GNSS Signals (1/3)

Military or Restricted Signal

System	Carrier Freq. (MHz)	Signal	I/Q	Min Rec. Power (dBW)	Modulation	Primary Code			Secondary Code		Navigation Data				Notes	Pocket SDR Signal ID
						Length (chip)	Chip Rate (Mcps)	Cycle (ms)	Length (chip)	Cycle (ms)	Data	Symbol Rate (sps)	Data Rate (bps)	FEC		
GPS [1][2][3]	1575.42	L1C/A	Q	-158.5	BPSK(1)	1023	1.023	1	-	-	LNAV	50	50	-		L1CA
		L1P(Y)*1	I	-161.5	BPSK(10)	1week	10.23	1week	-	-	LNAV	50	50	-		-
		L1M	I	?	BOC(10,5)	?	5.115	?	?	?	?	?	?	?	Block IIR-M~	-
		L1C-D	I	-163.0	BOC(1,1)	10230	1.023	10	-	-	CNAV-2	100	50	BCH,LDPC	GPS III~	L1CD
		L1C-P	I	-158.25	TMBOC(6,1,4/33)	10230	1.023	10	1800	18000	-	-	-	-		L1CP
	1227.6	L2C/A	Q	-164.5	BPSK(1)	1023	1.023	1	-	-	LNAV	50	50	-	Block IIR-M~	-
		L2P(Y)*1	I	-164.5/-161.5	BPSK(10)	1week	10.23	1week	-	1week	LNAV	50	50	-		-
		L2M	I	?	BOC(10,5)	?	5.115	?	?	?	?	?	?	?	Block IIR-M~	-
		L2C-M	Q/I	-160.0/ -158.5	BPSK(1)+TDM	10230	0.5115	20	-	-	LNAV	50	50	-	Block IIR-M~	-
											CNAV	50	25	1/2 *6		L2CM
		L2C-L			BPSK(1)+TDM	767250	0.5115	1500	-	-	-	-	-	-		(L2CL)
	1176.45	L5-I	I	-157.9/-157.0	BPSK(10)	10230	10.23	1	10 (NH)	10	CNAV	100	50	1/2 *6	Block IIF~	L5I
		L5-Q	Q	-157.9/-157.0	BPSK(10)	10230	10.23	1	20 (NH)	20	-	-	-	-		L5Q
GLONASS [4][5][6][7]	1602.0 + 0.5625K*2	L1C/A*4	I	-161.0	BPSK(0.5)	511	0.511	1	- / 2*3	- / 2*3	GLO-STR	100	50	-		G1CA
		L1P	Q	?	BPSK(5)	5110000	5.11	1000	-	-	?	?	?	-		-
	1600.995	L1OCd	Q	?	BPSK(1)+TDM	1023	0.5115	2	2 (MC)	4	GLO-STR	250	125	1/2 *6		G1OCD
		L1OCp			BOC(1,1)+TDM	4092	0.5115	8	-	-	-	-	-	-	GLO-K2~	G1OCP
		L1SC	I	?	?	?	?	?	?	?	?	?	?	?		-
	1246.0 + 0.4375K*2	L2C/A*5	I	-167.0	BPSK(0.5)	511	0.511	1	- / 2*3	- / 2*3	GLO-STR	100	50	-		G2CA
		L2P	Q	?	BPSK(5)	5110000	5.11	1000	-	-	?	?	?	-		-
	1248.06	L2CSI	Q	?	BPSK(1)+TDM	?	0.5115	?	?	?	?	?	?	?		-
		L2OCp	Q	?	BOC(1,1)+TDM	10230	0.5115	20	50	1000	-	-	-	-	GLO-K2~	G2OCP
		L2SC	I	?	?	?	?	?	?	?	?	?	?	?		-
	1202.025	L3OCd	I	?	BPSK(10)	10230	10.23	1	5 (BC)	5	GLO-STR	200	100	1/2 *6	GLO-K1~	G3OCD
		L3OCp	Q	?	BPSK(10)	10230	10.23	1	10 (NH)	10	-	-	-	-		G3OCP
Galileo[8]	1575.42	E1-A	Q	?	BOC(15,2.5)	?	2.5575	?	?	?	G/NAV	?	?	?	PRS	-
		E1-B	I	-157.0	CBOC(6,1,1/11)	4092	1.023	4	-	-	I/NAV	250	125	1/2 *6	OS, SoL, CS	E1B
		E1-C	I		CBOC(6,1,1/11)	4092	1.023	4	25	100	-	-	-	-		E1C
	1176.45	E5a-I	I	-155.0	BPSK(10)	10230	10.23	1	20	20	F/NAV	50	25	1/2 *6	OS, CS	E5AI
		E5a-Q	Q		BPSK(10)	10230	10.23	1	100	100	-	-	-	-		E5AQ
	1207.14	E5b-I	I	-155.0	BPSK(10)	10230	10.23	1	4	4	I/NAV	250	125	1/2 *6	OS, SoL, CS	E5BI
		E5b-Q	Q		BPSK(10)	10230	10.23	1	100	100	-	-	-	-		E5BQ

*1 AS ON, *2 K = {-7, ..., +6}, *3 Odd FCN, *4 L1OF, *5 L2OF, *6 Convolutional Code (R=1/2, K=7), NH: Neuman Hoffman Code, MC: Manchester Code, BC: Barker Code

GNSS Signals (2/3)

Military or Restricted Signal

System	Carrier Freq. (MHz)	Signal	I/Q	Min Rec. Power (dBW)	Modulation	Primary Code			Secondary Code		Navigation Data				Notes	Pocket SDR Signal ID
						Length (chip)	Chip Rate (Mcps)	Cycle (ms)	Length (chip)	Cycle (ms)	Data	Symbol Rate (sps)	Data Rate (bps)	FEC		
Galileo (Cont.)	1191.795	E5a+b*7	-	(-152.0)	8-PSK(10)	10230	10.23	1	100	100	-	-	-	-		-
	1278.75	E6-A	Q	?	BOC(10,5)	?	5.115	?	?	?	G/NAV	?	?	?	PRS	-
		E6-B	I	-155.0	BPSK(5)	5115	5.115	1	-	-	C/NAV	1000	500	1/2 *6	CAS, HAS	E6B
		E6-C	I		BPSK(5)	5115	5.115	1	100	100	-	-	-	-		E6C
QZSS [9][10][11][12]	1575.42	L1C/A	I/Q	-158.5*8	BPSK(1)	1023	1.023	1	-	-	LNAV	50	50	-		L1CA
		L1C/B	I	-158.5	BOC(1,1)	1023	1.023	1	-	-	LNAV	50	50	-		L1CB
		L1C-D	I	-163.0*9	BOC(1,1)	10230	1.023	10	-	-	CNAV2	100	50	BCH,LDPC		L1CD
		L1C-P	Q	-158.25	BOC(1,1)	10230	1.023	10	1800	18000	-	-	-	-	Block I	L1CP
			I	-158.25*10	TMBOC(6,1,4/33)	10230	1.023	10	1800	18000	-	-	-	-	Block II ~	L1CP
		L1S	I	-161.0/-158.5	BPSK(1)	1023	1.023	1	-	-	L1S	500	250	1/2 *6	SLAS	L1S
	1227.6	L2C-M	I	-160.0/ -158.5	BPSK(1)+TDM	10230	0.5115	20	-	-	CNAV	50	25	1/2 *6		L2CM
		L2C-L			BPSK(1)+TDM	767250	0.5115	1500	-	-	-	-	-	-		(L2CL)
	1176.45	L5-I	I	-157.9/-157.0	BPSK(10)	10230	10.23	1	10 (NH)	10	CNAV	100	50	1/2 *6		L5I
		L5-Q	Q	-157.9/-157.0	BPSK(10)	10230	10.23	1	20 (NH)	20	-	-	-	-		L5Q
		L5S-I	I	-157.0*11	BPSK(10)	10230	10.23	1	-	-	L5S	500	250	1/2 *6	Normal mode	L5SI
									2 (MC)	2	L5S	500	250	1/2 *6	Verif. mode	L5SIV
		L5S-Q	Q		BPSK(10)	10230	10.23	1	20 (NH)	20	-	-	-	-	Normal mode	L5SQ
									2 (MC)	2	-	-	-	-	Verif. mode	L5SQV
	1278.75	L6D	I	-155.7	BPSK(5)+TDM*12	10230	2.5575	4	-	-	L6D	2000	2000	RS	CLAS	L6D
		L6L			BPSK(5)+TDM	1048575	2.5575	410	2 (MC)	820	-	-	-	-	Block I	-
		L6E			BPSK(5)+TDM*12	10230	2.5575	4	-	-	L6E	2000	2000	RS	MADOCA-PPP	L6E
BeiDou [13][14][15] [16][17]	1561.098	B1I	I	-163.0	BPSK(2)	2046	2.046	1	20 (NH)	20	D1	50	50	BCH		B1I
								1	-	-	D2	500	500	BCH	GEO	B1I
		B1Q	Q	?	BPSK(2)	?	2.046	?	?	?	?	?	?	?		-
	1575.42	B1C-D	I	-159.0/ -161.0	BOC(1,1)	10230	1.023	10	-	-	B-CNAV1	100	50	NB-LDPC	BDS-3	B1CD
		B1C-P	I		QMBOC(6,1,4/33)	10230	1.023	10	1800	18000	-	-	-	-		B1CP
		B1A-D	Q	?	BOC(14,2)	?	2.046	?	?	?	?	?	?	?		-
		B1A-P	Q			?	2.046	?	?	?	-	-	-	-		-
	1176.45	B2a-D	I	-156.0/ -158.0	BPSK(10)	10230	10.23	1	5	5	B-CNAV2	50	25	NB-LDPC	BDS-3	B2AD
		B2a-P	Q		BPSK(10)	10230	10.23	1	100	100	-	-	-	-		B2AP
	1207.14	B2I	I	?	BPSK(2)	2046	2.046	1	20 (NH)	20	D1	50	50	BCH		B2I
								1	-	-	D2	500	500	BCH	GEO	B2I

*7 AltBOC, *8 -164.0 dBW (SVID=7), *9 -167.2 dBW (SVID=7), *10 -162.4 dBW (SVID=7), *11 -162.6 dBW (SVID=3), *12 +CSK by Nav Data

GNSS Signals (3/3)

Military or Restricted Signal

System	Carrier Freq. (MHz)	Signal	I/Q	Min Rec. Power (dBW)	Modulation	Primary Code			Secondary Code		Navigation Data				Notes	Pocket SDR Signal ID
						Length (chip)	Chip Rate (Mcps)	Cycle (ms)	Length (chip)	Cycle (ms)	Data	Symbol Rate (sps)	Data Rate (bps)	FEC		
BeiDou (Cont.)	1207.14	B2Q	Q	?	BPSK(10)	10230	10.23	1	?	?	?	?	?	?		-
		B2b-I	I	-160.0/ -162.0	BPSK(10)	10230	10.23	1	-	-	B-CNAV3	1000	500	NB-LDPC	BDS-3	B2BI
											B2b-PPP	1000	500	NB-LDPC	BDS-3, GEO	B2BI
		B2b-Q	Q	?	BPSK(10)	10230	10.23	1	?	?	?	?	?	?	BDS-3	-
	1191.795	B2a+b[*13]	-	?	8-PSK(10)	10230	10.23	1	?	?	-	-	-	-		-
	1268.52	B3I	I	-163.0	BPSK(10)	10230	10.23	1	20 (NH)	20	D1	50	50	BCH		B3I
								1	-	-	D2	500	500	BCH	GEO	B3I
		B3Q	Q	?	BPSK(10)	?	10.23	?	?	?	?	?	?	?		-
		B3A-D	I	?	BPSK(10)	?	10.23	?	?	?	?	?	?	?	BDS-3	-
		B3A-P	I		BPSK(10)	?	10.23	?	?	?	-	-	-	-		-
NavIC [18][19]	1575.42	L1-SPS-D	Q	-159.6	BOC(1,1)	10230	1.023	10	-	-	IRN-NAV	100	50	BCH,LDPC	NVS-01~	I1SD
		L1-SPS-P	I	-158.2	CSBOC(6,1,4/33)	10230	1.023	10	1800	18000	-	-	-	-		I1SP
	1176.45	L5-SPS	*14	-159.0	BPSK(1)	1023	1.023	1	-	-	IRN-NAV	50	25	1/2 [*6]		I5S
		L5-RS-D	*14	?	BOC(5,2)	?	2.046	?	?	?	?	50	25	1/2 [*6]		-
		L5-RS-P	*14	?	BOC(5,2)	?	2.046	?	?	?	-	-	-	-		-
	2492.028	S-SPS	*14	-162.3	BPSK(1)	1023	1.023	1	-	-	IRN-NAV	50	25	1/2 [*6]		(ISS)
		S-RS-D	*14	?	BOC(5,2)	?	2.046	?	?	?	?	50	25	1/2 [*6]		-
		S-RS-P	*14	?	BOC(5,2)	?	2.046	?	?	?	-	-	-	-		-
SBAS [*15] [20]	1575.42	L1C/A	I	-	BPSK(1)	1023	1.023	1	-	-	SBAS	500	250	1/2 [*6]		L1CA
	1176.45	L5-I	I	-	BPSK(10)	10230	10.23	1	2 (MC)	2	L5 SBAS	500	250	1/2 [*6]	PRN120-158	L5I
		L5-Q	Q	-	BPSK(10)	10230	10.23	1	2 (MC)	2	-	-	-	-		L5Q

*13 ACE-BOC, *14 Interplex Modulation, *15 including QZSS L1Sb, BeiDou BDSBAS-B1C/B2a

[1] IS-GPS-200K, Navstar GPS space segment/navigation user interfaces - interface specification, 2019, [2] IS-GPS-800F, Navstar GPS space segment/user segment L1C interface - interface specification, 2019, [3] IS-GPS-705A, Navstar GPS space segment/user segment L5 interface - interface specification, 2010, [4] GLONASS interface control document - navigation radiosignal in bands L1, L2, version 5.1, 2008, [5] GLONASS interface control document - code division multiple access open service navigation signal in L1 frequency band, edition 1.0, 2016, [6] GLONASS interface control document - code division multiple access open service navigation signal in L2 frequency band, edition 1.0, 2016, [7] GLONASS interface control document - code division multiple access open service navigation signal in L3 frequency band, edition 1.0, 2016, [8] European GNSS (Galileo) open service signal-in-space interface control document (OS SIS ICD), Issue 1, Revision 3, 2016, [9] Quasi-Zenith satellite system interface specification - satellite positioning, navigation and timing service (IS-QZSS-PNT-003), 2018, [10] Quasi-zenith satellite system interface specification - sub-meter level augmentation service (IS-QZSS-L1S-003), 2018, [11] Quasi-zenith satellite system interface specification - centimeter level augmentation service (IS-QZSS-L6-003), 2018, [12] Quasi-zenith satellite system interface specification - positioning technology verification service (IS-QZSS-TV-004), 2023, [13] BeiDou navigation satellite system signal in space interface control document - open service signal B1I, version 3, 2019, [14] BeiDou navigation satellite system signal in space interface control document - open service signal B1C, version 1.0, 2017, [15] BeiDou navigation satellite system signal in space interface control document - open service signal B2a, version 1.0, 2017, [16] BeiDou navigation satellite system signal in space interface control document - open service signal B3I, version 1.0, 2018, [17] BeiDou navigation satellite system signal in space interface control document - Precise Point Positioning service signal PPP-B2b, version 1.0, 2020, [18] Indian Regional Navigation Satellite System, Signal in space ICD for standard positioning service version 1.1, 2017, [19] NAVIC signal in space ICD for standard positioning service in L1 frequency version 1.0, 2023, [20] RTCA, Minimum Operational Performance Standards for Airborne Equipment Using Global. Positioning System/Wide Area Augmentation System, DO-229, 1996