and sense.

Verification: The process of assuring that an intended operation has been performed.

W

Write: The process of transferring data to a transponder, the internal actions of storing the data, which may also encompass the reading of data to verify the data content.

Write Once Read Many (WORM): Distinguishing a transponder that can be part or totally programmed once by the user, and thereafter only read.

Write Rate: The rate at which data is transferred to a transponder and stored within the memory of the device and verified. The rate is usually expressed as the average number of bits or bytes per second over which the complete transfer is performed.