INFORMATION SOCIETY TECHNOLOGIES (IST) PROGRAMME

Best Practice Action

D2.2 SIDCOM Training Material Contactless Technologies - Glossary Period 1: 01. July 2001 – 31. December 2001

Project acronym:	SIDCOM
Project full title:	Network on Sensing, Identification and Data Communications with passive Non-Contact Technologies
Proposal/Contract no.:	29551
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Date of printing:	13.02.2002 / 11:12 Revision 2.24

CONTACTLESS TECHNOLOGIES – GLOSSARY OF TERMS

Active Tag

Colloquial term for a radio frequency ***transponder*** powered partly or completely by a battery. Batteries may be replaceable or sealed within the device (when the term ***unitised active tag*** is sometimes used). Compare ***Passive Tag.***

Active Transponder

A battery-powered data carrying device that reacts to a specific, reader produced, inductively ***coupled*** or radiated ***electromagnetic field,*** by delivering a data ***modulated*** radio frequency response.

Compare ***Passive Transponder (Tag).***

Addressability

The ability to address bits, fields, pages, files or other defined areas of memory within a ***radio frequency tag***.

Air Interface

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

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.

Amplitude Modulation (AM)

Representation of data or signal states by the amplitude of a fixed frequency ***sinusoidal carrier*** wave. Where data is in binary form the modulation involves two levels of amplitude and is referred to as ***Amplitude Shift Keying*** (ASK).

Amplitude Shift Keying (ASK)

Representation of binary data states, 0 and 1, by the amplitude of a fixed frequency ***sinusoidal carrier*** wave. Where the amplitudes are determined by the carrier being switched on and off, the process is known as ***On-Off Keying*** (OOK).

Antenna

A conductive structure specifically designed to couple or radiate ***electromagnetic energy***. In a driven mode the structure is a transmitter antenna. In receiver mode the structure is a receiver antenna. Antenna structures, often encountered in ***radio frequency identification*** systems, may be used to both transmit and receive electromagnetic energy, particularly data modulated electromagnetic energy.

See also ***dipole***.

Anti-clash

(*Anti-contention)*

A term describing a facility for avoiding contention 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.

Asynchronous Transmission (Start/stop transmission)

A method of data transmission that does not require timing or ***clocking information*** in addition to data. Transmission is achieved by receiver reference to start and stop bits positioned at the beginning and end of each character or blocks of characters. A variable time interval can exist between characters or blocks of characters.

Compare ***Synchronous transmission***.

Awake

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

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***.
Bandwidth	The range or band of frequencies, defined within the ***electromagnetic spectrum***, that a system is capable of receiving or delivering.
Baud	A unit of signalling or transmission speed representing the number of signalling events per unit time. When the signal event is a single bit, binary state representation, the baud is equivalent to the bit rate, expressed in bits per second (bps). Compare ***Data Transfer Rate***.
BCC (Block Check Character)	A parity error checking character added to data for the purposes of detecting transmission errors.
BER (Bit Error Rate)	The ratio of the number of bits received in error to the total of bits transmitted.
Bi-directional	A term used to describe the capability of two way communication.
Bit rate	Rate at which bits are electronically communicated, measured in $bits.s^{-1}$
Bit Error Rate (BER)	The ratio of the number of bits received that are found to be in error to the total number of bits transmitted.
Byte	A group of bits, usually eight, used to represent characters in a binary processing system.
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
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 signalled to deliver a response.
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.
Channel	A medium or medium associated allocation, such as carrier frequency, for electronic communication.
Checksum	A summation of check digits used to determine if an error has occurred in the transmission of data.
Clocking information	Timing signals or pulses used to synchronise the transfer of data from a source to a host destination.
Closed 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 organisation to which the system belongs. Compare with ***Open Systems.***
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)***
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***.
Contention (Clash)	Term denoting simultaneous ***transponder*** responses capable of causing potential confusion, and misreading, within a ***reader/interrogator*** system unequipped with anti-contention facilities.
Corruption - data	In data terms, the manifestations of errors within a transmitted data stream due to noise, interference or distortion.
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 Capacity	See ***Capacity - 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 transfer	The process of transferring data from a data holding source to a destination.
Data Transfer Rate	See ***Data Rate***.
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.

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***

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 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 Label

An alternative colloquial term for a ***transponder***.

Encryption of data

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***.

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 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 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.

Error rate

See ***Bit Error Rate.***

Exciter

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

Factory Programming

The entering of data into a ***transponder*** as part of the manufacturing process, resulting in a ***read-only*** tag.

Compare ***Field Programming***.

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 metre ($V.m^{-1}$) and magnetic field strengths in amperes per metre ($A.m^{-1}$).

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 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***.

Handshaking

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

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***.
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.
Information - general	Something which is meaningful. Data may be regarded as information once its meaning is revealed.
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.
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***.
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***.
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.
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.
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 a 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.
Near field	The region of an electromagnetic field comprising two components, the reactive Rayleigh region immediately surrounding the antenna and a radiating near field or Fresnel component which exists when the major dimension of the antenna, D, is large compared with the wavelength, λ, of transmission.
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.
Noise immunity	A measure of the extent or capability of a system to operate effectively in the presence of noise.
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.
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^o 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^o being used to represent the respective values.
Programmability	The ability to enter data and to change 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.
Radio frequency identification system	An automatic identification and data capture system comprising 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 **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. See also ***Factory Programming***.
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 both read data from a transponder and to change data (write process) using a suitable programming device. See ***Reader/Interrogator***
Reprogrammability	The ability to change the data content of a transponder using a suitable programming device.

	programming device. See also ***In-use Programming***.
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 metres. 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 metres.
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 kilometre.
Scrambling	The rearrangement or transposition of data to enhance security of stored data or the effectiveness of error control schemes.
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.
SRD (Short range Device)	A tag that is used at short range (less than 100mm)
Synchronisation	The process of controlling the transmission of data using a separate or derived clocking signal.
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 energised. In this respect it is also referred to as an exciter.
Transponder	An electronic TRANSmitter/resPONDER, commonly referred to as a ***Tag***.
Uplink	Term which defines the direction of communications as being from ***transponder*** to ***reader/interrogator.*** Compare ***Downlink***

Verification	The process of assuring that an intended operation has been performed.
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 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.
Write Once Read Many (WORM)	Distinguishing a transponder that can be part or totally programmed once by the user, and thereafter only read.