

The EuroGPR Association Glossary of GPR terms

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Please note that this is live document and we encourage users of the glossary to give us feedback on:

- a) the accuracy of the definitions provided
 b) offer definitions where none have been provided (cells marked in orange)
 c) offer new terms which need adding and where possible how they should be defined

Feedback should be sent to glossary@eurgpr.org

Number	Term	Acronym	Symbol	Units	Short definition	Full definition	Contributor / Source
1	A Scan				Visualisation of recorded signal amplitude vs time.		Orfeus Project
2	A Scan processing				Signal processing routines which are operated in the temporal or z axis only. i.e. performed with no consideration/influence from adjacent traces.		Stefan van der Baan
3	Acquisition Time				There are three definitions: 1) for an array based system the time taken to acquire data through the designated time window/frequency range for a single trace across all the individual antenna elements in the array. 2) equivalent to the time window for a impulse GPR. 3) the integration or stacking time for the measurement of a single trace.		
4	Active Background Canceller	ABC			A device (being developed in ORFEUS) capable of adaptively cancellation of the effects of the soil as they are perceived by the antenna system.		Orfeus Project
5	Air launched antenna				Antenna impedance matched to propagate radar antenna through the air into the subsurface without being in close contact with the ground. Can have advantages in certain application areas, e.g. UXO detection, land mine clearance etc. Or where the surface conditions make it difficult to maintain close contact with a ground coupled antenna. See also Horn Antennas		Additions made by Neil Linford and Michael Arvantis
6	Air wave				Direct wave through the air		Stefan van der Baan
7	Antenna				The means or device by which Radar energy is transmitted into (and also received back from) the ground or material	The transmitting or receiving transducers of the GPR system. Both antenna are in most cases the same in terms of design and properties and are said to be 'matched'. GPR systems can have different antenna frequencies and physical designs including dipole, bow-tie, and horn antennas. The transmitting antenna produces the radiating GPR wave whilst the receiving antenna captures the reflected/scattered energy from the targets. For monostatic antennas transmitting and receiving dipole are identical. For bistatic antennas the transmitting (TX) and receiving dipole (RX) are spatially separated.	Edits in red made by Andy Kathage
8	Algorithm				In mathematics and computer science, an algorithm is a step-by-step procedure for calculations. Algorithms are used for calculation, data processing, and automated reasoning.		Wikipedia via Andy Kathage
9	Analog Digital Conversion	ADC			An analog-to-digital converter (abbreviated ADC, A/D or A to D) is a device that converts a continuous physical quantity (usually voltage) to a digital number that represents the quantity's amplitude.		Addition made by Stefan van der Baan + Wikipedia via Andy Kathage

10	Analog Signal				An analog or analogue signal is any continuous signal for which the time varying feature (variable) of the signal is a representation of some other time varying quantity, i.e., analogous to another time varying signal.		Wikipedia via Andy Kathage
11	Antenna				Usually the GPR antenna is meant to include the transmitter, the receiver and the radiating elements (i.e. the true antenna; but see monostatic and bistatic).		Orfeus Project
12	Antenna				Device used to couple electromagnetic energy into the ground/material. Sometimes called a transducer.	A component of an impulse radar system designed to radiate radio waves (electromagnetic radiation) from Applied voltage impulses (transmitting antenna), or conversely, to intercept radio waves and convert them back into electrical impulses (receiving antenna). Antennas radiate or receive electromagnetic energy.	Sensors & Software
13	Antenna loading				See Loss (antenna)	Technique to improve the antenna's bandwidth, usually at the expense of efficiency	Stefan van der Baan
14	Antenna Radiation Pattern				A plot of the intensity of the radiation received at a given radial distance from an antenna versus angle, relative to a given reference axis. The pattern is a three dimensional measure of the energy at a fixed radial distance from the antenna.		
15	Antenna Separation				Spacing between transmitting and receiving antennas.	Distance between 2 or more antennas, not to be misunderstood as offset between transmitting and receiving antenna/dipole.	Orfeus Project Edits made by Andy Kathage
16	Anti Aliasing				Low pass filters are commonly applied for avoiding aliasing, so called anti aliasing filter.		Edits made by Andy Kathage
17	Apparent Depth				The estimated depth of targets based upon an assumed velocity of propagation in the soil (see Relative Permittivity)	The estimated depth of targets based upon an assumed velocity of propagation in the soil (see Relative Permittivity)	Orfeus Project
18	Attenuation		α	<i>decibels per Metre dB/m</i>	A reduction in GPR signal amplitude caused by energy dissipation in the radiated material (commonly expressed in dB/metre)	A reduction in GPR signal amplitude caused by energy dissipation in the radiated material (commonly expressed in dB/metre)	Orfeus Project
19	Attenuation				The loss of signal energy affecting GPR waves as they propagate through the subsurface or any material.	The loss of signal energy affecting GPR waves as they propagate through the subsurface or any material. The attenuation is caused by a combination of material losses (the electromagnetic energy is converted into heat) scattering and the spreading loss of energy as the wave travels outwards (like ripples on a pond).	Edits in red made by Andy Kathage
20	Attenuation				A reduction in signal amplitude caused by energy dissipation in the transmitting media (see α).	A measure of the loss of radiated signal amplitude or signal energy as it progresses through a lossy medium. The loss can be due to a spreading loss as the wave expands out into the medium and also due to an ohmic loss, due to the finite conductivity of the medium, ohmic loss due to the finite conductivity of the medium and dielectric loss due to molecular rotation and volume scattering.	Sensors and software, Stefan van der Baan and Andy Kathage
21	Automatic Gain Control	AGC			Automatic Gain Control. When gain is controlled and adjusted automatically by the system in order to achieve the best S/N ration		Giovanni Alli, IDS,

22	Averaging				Averaging typically refers to the arithmetic mean of data		Andy Kathage
23	B Scan				Same as GPR section		Orfeus Project
24	B Scan processing				Processing based on data of a radar section (multiple traces)		Stefan van der Baan
25	Background Removal				A digital signal processing function that filters by subtracting an average of a large number of scans from each individual scan. The result is horizontal changes in the data are accentuated while linear features(background) are suppressed.		
26	Backscatter				A portion of a radar's transmitted energy that is intercepted by a target, or other object and reflected (scattered) back in the radar's direction.		
27	Bandwidth	BW			Frequency range transmitted by the GPR	The range of frequencies over which a given device transmits or detects signals above a specified amplitude or power. The band of frequencies occupied by the central lobe of the spectrum of an electromagnetic signal. Bandwidth is usually defined so that it includes most, but not all of the signal power. Generally, it includes the portion lying between the points at which the power has dropped to half that at the center of the band; the so called -3dB limit	Orfeus Project, Sensors & Software, Stefan van der Baan and Andy Kathage
28	Band pass filter				A filter operation that excludes frequencies below a low frequency cut off value and above a high frequency cut off value, passing the frequencies within the intermediate band. Often matched around the centre frequency to reduce noise outside the peak response of a particular antenna.		Stefan van der Baan / Neil Linford
29	Balun				Balanced to unbalanced convertor		Stefan van der Baan
30	Beamwidth				The angular width of a slice through the main lobe of the radiation pattern of an antenna, typically given in survey profile direction as well as perpendicular to it.		Andy Kathage
31	Bias				The amount by which the average of a set of values departs from a reference value.		
32	Bistatic				Tx and Rx antennas are separated in space (see Antenna and Antenna offset)	The survey method that utilizes two separate antennas at a constant distance. One antenna has a transmitter and the other contains a receiver sampler. With this method it is possible to transmit a higher power signal and receive reflections with a greater time delay.	Orfeus Project and Andy Kathage
33	Black field (or blank field or blank area)				The part of the search area between wall or other boundary limit and the centre of antenna which therefore cannot be imaged		Adam Szynkiewicz
34	Blend mode				High and low frequency data combined in one data set.		Michael Arvanitis

35	Bowtie antenna				Antenna with the active element shaped like two isosceles triangles with vertices pointing toward one another.		Stefan van der Baan	
36	Broadfire					Acquisition geometry where antennas are oriented such that their long axes are next to each other, always copolarized	Elmar Strobach	
37	C Scan				Time Slice of a 3D cube. (see also Time Slice)	3-D display of GPR data; it results from the side-by-side display of a number of GPR sections in a 3-D volume	Orfeus Project and Andy Kathage	
38	Cartesian Coordinate System				A Cartesian coordinate system is a coordinate system that specifies each point uniquely in a plane by a pair of numerical coordinates, which are the signed distances from the point to two fixed perpendicular directed lines, measured in the same unit of length.		Wikipedia via Andy Kathage	
39	Centre Frequency				Middle of the frequency band defined by a device's bandwidth	Frequency at which the highest power is radiated by a transmit antenna. Frequency of highest sensitivity of a receiving antenna.	Sensors & Software and Andy Kathage	
40	Clutter				Unwanted reflections from the ground, from within the ground or from above the ground. In the case of ground penetrating radar (GPR), clutter may be produced by boulders, soil interfaces and other scatterers that are not of interest. Clutter is also produced within the radar system.	Interfering signal comprising all of the components of the GPR that interact with each other and the ground to generate multiple signals that produce a signal that competes with, and may mask, reflections from targets. This is the most significant limitation on the overall performance of GPRs	Orfeus Project	
41	Common Depth Point	CDP			Also known as Common Midpoint (CMP) in case of flat reflectors and symmetric transmit/receive conditions. Having the same midpoint between source and detector.	A survey method that can be performed to calculate the electromagnetic velocity of a material. This is conducted by transmitting from one antenna and receiving from a second antenna at several known offsets (surface horizontal distance).	Andy Kathage	
42	Common Mid Point	CMP			Survey type where a transmitter and receiver antenna offset are changed but the mid point remains constant due to perfectly flat reflectors.		Giovanni Alli IDS, Sensors and Software and Andy Kathage	
43	Common Offset Reflection	COR			Survey type where a constant antenna offset is maintained		Sensors & Software and Andy Kathage	
44	Conductivity				Electrical conductivity or specific conductance is the reciprocal of electrical resistivity, and measures a material's ability to conduct an electric current. In general the higher the conductivity the shallower the GPR penetrates.	The ability of a material to conduct electrical current. In isotropic materials the reciprocal of resistivity. Sometimes called specific conductance. Units are siemen/m or S/m. (Or occasionally, mhos/m). For GPR, usually expressed as mS/m . Common symbol σ	Giovanni Alli, IDS and Wikipedia via Andy Kathage	
45	Constructive interference				If a crest of a wave meets a crest of another wave of the same frequency at the same point, then the magnitude of the displacement is the sum of the individual magnitudes – this is constructive interference		Stefan van der Baan / Wikipedia	
46	Control Unit	CU			An electronic instrument that interfaces a transducer (s) to recorders, processors, displays, survey wheel, power supply, etc. It also has controls to allow radar functions such as range, gain and filtering to be adjusted. A C/U can be analog, digital, or hybrid.			
47	Cross Section				Image that results from side-by-side display of a number of traces which are from adjacent spatial measurement position		Sensors & Software and Andy Kathage	

48	Cross-Coupling				Antennas can couple electromagnetically under certain impedance conditions. This is also called cross talk. It causes a high level of clutter and needs to be minimized for keeping good sensitivity.		Giovanni Alli, IDS and Andy Kathage
49	Crosswell					Acquisition geometry where measurements are made in between two adjacent boreholes, see also zero-offset profiling, tomography	Elmar Strobach
50	DC Offset				When describing a periodic function in the time domain, the DC bias , DC component , DC offset , or DC coefficient is the mean value of the waveform. If the mean amplitude is zero, there is no DC offset.		Vincent Utsi / Wikipedia
51	Data Acquisition Speed				Also called scan-rate.		Andy Kathage
52	Data Channel				A software channel on the control unit that displays and records a received signal. It is possible to have one transducer and four data channels with the same or varied processes. Some GPR's also provide several hardware channels that allow a free combination of more than 2 antennas		Andy Kathage
53	Data Imaging				First, adapted, step in data inversion process		Stefan van der Baan
54	Data inversion				Multi-step repetitive mathematical technique for computing ground electrical parameters out of measured data.		Stefan van der Baan
55	Decibel	dB			A unit of measure for gain. A logarithmic unit used to express power ratios. One decibel equals 20 LOG (P2/P1). Decibels are also used to express voltage ratios.		
56	Decibels per Metre	dB/m	α		Common unit for measurement for attenuation		Sensors & Software
57	Deconvolution				A digital signal processing function designed to attenuate multiples and improve the recognition and resolution of reflected events. A process that restores a waveshape to the form it had before it underwent a linear filtering action (convolution).	We distinguish between predictive deconvolution for removing multiples or ringing and spike deconvolution which is designed for improving the vertical resolution of the signal.	Andy Kathage
58	Delay Time				Time measured between signal transmission at antenna feedpoint and the received signals which have travelled through the ground/material and/or air.	The amount of time the radar wave propagates through a material, reflects off an interface and returns to the receiver. Time lag introduced by either hardware (cable length, etc.) or software (filter averaging, etc.).	Andy Kathage
59	Depth of Penetration				In any medium, the radar wave is attenuated as it progresses due to losses that occur. At radar frequencies in a conductive material (sea water, metallic materials, clay soils, etc.) the rate of attenuation is high and the wave may penetrate only a short distance (<1m) before being reduced to a negligibly small value. In a resistive dielectric earth material (fresh water, granite, quartz sand, etc.), where the losses are low, the depth of penetration can be quite great (>30m).		Andy Kathage
60	Depth slice				See time slice		
61	Destructive interference				If a crest of one wave meets a trough of another wave then the magnitude of the displacements is equal to the difference in the individual magnitudes – this is known as destructive interference		Stefan van der Baan / Wikipedia
62	Detection				Collection of a coherent signal signature of a target.	Generally speaking, it is the process of deciding on the existence, or not, of a target.	Orfeus Project and Andy Kathage

63	Detection range				The maximum distance at which the radar can provide a signal useful for detection. For GPR it is also called depth of penetration and is primarily affected by the signal attenuation caused by the ground. The detection range can be calculated with the so called Radar Equation.		Orfeus Project and Andy Kathage
64	Detection rate				Usually expressed as a percentage of the total number of targets available for detection	Usually expressed as a percentage of the total number of targets available for detection	Orfeus Project
65	Dewow				A low-pass filter often applied to individual traces of data to centre the response around a common zero value.		Vincent Utsi / Stefan van der Baan / Neil Linford
66	Dielectric				Any material which is a poor conductor of electricity ie. An insulator	A dielectric material (dielectric for short) is an electrical insulator that can be polarized by an applied electric field.	Andy Kathage
67	Dielectric Constant		<i>K</i>		Former name for Relative Permittivity		Andy Kathage
68	Dielectric Interface				A discontinuity in the subsurface of a dielectric material where the dielectric permittivity changes between two layers.		Andy Kathage
69	Dielectric loss				Loss of an electromagnetic wave due to molecular rotation. Occurs mainly in wet soils at high frequency.		Stefan van der Baan
70	Dielectric Permittivity				The relative permittivity of a material under given conditions reflects the extent to which it concentrates electrostatic lines of flux. In technical terms, it is the ratio of the amount of electrical energy stored in a material by an applied voltage, relative to that stored in a vacuum (see: vacuum permittivity).	Dielectric Permittivity is a property of an electrical insulating material (a dielectric) equal to the ratio of the capacitance of a capacitor filled with the given material to the capacitance of the identical capacitor filled with air. Earth materials are classified generally as conductors, semiconductors and insulators (dielectrics). A dielectric material is a poor conductor of electric current. The specific capacitance of a vacuum is $\epsilon_0 = 8.85 \times 10^{-12}$ Farads per metre. The relative dielectric constant, ϵ_r for air is 1 and is approximately 81 for fresh water.	Andy Kathage (Wikipedia)
71	Dielectric slab					see waveguide, in this case, a high dielectric permittivity layer is surrounded by two layers of lower dielectric permittivity (e.g. air -> wet soil/water puddle -> drier soil)	Elmar Strobach
72	Diffraction				The phenomenon that causes electromagnetic waves in the beam of a direction antenna to spread out.	Diffraction refers to various phenomena which occur when a wave encounters an obstacle or a slit. In classical physics, the diffraction phenomenon is described as the apparent bending of waves around small obstacles and the spreading out of waves past small openings. These characteristic behaviours are exhibited when a wave encounters an obstacle or a slit that is comparable in size to its wavelength.	Andy Kathage (Wikipedia)
73	Diffuse				To break up and distribute the energy in an incident electromagnetic wave in many directions		
74	Digital Signal				Signal represented electronically by a series of zeros and ones.	A digital signal is a physical signal that is a representation of a sequence of discrete values (a quantified discrete-time signal), for example of an arbitrary bit stream, or of a digitized (sampled and analog-to-digital converted) analog signal.	Andy Kathage (Wikipedia)
75	Digital Signal Processing	DSP			Manipulated digital signal.	Digital signal processing (DSP) is the mathematical manipulation of an information signal to modify or improve it in some way. It is characterized by the representation of discrete time, discrete frequency, or other discrete domain signals by a sequence of numbers or symbols and the processing of these signals.	Andy Kathage (Wikipedia)

76	Dipole				A simple antenna having two elements driven from the center of the antenna by a balanced source.	The most common form of dipole is two straight rods or wires oriented end to end on the same axis, with the feedline connected to the two adjacent ends. This is the simplest type of antenna from a theoretical point of view. Dipoles are resonant antennas, meaning that the elements serve as resonators, with standing waves of radio current flowing back and forth between their ends. So the length of the dipole elements is determined by the wavelength of the radio waves used. The most common form is the half-wave dipole, in which each of the two rod elements is approximately 1/4 wavelength long, so the whole antenna is a half-wavelength long. In GPR bowties are widely used as antennas.	Andy Kathage (Wikipedia)
77	Direct wave				Signal that travels directly from the transmitter to the receiver antenna, without reflection against a target in between.		Stefan van der Baan
78	Directional Antenna				A directional antenna or beam antenna is an antenna which radiates greater power in one or more directions allowing for increased performance on transmit and receive and reduced interference from unwanted sources		Vincent Utsi / Wikipedia
79	Directivity				Ability of an antenna to concentrate transmitted energy in a given direction and to emphasize the returned energy received from that direction.		
80	Dispersion				The tendency of the velocity of propagation in the soil or material to change, depending upon the frequency of the EM wave, causing the received time domain signal to be distorted (see Relative Permittivity)	The tendency of the velocity of propagation in the soil to change, depending upon the frequency of the EM wave, causing the received time domain signal to be distorted (see Relative Permittivity)	Orfeus Project and Andy Kathage
81	Dwell Time				For stepped frequency continuous wave systems the length of time each frequency stepped is broadcast and received. The frequency domain equivalent of stacking in the time domain.		Neil Linford
82	Dynamic Range				The spread between the minimum signal at the input of a system, which produces a discernible change in the output and the maximum input that the system can handle without saturating. Measured in decibels (db).		
83	Echo Signal				Energy reflected from a given target or object.		
84	Electrical Conductivity		σ	<i>siemens per metre (mS/m)</i>	The property of a material that determines its ability to attenuate a signal A measure of a material's ability to conduct an electric current.	The reciprocal of resistivity expressed in siemens/metre (a property of the ground that determines its attenuation)	Orfeus Project and Andy Kathage
85	Electro magnetic	EM			Electromagnetic is a prefix used to specialise many technical terms that involve electromagnetism.		Orfeus Project and Andy Kathage
86	Electro Magnetic Compatibility	EMC				Electromagnetic compatibility (EMC) is the branch of electrical sciences which studies the unintentional generation, propagation and reception of electromagnetic energy with reference to the unwanted effects (electromagnetic interference, or EMI) that such energy may induce.	Giovanni Alli, IDS and Andy Kathage (Wikipedia)
87	Electromagnetic Energy				The loss of signal energy affecting GPR waves as they propagate through the subsurface. The attenuation is caused by a combination of material losses (the electromagnetic energy is converted into heat) and the spreading loss of energy as the wave travels outwards (like ripples on a pond). See also 'Attenuation'.	Propagating energy made up of coupled, alternating electrical and magnetic. Sunlight is electromagnetic energy at frequencies of 100s of Terra Hertz (10^{12} cycles per second). Microwave ovens use electromagnetic energy to heat food at frequencies in the Giga Hertz (10^9 cycles per second). GPR uses radio wave electromagnetic energy at between 1 MHz and 4GHz.	Neil Linford

88	Electro Magnetic Interference	EMI			Electro-Magnetic Interference	Electromagnetic interference (or EMI, also called radio-frequency interference or RFI when in radio frequency) is disturbance that affects an electrical circuit due to either electromagnetic induction or electromagnetic radiation emitted from an external source	Giovanni Alli, IDS and Andy Kathage (Wikipedia)	
89	Electro-Magnetic spectrum...				The range of frequencies in which electromagnetic waves exist.	The electromagnetic spectrum is the range of all possible frequencies of electromagnetic radiation. The "electromagnetic spectrum" of an object has a different meaning, and is instead the characteristic distribution of electromagnetic radiation emitted or absorbed by that particular object.	Giovanni Alli, IDS and Andy Kathage (Wikipedia)	
90	Electromagnetic Wave				A wave that is propagated by the mutual interaction of electric and magnetic fields. Radiant heat, light and radio waves, are electromagnetic waves.			
91	Encoder Spacing				The distance required to travel for an encoder to output a trigger pulse.		Addition made by Vincent Utsi	
92	Endfire					Acquisition geometry where antennas are oriented inline such that the long axis is aligned, always copolarized	Elmar Strobach	
93	Evanescent Wave					An evanescent wave is a near-field wave with an intensity that exhibits exponential decay without absorption as a function of the distance from the boundary at which the wave was formed.	Wikipedia	
94	Exponential Attenuation Coefficient			Decibels per Metre dB/m	See also 'Attenuation'	Coefficient that quantifies the attenuation within a length unit of a material.	Sensors & Software and Andy Kathage	
95	European Telecommunication Standards Institute	ETSI			The European Telecommunications Standards Institute (ETSI) is an independent, not-for-profit, standardization organization in the telecommunications industry (equipment makers and network operators) in Europe, with worldwide projection. ETSI produces globally-applicable standards for Information and Communications Technologies (ICT), including fixed, mobile, radio, converged, broadcast and internet technologies		Stefan van der Baan / Wikipedia	
96	fk-filtering				A 2 dimensional filter which can be applied in the frequency-wavenumber domain. Permits the removal of particularly complex noise trends.		Elmar Strobach Matt Guy/ taken from K.J.Sandmeir Help guide.	
97	fk-spectrum				The resulting frequency-wavenumber plot produced after the FFT computation, from which noise trends can be identified.		Elmar Strobach Matt Guy/ taken from K.J.Sandmeir Help guide.	
98	FDTD Modelling				Finite-difference time-domain (FDTD) is a numerical analysis technique used for modelling computational electrodynamics (finding approximate solutions to the associated system of differential equations). Since it is a time-domain method, FDTD solutions can cover a wide frequency range with a single simulation run, and treat nonlinear material properties in a natural way.		Elmar Strobach / Wikipedia	
99	False alarm rate				Usually expressed as a percentage of the total number of true targets detected by the radar		Orfeus Project	
100	Fast Fourier Transformation	FFT				A fast Fourier transform (FFT) is an algorithm to compute the Discrete Fourier transform (DFT) and its inverse. A Fourier transform converts time (or space) to frequency and vice versa	Giovanni Alli, IDS and Andy Kathage (Wikipedia)	

101	Federal Communications Commission	FCC			The Federal Communications Commission (FCC) is an independent agency of the United States government, created by Congressional statute to regulate interstate communications by radio, television, wire, satellite, and cable in all 50 states, the District of Columbia and U.S. territories. The FCC works towards six goals in the areas of broadband, competition, the spectrum, the media, public safety and homeland security.		Stefan van der Baan / Wikipedia	
102	Filtering				In signal processing, especially electronics, an algorithm or device for removing part(s) of a signal:		Giovanni Alli, IDS and Andy Kathage (Wikipedia)	
103	Finite Impulse Response Filter	FIR			A type of filter	A digital signal processing function that convolves a finite length function (boxcar, triangle) with the data. Each data value is multiplied by the corresponding filter value and added together. FIR filters are digital filters and have no time delay.		
104	First arrival				Initial signal to be recorded by the instrument. Other than the direct arrival or ground wave.		Elmar Strobach	
105	Footprint				The approximate area of response illuminated by a radar, increasing with depth below the transmitter restricting the lateral resolution of individual reflectors.		Stefan van der Baan / Neil Linford	
106	Frequency				Frequency is the number of occurrences of a repeating event per unit time.	The number of positive and negative voltage amplitude cycles that a pure unmodulated sine wave completes per second. The unit of frequency is Hertz (Hz).	Giovanni Alli, IDS and Andy Kathage (Wikipedia)	
107	Frequency Domain				Mathematical realm in which the amplitudes of signals are expressed as functions of frequency, rather than time. The frequency spectrum of a time varying signal is obtained by translating the expression for the signal from the time domain to the frequency domain.			
108	Frequency Domain Filter	FK			Also called a velocity filter. A digital signal processing function that discriminates on the basis of apparent velocity. Coherent arrivals with certain apparent velocities are attenuated.			
109	Frequency Modulation				In telecommunications and signal processing, frequency modulation (FM) is the encoding of information in a carrier wave by varying the instantaneous frequency of the wave		Edits in red by Andy Kathage (Wikipedia)	
110	Frequency Modulated Continuous Wave	FMCW			Frequency-modulated continuous-wave radar (FM-CW) – also called continuous-wave frequency-modulated (CWF) radar[5] – is a short-range measuring radar set capable of determining distance		Andy Kathage / Wikipedia	
111	Frequency-domain GPR				In these systems, the frequency of the transmitted signal is constantly varying with time. The usual implementation of this technology in GPRs is named "Stepped-Frequency" because the frequency is changed in discrete, highly repeatable and stable, steps.		Orfeus Project	
112	Fresnel Zone				The portion of a reflector from which reflected energy can reach a detector within one-half wavelength of the first reflected energy.	Amplification or adjustment of signal amplitudes carried out by software settings on control unit or during post-processing	Andy Kathage	
113	Full waveform inversion				Production of a geophysical model based on the complete waveform and not a subset thereof.		Elmar Strobach	

114	Fundamental Operating Specifications				Instrument specifications set within a tight set of parameters, typically within a laboratory environment.		Andy Kathage
115	Gain				Process of amplifying signals to match recording device or display dynamic range	Amplification or adjustment of signal amplitudes carried out by software settings on control unit or during post-processing	Sensors and Software and Andy Kathage
116	Gain correction				Adjustment of gain in post-processing		Andy Kathage
117	Gigahertz	GHz			A unit of frequency. One GHz equals 1000MHz		
118	Global Navigation Satellite System	GNSS			GNSS (Global Navigation Satellite System) is a satellite system that is used to pinpoint the geographic location of a user's receiver anywhere in the world. Three GNSS systems are currently in operation: the United States' Global Positioning System (GPS) and the Russian Federation's Global Orbiting Navigation Satellite System (GLONASS), and the third, Europe's Galileo has now reached full operational capacity. Each of the GNSS systems employs a constellation of orbiting satellites working in conjunction with a network of ground stations.		TSA Client Guide
119	Global Positioning System	GPS			The Global Positioning System (GPS) is a space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites	Global Positioning System – device for spatial navigation and positioning. Only differential GPS systems (typically operated in RTK-mode) are accurate enough for GPR and only for precision requirements not higher than 2 cm. Relative survey accuracy is important for high quality data interpretation and, at high GPR-frequencies, physical measuring systems (odometers, tapes, grids, etc) and survey levels and/or total stations allow higher position accuracies than GPS.	Andy Kathage
120	Grey-scale				A sequence of grey shades from black through greys to white used to show the amplitude of a GPR trace. Produces a GPR section that has the same colouring as a 'black and white' photograph. Grey scale images and displays have good contrast and are easier to see in daylight.		
121	GPR Section				The cross-sectional image of the subsurface generated by the GPR system in the form of a collection of coloured or grey-scale strips that relate to the amplitude of the recorded voltage signal trace. The GPR section usually has distance along the survey line as the horizontal axis and recorded time (as two-way travel time in nanoseconds) as the vertical axis.		
122	GPR Velocity			metre per nano second (m/ns)	Common unit of measurement ,		Sensors & Software
123	Ground Penetrating Radar	GPR			Also known as Ground Probing Radar and Surface Penetrating Radar		
124	Ground Coupling / Ground Coupled Antenna				An antenna designed to propagate radar energy most efficiently whilst in close contact ($\lambda/4$) with the ground surface.		Neil Linford & Vincent Utsi
125	Ground wave				Direct wave through the soil		Stefan van der Baan

126	Hertz	Hz			A unit of frequency. One Hertz equals one cycle per second			
127	High Pass Filter				A filter that passes without significant attenuation frequencies above some cutoff frequency while attenuating lower frequencies. The same as low-cut filter			
128	Hilbert Transform				A digital signal processing function that determines the magnitude envelope, instantaneous phase and instantaneous frequency of the received signal	Used in signal processing as means of achieving an analytic representation of a signal. Transform output is magnitude-, frequency- or phase-display of data.	Andy Kathage	
129	Horizontal Filter				A digital signal processing function that attenuates signals outside the filter function across adjacent scans.			
130	Horizontal Patterning							
131	Horizontal Slice				See Time Slice (also known as Depth Slice)			
132	Horn Antenna				Antenna design model for air coupled antennas. Advantage: good focussing, antenna performance not a function of ground/material impedance. Disadvantage: typically larger than bowties.		Andy Kathage	
133	Hybrid Scanning							
134	Hyperbola				Shape of hyperbola may be used for determining soil wave speed.	A hyperbola may be defined equivalently as the locus of points where the absolute value of the difference of the distances to the two foci is a constant equal to $2a$, the distance between its two vertices.	Giovanni Alli, IDS, Stefan van der Baan and Andy Kathage	
135	Impulse				In GPR-terminology the impulse is a short duration wideband GPR-signal, while a pulse is a time limited single frequency or very band limited antenna signal.		Giovanni Alli, IDS and Andy Kathage	
136	Infinite Impulse Response Filter	IIR			A digital signal processing function that emulates an analog filter function. An IIR filter is a fast filter function that offsets the data in time. It is called IIR because these filters approximate a desired output by using iterative filter functions.			
137	Interface				The common surface separating two different media in contact. A location in the subsurface where the dielectric constant changes abruptly.		Andy Kathage	
138	Interference				See constructive interference and destructive interference		Vincent Utsi	
139	Interpolation				In the mathematical field of numerical analysis, interpolation is a method of constructing new data points within the range of a discrete set of known data points.		Andy Kathage (Wikipedia)	
140	Interpretation				The process of analysing the acquired data and presenting the results in a more directly accessible format.		Neil Linford	

141	Isotropic Radiator				An antenna that radiates equally (both in amplitude and in phase) in all directions. The imaginary source of the radiation used as a reference for the gain of a directional antenna.		
142	Jitter				Jitter is the undesired deviation from true periodicity of an assumed periodic signal in electronics and telecommunications, often in relation to a reference clock source.	Giovanni Alli IDS and Andy Kathage (Wikipedia)	
143	Lateral Resolution				The ability of the system to resolve in a horizontal direction the smallest discernible target. This is a function of antenna frequency, scan rate and speed of travel. It can be evaluated by calculating the first Fresnel Zone.	Edits in red made by Andy Kathage	
144	Licence / Operating Licence				A licence to operate GPR systems issued by a national radio frequency regulatory authority. Eg OFCOM within the UK	Editor	
145	Loss (antenna)				The power supplied to the antenna terminals which is not radiated is converted into heat. This is usually through loss resistance in the antenna's conductors, but can also be due to dielectric or magnetic core losses in antennas (or antenna systems) using such components.	Giovanni Alli IDS and Andy Kathage (Wikipedia)	
146	Loss (soil)				Includes attenuation (conductive loss), geometrical spreading, scattering loss. Results in reduction of signal amplitude as well as dispersion or phase shifts.	Giovanni Alli, IDS and Andy Kathage	
147	Low Pass Filter				A filter that passes frequencies below some cutoff frequency while substantially attenuating higher frequencies. Same as a high-cut filter.		
148	Magnetic Permeability				In electromagnetism, permeability is the measure of the ability of a material to support the formation of a magnetic field within itself. In other words, it is the degree of magnetization that a material obtains in response to an applied magnetic field.	The magnetic permeability of a material is a measure of the difficulty of magnetization of the material in an external field. The magnetic permeability of earth materials is taken to be that of free space, = 4×10^{-7} Henrys per meter. Therefore, the relative permeability of earth materials is $\mu_r = 1$.	Andy Kathage
149	Matched filter				In signal processing, a matched filter (originally known as a North filter) is obtained by correlating a known signal, or template, with an unknown signal to detect the presence of the template in the unknown signal. Pulse compression is an example of matched filtering.	Giovanni Alli IDS and Andy Kathage (Wikipedia)	
150	Maxwell equations				Maxwell's equations describe how electric and magnetic fields are generated and altered by each other and by charges and currents.	Giovanni Alli IDS and Andy Kathage (Wikipedia)	
151	Meander				The ability collects data without the requirement of a grid. GPS positions are relied upon to locate traces.	Vincent Utsi	
152	Megahertz	MHz			A unit of frequency. One MHz equals 1000 Hertz.		
153	Microsecond	us			Unit of time occasionally used for GPR	1 microsecond = 1000ns = 10^{-6} s,	Sensors & Software
154	Microwave				Broadly defined as the range of EM frequencies between 300MHz and 3GHz encompassing an area of the spectrum used by many GPR systems	Neil Linford	

155	Migration				A digital signal processing technique which clarity of the image.	A digital signal processing function that rearranges data so that reflections and diffractions are plotted at the locations of the reflectors and diffracting points rather than with respect to observation points on the profile. Migration by computer is accomplished by integration along diffraction curves (Kirchhoff migration), by numerical finite-difference downward-continuation of the wave equation and other algorithms.		
156	Modelling				Transformation of the recorded field data into a real-world representation of the subsurface.		Elmar Strobach	
157	Modulation				In electronics and telecommunications, modulation is the process of varying one or more properties of a periodic waveform, called the carrier signal (high frequency signal), with a modulating signal that typically contains information to be transmitted.		Giovanni Alli IDS and Andy Kathage (Wikipedia)	
158	Monostatic				A survey method that utilizes a single transducer with either a single antenna with transceiver or a dual antenna transducer with separate electronics.	Antenna configuration where transmitter-dipole and-receiver-dipole are identical. Typical monostatic antennas need a so-called cleartime in order to protect the receiver during the transmitting process.	Andy Kathage	
159	Moving average				An averaging filter that moves through the data		Giovanni Alli IDS and Andy Kathage	
160	Multi Channel Array	MCA			A MCA consists of many antennas connected via many software and/or hardware channels with the control unit		Andy Kathage	
161	Multi offset acquisition				Data recorded with varying transmitter and receiver separations.		Elmar Strobach	
162	Multiplexing				Automated switching between individual antennas during acquisition		Neil Linford	
163	NMEA-String				A combined electrical and data specification for communication between marine electronic devices such as echo sounder, sonars, anemometer, gyrocompass, autopilot, GPS receivers and many other types of instruments		Elmar Strobach / Wikipedia	
164	Nanosecond	ns			A common unit of time used for GPR	1 nanosecond = 10^{-9} s or One Billionth of a Second	Sensors & Software	
165	Near field				a region of space close to the antenna.	The close-in region of an antenna where the angular field distribution is dependent upon the distance from the antenna. Part of the Near Field is reactive. In this reactive region, not only is an electromagnetic wave being radiated outward into far-space but there is a "reactive" component to the electromagnetic field, meaning that the nature of the field around the antenna is sensitive to, and reacts to, EM absorption in this region (this is not true for absorption far from the antenna, which has no effect on the transmitter or antenna near-field).	Giovanni Alli IDS and Andy Kathage (Wikipedia)	
166	Noise				Unwanted electromagnetic signal.		Giovanni Alli IDS and Andy Kathage (Wikipedia)	
167	Numerical dispersion						Elmar Strobach	

168	Nyquist (criterion)				The Nyquist frequency, named after electronic engineer Harry Nyquist, is ½ of the sampling rate of a discrete signal processing system. Sampling data with a frequency of less than Nyquist frequency results in Aliasing.		Giovanni Alli IDS and Andy Kathage (Wikipedia)	
169	Odometer (addition made by Vincent Utsi)				The device that triggers the GPR data collection when we collect under distance mode. This encoder correlates distance units with scans collected by the GPR.		Vincent Utsi and Michael Arvanitis	
170	PPS-Signal				A pulse per second (PPS or 1PPS) is an electrical signal that has a width of less than one second and a sharply rising or abruptly falling edge that accurately		Elmar Strobach / Wikipedia	
171	Parallel acquisition				An specific antenna configuration.	Acquisition geometry where the polarization of the E-Field is parallel to the acquisition direction	Elmar Strobach	
172	Penetration Depth				Penetration depth is a measure of how deep light or any electromagnetic radiation can penetrate into a material. It is defined as the depth at which the intensity of the radiation inside the material falls to 1/e (about 37%) of its original value at (or more properly, just beneath) the surface. Often mistakenly used instead of Detection Range		Andy Kathage (Wikipedia)	
173	Permeability				In electromagnetism, permeability is the measure of the ability of a material to support the formation of a magnetic field within itself. In other words, it is the degree of magnetization that a material obtains in response to an applied magnetic field.		Giovanni Alli IDS Edits in red made by Andy Kathage (Wikipedia)	
174	Permittivity				See Dielectric Permittivity.		Giovanni Alli, IDS	
175	Perpendicular acquisition				An specific antenna configuration.	Acquisition geometry where the polarization of the E-Field is perpendicular to the acquisition direction	Elmar Strobach	
176	Phase				Degree of coincidence in time between a repetitive signal, such as a sine wave and a reference signal, having the same frequency. The angle of lag or lead of a sine wave with respect to a reference. Generally expressed in degrees. 360 degrees corresponds to the period of the signal.			
177	Picosecond	ps			Unit of time occasionally used for GPR	1 picosecond = 0.001 ns = 10 ⁻¹² s,	Sensors & Software	
178	Plan View				see time slice			
179	Plane Reflector				Perfectly flat and smooth discontinuity		Andy Kathage	
180	Point Reflector				A reflector or more precisely said scatterer which is much smaller than the signal wavelength.	A subsurface feature with electromagnetic properties different from its surroundings, whose dimensions are approximately the same as the fresnel zone of the radar wave.	Andy Kathage	
181	Polarisation				The orientation of the electric and magnetic fields of an electromagnetic wave, such as a radio wave. By convention, the polarisation of the wave is the direction of the electric field. If the polarisation does not change as the wave propagates, the polarisation is said to be linear.	Polarsation (also polarization) is a property of waves that can oscillate with more than one orientation. All radio (and microwave) antennas used for transmitting or receiving are intrinsically polarized. They transmit in (or receive signals from) a particular polarisation, being totally insensitive to the opposite polarisation; in certain cases that polarisation is a function of direction. As is the convention in optics, the "polarisation" of a radio wave is understood to refer to the polarisation of its electric field, with the magnetic field being at a 90 degree rotation with respect to it for a linearly polarised wave. The vast majority of antennas are linearly polarised.	Giovanni Alli IDS and Andy Kathage (Wikipedia)	
182	Power				A measure of the quantity of electric energy, commonly expressed in Watts. One watt equals one Joule per second.			

183	Profile				A graph showing the depth measurements as a vertical cross section of the medium along a horizontal line. Also referred to a Survey Line or Radargram.		Andy Kathage
184	Propagation				The outward spreading, or travel, of an electromagnetic wave, such as a radio wave.		
185	Propagation Velocity		v	centimetres/nanoseconds (cm/ns)	Also called Phase Velocity. The phase velocity of a wave is the rate at which the phase of the wave propagates in space.		Sensors & Software and Andy Kathage (Wikipedia)
186	Pulse Compression				Pulse compression is a signal processing technique mainly used in radar, sonar and echography to increase the range resolution as well as the signal to noise ratio. This is achieved by modulating the transmitted pulse and then correlating the received signal with the transmitted pulse		Vincent Utsi / Wikipedia
187	Pulse Repetition Frequency	PRF			The number of pulses per second transmitted by a pulsed radar. The word pulse is used here even though most GPR's use impulses.		Andy Kathage
188	Radar				Radio Detection And Ranging.	An electronic system that transmits electromagnetic energy and detects the location of reflected energy.	
189	Radar Cross Section	RCS			The RCS of a radar target is an effective area that intercepts the transmitted radar power and then scatters that power isotropically back to the radar receiver.	A factor relating the power of the radio waves that a radar target scatters back in the direction of the radar, to the power density of the radar's transmitted waves at the target's range. Takes account of the cross sectional area of the target, as viewed by the radar, the target's reflectivity and its directivity.	Andy Kathage (Wikipedia)
190	Radargram				See Profile		
191	Radar range equation	RRE			Equation for estimating the expected penetration depth. Includes loss factors associated with the GPR-system and soil parameters.		Stefan van der Baan
192	Radiation				Energy in the form of an electromagnetic wave emitted by an antenna, in which free electrons are accelerated. Radiant heat, light and radio waves are electromagnetic radiation. They differ only in wavelengths		
193	Radio Spectrum				Radio spectrum refers to the part of the electromagnetic spectrum corresponding to radio frequencies		Andy Kathage (Wikipedia)
194	Radio waves				Electromagnetic energy at a frequency of Mega Hertz (MHz - millions of cycles per second). At these frequencies, electromagnetic energy is able to travel through the air or ground relatively easily – called radiating electromagnetic energy. These frequencies are referred to as 'radio waves' as this is the frequency band of AM radio stations.		Andy Kathage
195	Radio Wave				Electromagnetic fields that travel through a material as waves and typically have oscillating frequencies in the 1 GHz to 10 GHz range		Sensors & Software
196	Range				The radial distance from a radar to a target or other object. A user adjustable setting on a control unit to determine the amount of time displayed and recorded (0 - thousands of nanoseconds).		

197	Range Gain				Also known as time gain control or time varying gain. Control for varying the amplification or attenuation of an amplifier, used to compensate for variations in input signal strength over time.		
198	Raster Scanning				Scanning on a grid		Andy Kathage
199	Receiver				The portion of the antenna used, to intercept the radio waves reflected from the subsurface and convert them back into electrical impulses (receiving antenna).	Electronics at receiver antenna used to pre-amplify the signals. Often also samplers are integrated with the receivers.	Andy Kathage
200	Receiver	Rx			General term for electronics devices used to detect fields and translate signals into records or displays		Sensors & Software
201	Reflected Wave				A wave which has been reflected.		Andy Kathage
202	Reflection				The degree to which an object returns incident radio waves.	Reflection is the change in direction of a wavefront at an interface between two different media so that the wavefront returns into the medium from which it originated.	Andy Kathage (Wikipedia)
203	Reflection Coefficient				The reflection coefficient is used in physics and electrical engineering when wave propagation in a medium containing discontinuities is considered. A reflection coefficient describes the amplitude of a reflected wave relative to that of the incident wave.	A description of the reflected field strength from an infinite interface between two media 1 and 2. The reflection coefficient r is defined by: $r = \frac{Z_2 - Z_1}{Z_2 + Z_1}$ where Z is the impedance of the respective media.	Andy Kathage (Wikipedia)
204	Reflector				An object with sufficient ϵ contrast to reflect & refract an EM wave.		Elmar Strobach
205	Refraction				The bending of an electromagnetic wave that occurs when the wave passes obliquely from one medium into another whose dielectric constant is different from that of the first medium. The bending results from the speed of the propagation being different in one medium than in the other. Refraction may also occur in a single medium whose dielectric constant gradually changes in a direction normal to the wave's direction of propagation.		
206	Relative Permittivity		K		Another name for Dielectric Constant		Sensors & Software
207	Resistivity				The inverse of Conductivity, measured in Ohm metres	The reciprocal of the electrical conductivity is the electrical resistivity. The electrical resistivity of a substance is a measure of the difficulty an electrical current can have flowing through it. In the MKS system the unit of resistivity is the ohm-metre ($\Omega \cdot m$).	
208	Resolution				The minimum separation of two objects before their individual responses merge into a single response In GPR we have to distinguish between horizontal or lateral resolution and vertical resolution.	The ability to separate two features that are very close together. The minimum separation of two bodies before their individual identities are impossible to interpret. The smallest change in input that will produce a detectable change in output.	Sensors & Software and Andy Kathage
209	Ringng				Wave energy that has been reflected more than once. In radar data multiples may occur when there is a large change in the dielectric permittivity or conductivity of the medium. A multiple can be identified by signals that have the same time delay as between the surface and the first reflector.	Ringng can also be produced by non-matched antennas. Ringng is a type of Clutter.	Andy Kathage

210	Robotic Total Station				A positioning system using an automated laser based electronic distance meter to follow an optical target reflector mounted on the GPR antenna. Such systems can be used instead of GPS receivers for positional data, for example under tree cover or within buildings.		Vincent Utsi /Neil Linford
211	Running Average				Also known as 'Moving Average'. A digital signal processing function that averages a finite number of scans with a user designated function to produce a single output scan. This method can be operated in continuous or static modes.		Andy Kathage
212	Sample Point				Signal amplitude measured at specific point in time		Sensors & Software
213	Sampler				A circuit whose output is a series of discrete values representative of the values of the input at a series of points in time.		
214	Sampling				In signal processing, sampling is the reduction of a continuous signal to a discrete signal.		Giovanni Alli, IDS and Andy Kathage (Wikipedia)
215	Sampling Rate				Samples per time unit.		Andy Kathage
216	Sampling resolution		N	bit	The interval of time between successive digital samples of the radar wave.	Every acquired analogue value is put into one of 2^N bins	Stefan van der Baan
217	Scan				One discrete sequence of events such as a sampling at all time points the amplitudes at a receiver.	GPR-slang for a data trace of a radargram or sometimes the whole radargram is called a scan.	Andy Kathage
218	Scanbox						
219	Scatter				The irregular and diffuse dispersion of energy caused by inhomogeneities in the medium through which the energy is traveling.	In physics, scattering is the study of collisions, especially of waves and particles (synonymous in quantum mechanics).	Andy Kathage (Wikipedia)
220	Scatter Patterns						
221	Scattering				see Scatter		Giovanni Alli, IDS
222	Screening						Vincent Utsi
223	Semblance analysis				Used in normal move-out (NMO) correction to define the wave velocity against time throughout a record from multi-offset data.		Elmar Strobach
224	Sensitivity Time Control	STC			Sensitivity Time Control, similar to Automatic Gain Control and Time Varying Gain		Giovanni Alli, IDS
225	Signal Amplitude				A measure of the strength of the radio wave signal		Sensors & Software
226	Signal Filtering				With Filtering some unwanted component or feature gets removed from a signal.		Andy Kathage (Wikipedia)
227	Signal Position				The relative delay between the time when the Radar system sends out a transmit pulse and when the Radar systems sends out a receiver pulse	GPR display operates similar to an oscilloscope which can be adjusted so that repetitive signals can be observed as a continuous shape on the screen. The position of that signals on the screen is called Signal Position and includes the delay between firing the transmitter electronics and receiving the first signals.	Andy Kathage (Wikipedia)

228	Signal stability				See Jitter		Stefan van der Baan
229	Signal to Noise ratio	SNR, S/N			Provides a comparison of the level of a desired signal to the level of background noise. The higher the ratio, the less obtrusive the background noise is	Defined as the ratio of a signal power to the noise power corrupting the signal. A ratio higher than 1:1 indicates more signal than noise.	Stefan van der Baan
230	Single Channel				A GPR instrument which can only operate a single transmitter/receiver pair.		
231	Soil attenuation				The reduction of signal amplitude, especially for high frequencies, as the wavelet passes through a typical, conductive soil.		Neil Linford
232	Short Pulse Transmission						
233	Spatial Imaging Resolution				Pixel size.		
234	Spatial Resolution				The smallest object able to be resolved.	The smallest object able to be resolved based on the wavelength, the instrument sample interval and number of scans per meter.	
235	Spectrum				The distribution of the power or energy of a signal over the range of possible frequencies is commonly represented by a plot of amplitude versus frequency. If the amplitude is a voltage, a plot of the square of the amplitude is the power spectrum. The area under the power spectrum corresponds to the signal's energy.		
236	Spread Spectrum						Vincent Utsi
237	Stack fold				Number of traces being added in stacking		Stefan van der Baan
238	Stacks / Stacking				Adding multiple traces at the same location, used to increase the signal to noise ratio	Multiple repetition and averaging of the trace collected at each sample station to improve the overall signal to noise ratio.	Stefan van der Baan and Neil Linford
239	Station Interval				Spatial distance between observation points along a survey traverse line or mesh points on a grid		Sensors & Software
240	Step Size				See Station Interval		Sensors & Software
241	Stepped Frequency				See SFCW		
242	Stepped Frequency Continuous Wave Radar	SFCW			A radar system generating a continuous output over a series of stepped frequencies across the response range of the antenna rather than a single ultra wide band impulse response.		Giovanni Alli, IDS
243	Stratigraphy				The layered structure of the subsurface where it is generally assumed that younger features tend to be above (or shallower) than older features. Important for archaeology and geology where relative ages are needed.		
244	Swept Gain				Exponential time varying function.		Vincent Utsi
245	Synthetic Aperture Radar	SAR			Synthetic-aperture radar (SAR) is a form of radar which is used to create images of an object, such as a landscape – these images can be 2D or 3D representations of the object.		Vincent Utsi / Wikipedia
246	Tangent loss / delta						Giovanni Alli, IDS and Stefan van der Baan
247	Time Slice				A resampled horizontal slice through a 3D cube of data. If the velocity of propagation is known then this time can be converted to depth. (See also C-Scan, Depth Slice and Horizontal Slice)		

248	Time varying gain				Another name for Sensitivity Time Control (STC)		Giovanni Alli, IDS
249	Time window				See Range		Stefan van der Baan
250	Time zero				See Signal Position		Stefan van der Baan
251	Tomography				Multi transmitter and receiver methodology.	Acquisition geometry where waves are sent through a medium and recorded at a different position. Often used in between two boreholes or in multi-offset reflection mode. Travelttime, Amplitude or full Waveform analysis provides physical properties of the medium between transmit and receive point.	Elmar Strobach
252	Tomographic inversion				Determining the subsurface velocity distribution based on tomographic methods.		Elmar Strobach
253	Top Surface Normalization				Correction of data for the effects of surface elevation changes by time (depth) shifting the data. The result is to present the data as if all measurements had been made on a flat plane.		
254	Topographic Correction				Correction for elevation changes.		Vincent Utsi / Elmar Strobach
255	Total Station				See Robotic Total Station		Vincent Utsi
256	Trace				One single scan or one vertical line of a radargram or GPR-section, recorded at one position. It displays amplitude as a function of 2-way travelttime, either in scan mode (gray, colour) or scope view.	This is the recorded output of the received GPR signal. It is a simple recording of the voltage (in millivolts usually) at the receiving antenna over a specific period of time from the start or 'triggering' of the GPR system. The trace takes the form of wiggles or wavelets (a bit like the signals one would see on an oscilloscope – hence the name, 'traces') and is usually converted into a coloured or greyscale strip of pixels in a GPR section.	Andy Kathage
257	Transducer				An antenna with built-in or plug-in transmitter and receiver electronics.		
258	Transducer				Name used where GPR antenna, electronics, and shield are combined into one physical unit		Sensors & Software
259	Transect				The line along the surface that a profile is acquired.		
260	Trans-illumination				A method of surveying where a transmitting antenna transmits one way through a material to a receiving antenna. Example; crosshole investigations.		
261	Transmission				To emit an electromagnetic wave.		Giovanni Alli, IDS
262	Transmission reflections				Returned energy.		
263	Transmit Pulse				The impulse of radar energy from the transmitting antenna as seen at the receiving antenna. This is shown on the recorded data at the top of the display. When the transducer is moved on the ground surface the first arrival of the transmit pulse is interpreted as the surface.		
264	Transmit Rate				The interval between discrete pulses.		Michael Arvanitis
265	Transmitter	Tx			General term used for electronics devices used to create propagating electromagnetic fields	The electronics, which after receiving a trigger pulse from the control unit, sends an impulse of electromagnetic energy to the attached antenna.	Sensors & Software
266	Transversal				Cross line data acquisition.		Giovanni Alli, IDS
267	Travel Time				The amount of time (nanoseconds) that the radar signal takes to travel from the transmitting antenna to a target or receiving antenna. This is used for transillumination methods (also called Transit Time).		

268	Traveltime inversion						Elmar Strobach	
269	Trigger Pulse				Pulse generated in the control unit that is sent through the cable to the transmitting antenna.			
270	Triggering				Electronically informing the instrument to commence recording.		Elmar Strobach	
271	Two-way travel time				The time it takes the GPR wave to travel down to a target (dielectric or electric discontinuity) and back up to the receiving antenna in nanoseconds. This is converted into a depth if the velocity of the subsurface is known.		Andy Kathage	
272	Ultra Wide Band	UWB			Antenna which transmits a large range of frequencies.	Ultra-wideband (also known as UWB, ultra-wide band and ultraband) is a radio technology pioneered by Robert A. Scholtz and others which may be used at a very low energy level for short-range, high-bandwidth communications using a large portion of the radio spectrum.[1] UWB has traditional applications in non-cooperative radar imaging. Most recent applications target sensor data collection, precision locating and tracking applications	Giovanni Alli, IDS / Wikipedia	
273	Velocity			m/s or m/nsec	Propagation speed of light in a given medium...	The speed at which electromagnetic signals propagate. In air or free space, electromagnetic energy propagates at the speed of light. In dielectric materials, the velocity of propagation is slower by the square root of the dielectric constant.	Giovanni Alli, IDS	
274	Velocity Filter	VF			Also called a frequency domain filter. A digital signal processing function that discriminates on the basis of apparent velocity. Coherent arrivals with certain apparent velocities are attenuated.			
275	Vertical Filter				A digital signal processing function that attenuates signals outside of the filter function for each individual scan			
276	Vertical Radar Profiling					Acquisition geometry used if only one borehole is available where one antenna remains on the surface (typically transmitter) while the second antenna (typically receiver) is lowered into the borehole.		
277	Vertical Resolution				The ability to separate two feature within one scan that are very close together. The minimum separation of two bodies before their individual identities are lost on the resultant map or cross-section. A function of transducer frequency, sampling interval and range.			
278	Wall Probing Radar	WPR			A radar that can see movement behind walls. Mainly used in the defence sector.		MA	
279	Waveguide				Low velocity layer.	situation where a layering with strong contrast in dielectric properties occurs between layers. Typically observed if high dielectric permittivity is surrounded by two layers of lower dielectric permittivity (see dielectric slab, e.g. air -> wet soil/water puddle -> drier soil), geometric dispersion effects can be used to quantify layer properties	Elmar Strobach	
280	Waveguide diffraction					in case of dielectric anomalies within a waveguide structure diffractions may occur that backscatter some of the energy. Due to the low-loss characteristics of low-velocity waveguide structures,	Elmar Strobach	

281	Waveguide Dispersion					The geometric effect of different propagation velocity within a dielectric slab or waveguide, waves with low frequency are typically faster than higher frequencies due to geometric effects (internal reflections, interferences), note that various modes can lead to complex dispersion images	Elmar Strobach
282	Wavelength					The wavelength of a wave is the spatial period of the wave—the distance over which the wave's shape repeats and the inverse of the spatial frequency. It is usually determined by considering the distance between consecutive corresponding points of the same phase, such as crests, troughs, or zero crossings and is a characteristic of both traveling waves and standing waves.	Vincent Utsi / Wikipedia
283	Wavelet					A short duration signal, brief oscillation	Stefan van der Baan
284	Wavefront					The surface over which the phase of a traveling is the same.	Matt Guy (Sheriff 2002)
284	Wavefront Measurement						
284	Wide Angle Reflection and Refraction	WARR				Reflection where the angle of incidence is greater than the critical angle.	Vincent Utsi
284	Wiggle Trace					See Trace	Stefan van der Baan
284	X Band						
284	Y Band						
284	Zero crossing					The point in sinusoidal wave where the amplitude is zero.	Giovanni Alli, IDS
284	Zero-offset	ZSR				Source and receiver located in the same place.	Matt Guy/ (Sheriff 2002)
284	Zero-offset Profiling					Acquisition geometry used for two boreholes. Both antennas are lowered simultaneously into the separated boreholes, measurements are triggered at constant depth intervals.	Elmar Strobach
284	Zero-time correction					Altering the record start time in order to compensate for the time taken for the transmitted signal to travel to the ground surface.	Elmar Strobach

Sheriff, R.E. 2002. Encyclopaedic Dictionary of Applied Geophysics. Fourth Edition. Tulsa: Society of Exploration Geophysicists.