

---

## INDEX

---

### Numerics

---

1:N protection switching, 390  
 1xRTT, 32  
 2.5G (2.5 generation), 29–34  
 2G (second generation), 26–29, 30, 31, 35, 39, 55, 415, 549  
 3 dB bandwidth, 281  
 3G (third generation), 23, 26, 29, 30, 32, 33, 34–40, 51, 55  
 3GPP, 35, 37, 450, 661  
 3GPP2, 35, 38, 450, 661  
 3xRTT, 32  
 4G, 25, 27, 29, 35, 38–40, 56  
 5G, 21, 24, 25–27, 40–42, 44, 56

---

### A

---

Adaptive delta modulation (ADM), 437  
 ADPCM, 416, 423–425  
 Advanced intelligent network (AIN), 522  
 ALOHA, 464, 465  
 Amplitude modulation, 256, 257–264  
   modulation index, 257  
   percentage modulation, 257  
   pilot tone SSB, 261  
   tone-in-band, 262  
 SSB, 260

balanced modulator, 261  
 filter method, 260  
 AMPS, 7, 27, 474, 533–543, 547, 549, 557, 567, 582, 594, 613–614  
 blank-and-burst encoding, 539  
 compander, 538  
 deviation limiter, 538  
 electronic serial number, 499, 536  
 paging channel, 537  
 pre-emphasis, 538  
 SAT tone, 535, 539  
 Signaling tone, 536, 539  
 Station class mark, 536  
 System identification number, 535  
 Voice mobile attenuation code, 535  
 Angle modulation, 264  
   frequency modulation, 256  
   phase modulation, 265  
 ANSI J-STD-007, 28  
 ANSI J-STD-008, 28, 675  
 ANSI J-STD-011, 28  
 Antenna diversity. *See* space diversity  
 Antenna downtilting, 88  
 Antenna gain, 107  
 Antenna polarization diversity, 356  
 Antenna temperature, 612  
 APC, 416

ARDIS, 508  
 Asynchronous applications, 591  
 Asynchronous transfer mode (ATM), 513  
 AT&T, 4, 157, 493, 533  
 AT&T Wireless, 28  
 Attenuation factor, 161, 163  
     *see also* floor attenuation factor (FAF)  
 Authentication center, 520, 553  
 Autonomous registration, 499  
 Average fade duration, 224  
 Average holding time, 603  
 AWGN, 294, 355

---

**B**

---

Bandwidth efficiency, 394  
 Base station, 9, 10, 13  
 BCH code, 400, 540  
 Bell Laboratories, 2, 4, 157, 533  
 Bell Operating Companies, 494  
 Berlekamp–Massey algorithm, 405, 407  
 BFSK, 312  
     bandwidth, 313  
     complementary channel, 334  
     detection, 313  
     error probability for noncoherent detection, 314  
     PSD, 313  
     transmission channel, 334  
 B-ISDN, 500  
 Bistatic radar equation, 136  
 Blank-and-burst, 536  
 Blind algorithms, 360  
 Block codes, 356, 395  
     cyclic, 396  
     forward error correction, 395  
     linearity, 396  
     systematic, 396  
 Blocked calls cleared, 78  
 Blocked calls delayed, 80  
 Bluetooth, 25, 26, 47, 52–54, 457  
 Boltzmann’s constant, 612  
 BPSK, 295, 344  
     bandwidth, 296  
     geometric representation, 293  
     PSD, 296  
     receiver, 297

Branch, 381  
 Breathing cell, 73  
 Brick-wall filter, 287  
 Burst noise, 256  
 Busy-idle, 467

---

**C**

---

C-450, 8, 594  
 CAD, 48  
 Capacity, 5, 6, 13, 28, 34, 2, 57, 58, 59, 60, 62, 66,  
     67–77, 78, 79, 86–96, 138, 167, 184, 279,  
     338, 388, 394, 412, 415, 436, 438, 447,  
     449, 459, 460, 461, 469–487, 492, 493,  
     495, 502, 510, 512, 528, 531, 533, 536,  
     540, 541, 566, 567, 580, 584, 590, 593  
 Capture, 458  
 Capture ratio, 468  
 Carson’s rule. *See* FM bandwidth  
 CD-900, 426, 438  
 CDMA, 5, 36, 448, 458  
     capacity, 481  
     near-far effect, 74, 458  
     self-jamming, 459  
 cdma2000, 32, 36  
 cdmaOne, 27, 28, 34, 38  
 CDPD, 7, 400, 401, 405, 506  
     MDBS, 507  
     MD-IS, 507  
     MDLP, 507  
     M-ES, 507  
     RRMP, 507  
 Cell broadcast, 550  
 Cell planning, 535  
 Cell splitting, 86, 86–88, 90, 96  
 Cellular packet-switched architecture, 523  
     base station interface unit, 525  
     cellular controller interface unit, 527  
     gateway interface unit, 524  
     trunk interface unit, 525  
         PAD, 525  
     visitor interface unit, 524  
     wireless terminal interface unit, 525  
 Central office, 493  
 CEPT, 501, 549

- Channel assignment, 62, 65  
   adaptive, 473  
   dynamic, 62, 548  
   fixed, 62
- Channel coding, 356, 393, 394  
   distance of a code, 396  
   weight of a code, 396
- Channel decoding, 409  
   Fano's sequential algorithm, 410  
   feedback decoding, 410  
   stack sequential algorithm, 410  
   Viterbi algorithm, 409
- Channel planning, 72–73
- Channel vocoders, 429
- Characteristics of speech signals, 417  
   ACF, 417  
   PDF, 417  
   PSD, 418  
   spectral flatness measure, 418
- Chien search algorithm, 405
- Cingular, 28
- Circuit switching, 503
- Cisco Systems, Inc., 47
- Clarke and Gans fading model, 214, 220
- Clear sky, 44
- Click noise, 276
- Cluster size, 60
- Co-channel reuse ratio, 68
- Code book, 422  
   index, 422
- Code division multiple access. *See* CDMA
- Coded digital verification color code. *See* USDC (IS-136), channels, CDVCC
- Codeword polynomial, 401
- Codewords, 395
- Coherence bandwidth, 202
- Coherence distance, 230, 232, 241, 243
- Coherence time, 179, 203
- Comfort noise subsystem, 563
- Common channel signaling, 496, 500, 522  
   architecture, 511  
   database service management system, 512  
   in-band signaling, 510  
   service management system, 512  
   signaling transfer point, 512  
   switching end point, 511
- Companding, 420, 538  
   A-law, 420  
    $\mu$ -law, 419, 420
- Complex voltage fluctuations, 234
- Complimentary code keying orthogonal frequency division multiplexing (CCK-OFDM), 46
- Computational loading, 63
- Computer-aided design (CAD), 48
- Connectionless protocol, 507
- Constant envelope, 264
- Constant modulus algorithm, 360
- Constraint length, 408
- Contention protocols  
   hybrid access, 464  
   random, 464  
   scheduled access, 464
- Control file messages, 537
- Control messages, 537
- Convolutional codes, 356, 407, 409
- COST (Cooperative for Scientific and Technical Research), 154
- Cost function, 360
- CPE, 51, 494
- CPFSK, 314
- CSMA  
   1-persistent, 467  
   CSMA/CD, 467  
   nonpersistent, 467  
   p-persistent, 467
- CT2, 6, 8, 423, 438, 499, 580, 595  
   duplexing, 582  
   modulation, 582  
   speech coding, 582
- Customer premises equipment. *See* CPE
- CVSDM, 416
- Cyclic code, 399
- 
- D**
- 
- D-AMPS. *See* USDC
- DAS, 93
- Data sense multiple access, 467

- dBd, 108
- dBi, 108
- DCS, 596
- DCS-1800, 8, 438
- DCS-1900, 7, 28
- Decision feedback equalizer, 369
  - lattice implementation, 370
  - MMSE, 370
  - predictive DFE, 370
- DECT, 6, 8, 36, 423, 437, 438, 499, 582–586, 590, 595
  - antenna diversity, 586
  - architecture, 582–584
  - channel coding, 586
  - channel types, 585
  - DLC layer, 584
  - MAC layer, 583
  - modulation, 586
  - network layer, 584
  - physical layer, 583
  - speech coding, 585
- Delay line, 273
- DEM, 146
- Demodulation of AM, 262
  - coherent, 262
  - noncoherent, 262, 264
- Demodulation of BFSK
  - coherent, 313
  - noncoherent, 314
- Demodulation of FM, 268
  - PLL detector, 270
  - quadrature detector, 270
  - slope detector, 269
  - zero-crossing detector, 270
- Depolarization matrix, 117
- Diagnostic acceptability measure (DAM), 444
- Diagnostic rhyme test (DRT), 442
- Dielectrics, 114, 115, 121
- Diffraction, 113, 126–135
  - Fresnel zones, 126
  - Huygen's principle, 126
- Diffraction models, 126–135
- Digital elevation models. *See* DEM
- Digital european cordless telephone. *See* DECT
- Digital hierarchy, 501
- Digital signals, 281
  - absolute bandwidth, 281
  - half-power bandwidth, 281
  - null-to-null bandwidth, 281
  - PSD, 281
- Digital subscriber line. *See* DSL, 41
- Digital traffic channel, *See* USDC (IS-136), channels, DTC
- Direct RF pulse system, 192
- Direct sequence SS, 331
  - error probability, 337
  - near-far problem, 338, 339
  - processing gain, 333
  - receiver, 333
- Directed retry, 536
- Discrete cosine transform, 428
- Dispersion
  - frequency, 205
  - time, 205
- Distributed antenna systems. *See* DAS
- Diversity, 355, 380–390
- DM, 416
- DoCoMo, 30
- Doppler frequency, 224, 225
- Doppler shift, 179–180, 347
- Doppler spectrum, 615
- Doppler spread, 203–205, 222, 261, 262, 339, 44, 347, 348, 355, 373
  - fading effects, 208–209, 220
  - in Clarke's model, 217–218
- Doupoly, 4
- DPCM, 416
- DPSK, 298
  - error probability, 299
  - receiver, 299
  - transmitter, 298
- Dropped call, 64
- DS formats, 501
- DSL, 41
- DSMA, 467
- DSS1, 512
- DS-SS, 46
- DTX, 474

Duplexer, 10, 11, 447  
 Duplexing, 447  
 Durkin's model, 146

---

**E**


---

EDGE, 30, 32, 33, 34, 33–34, 35, 37, 38  
 Effective isotropic radiated power (EIRP), 107  
 Effective noise temperature, 612  
 Effective radiated power (ERP), 107  
 EGPRS. *See* Enhanced GPRS  
 Electronic serial number. *See* AMPS  
 e-mail, 29, 506, 523  
 End-of-call message, 539  
 Enhanced GPRS (*also* EGPRS), 33  
 Equalization, 355, 356  
 Equalizers, 355
 

- adaptive, 357, 372–378
  - algorithms, 372–378
- classification, 364
- computational complexity, 372
- fractionally spaced, 380
- linear, 366–368
- mean squared error, 363
- misadjustment, 372
- nonlinear, 368–371
- numerical properties, 372
- prediction error, 363
- rate of convergence, 372
- summary, 379

 Equipment identity register, 553  
 Ericsson multiple breakpoint model, 161  
 Erlang, 77
 

- Erlang B, 79, 602–606
- Erlang C, 80, 607–610

 ERMES, 8  
 Error control coding, 34, 279, 343, 390, 393, 395, 457, 503, 504
 

- algorithms, 30

 Error locator polynomial, 405, 407  
 Error probability for frequency selective fading, 344  
 Error probability for slow fading, 342  
 ETACS, 8, 27, 534–543, 594
 

- area identification number, 535

 ETSI, 23, 549

Euclidean distance, 294, 422  
 Excess delay, 183  
 Excess delay spread, 199  
 Extended Hata model, 154  
 Extension field, 397

---

**F**


---

f1/f2 cell, 73  
 Fading, 177
 

- Doppler, 220
- fast, 208
- flat, 205
- frequency selective, 207
- large-scale, 105, 380
- slow, 209
- small-scale, 106, 113, 177, 178, 178–179, 185, 188, 192, 205–210, 228, 256, 380, 381, 459, 619
- time selective, 205

 Fano algorithm, 410  
 Far-field, 108  
 Fast associated control channel. *See* USDC (IS-136), channels, FACCH  
 Fast FSK. *See* MSK  
 FDMA, 5, 448, 449  
 Feed forward, 364, 366, 369, 370  
 Feedback, 270, 290, 331, 364, 366, 368, 369, 370, 371, 385, 386, 400, 404, 410, 411, 424, 462, 464, 525, 527, 529, 548  
 Fixed cellular, 21  
 FFSR, 262  
 FHMA, 457
 

- erasures, 457
- fast frequency hopping, 457
- slow frequency hopping, 457

 FH–SS, 46  
 Finite fields, 396  
 FIR filter, 366  
 Fixed network transmission hierarchy, 501  
 Fixed wireless access, 21, 24, 25, 40–41, 44, 54, 448  
 FLEX, 7  
 Floor attenuation factor (FAF), 160  
 FM bandwidth, 266–7
 

- Carson's rule, 266, 267, 313

 Footprint, 58

Formants, 429  
 Forward band, 447  
 Forward channel, 10, 11  
   control, 10, 14  
   voice, 14, 534, 535  
 FPLMTS, 20, 501  
 Fraunhofer region, 108  
 Free space propagation model, 107–110, 120  
   Friis equation, 107  
 Frequency diversity, 356, 390  
 Frequency division duplexing (FDD), 10, 447  
 Frequency division multiple access. *See* FDMA  
 Frequency division multiplex, 390  
 Frequency domain channel sounding, 196  
 Frequency domain coding, 425  
   adaptive, 428  
   block transform, 425  
   sub-band, 425  
 Frequency hopping  
   error probability, 338  
   hop duration, 334  
   hopping cell, 566  
   hopset, 334  
   instantaneous bandwidth, 334  
   single channel modulation, 334  
   slotted, 339  
   total hopping bandwidth, 334  
 Frequency modulation, 264, 265  
   bandwidth, 266  
   capture effect, 257  
   detection gain, 276  
   direct method, 267  
   indirect method, 267  
   SNR, 276  
 Frequency reuse, 5, 15, 57, 58–60, 62, 68, 70, 71, 72,  
   73, 74, 86, 87, 88, 90, 91, 96, 471, 474,  
   477, 478, 480, 481, 483, 486, 496, 541, 585  
 Frequency shift keying (FSK), 6  
   *See also* BFSK, CPFSK, MFSK  
 Frequency-to-amplitude converter, 268  
 Fresnel zone geometry, 126  
   excess path length, 126  
   Fresnel zone, 125, 127  
   Fresnel-Kirchoff diffraction parameter, 126  
 Full-duplex, 9, 10, 11  
 FWA. *See* Fixed Wireless Access

**G**

G.721, 423  
 Galois field, 397  
 Gaussian approximation, 629  
 Gaussian filter, 290  
 General packet radio service. *See* GPRS  
 Generator matrix, 408  
 Generator polynomial, 400, 401, 408  
 Geometric representation, 291  
   constellation diagram, 293  
 GIS database, 167  
 Global balance equation, 605  
 Global system mobile. *See* GSM  
 GMSK, 290, 318  
   PSD, 319  
   receiver, 320  
   transmitter, 320  
 Golay code, 399  
 GPRS, 30, 31, 32, 33, 34, 37, 542  
 Grade of service, 77–86, 540, 601  
 Ground reflection model, 120  
   method of images, 122  
 GSC, 7  
 GSM, 8, 9, 26, 28, 29, 438, 474, 499, 549–555, 596  
   Abis interface, 551  
   ARFCN, 553  
   base station controller, 551  
   base station subsystem, 551  
   broadcast channel (BCH), 557  
   burst formatting, 566  
   ciphering, 565  
   common control channel (CCCH), 559  
   control channel coding, 564  
   control channels (CCH), 557  
   data channel coding, 564  
   dedicated control channel (DCCH), 559  
   demodulation, 566  
   equalization, 566  
   frame structure, 561  
   frequency hopping, 566  
   interleaving, 565  
   logical channel, 554  
   modulation, 566  
   network and switching subsystem, 553

operation support subsystem, 553  
 physical channel, 554  
 speech coding, 563  
 subscriber identity module, 550  
 TCH/FS, SACCH, FACCH coding, 563  
 traffic channels, 555  
   full-rate TCH, 556  
   half-rate TCH, 556

Guard channel, 65

---

## H

---

Hadamard code, 399  
 Half duplex, 9, 10, 11  
 Half power beamwidth. *See* HPBW  
 Hamming code, 399  
 Hamming distance, 396, 410  
 Handoff, 6, 10, 13, 14, 15, 62–64, 86, 88, 92, 96, 452, 454, 461, 493, 497, 500, 507, 518, 520, 522, 525, 527, 530, 536, 538, 543, 551, 560, 569, 583, 591  
   cell dragging, 66  
   dwell time, 64  
   hard, 34, 67, 73  
   prioritizing, 65  
   mobile assisted. *see* MAHO  
   soft, 34, 67, 73, 459, 460, 568  
   strategies, 62–67  
 Handover (*see also* handoff), 551  
 Hard decision decoding, 409  
 Hata model, 153–154  
 Hidden transmitter, 468  
 High data rate, 39  
 High performance radio local area network. *See* HIPERLAN, 49  
 Hilbert transform, 260  
 HIPERACCESS, 43  
 HIPERLAN, 43, 49  
 HIPERLINK, 43  
 Home location register, 520, 553  
 HomeRF, 46, 457  
 HPBW, 168  
 HSCSD, 30, 30–31, 32  
 Hunting sequence, 101

Hybrid multiple access techniques  
   DS/FHMA, 460  
   DSMA/CD, 507  
   FCDMA, 459  
   TCDMA, 460  
   TDFH, 461  
 Hyperframe, 563

---

## I

---

iDen, 7  
 IEEE 802.11, 20, 46, 47, 49  
   IEEE 802.11a, 46, 50, 329  
   IEEE 802.11b, 46, 47, 48, 53  
   IEEE 802.11g, 46  
 IEEE 802.15, 53  
 IEEE 802.16, 43  
 IF, 74  
 I-mode, 30  
 Improved Gaussian approximation, 635  
 Impulse response model, 181–191, 340  
 IMSI, 553  
 IMT-2000, 20, 501  
 Incremental redundancy, 33  
 Indoor propagation, 227  
   studies, 197  
 Indoor propagation models, 157–166  
 Information polynomial, 401, 403  
 Input vector, 422  
 Interexchange carrier, 493  
 Interference, 67–77, 86, 90, 127, 177, 192, 194, 195, 214, 230, 279, 330, 333, 334, 338, 346–350, 436, 438, 449, 451, 454, 456, 459, 461, 462, 463, 473, 474, 475, 476, 477, 478, 480, 481, 483, 484, 485, 486, 523, 535, 536, 539, 541, 563, 565, 566, 568, 572, 578, 580, 584, 585, 586, 590, 591, 621, 623, 625, 626, 629, 630, 633, 634, 635, 637, 638  
   adjacent channel, 74–76, 547  
   C/I ratio, 469  
   co-channel, 68–72, 257, 346, 469  
   cross-rail, 344  
   forward channel, 469  
   intersymbol. *See also* ISI, 178, 344

- Interference (*continued*)  
 multiple access. *See* MAI  
 out-of-band, 68  
 reverse channel, 469  
 S/I ratio, 533  
 SIR (*also* S/I ratio), 69, 70
- Interleaving, 393, 457, 531, 542, 546, 547, 555, 565, 566, 568, 571, 576, 586,  
 block, 393  
 convolutional, 393
- Intermediate frequency. *See* IF
- Internet protocol, 507
- Irreducible polynomial, 398, 400
- IS-136, 5, 27, 28, 29, 30, 31, 33, 37, 38, 73, 438, 442, 541–549, 67, 590, 596, 591
- IS-41, 499
- IS-54. *See also* USDC, 5, 28, 438, 499, 541–549, 590  
 Rev.C, 549
- IS-94, 548
- IS-95, 5, 7, 27, 28, 35, 38, 39, 67, 73, 392, 411, 435, 438, 499, 542, 549, 567–580, 591  
 channel specifications, 567  
 forward channel, 569–575  
 forward channel block interleaver, 571  
 forward channel convolutional encoder, 569  
 forward channel data scrambler, 572  
 forward channel long PN sequence, 571  
 forward channel orthogonal coverage, 573  
 forward channel power control subchannel, 572  
 forward channel quadrature modulation, 574  
 reverse channel, 575–580  
 reverse channel block interleaver, 576  
 reverse channel convolutional encoder, 576  
 reverse channel direct sequence spreading, 578  
 reverse channel orthogonal modulation, 576  
 reverse channel quadrature modulation, 580  
 reverse channel variable data rate, 576  
 Walsh function matrix, 573
- IS-95A, 32, 34, 36, 38
- IS-95B, 32, 34, 35, 36, 38
- ISDN, 512  
 access signaling, 512  
 basic rate interface, 512  
 bearer channels, 512  
 data channels, 512  
 network signaling, 512  
 primary rate interface, 512
- ISI, 355, 356, 391, 547  
 in GMSK, 320
- ISM bands, 591
- Isochronous, 591
- Isolation, 11
- Isotropic radiator, 107
- Isotropic source, 108
- ITFS, 593
- ITS model. *See* Longley Rice model
- ITU, 21
- ITU World Radio Conference (WRC-2000), 21
- ITU-R, 20, 21
- IXC, 519
- IxEV, 32
- 
- J**
- 
- Japanese digital cellular (JDC), 590
- JTACS, 8, 27
- 
- K**
- 
- Kalman RLS, 378
- Knife-edge diffraction model, 129
- 
- L**
- 
- LANFielder, 49
- Lattice filter, 367
- Least mean square algorithm (LMS), 373, 374, 375  
 MMSE, 375  
 normal equation, 375
- LEO, 21, 42
- Level crossing rate, 223
- License-free spectrum, 46
- Line coding, 282  
 Manchester codes, 282, 540  
 NRZ code, 282  
 RZ code, 282
- Linear predictive coder (LPC), 28, 429, 431–436, 442, 545, 563
- Listen before talk, 591
- Lloyd Max algorithm, 419
- LMDS, 26, 40–45, 54



- LMS. *See* least mean square algorithm  
 Local access and transport area, 493  
 Local multipoint distribution systems. *See* LMDS  
 Locator receiver, 64, 536  
 Log-distance indoor model, 161  
 Log-distance path loss model, 138–139, 156  
 Log-distance power law, 227  
 Log-normal shadowing, 139–141  
   path loss exponent, 140  
   standard deviation, 140  
 Logic tables, 408  
 Longley Rice model, 145  
   area mode, 145  
   point-to-point mode, 145  
   urban factor, 145  
 Low Earth Orbit satellite. *See* LEO
- 
- M**
- MAHO, 64, 454, 473, 500, 543, 544, 548, 590  
 MAI, 329, 337, 338, 339, 393  
 MAN. *See* metropolitan area network  
 Manchester code. *See* line coding  
 Markov chain, 604  
 M-ary, 322  
   MPSK, 323  
 Maximal ratio combining, 383  
 Maximum excess delay, 183, 199  
 Maximum likelihood decoding, 409  
 Maximum ratio combining, 385  
 MC. *See* multicarrier  
 M-commerce, 29  
 MCS, 33  
 MDR. *See* Medium data rate, 34  
 MDS, 593  
 Mean excess delay, 199  
 Mean opinion score (MOS), 444  
 Mean square distortion, 419  
 Medium data rate (MDR), 34  
 Metropolitan area network (MAN), 523, 529  
 MFSK, 328  
   bandwidth, 328, 329  
   error probability (coherent detection), 328  
   error probability (noncoherent detection), 328  
 Microcell, 6, 64, 65, 66, 86, 87, 88, 93, 120, 125,  
   227, 229, 437, 473, 491, 548, 587, 591  
   *see also* zone microcell  
   wideband PCS model, 155–157  
 Microscopic diversity techniques, 380  
 Millimeter wave, 42, 44, 51, 54  
 MIRS, 6, 7  
 MLSE, 370  
 MMDS, 329, 593  
 MMSE, 367  
 mmW. *See* millimeter wave  
 Mobile assisted handoff. *See* MAHO, 543  
 Mobile commerce (m-commerce), 29  
 Mobile identification number, 15, 534, 535  
 Mobile satellite networks, 20  
 Mobile station, 10, 13  
 Mobile Switching Center. *See* MSC  
 Mobile Telephone Switching Office. *See* MTSO  
 Modified final judgement, 493  
 Modulating signal, 257  
 Modulation, 255  
   bandwidth efficiency, 278  
   constant envelope, 311  
   linear techniques, 294  
   performance in fading and multipath channels,  
     339  
   power efficiency, 278  
   spread spectrum, 329  
     frequency hopped, 334  
 Motorola, 6, 7, 20, 21, 42, 508, 540, 545  
 MPSK  
   bandwidth, 325  
   error probability, 324  
   PSD, 324  
 MSC, 10, 13, 535  
 MSE, 419  
 MSK, 314, 344, 345  
   bandwidth, 316  
   geometric representation, 323  
   PSD, 316  
   receiver, 316  
   transmitter, 316  
 MTSO, 13  
 Multicarrier (MC), 38

Multicarrier transmissions, 34  
 Multiframe  
   control channel, 557  
   speech, 556  
 Multipath propagation, 195, 231, 239, 241, 248, 330,  
   55, 388  
   small-scale, 177–180  
 Multiple Access Interference. *See* MAI  
 Multiple access techniques  
   code division. *See* CDMA  
   frequency division. *See* FDMA  
   frequency hopped. *See* FHMA  
   hybrid, 459  
   narrowband, 449  
   packet radio (PR), 449, 462  
   space division. *See* SDMA  
   spread spectrum (SSMA), 456  
   time division. *See* TDMA  
   wideband, 449  
 Multiple knife-edge diffraction model, 134  
 Multiple modulation and coding schemes (MCS), 33

---

**N**


---

N-AMPS, 7, 540  
   DSAT, 540  
   DST, 540  
 Nearest neighbors cells, 73  
 Near–far effect, 468, 568  
 NEC, 8  
 Network database, 529  
   distributed hierarchy, 529  
 Newton's identities, 407  
 Nextel, 2, 6, 29  
 NMT-450, 8, 9, 594  
 NMT-900, 8, 594  
 Noise figure, 101, 172, 611, 613  
 Noise floor, 68, 101, 138, 199  
 Nonminimum phase, 370, 390, 391  
 North American Digital Cellular (NADC), 27, 28,  
   541  
 NRZ code. *See* line coding  
 NTACS, 8  
 NTT, 8, 28, 30  
 Nyquist criterion, 282  
 Nyquist filters, 286

---

**O**


---

OFDM, 35, 46, 328–329, 356, 390  
 Offset QPSK. *See* OQPSK  
 Okumura model, 150–153  
 OQPSK, 295, 303–304, 305, 315, 316, 344, 345, 547  
 Orbital Sciences Corp., 21  
 Orthogonal Frequency Division Multiplexing.  
   *See* OFDM  
 OSI model, 505  
 Outage probability, 340  
 Out-of-band signaling, 510–512, 515  
 Overhead messages, 537

---

**P**


---

$\pi/4$  DQPSK, 547  
   performance in fading, 346  
 $\pi/4$  QPSK, 295, 305, 305–311  
   detection techniques, 308–311  
   geometric representation, 305  
   receiver, 308  
   transmission techniques, 305–308  
 $\pi/4$  QPSK  
   receiver  
     baseband differential detection, 308  
     FM discriminator, 311  
     IF differential detector, 310  
 Pacific digital cellular. *See* PDC  
 Packet radio (PR), 462  
   CSMA, 466  
   protocols, 463  
   pure ALOHA, 464  
   reservation, 467–469  
   slotted ALOHA, 465  
 Packet reservation multiple access (PRMA), 528  
 Packet switching, 504–5, 513, 514, 523–7  
 PACS, 7, 438, 499, 587–590, 595, 596  
   channels, 589  
   modulation, 589  
   multiple access technique, 590  
   speech coding, 589  
   system architecture, 587  
 Page, 10, 11  
 Paging, 11  
 Paging message, 535  
 Paging system access number, 11

- PAN, 52–54  
 Parity polynomial, 400, 401  
 Partial syndromes, 404  
 Partition loss, 157  
   hard partition, 157  
   soft partition, 157  
 Path loss, 108  
   coverage area, 141  
   large-scale, 167  
   models, 138  
   small-scale, 167  
 PBX, 494, 548  
 PCM, 416, 423  
 PCN, 20, 522  
 PCS, 1, 2, 3, 6, 9, 10, 20, 25, 26, 29, 43, 93, 106,  
   154, 155–157, 438, 491, 501, 522–527,  
   533, 549, 567, 580, 587, 587–590, 591  
 PDC, 8, 9, 27, 28, 30, 438, 474, 590, 596  
 Personal access communication systems. *See* PACS  
 Personal area networks. *See* PAN  
 Personal communication networks. *See* PCN  
 Personal communication services. *See* PCS  
 Personal handyphone system. *See* PHS  
 Phase modulation, 264  
 PHS, 7, 8, 29, 438, 590, 595, 596  
 Pilot tones, 256  
 Plane of incidence, 114  
 PN sequences, 330  
   maximal length, 331  
 POCSAG, 6, 7  
 Point of presence (POP), 494  
 Polar, 282  
 Polarization diversity, 387  
   correlation coefficient, 390  
   theoretical model, 388  
 Polarization diversity reception, 388  
 Portable, 9  
 POTS (plain old telephone service), 28  
 Power, 581  
 Power amplifiers  
   Class A, 256  
   Class AB, 256  
   Class C, 256  
 Power control, 73, 76–77, 338, 458, 459, 474, 475,  
   476–477, 478, 481, 484, 485, 535, 567,  
   568, 572, 573, 578, 581, 590, 634, 637,  
   640, 641  
 Power delay profile, 185  
 Power efficient, 256  
 Power fluctuations, 234  
 Power flux density, 111  
 Power-sum symmetric functions, 407  
 Primitive polynomial, 400, 401  
 Property restoral blind algorithms, 360  
 Processing gain, 194, 195, 196, 333, 334, 391, 460,  
   475  
 PSTN, 2, 493, 535  
 Pulse shaping techniques, 282
- 
- Q**
- 
- QAM, 325  
   bandwidth, 327  
   error probability, 327  
   geometric representation, 325  
   PSD, 327  
 QPSK, 295, 300, 344, 345, 547  
   bandwidth, 301  
   geometric representation, 300  
   probability of error, 300  
   PSD, 301  
   receiver, 303  
   staggered. *See also* OQPSK, 303  
   transmitter, 301  
 Quadrature detector, 273  
 Quadrature tank circuit, 273  
 Quantization techniques, 418  
   adaptive, 421  
   nonuniform, 419  
   uniform, 418  
   vector. *See* VQ, 422  
 Quotient polynomial, 401
- 
- R**
- 
- Radar cross section model, 136  
 Radio capacity, 469–487  
   for CDMA, 474  
   for CDMA with multiple cells, 477  
   for FDMA, 473  
   for SDMA, 484  
   for TDMA, 473

- Radio General Assembly, 21  
 Radio signal strength indications. *See* RSSI  
 Radio transmission technology. *See* RTT  
 Raised cosine rolloff filter, 287  
 RAKE receiver, 330, 356, 385, 391, 568  
 RAM mobile data (RMD), 508  
 Range extension, 93  
 Rate of quantizer, 422  
 Ray tracing, 167  
   primary, 163  
 Rayleigh fading, 210, 234  
   two-ray model, 226  
 Recursive least squares algorithm (RLS), 373, 376  
 Reed–Solomon (RS) code, 400  
   decoding, 404  
   encoding, 401  
 Reflection, 113, 114, 114–120, 177, 214, 227, 228,  
   367, 380, 388, 432, 434, 440  
   Brewster angle, 119  
   Fresnel reflection coefficient, 114  
   from conductors, 120  
   from dielectrics, 114–119  
 Remainder polynomial, 401, 403  
 Repeaters, 93  
 Reverse band, 447  
 Reverse channel, 11  
   control, 14  
   voice, 14, 534, 535  
 Ricean fading, 213  
 Rms delay spread, 199  
 Roaming, 10, 18, 499  
 RPE-LTP vocoder, 440  
 RSSI, 62, 459  
 RTT, 38  
 RZ code. *See* line coding
- 
- S**
- 
- Saleh and Valenzuela model, 227  
 Scattering, 114, 135–138  
   loss factor, 136  
   object, 136  
 SDMA, 484, 449, 461  
 Search window, 391  
 Second generation. *See* 2G  
 Sectoring, 86, 90–92, 93, 94, 96, 533  
 Setup channels, 14  
 Shadowing, 139  
 Shannon’s channel capacity formula, 394  
 Shape factors, 229–247  
   approximate spatial autocovariance function,  
     619–620  
 Short messaging service. *See* SMS  
 Signal penetration into buildings, 166–167  
 Signaling tone, 538, 539  
 Signal-to-noise ratio. *See* SNR  
 Simplex, 9  
 Simplified expression for improved Gaussian  
   approximation, 637  
 Simulcasting, 11  
 Single sideband (SSB), 260  
 SIRCIM, 189, 227  
 SISP, 167  
 Site specific. *See* also SISP, 163  
   modeling, 167  
 SitePlanner, 48, 49, 93, 94, 167  
 SiteSpy, 49  
 Sleep mode, 549  
 Slope detector, 269  
 Slope filter, 269  
 Slow associated control channel. *See* USDC (IS-136),  
   channels, SACCH  
 Small-scale  
   *see also* Fading  
 Small-scale channel modeling, 185  
 Small-scale indoor channel impulse response mea-  
   surements. *See* SIRCIM  
 Small-scale link performance, 356  
 Small-scale multipath channel, 185  
 Small-scale multipath measurements, 192–197  
 Small-scale power delay profile, 197  
 small-scale received power, 187  
 SMRCIM, 189, 190, 227, 229, 231, 248, 671  
 SMS, 29, 550  
 SNR, 6, 68, 138, 225, 256, 276–277, 280, 343, 348,  
   374, 380, 381, 382, 383, 384, 385, 386,  
   387, 392, 394, 395, 411, 412, 442, 475,  
   476, 611, 613, 614  
 Soft decision decoding, 409

- Source bits, 393
- Space diversity, 385
  - equal gain combining, 387
  - feedback, 386
  - maximal ratio combining, 387
  - selection, 386
- Space-time processing, 356
- Spatial autocovariance, 240, 242–243, 245, 619–620
- Spatial channel parameters, 616
- Spatial diversity, 356, 586
- Spatial filtering, 40, 41, 184
- Spatial selectivity, 234, 236, 615
- Spatial separation, 68, 197
- Spatial-temporal channel model, 229
- Spectral coherence restoral algorithm, 360
- Spectral widening, 303
- Spectrum regrowth, 303
- Speech coders, 416
  - choice of codec, 436
  - for different cellular systems, 438
  - frequency domain coding, 425
  - GSM codec, 440
  - hierarchy, 416
  - performance evaluation, 442
  - QCELP, 13 435, 580
  - tandem signaling, 444
  - USDC codec, 442
  - vocoders, 416, 429
  - waveform coders, 416
- Speech coding, 423
- Speech compression, 426
- Spread spectrum sliding correlator, 193
- SQNR, 419
- Square root raised cosine filter, 547
- SS7, 514
  - congestion control, 519
  - Global cellular network interoperability, 520
    - call delivery, 522
    - intersystem handoff, 522
    - registration, 521
  - message transfer part, 516
    - level 1, 516
    - level 2, 516
    - level 3, 516
  - network services part, 515
  - performance, 519
  - Signaling connection control part (SCCP), 517
  - signaling traffic, 518
  - user part, 517
    - ISUP, 517
    - OMAP, 518
    - TCAP, 518
- SSB, 260
- Stack algorithm, 410
- State diagrams, 408
- Stochastic gradient algorithm. *See* least mean square algorithm (LMS), 375
- Stochastically excited linear predictive coders (SELP), 545
- Sub-band
  - quadrature mirror filter, 426
- Subscriber, 9, 10
- Superframe, 563
- Supervisory audio tone. *See* AMPS, SAT tone
- Synchronous optical network (SONET), 44
- Syndrome calculation, 406
- System capacity, 28, 67–77, 86, 580
- 
- T**
- 
- TACS, 594
- Tap gain vector, 377
- TDD. *See* time division duplex
- TDMA, 5, 448, 453
  - efficiency, 455
  - number of channels, 455
- TD-SCDMA, 36–40
- Telecommunications Industry Association. *See* TIA
- Temporary directory number, 522
- Thermal noise, 611
- Threshold extension, 277
- Third generation. *See* 3G
- Threshold, 276
- Throughput, 463
- TIA, 5
- Time diversity, 356, 390
- Time division duplex (TDD), 10, 11, 447
- Time division multiple access. *See* TDMA
- Timing advancement, 558
- Traffic occupancy, 463

Traffic routing in wireless networks, 502  
     connection oriented service, 502  
     connectionless service, 503  
 Training sequence, 360  
 Transceiver, 10, 11  
 Transformation matrix, 117  
 Transparent tone-in-band (TTIB), 262  
 Transversal filter. *See* FIR filter, 359  
 Tree diagrams, 408  
 Trellis coded modulation (TCM), 412  
 Trellis diagrams, 408  
 Trunking, 4, 62, 77–86, 520, 528  
     efficiency, 86, 92, 94, 96  
     theory, 78  
 Turbo codes, 356, 412  
 Two-wave channel model, 236

---

**U**


---

Umbrella cell, 66  
 UMTS, 35, 36, 37–38, 501, 530–531  
 Unipolar, 282  
 United States Geological Survey. *See* USGS  
 Universal mobile telecommunications service. *See*  
     UMTS  
 US digital cellular. *See* USDC  
 USDC (IS-136), 5, 7, 9, 373, 438, 474, 535, 541–549,  
     560  
     channel coding, 545  
     channels, 543  
         CDVCC, 543  
         DTC, 543  
         FACCH, 543  
         frame structure, 544  
         SACCH, 543  
     codec, 442  
     demodulation, 548  
     equalization, 548  
     interleaving, 546  
     modulation, 547  
     speech coding, 545  
 User service time, 603  
 USGS, 146  
 UTRA, 36  
 UWC-136, 36

---

**V**


---

Vector quantization. *See* VQ  
 Vector sum excited linear predictive coder (VSELP),  
     442, 545  
 Virtual home entertainment, 37  
 Virtual switching. *See* Packet switching, 504  
 Visitor location register, 520, 553  
 Viterbi algorithm, 409  
 Vocoder  
     cepstrum, 429, 430  
     channel, 429  
     formant, 429, 430  
     linear predictive coder, 429, 431  
         *see also* LPC  
         code excited, 434  
         multipulse excited, 434  
         predictor coefficients, 432  
         residual excited, 436  
         stochastic. *See* code excited, 434  
     voice excited, 429, 431  
 Voice activity, 475  
 Voice activity detector, 474, 528, 563  
 Voltage-controlled oscillator (VCO), 267, 268  
 VQ, 422  
     algorithms, 423  
         multistage, 423  
         shape-gain, 423  
         tree-structured, 423  
     code book, 422, 423  
 Vulnerable period, 463

---

**W**


---

WACS. *See* PACS  
 Walfisch and Bertoni model, 155  
 WARC, 21, 23  
 W-CDMA, 32, 36  
 Wearable computers, 54  
 Wide area network (WAN), 507  
 Wideband data signaling, 538  
 Wideband microcell model, 155  
 Wi-Fi, 46  
 WiMax, 329  
 Wireless applications protocol (WAP), 29, 30  
 Wireless cable television, 593

Wireless Ethernet Compatibility Alliance, 46  
Wireless internet service provider. *See* WISP  
Wireless local loop. *See* WLL  
Wireless local area networks. *See* WLAN  
Wireless Valley Communications Inc., 48, 49, 94  
WISP, 51  
WLAN, 25, 26, 42, 46–52, 53, 54, 329, 533  
WLL, 40–45  
World Administrative Radio Conference. *See* WARC  
Worldwide Interoperability for Microwave Access.  
*See* WiMax

WRC-2000, 21

---

**X**

---

X.25  
DCE, 505  
DSE, 505  
DTE, 505  
protocol, 505

---

**Z**

---

Zero forcing algorithm, 374  
Zone microcell, 86, 93