

# Product Survey GNSS Receivers

*In contrast to that of 2005, this product survey on GNSS receivers does not reveal any remarkable technological breakthroughs. Manufacturers are increasingly producing systems able to receive Navstar, Glonass and even Galileo signals.*

This year we have replaced the term GPS (Global Positioning System) by GNSS, because GNSS (Global Navigation Satellite System) better describes the significance and use of these receivers. From providing only position (where am I?) the receivers have evolved into real navigation systems (how do I get to get where I want to go?) The receivers listed here represent the high-end segment of a pyramid-shaped market.

Like all electronic devices, GNSS receivers are becoming smaller and lighter; onboard software is performing better and faster, interfaces are becoming more transparent and the number of simultaneously tracked satellites is on the increase, all whilst the price remains the same or even falls. GNSS receivers are evolving into systems that gather all kind of information or, put in another way, GNSS receivers are becoming more and more integrated with other systems. Perhaps GNSS receivers that provide only position and time will disappear from the market with the growing need to simultaneously collect position, time and other types of information.

Just two decades ago, a receiver weighed over 25 kilos, was very voluminous, cost more than US\$200,000 and was difficult to operate. As there were only a few satellites in orbit, the surveyor had to download an almanac to determine at which moment of the day a satellite constellation would enable calculation of a position. The modern GNSS receivers weigh less than a kilo, cost less than US\$5,000 and perform significantly better than their predecessors. And since the total number of satellites will increase within a few years to number approximately seventy, downloading an almanac now belongs to surveying history.

The Technology in Focus feature on page 13 elaborates on the characteristics and development of GPS and Glonass.

Henk J. Key, contributing editor, GIM International, e-mail: [henk.key@reedbusiness.nl](mailto:henk.key@reedbusiness.nl)

Brand	Leica Geosystems	Leica Geosystems
Model name/Type	GX1230 GG	ATX1230 GG
Introduction	May 2006	May 2006
Class (GPS, Glonass, Galileo/ S, D en T)	GPS, Glonass, dual frequency, RTK	GPS, Glonass, dual frequency, RTK
<b>Receiver and Antenna</b>		
Dimensions (h*d*w* in cm): base station case/ rover set case	21.2 x 16.6 x 7.9	18.6 x 8.9
Weight (receiver, rover, antenna, communications, batteries, pole)	All on the pole setup: 4.15kg. Backpack setup: 1.8kg (weight of pole), 2.2kg weight of backpack	All on the pole setup: 2.79kg
Static [mm + pmm]	2)	2)
RTK [mm + ppm]	RTK static: 5mm+0.5ppm, RTK kinematic: 10+1ppm (horizontal accuracies)	RTK static: 5mm+0.5ppm, RTK kinematic: 10+1ppm (horizontal accuracies)
Signal(s) tracked (types / bands / codes)	3)	3)
Single/dual/triple frequency	Dual	Dual
Number of channels / tracking mode	72	72
Max. no. of satellites tracked parallel (GPS/ Glonass/Galileo/Other)	28	28
Time to first fix (C/W/R) [sec/sec/sec]	Typically 60s/30s/1s	Typically 60s/30s/1s
Can the receiver perform RTK surveys	Y	Y
RTK initialisation (s/d) [sec]	8s (static and kinematic)	8s (static and kinematic)
PPS (Puls per second)	Y, optional	Y, optional
Update rate of position (frequency) [Hz]	20Hz	20Hz
Supported RTCM version	2 x with and RTCM Version 3	2 x with and RTCM Version 3
Possible types of messages	2 x with 1,2,3,9,18,19,20,21,22,23,24	2 x with 1,2,3,9,18,19,20,21,22,23,24
Id. proprietary format	Leica proprietary, CMR, CMR+	Leica proprietary, CMR, CMR+
Antenna (integr. and / or ext.)	External	External
Rover (r/rd/rdm) [V - W/W/W]	12V nominal, range 10.5-28V - 3.8/ 3.8 / 3.8	12V nominal, range 10.5-28V - 3.8/ 3.8 / 3.8
Base (bl/bm) [V - W/W/W]	12V nominal, range 10.5-28V - 3.8/ 3.8	12V nominal, range 10.5-28V - 3.8/ 3.8
Operating time w/o/w radio (h) [hrs/hrs]	15hrs without radio, 10hrs with radio	15hrs without radio, 10hrs with radio
Use of cellular phone for the datalink/ Protocol	Supported in housing: Siemens MC75, CDMA MultiTech. Supported without housing: any suitable phone.	Supported in housing: Siemens MC75, CDMA MultiTech. Supported without housing: any suitable phone.
Supported GSM protocols, ISDN, GPRS, UMTS	ISDN, GPRS, EDGE, CDMA, TDMA	ISDN, GPRS, EDGE, CDMA, TDMA
I/O-ports (number and type of plug)	4 x RS232 (8-pin LEMO)	1 x RS232 (clip-on), 1 USB port
Remote managing receiver	Y, modem and serial	Y, modem and serial
Options remote	Configure, status, download data, update firmware	Configure, status, download data, update firmware
Special remote software needed?	Y, Leica Geo Office or Leica Spider Software	Y, Leica Geo Office or Leica Spider Software
Integrity warnings (warning at failure datalink, loss of lock i.e.)	Y, all events trigger message warnings. Icons permanently show most important status information	Y, all events trigger message warnings. Icons permanently show most important status information
Base antenna phase centre stability I)	Sub mm	Sub mm
Rover antenna phase centre stability I)	Sub mm	Sub mm
<b>Data Storage and User Interface</b>		
Data storage on receiver	Y, removable CF card or fixed internal memory (optional)	Y, removable CF card or fixed internal memory (optional)
Storage medium (type) / memory [MB]	CF card 64MB, 256MB or 1GB (not for internal memory)	CF card 64MB, 256MB or 1GB (not for internal memory)
Exchangeable / fixed	Removable	Removable
Display; size (lines and char. / line)	Y, 1/4 VGA screen 11 lines, 32 characters per line	Y, 1/4 VGA screen 11 lines, 32 characters per line
Data input (pen / keys / qwerty board)	4)	4)
Graphical display functions	Y	Y
Background map support	Y, converters from dxf, XML and other formats	Y, converters from dxf, XML and other formats
Suitable for other auxiliary input devices?	Y, laser distance, tilt, meteo, echo sounders, bar code readers etc	Y, laser distance, tilt, meteo, echo sounders, bar code readers etc
Stakeout options (Graphical/E'N'H)	Y, graphically assisted	Y, graphically assisted
Support of RTK network solutions based on (VRS, FKP, PRS, RTCM3)	Y, VRS, FKP, RTCM3 and Leica Spider network formats	Y, VRS, FKP, RTCM3 and Leica Spider network formats
<b>Office Software</b>		
Brand / name	Leica Geo Office	Leica Geo Office
Hardware requirements	5)	5)
Network design (reconnaissance)	Y	Y
Network adjustment	Y	Y
Determination of local coordinate system parameters and input of pre- defined coordinate system parameters	Y	Y
User file output supported, specify	Y, customisable format files allows most formats to be created	Y, customisable format files allows most formats to be created
Predefined output format supported DXF, SHP...	Dxf, dgn, mif and shape files	Dxf, dgn, mif and shape files
Feature code processing	Line and area objects directly imported	Line and area objects directly imported
DTM and Volume calculations	N	N
Stakeout preparation	Y, all	Y, all
<b>Batteries</b>		
Internal and/or External	Internal and external	Internal and external
Number	2 internal Li-Ion and 2 external	2 internal Li-Ion and 2 external
Fixed or Exchangeable	Exchangeable	Exchangeable
Free available f.e. penlight / brand bound	Brand bound	Brand bound
Rechargeable with (auto)battery	N	N
Direct car connection cable available	Y	Y

N/A = Not Applicable  
□ = No information received



Brand	Leica Geosystems	Leica Geosystems	Penmap	NavCom Technology
Model name/ Type	GXI230	ATX1230	Penmap GPS RTK	NCT-2030M
Introduction	March 2004	March 2005	July 2006	October 2003
Class (GPS, Glonass, Galileo/ S, D en T)	GPS only, dual frequency, RTK	GPS only, dual frequency, RTK	GPS (+Glonass in September)	GPS, dual
<b>Receiver and Antenna</b>				
Dimensions (h <sup>o</sup> d <sup>o</sup> w <sup>o</sup> in cm): base station case/ rover set case	21.2 x 16.6 x 7.9	18.6 x 8.9	6 x 19 x 10	20 x 40 x 43
Weight (receiver, rover, antenna, communications, batteries, pole)	All on the pole setup: 4.15kg, Backpack setup: 1.8kg (weight of pole), 2.2kg weight of backpack	All on the pole setup: 2.79kg	1.2kg inc pole (Rover)	5.0kg
Static [mm + ppm]	2)	2)	10mm+1ppm	5mm+1ppm (rms)
RTK [mm + ppm]	RTK static: 5mm+0.5ppm, RTK kinematic: 10mm+1ppm (H)	RTK static: 5mm+0.5ppm, RTK kinematic: 10mm+1ppm (H)	10mm+1ppm	10mm+1ppm (rms)
Signal(s) tracked (types / bands / codes)	6)	6)	L1 L2	L1 & L2 Phase, C/A, P1, P2, SBAS
Single/dual/triple frequency	Dual	Dual	Dual	Dual
Number of channels / tracking mode	72	72	72	2 SBAS + 24 GPS Paralell
Max. no. of satellites tracked parallel (GPS/ Glonass/Galileo/Other)	16	16	14 GPS - 12 Glonass - 2 Sbas - 6 LS	2 SBAS + 12 GPS
Time to first fix (C/W/R) [sec/sec/sec]	Typically 60s/30s/1s	Typically 60s/30s/1s	50s/40s/30s	60s/60s/1s
Can the receiver perform RTK surveys	Y	Y	Y	Y, OTF RTK software upgrade
RTK initialisation (s/d) [sec]	8s (static and kinematic)	8s (static and kinematic)	10s	< 2s
PPS (Puls per second)	Y, optional	Y, optional	20 nano seconds	Y, standard
Update rate of position (frequency) [Hz]	20Hz	20Hz	20Hz	10Hz Position, 50 Hz Raw Data
Supported RTCM version	2 x with and RTCM Version 3	2 x with and RTCM Version 3	2, 1, 1, 1, Up to RTCMV3	2, 3
Possible types of messages	2 x with 1, 2, 3, 9, 18, 19, 20, 21, 22, 23, 24	2 x with 1, 2, 3, 9, 18, 19, 20, 21, 22, 23, 24	All major messages supported	□
Id, proprietary format	Leica proprietary, CMR, CMR+	Leica proprietary, CMR, CMR+	Y, but CMR and others supported	Y, NCT Ultra Compact, CMR, CMR+
Antenna (integr. and / or ext.)	External	External	Integrated Antenna on Rover	External
Rover (r/r/d/r/dm) [V - W/W/W]	12V nominal, range 10.5-28V - 3.8/ 3.8 / 3.8	12V nominal, range 10.5-28V - 3.8/ 3.8 / 3.8	□	10-30VDC 4 / 5 / 6
Base (b/b/m) [V - W/W]	12V nominal, range 10.5-28V - 3.8/ 3.8	12V nominal, range 10.5-28V - 3.8/ 3.8	10hrs	10-30VDC 4 / 5
Operating time wo/w radio (h) [hrs/hrs]	15hrs without radio, 10hrs with radio	15hrs without radio, 10hrs with radio	10hrs	Battery dependent
Use of cellular phone for the datalink/ Protocol	Supported in housing: Siemens MC75, CDMA MultiTech, Supported without housing: any suitable phone.	Supported in housing: Siemens MC75, CDMA MultiTech, Supported without housing: any suitable phone.	Y	Various external
Supported GSM protocols, ISDN, GPRS, UMTS	ISDN, GPRS, EDGE, CDMA, TDMA	ISDN, GPRS, EDGE, CDMA, TDMA	GSM, GPRS UMTS	External cellular phone specific
I/O-ports (number and type of plug)	4 x RS232 (8-pin LEMO)	1x RS232 (clip-on), 1 USB port	3 RS232, USB, TTL	2 RS232, 1 Power, LEMO
Remote managing receiver	Y, modem and serial	Y, modem and serial	Y	Y, Geo++ Modem, Serial, IP
Options remote	Configure, status, download data, update firmware	Configure, status, download data, update firmware	Y	Y, StarUtils, Geo++
Special remote software needed?	Y, Leica Geo Office or Leica Spider Software	Y, Leica Geo Office or Leica Spider Software	N	Y, StarUtils, Geo++
Integrity warnings (warning at failure datalink, loss of lock i.e.)	Y, all events trigger message warnings. Icons permanently show most important status information	Y, all events trigger message warnings. Icons permanently show most important status information	Y	Y, Geo++
Base antenna phase centre stability 1)	Sub mm	Sub mm	Max. 3mm	0.5, 0.3, 0.5 / 94.0% / 99.9%
Rover antenna phase centre stability 1)	Sub mm	Sub mm	Max. 3mm	0.5, 0.3, 0.5 / 94.0% / 99.9%
<b>Data Storage and User Interface</b>				
Data storage on receiver	Y, removable CF card or fixed internal memory (optional)	Y, removable CF card or fixed internal memory (optional)	N	Y
Storage medium (type) / memory [MB]	CF card 64MB, 256MB or 1GB (not for internal memory)	CF card 64MB, 256MB or 1GB (not for internal memory)	SD flash 6GB	MMC / 64
Exchangeable / fixed	Removable	Removable	Exchangeable	Fixed
Display: size (lines and char. / line)	Y, 1/4VGA screen 11 lines, 32 characters per line	Y, 1/4VGA screen 11 lines, 32 characters per line	640 x 480VGA display	See website: www.navcomtech.com
Data input (pen / keys / qwerty board)	4)	4)	Pen Keys and qwerty keyboard	See website
Graphical display functions	Y	Y	Y	See website
Background map support	Y, converters from dxf, XML and other formats	Y, converters from dxf, XML and other formats	Y	See website
Suitable for other auxiliary input devices?	Y, laser distance, tilt, meteo, echo sounders, bar code readers etc	Y, laser distance, tilt, meteo, echo sounders, bar code readers etc	Y	See website
Stakeout options (Graphical/ENH)	Y, graphically assisted	Y, graphically assisted	Y, both graphical and ENH)	See website
Support of RTK network solutions based on (VRS, FKP, PRS, RTCM3)	Y, VRS, FKP, RTCM3 and LEICA Spider network formats	Y, VRS, FKP, RTCM3 and LEICA Spider network formats	Y, VRS + FKP	See website
<b>Office Software</b>				
Brand / name	Leica Geo Office	Leica Geo Office	Penmap Office	Waypoint Consulting / GrafNav - GrafNet
Hardware requirements	5)	5)	Pentium 3 or above	Pentium / MS 95,98,2000,NT,XP / 64MB RAM
Network design (reconnaissance)	Y	Y	Y	Y
Network adjustment	Y	Y	Y	Y
Determination of local coordinate system parameters and input of pre- defined coordinate system parameters	Y	Y	Y	Y
User file output supported, specify	Y, customisable format files allow most formats to be created	Y, customisable format files allow most formats to be created	Users can design their own output formats	Y
Predefined output format supported DXF, SHP, ..	Dxf, dgn, mif and shape files	Dxf, dgn, mif and shape files	DXF, SHP, DGN	N
Feature code processing	Line and area objects directly imported	Line and area objects directly imported	Y	N
DTM and Volume calculations	N	N	Y	N
Stakeout preparation	Y, all	Y to all	Y	N
<b>Batteries</b>				
Internal and/or External	2 internal and external	2 internal and external	Internal and External	External
Number	2 internal Li-Ion and 2 external	2 internal Li-Ion and 2 external	1	User selected
Fixed or Exchangeable	Exchangeable	Exchangeable	Exchangeable	Exchangeable
Free available i.e. penlight / brand bound	Brand bound	Brand bound	Freely Available	User selected
Rechargeable with (auto)battery	N	N	Y	N
Direct car connection cable available	Y	Y	Y	N

N/A = Not Applicable  
 □ = No information received



NavCom Technology	NavCom Technology	Nippon GPS Solutions Corp. (NGS)	NovAtel	NovAtel
StarFire Receivers SF-2040G/ SF-2050G & M & VueStar	RTK Receivers RT-3010S / RT-3020S & RT-3020M	NetSurv3000 / v, vs, vsr	EuroPak - 15a	OEMV-2
September 2002 / September 2004 GPS dual	September 2002 GPS dual	<input type="checkbox"/> GPS	<input type="checkbox"/> GPS L1/L5 and Galileo L1/E5a	2006 GPS, G, dual, RTK
20 x 40 x 43	20 x 40 x 43	7 x 12.5 x 18	2,35 x 1,54 x 0,71	0,85 x 1,25 x 0,13
4.5kg / 5.0kg	4.5kg / 5.0kg	Receiver: 0,85kg (With 2 internal batteries)	1.2kg	0,056kg
5mm+1ppm (rms) 10mm+1ppm (rms)	5mm+1ppm (rms) 10mm+1ppm (rms)	H: 5mm+1ppm, V: 10mm+2ppm H: 10mm+1ppm, V: 20mm+2ppm	<input type="checkbox"/> <input type="checkbox"/>	10mm+1ppm 10mm+1ppm
L1 & L2 Phase, C/A, P1, P2, SBAS, StarFire	L1&L2 Phase, C/A, P1, P2, SBAS	L1 C/A Code, L2- P Code, L1/L2 Carrier Phase	GPS L1/L5 and Galileo L1/E5a	L1 C/A code and CP, L2 P(Y) code and CP, SBAS, Glonass
Dual 2 SBAS + 24 GPS Parallel + 1 StarFire	Dual 2 SBAS + 24 GPS Parallel	Dual (L1/L2) 24 (12: L1 / CA , 12: L2 / P-semi codeless)	Dual L1/L5 16 channels configurable	Dual 14 L1, 14 L2 GPS, 12 L1, 12 L2, Glonass, 2 SBAS
2 SBAS + 12 GPS + 1 StarFire	2 SBAS + 12 GPS	12 (GPS only)	16	14 GPS +12 Glonass + 2 SBAS
60s/60s/1s	60s/60s/1s	50s/40s/30s		50s/40s/1s
Y, OTF RTK software upgrade < 2s	Y, with OTF RTK < 2s	Y, by receiver itself or by RTK Server Our Server RTK-Solution : 15s (Sv=7), 30s (Sv=6), 40s (Sv=5)	N	Y < 30s (short baseline, low multipath conditions)
N / Y, standard SF-2050M & VueStar 25Hz Position, 50Hz Raw Data 2.3	N / Y, standard RT-3020M 25Hz Position, 50Hz Raw Data 2.3	N Positioning: 1Hz (on Server calculation) 2.3 Type 1, 3, 9, 15, 16, 18, 19, 20, 21, 22, 59	Y 1Hz <input type="checkbox"/> <input type="checkbox"/>	Y, standard 20Hz 3.0 RTCA, RTCM, RTCMV3, CMR, CMR+, NovAtel proprietary
Y, NCT RTK Extend, CMR, CMR+	Y, NCT Ultra Compact, CMR, CMR+	Y, original format for Serverside-RTK / RTCM or CMR for receiver-side-RTK	Y	Y
Integrated / External 10-30VDC 8 / 9 / 9	Integrated / External 10-30VDC 5 / 6 / 7	External GPS Antenna 5V- 2.4W	GPS-704X external <input type="checkbox"/>	External N/A
10-30VDC 8 / 8 10hrs / 8hrs	10-30VDC 5 / 6 18hrs / 15hrs	5V- 2.4W 6hrs / 6hrs (dependent on radio power supply)	<input type="checkbox"/> <input type="checkbox"/>	N/A N/A
Various external	Various external	Y, for transmitting data to server with PDA -controller / TCP. IP	<input type="checkbox"/>	N/A
External cellular phone specific	External cellular phone specific	Y, GSM, GPRS, CDMA, etc.	<input type="checkbox"/>	N/A
2 RS232, 1 Power (+ IPPS + 1 Event SF-2050M & VueStar) LEMO Y, Geo++ Modem, Serial, IP Y, StarUtils, Geo++	2 RS232, 1 Power (+ IPPS + 1 Event RT-3020M) LEMO Y, Geo++ Modem, Serial, IP Y, StarUtils, Geo++	3 RS232 Serial Ports, 1 external power port, 1 Antenna Connector Y, only with our PDA-controller Bluetooth (communication to PDA-controller) N	2 RS-232 9.6-230.9K <input type="checkbox"/> <input type="checkbox"/>	1 RS-232 or RS-422, 1 LV-TTL, 1 CAN, 1 USB Y, serial Configuration, data logging, firmware updates N
Y, StarUtils, Geo++	Y, StarUtils, Geo++	Y, only with our PDA-controller	GPSolution4	N
Y, Geo++	Y, Geo++	Y, only with our PDA-controller	Y	Y
0.5, 0.3, 0.5 / 94.0% / 99.9%	0.5, 0.3, 0.5 / 94.0% / 99.9%	7)	<input type="checkbox"/>	N/A
0.5, 0.8, 1.1 / 94.0% / 99.9%	0.5, 0.8, 1.1 / 94.0% / 99.9%	7)	<input type="checkbox"/>	N/A
Y	Y	Y	N	N
MMC / 64	MMC / 64	Compact Flash Memory Card (128M -)	N/A	N/A
Fixed See website: www.navcomtech.com	Fixed See website: www.navcomtech.com	Exchangeable Y, only with our PDA-controller	N/A N	N/A N
See website	See website	Y, only with our PDA-controller	Com Port	N/A
See website	See website	Y, only with our PDA-controller	GPSolution4	N/A
See website	See website	Y, only with our PDA-controller	N/A	N/A
See website	See website	Y, only with our PDA-controller	N/A	N/A
See website	See website	Y, only with our PDA-controller	N/A	N/A
See website	See website	Y, VRS, I-MAX	N/A	N/A
Waypoint Consulting / GrafNav - GrafNet Pentium / MS 95,98,2000,NT,XP / 64MB RAM	Waypoint Consulting / GrafNav - GrafNet Pentium / MS 95,98,2000,NT,XP / 64MB RAM	NS-Survey, NS-Network, NS-Note, NS-Sketch Windows 98Me/2000/XP	GPSolution4 PC	N/A N/A
Y	Y	Y	<input type="checkbox"/>	N/A
Y	Y	Y	<input type="checkbox"/>	N/A
Y	Y	Y		N/A
Y	Y	Y, PDF, DXF	<input type="checkbox"/>	N/A
N	N	Y, DXF: drawing data for points, lines, etc. by PDA software	<input type="checkbox"/>	N/A
N	N	N	<input type="checkbox"/>	N/A
N	N	N	<input type="checkbox"/>	N/A
N	N	Y	<input type="checkbox"/>	N/A
Internal / External 2 / User selected Exchangeable NavCom / User selected N N	Internal / External 2 / User selected Exchangeable NavCom / User selected N N	Internal or External 2 internal Exchangeable N Y, internal Y	9-18vdc ext 6W <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	N/A N/A N/A N/A N/A N



Brand	NovAtel	NovAtel	NovAtel	Septentrio
Model name/ Type	OEMV3	FlexPak-V2: Receiver enclosure	ProPak-V3: Receiver enclosure	PolarX2e_SBAS
Introduction	2006	2006	2006	October 2005
Class (GPS, Glonass, Galileo/ S, D en T)	GPS, G, triple, RTK	GPS, G, dual, RTK	GPS, G, triple, RTK	GPS, single, RTK, EGNOS/WAAS
<b>Data Storage and User Interface</b>				
Dimensions (h*d*w* in cm):base station case/ rover set case	0,85 x 1,25 x 0,13	1,23 x 1,465 x 0,443	1,85 x 1,60 x 0,71	3,7 x 28,5 x 1
Weight (receiver, rover, antenna, communications, batteries, pole)	0,075kg	0,350kg	1kg	0,93kg
Static [mm + ppm]	10mm+1ppm	10mm+1ppm	10mm+1ppm	10mm+1ppm
RTK [mm + ppm]	10mm+1ppm	10mm+1ppm	10mm+1ppm	10mm+1ppm
Signal(s) tracked (types / bands / codes)	L1 C/A code and CP, L2 P(Y) code and CP, L5, SBAS, Glonass, L-Band	L1 C/A code and CP, L2 P(Y) code and CP, L5, SBAS, Glonass	L1 C/A code and CP, L2 P(Y) code and CP, L5, SBAS, Glonass, L-Band	L1 CA+SBAS code+phase
Single/dual/triple frequency	Triple	Dual	Triple	Single
Number of channels / tracking mode	14 L1, 14 L2 GPS, 12 L1, 12 L2, Glonass, 2 SBAS, 1 L-Band	14 L1, 14 L2 GPS, 12 L1, 12 L2, Glonass, 2 SBAS	14 L1, 14 L2 GPS, 12 L1, 12 L2, Glonass, 2 SBAS, 1 L-Band	48, parallel
Max. no. of satellites tracked parallel (GPS/ Glonass/Galileo/Other)	14 GPS +12 Glonass +6 L5 + 2 SBAS + 1 L-Band	14 GPS +12 Glonass + 2 SBAS	14 GPS +12 Glonass +6 L5 + 2 SBAS + 1 L-Band	All in view
Time to first fix (C/W/R) [sec/sec/sec]		50s/40s/1s	50s/40s/1s	<90s/<20s/<2s
Can the receiver perform RTK surveys	Y	Y	Y	Y
RTK initialisation (s/d) [sec]	<30s (short baseline, low multipath conditions)	< 30s (short baseline, low multipath conditions)	< 30s (short baseline, low multipath conditions)	60s
PPS (Puls per second)	Y, standard	Y, standard	Y, standard	Y
Update rate of position (frequency) [Hz]	20Hz	20Hz	20Hz	10Hz
Supported RTCM version	3.0	3.0	3.0	RTCM v2.2, 2.3 and 3.0
Possible types of messages	RTCA, RTCM, RTCMV3, CMR, CMR+, NovAtel proprietary	RTCA, RTCM, RTCMV3, CMR, CMR+, NovAtel proprietary	RTCA, RTCM, RTCMV3, CMR, CMR+, NovAtel proprietary	1, 2, 3, 9, 16, 18, 19, 20, 21, 22, 59
Id. proprietary format	Y	Y	Y	Y: CMR; Septentrio Binary Format (SBF)
Antenna (integr. and / or ext.)	External	External	External	External
Rover (r/rd/rdm) [V - W/W/W]	N/A	N/A	N/A	9-30 VDC; 5W typ
Base (b/bm) [V - W/W]	N/A	N/A	N/A	9-30 VDC; 5W typ
Operating time wo/w radio (h) [hrs/hrs]	N/A	N/A	N/A	N/A
Use of cellular phone for the datalink/ Protocol	N/A	N/A	N/A	NA
Supported GSM protocols, ISDN, GPRS, UMTS	N/A	N/A	N/A	N/A
I/O-ports (number and type of plug)	1 RS-232 or RS-422, 1 RS-232, 1 LVTTL, 1 CAN, 1 USB	1 RS-232, 1 RS-232 or RS-422, 1 USB	2 RS-232 or RS-422, 1 RS-232, 1 USB	PWR ODU 3 pins female; IN/ COM1&2 ODU 7 pins female; OUT/ COM3&4 ODU 5 pins female; ETH ODU 4pins female
Remote managing receiver	Y, serial	Y, serial	Y, serial	Y, serial/ethernet
Options remote	Configuration, data logging, firmware updates	Configuration, data logging, firmware updates	Configuration, data logging, firmware updates	Configuration, data download, firmware update, perm. Reference stations..
Special remote software needed?	N	N	N	Y, RxControl
Integrity warnings (warning at failure datalink, loss of lock i.e.	Y	Y	Y	Y
Base antenna phase centre stability 1)	N/A	N/A	N/A	N/A
Rover antenna phase centre stability 1)	N/A	N/A	N/A	N/A
<b>Data Storage and User Interface</b>				
Data storage on receiver	N	N	N	Y
Storage medium (type) / memory [MB]	N/A	N/A	N/A	CF card standard 256MB, other possible
Exchangeable / fixed	N/A	N/A	N/A	fixed
Display; size (lines and char. / line)	N	N	N	RxMobile
Data input (pen / keys / qwerty board)	N/A	N/A	N/A	RxMobile
Graphical display functions	N/A	N/A	N/A	RxMobile
Background map support	N/A	N/A	N/A	N
Suitable for other auxiliary input devices?	N/A	N/A	N/A	N
Stakeout options (Graphical/E'N'H)	N/A	N/A	N/A	N
Support of RTK network solutions based on (VRS, FKP, PRS, RTCM3)	N/A	N/A	N/A	Y, FKP, RTCM3
<b>Office Software</b>				
Brand / name	N/A	N/A	N/A	GrafNav and other
Hardware requirements	N/A	N/A	N/A	N/A
Network design (reconnaissance)	N/A	N/A	N/A	N/A
Network adjustment	N/A	N/A	N/A	N/A
Determination of local coordinate system parameters and input of pre- defined coordinate system parameters	N/A	N/A	N/A	N/A
User file output supported, specify	N/A	N/A	N/A	N/A
Predefined output format supported DXF, SHP...	N/A	N/A	N/A	N/A
Feature code processing	N/A	N/A	N/A	N/A
DTM and Volume calculations	N/A	N/A	N/A	N/A
Stakeout preparation	N/A	N/A	N/A	N/A
<b>Batteries</b>				
Internal and/or External	N/A	N/A	N/A	External
Number	N/A	N/A	N/A	N/A
Fixed or Exchangeable	N/A	N/A	N/A	Exchangeable
Free available i.e. penlight / brand bound	N/A	N/A	N/A	Free available
Rechargeable with (auto)battery	N/A	N/A	N/A	Depends
Direct car connection cable available	N	Y	Y	Y

N/A = Not Applicable  
 □ = No information received



Septentrio	Septentrio	Septentrio	Sokkia
PolaRx2e_OEM	PolaRx2e/2eTR/2e_FDL (Field Data Logger)	PolaRx2e@/2eH	GSR2700 IS
October 2005	October 2005	October 2005	
GPS single, dual, RTK, EGNOS/WAAS	GPS single, dual, RTK, EGNOS/WAAS	GPS single, dual, RTK, EGNOS/WAAS	GPS dual
1,3 x 16 x 16	3,7 x 28,5 x 14	3,7 x 28,5 x 14	22.5cm f x 10.5cm D
0,12kg	0,93kg	0,93kg	1.8kg (3.9 lb) with internal radio
10mm+1ppm	10mm+1ppm	10mm+1ppm	3mm+0.5ppm (H) 10mm+1ppm (V)
10mm+1ppm	10mm+1ppm	10mm+1ppm	10mm+1ppm (H) 20mm+1ppm (V)
L1 CA+P code+phase, L2P code+phase, SBAS	L1 CA+P code+phase, L2P code+phase, SBAS	L1 CA+P code+phase, L2P code+phase, SBAS	L1: C/A Code and Carrier Phase, L2: P(Y)-Code and Carrier Phase
Dual	Dual	Dual	Dual
48, parallel	48, parallel	48, parallel	24 Parallel Channels
16 GPS DF; 6 SBAS	16 GPS DF; 6 SBAS	PolaRx2e@: 16 SF (3 ant), 9 DF (3 ant) - PolaRx2eH: 24 SF (2 ant), 12 DF (2 ant)	12 GPS
<90s/<20s/<2s	<90s/<20s/<2s	<90s/<20s/<2s	50s/40s/L1:0.5 sec and L2: 1.0 sec
Y	Y	Y	Y
5s	5s	5s	<15 sec., varies with bl length
Y	Y	Y	1PPS (out)
10Hz	10Hz	10Hz	20Hz
RTCM v2.2, 2.3 and 3.0	RTCM v2.2, 2.3 and 3.0	RTCM v2.2, 2.3 and 3.0	v2, v3
1, 2, 3, 9, 16, 18, 19, 20, 21, 22, 59	1, 2, 3, 9, 16, 18, 19, 20, 21, 22, 59	1, 2, 3, 9, 16, 18, 19, 20, 21, 22, 59	RTCA, RTCM, CMR, CMR+, NTRIP, NMEA, 1 PPS (out), mark in
Y, CMR; Septentrio Binary Format (SBF)	Y, CMR; Septentrio Binary Format (SBF)	Y, CMR; Septentrio Binary Format (SBF)	Y
External	External	External	Integrated Pinwheel
5VDC, 5W typ	9-30 VDC; 5W typ	9-30 VDC; 5W typ	
5VDC, 5W typ	9-30 VDC; 5W typ	9-30 VDC; 5W typ	
N/A	N/A	N/A	16hrs/10hrs
NA	NA	NA	Y, integrated
N/A	N/A	N/A	GSM/GPRS
PWR (1); IN (1); COM (2-4); OUT (1); ETH (1) - OEM	PWR ODU 3 pins female; IN/COM1&2 ODU 7 pins female; OUT/COM3&4 ODU 5 pins female; ETH ODU 4pins female	PWR ODU 3 pins female; IN/COM1&2 ODU 7 pins female; OUT/COM3&4 ODU 5 pins female; ETH ODU 4pins female	2 x RS232, 1 x USB, 1x Bluetooth, 1 x Internal Radio
Y, serial/ethernet	Y, serial/ethernet	Y, serial/ethernet	N
Configuration, data download, firmware update, perm. Reference stations..	Configuration, data download, firmware update, perm. Reference stations..	Configuration, data download, firmware update, perm. Reference stations..	N
Y, RxControl	Y, RxControl	Y, RxControl	N
Y	Y	Y	Y
N/A	N/A	N/A	L1 and L2 phase centre in same location with zero offset
N/A	N/A	N/A	L1 and L2 phase centre in same location with zero offset
Y	Y	Y	Y
CF card standard 256MB, other possible	CF card standard 256MB, other possible	CF card standard 256MB, other possible	Flash / 64MB Standard. Options up to 2GB
Exchangeable	Fixed	Fixed	Fixed
RxMobile	RxMobile	RxMobile	Y, fuel gauge style
RxMobile	RxMobile	RxMobile	Single button interface
RxMobile	RxMobile	RxMobile	Y, via data collector
N	N	N	Y, via data collector
N	N	N	Y
N	N	N	Y, via data collector
Y, FKP, RTCM3	Y, FKP, RTCM3	Y, FKP, RTCM3	Y,VRS, FKP, RTCM3
GrafNav and other	GrafNav and other	GrafNav and other	Spectrum Survey Suite
N/A	N/A	N/A	Windows 95 or later, min 16MB RAM, Pentium or later
N/A	N/A	N/A	N
N/A	N/A	N/A	Y
N/A	N/A	N/A	Y
N/A	N/A	N/A	Y, definable exports
N/A	N/A	N/A	PICS, IOB, SDR, IMAP, SGL, ASCII
N/A	N/A	N/A	Y
N/A	N/A	N/A	N
N/A	N/A	N/A	N
External	External	External	Internal and External
N/A	N/A	N/A	2
Exchangeable	Exchangeable	Exchangeable	Fixed
Free available	Free available	Free available	Via Sokkia Dealer
Depends	Depends	Depends	Charge in receiver
Y	Y	Y	N



Brand	Sokkia	Sokkia	Sokkia	Spectra Precision
Model name/ Type	GSR2600	GSR2650 LB	Stratus	Epoch 10
Introduction				
Class (GPS, Glonass, Galileo/ S, D en T)	GPS dual	GPS dual	GPS single	GPS
<b>Receiver and Antenna</b>				
Dimensions (h*d*w* in cm): base station case/ rover set case	7.0 x 18.3 x 15	7.1 x 18 x 15.4	15.5 x 12.5	4.4 x 24.2 x 9.5
Weight (receiver, rover, antenna, communications, batteries, pole)	1.3kg	1.1kg	0.8kg (with batteries)	With internal batteries: 0.62kg (1.37 lb)
Static [mm + ppm]	3mm+0.5ppm (H) 10mm+1ppm (V)	3mm+0.5ppm (H) 10mm+1ppm (V)	5mm+1ppm (H) 10mm+2ppm (V)	±5mm+ 0.5ppm × (baseline length) RMS (H) ±5mm+1ppm × (baseline length) RMS (V)
RTK [mm + ppm]	10mm+1ppm (H) 20mm+1ppm (V)	10mm+1ppm (H) 20mm+1ppm (V)	N/A	N/A
Signal(s) tracked (types / bands / codes)	L1: C/A-Code and Carrier Phase, L2: P(Y)-Code and Carrier Phase	L1: C/A-Code and Carrier Phase, L2: P(Y)-Code and Carrier Phase	L1 Full code and Carrier	12 Channels L1 C/A Code, L1 Full Cycle Carrier, WAAS/EGNOS I
Single/dual/triple frequency	Dual	Dual	Single	Single
Number of channels / tracking mode	24 Parallel Channels	24 Parallel Channels	12 Channels	12 Channels
Max. no. of satellites tracked parallel (GPS/ Glonass/Galileo/Other)	12 GPS	12 GPS	12 GPS	12
Time to first fix (C/W/R) [sec/sec/sec]	50s/40s/L1:0.5s and L2: 1.0s	50s/40s/L1:0.5s and L2: 1.0s	120s/40s/1s	N/A
Can the receiver perform RTK surveys	Y	Y	N	N
RTK initialisation (s/d) [sec]	<15s, varies with bl length	<15s, varies with bl length	N/A	N/A
PPS (Puls per second)	1PPS (out)	1PPS (out)	N	N
Update rate of position (frequency) [Hz]	20 Hz	20Hz	1Hz	1Hz
Supported RTCM version	v2, v3	v2, v3	None	N/A
Possible types of messages	RTCA, RTCM, CMR, CMR+, NTRIP, NMEA, 1 PPS (out), mark in	RTCA, RTCM, CMR, CMR+, NTRIP, NMEA, 1 PPS (out), mark in	None	N/A
Id, proprietary format	Y	Y	Y	N/A
Antenna (integ: and / or ext.)	External Pinwheel	External L-Band Pinwheel	Integrated	Integrated / Removable
Rover (r/rd/rdm) [V -W/W/W]				
Base (b/bm) [V -W/W]				
Operating time wo/w radio (h) [hrs/hrs]	Varies with power option chosen	8 to 12hrs	30hrs	8hrs
Use of cellular phone for the datalink/ Protocol	External GSM module available	External GSM module available	N	N/A
Supported GSM protocols, ISDN, GPRS, UMTS	GSM/GPRS	GSM/GPRS	N	N/A
I/O-ports (number and type of plug)	2 x RS232, 1 x Power, 1 x Antenna	3 x RS232, 1 x Power, 1 x Antenna	Serial and infrared communications link	8)
Remote managing receiver	N	N	N	N
Options remote	N	N	N	N/A
Special remote software needed?	N	N	N/A	Not needed
Integrity warnings (warning at failure datalink, loss of lock i.e. (Y/N)	Y	N	Y	Y
Base antenna phase centre stability 1)	L1 and L2 phase centre in same location with zero offset	L1 and L2 phase centre in same location with zero offset	L1 and L2 phase centre in same location with zero offset	Submm phase center repeatability
Rover antenna phase centre stability 1)	L1 and L2 phase centre in same location with zero offset	L1 and L2 phase centre in same location with zero offset	L1 and L2 phase centre in same location with zero offset	Submm phase center repeatability
<b>Data Storage and User Interface</b>				
Data storage on receiver	Y	N	Y	Y
Storage medium (type) / memory [MB]	Compact Flash / 16MB Standard. Options up to 2GB	N/A	Flash / 4MB Standard. Options up to 2 GB	9)
Exchangeable / fixed	Exchangeable	N/A	Exchangeable	Fixed
Display; size (lines and char. / line)	Y, 3 lines, variable length	N	Y, fuel gauge style	240 x 320 pixel (¼ VGA) color TFT with LED front light
Data input (pen / keys / qwerty board)	7 button interface	N/A	Single button interface	Keys
Graphical display functions	Y, via data collector	Y, via data collector	Y, via data collector	Y
Background map support	Y, via data collector	Y, via data collector	N	Y
Suitable for other auxiliary input devices?	Y	Y	N	N/A
Stakeout options (Graphical/ENH)	Y, via data collector	Y, via data collector	N	N/A
Support of RTK network solutions based on (VRS, FKP, PRS, RTCM3)	Y, VRS, FKP, RTCM3	Y, VRS, FKP, RTCM3	N	N
<b>Office Software</b>				
Brand / name	Spectrum Survey Suite	<input type="checkbox"/>	Spectrum Survey Suite	Spectra Precision Survey Office
Hardware requirements	Windows 95 or later, min 16MB RAM, Pentium or later	<input type="checkbox"/>	Windows 95 or later, min 16MB RAM, Pentium or later	10)
Network design (reconnaissance)	N	<input type="checkbox"/>	N	Y
Network adjustment	Y	<input type="checkbox"/>	Y	Y
Determination of local coordinate system parameters and input of pre- defined coordinate system parameters	Y	<input type="checkbox"/>	Y	Y
User file output supported, specify	Y, definable exports	<input type="checkbox"/>	Y, definable exports	Y, user configurable CSV file export
Predefined output format supported DXF, SHP,...	PICS, IOB, SDR, IMAR, SGL, ASCII	<input type="checkbox"/>	PICS, IOB, SDR, IMAR, SGL, ASCII	Y, DWG/DXF
Feature code processing	Y	<input type="checkbox"/>	Y	N
DTM and Volume calculations	N	<input type="checkbox"/>	N	N
Stakeout preparation	N	<input type="checkbox"/>	N	N
<b>Batteries</b>				
Internal and/or External	External	External	Internal and External	Internal
Number	N/A	N/A	2	1
Fixed or Exchangeable	N/A	N/A	Exchangeable	Exchangeable
Free available f.e. penlight / brand bound	N/A	N/A	Via Sokkia Dealer	N
Rechargeable with (auto)battery	N/A	N/A	N	Y
Direct car connection cable available	N	Y	N	Y

N/A = Not Applicable  
 = No information received



Thales Navigation	Thales Navigation	Topcon	Topcon	Topcon
Z-Max.Net 2006	ProMark3 2005	GR-3 July 2006	HiPer Pro / HiPer+ May 2003/ January 2005	GB-1000 / GB-500 February 2004
GPS dual	GPS single	GPS, Glonass, Galileo: triple	GPS, Glonass/ dual 12)	GPS, Glonass dual 12)
<input type="checkbox"/>	19.5 x 9 x 4.6	23,4 x 15,8 x 15,8	15.9 x 8.8 x 17.2	25.7 x 15 x 6.3
4.5kg	0,48kg receiver + 0,45kg antenna	1,84kg (rcvr,ant,comm,batt)	1,65kg (rcvr,ant,comm,batt), 3,44kg (complete rover set)	1,2kg (rcvr;batt), 0,5kg (ant)
5mm+0.5 ppm	5mm + 1ppm	H: 3mm+0.5ppm V: 5mm+0.5ppm	H: 3mm+0.5ppm, V: 5mm+0.5ppm	H: 3mm+0.5ppm V: 5mm+0.5ppm
10mm+1.0 ppm	N/A	H: 10mm+1ppm V: 15mm+1ppm	H: 10mm+1ppm, V: 15mm+1ppm	H: 10mm+1ppm V: 15mm+1ppm
L1/L2 code+carrier	L1 code + carrier	11)	13)	13)
Dual	Single	Triple	Dual 12)	Dual 12)
24 parallel	14	72 Universal Channels	40(L1) 20(L1+L2) / parallel 12)	40(L1) 20(L1+L2) / parallel 12)
12	12+2	36	40 (L1) 20(L1+L2) 12)	40 (L1) 20(L1+L2) 12)
105s/16s/2s	Post-processing	<60s/<10s/<1s	<60s/<10s/<1s	<60s/<10s/<1s
Y	N	Y, on-the-fly	Y, on-the-fly	Y, on-the-fly
2s	N/A	Situation dependent ~ seconds	Situation dependent ~ seconds	Situation dependent ~ seconds
Y, standard	<input type="checkbox"/>	Y	Y	Y
10Hz	1Hz	Up to 20Hz	Up to 20Hz	Up to 20Hz
All versions	RTCM 2.1	2.1, 2.2, 2.3, 3.0	2.1, 2.2, 2.3, 3.0	2.1, 2.2, 2.3, 3.0
NMEA, NTRIP	NMEA	1, 2, 3, 6, 9, 15, 16, 18, 19, 20, 21, 22, 31, 32, 34, 36, 59 User selectable (incl. Special Glonass messages)	1, 2, 3, 6, 9, 15, 16, 18, 19, 20, 21, 22, 31, 32, 34, 36, 59 User selectable (incl. Special Glonass messages)	<input type="checkbox"/>
Y	<input type="checkbox"/>	Y,TPS, CMR, CMR+	Y,TPS, CMR, CMR+	Y,TPS, CMR, CMR+
External	Internal and external	Integrated	Integrated and external	External
10 - 28VDC - 6.0W	3.7V Li-Ion, 3900 mAh	7.2 - 3.3 / 4.3	7.2 - 4.6	7.4 - 3.4/-/-
10 - 28VDC - 6.0W		7.2 - 3.3 / 5	7.2 - 10 (1Watt Radio)	7.4 - 3.4/-/-
14hrs. at 0° C	8hrs	17hrs /13hrs	16hrs /14hrs(RX)/ 10hrs(TX)	GB-1000: 7hrs / GB-500: 9hrs
Built-in GSM module	N	Y, GSM, NTRIP (GPRS/UMTS)	Y, GSM, NTRIP (GPRS/UMTS)	Y, GSM, NTRIP (GPRS/UMTS)
ISDN, GPRS	N/A	GPRS, UMTS	GPRS, UMTS	GPRS, UMTS
4, RS232, RS422, USB, Bluetooth	3, RS232, USB, Bluetooth	1 RS232, 1 USB, 1 External Power. (ODU type)	4 serial, 1 power, USB, PPS, Events, Bluetooth (ODU & BNC type)	14)
Y, Modem,GSM	N	Y	Y	Y
Y	N	Y, modem, serial, USB and Ethernet (IP)	Y, modem, serial, USB and Ethernet (IP)	Y, modem, serial, USB and Ethernet (IP)
Y	N/A	Y, PCCDU, TopNet CORS	Y, PCCDU, TopNet CORS	Y, PCCDU, TopNet CORS
Y	Y	Y	Y	Y
0.3, 0.8, 0.5/	North : 1.0mm, East : 3.8mm, up : 73.2mm above ARP	<1mm phase center stability	<1mm phase center stability	<1mm phase center stability
0.3, 0.8, 0.5/	North : 1.0mm, East : 3.8mm, up : 73.2mm above ARP	<1mm phase center stability	<1mm phase center stability	<1mm phase center stability
Y	Y	Y	Y	Y
Secure digital, 128MB available	Internal 128MB, external SC card	SD memory card / 1024MB	Internal memory / 128MB	CF memory card/1024MB (GB-1000), Internal memory 128MB (GB-500)
Exchangeable	Exchangeable	Exchangeable	Fixed	Exchangeable (GB-1000), Fixed (GB-500)
Y, /I line; 8 Char. Scrolling	Y, 320x240	Y, 240 x 320 pixel dimensions (FC100/FC200/GMS-2/FC2000)	Y, 240 x 320 pixel dimensions (FC100/FC200/GMS-2/FC2000)	Y, 240 x 320 pixel dimensions (FC100/FC200/GMS-2/FC2000)
Y	Y, all	Y, all	Y, all	Y, all
ASCII	Y	Y	Y	Y
N	Y	Y	Y	Y
Y	N	Y, laser distance, tilt, meteo, echo sounder	Y, laser distance, tilt, meteo, echo sounder	Y, laser distance, tilt, meteo, echo sounder
Y	N	Y, both	Y, both	Y, both
Y,VRS, FKP, RTCM3	N	Y,VRS, FKP, RTCM 3.0	Y,VRS, FKP, RTCM 3.0	Y,VRS, FKP, RTCM 3.0
GNSS Solutions	GNSS Solutions	Topcon Link / Topcon Tools / 3D Office	Topcon Link / Topcon Tools / 3D Office	Topcon Link / Topcon Tools/3D Office
Win 98/NT/2000/XP	Win 98/NT/2000/XP	32 bit, Windows compatible OS, Windows 98 or higher Version	32 bit, Windows compatible OS, Windows 98 or higher Version	32 bit, Windows compatible OS, Windows 98 or higher Version
Y	Y	Y	Y	Y
Y	Y	Y	Y	Y
Y	Y	Y, localisation, predefined (Global) and user-defined projections	Y, localisation, predefined (Global) and user-defined projections	Y, localisation, predefined (Global) and user-defined projections
Customised formats	Customised formats	Y, user defines text file format (ASCII)	Y, user defines text file format (ASCII)	Y, user defines text file format (ASCII)
DXF	DXF	Y, all commonly used formats supported	Y, all commonly used formats supported	Y, all commonly used formats supported
Y	Y	Y	Y	Y
N	N	Y	Y	Y
Points	Points	Y, points, lines, roads, DTM, alignments	Y, points, lines, roads, DTM, alignments	Y, points, lines, roads, DTM, alignments
Internal/external	Internal/External	Internal and External	Internal and External	Internal and External
I	I	2 x Internal (Hot-Swappable)	2 x Internal	2 x Internal (Hot-Swappable)
Exchangeable	Exchangeable	Exchangeable	Service Centre Exchangeable	Exchangeable
<input type="checkbox"/>	<input type="checkbox"/>	Both, Lithium Ion packs and optional AA (penlight) batteries	Brand bound, Lithium Ion	Brand bound, Lithium Ion
Y	Y	Y	Y	Y
Y	N	Y	Y	Y



Brand	Topcon	Trimble	Trimble
Model name/ Type	Odyssey-RS	R8 GNSS	NetR5
Introduction	December 2001		
Class (GPS, Glonass, Galileo/ S, D en T)	GPS, Glonass dual I2)	GPS, Glonass	GPS, Glonass
<b>Receiver and Antenna</b>			
Dimensions (h*d*w* in cm): base station case/ rover set case	24.2 x 15.9 x 4.9	11.2 x 19	5 x 24 x 12
Weight (receiver, rover, antenna, communications, batteries, pole)	1.8kg (rcvr, batt), 0.5kg (ant)	1.35kg (2.97lb) with internal battery, internal radio, standard UHF antenna.	1.55kg (3.42lb) receiver with internal battery
Static [mm + ppm]	H: 3mm+0.5ppm V: 5mm+0.5ppm	H ± 5mm + 0.5 ppm RMS, V ± 5mm + 1 ppm RMS	H ± 5mm + 0.5ppm RMS, V ± 5mm + 1ppm RMS
RTK [mm + ppm]	H: 10mm+1ppm V: 15mm+1ppm	H ± 10mm+ 1 ppm RMS, V ± 20 mm+ 1 ppm RMS	H ± 10mm + 1ppm RMS, V ± 20mm + 1ppm RMS
Signal(s) tracked (types / bands / codes)	I3)	I5)	I5)
Single/dual/triple frequency	Dual I2)	Triple frequency	Triple frequency
Number of channels / tracking mode	40(L1) 20(L1+L2) / parallel I2)	72/Trimble R-Track technology	72/Trimble R-Track technology
Max. no. of satellites tracked parallel (GPS/Glonass/Galileo/Other)	40 (L1) 20(L1+L2) I2)	GPS, Glonass 'All in View'	GPS, Glonass 'All in View'
Time to first fix (C/W/R) [sec/sec/sec]	<60s/<10s/<1s	<60s/<30s/<15s	<60s/<30s/<15s
Can the receiver perform RTK surveys	Y, on-the-fly	Y	Y, only as GPSNet rover integrity monitor
RTK initialisation (s/d) [sec]	Situation dependent ~ seconds	Typically <10s	Typically <10s
PPS (Puls per second)	Y	N	N
Update rate of position (frequency) [Hz]	Up to 20 Hz	1 Hz, 2 Hz, 5 Hz, and 10 Hz	1 Hz, 2 Hz, 5 Hz, 10 Hz and 20 Hz
Supported RTCM version	2.1, 2.2, 2.3, 3.0	CMRll, CMR+, RTCM 2.1, RTCM 2.3, RTCM 3.0 Input and Output	CMR, CMR+, BINEX and RTCM 2.1, 2.2, 2.3, 3.0 Input and Output
Possible types of messages	I, 2, 3, 6, 9, 15, 16, 18, 19, 20, 21, 22, 31, 32, 34, 36, 59 User selectable (incl. Special Glonass messages)	16 NMEA outputs. GSOF and RT17 outputs. Supports BINEX and smoothed carrier	RT-17/RT-27 outputs
Id. proprietary format	Y,TPS, CMR, CMR+	CMR+	CMR+
Antenna (integr. and / or ext.)	External	Integrated	External
Rover (r/rd/rdm) [V -W/W/W]	7.4 - 4.3/-/-		
Base (b/bm) [V -W/W]	7.4 - 4.3/-/-		
Operating time wo/w radio (h) [hrs/hrs]	20hrs/ 15hrs	I6)	I5hrs
Use of cellular phone for the datalink/ Protocol	Y, GSM, NTRIP (GPRS/UMTS)	Y, Circuit Switched/ Packet Switched	Y, Circuit Switched/ Packet Switched
Supported GSM protocols, ISDN, GPRS, UMTS	GPRS, UMTS	All	All
I/O-ports (number and type of plug)	4 serial, 1 power; USB, Ethernet, PPS, Events, Freq. Input/Output (ODU & BNC type)	3-wire serial (7-pin Lemo) on Port 1. Full RS-232 serial on Port 2 (Dsub 9 pin)	1 LAN port: 1 port with RJ45 connector, 3 RS232 ports, Bluetooth port, 1 USB port: host and slave
Remote managing receiver	Y	N	Y
Options remote	Y, modem, serial, USB and Ethernet (IP)	N/A	
Special remote software needed?	Y, PC, CDU, TopNet, CORS	N/A	Not needed
Integrity warnings (warning at failure datalink, loss of lock i.e.)	Y	Y	Y
Base antenna phase centre stability I)	<1mm phase centre stability	Submm phase centre repeatability	Submm phase centre repeatability
Rover antenna phase centre stability I)	<1mm phase centre stability	Submm phase centre repeatability	Submm phase centre repeatability
<b>Data Storage and User Interface</b>			
Data storage on receiver	Y	Y	Y
Storage medium (type) / memory [MB]	CF memory card / 1024MB	Internal memory/11MB: 302 hrs of raw observables based on recording data from 6 satellites at 15s intervals	59MB (1620hrs) of raw data observables based on recording data from 6 satellites at 15s intervals
Exchangeable / fixed	Exchangeable	Fixed	Fixed I9)
Display, size (lines and char. / line)	Y, 240 x 320 pixel dimensions (FC100/FC200/GMS-2/FC2000)	I7)	Y, 2 lines, 16 char./line
Data input (pen / keys / qwerty board)	Y, all	Data collector: 53 key alphanumeric keypad, 8-position spider key	Keys
Graphical display functions	Y	Y	N/A
Background map support	Y	Y	N/A
Suitable for other auxiliary input devices?	Y, laser distance, tilt, meteo, echo sounder	N/A	N/A
Stakeout options (Graphical/E'N'H)	Y, both	Y, Graphical/ 'E'N'H	N/A
Support of RTK network solutions based on (VRS, FKP, PRS, RTCM3)	Y, VRS, FKP, RTCM 3.0	Y	Y, only as GPSNet rover integrity monitor
<b>Office Software</b>			
Brand / name	Topcon Link / Topcon Tools / 3D Office	Trimble / TGO, TTC	Trimble / TGO, TTC
Hardware requirements	32 bit, Windows compatible OS, Windows 98 or higher Version	I8)	I8)
Network design (reconnaissance)	Y	Y	Y
Network adjustment	Y	Y	Y
Determination of local coordinate system parameters and input of pre-defined coordinate system parameters	Y, localisation, predefined (Global) and user-defined projections	Y	Y
User file output supported, specify	Y, user defines text file format (ASCII)	Y, see website www.trimble.com	Y, see website www.trimble.com
Predefined output format supported DXF, SHP, ...	Y, all commonly used formats supported	Y	Y
Feature code processing	Y	Y	Y
DTM and Volume calculations	Y	Y	Y
Stakeout preparation	Y, points, lines, roads, DTM, alignments	Y	Y
<b>Batteries</b>			
Internal and/or External	Internal and External	Internal and External	Internal, not user replaceable
Number	2 x Internal	2	I
Fixed or Exchangeable	Service Centre Exchangeable	Exchangeable	Fixed
Free available f.e. penlight / brand bound	Brand bound, Lithium Ion	Y	N/A
Rechargeable with (auto)battery	Y	N	Y
Direct car connection cable available	Y	Y	N/A

- Notes**
- Noise in mm, E, N, H / %epoch 0-10° / %epoch 10-90°
  - Post-processing (static and rapid static)=5mm+0.5ppm, post-processing kinematic=10mm+1ppm (horizontal accuracies)
  - Fully independent L1 and L2 code and phase measurements. GPS: 14 L1 + 14 L2. (L1 Carrier phase full wavelength, C/A narrow code) (L2 Carrier phase full wavelength with C-code and P-Code [AS off] or P-code aided under AS. Equal performance with AS on or off). Glonass: 12 L1 + 12 L2. (L1 Carrier phase full wavelength, C/A narrow code) (L2 Carrier phase full wavelength, P narrow code). WAAS, EGNOS.
  - Touch Screen, Full alpha QWERTY keyboard, function keys and user-definable keys.
  - Minimum: Pentium 150MHz/ 32MB RAM/ 100MB free HD space/ Windows98/ Explorer 4.0 Recom. Pentium 300MHz or higher/ 256MB RAM/ 300MB free HD space/ Windows 2000 or XP/ Explorer 5.5.
  - Fully independent L1 and L2 code and phase measurements. GPS: 14 L1 + 14 L2. (L1 Carrier phase full wavelength, C/A narrow code) (L2 Carrier phase full wavelength with C-code and P-Code [AS off] or P-code aided under AS. Equal performance with AS on or off). WAAS, EGNOS.
  - L1: -0.5, 2.4, 87.2 / 0.0 0.0 -5.2 -2.2 0.4 2.8 4.6 5.8 6.7 7.0 6.9 6.4 5.5 4.5 3.3 2.0 1.0 0.2 0.0 L2: -0.8, -0.5, 78.8 / 0.0 0.0 -5.1 -3.3 -1.6 -0.1 1.2 2.1 2.8 3.0 2.8 2.5 1.8 1.1 0.3 -0.4 -0.8 -0.8 0.0.
  - 1x external DC power port, 1x RS232 serial port, Integrated USB for data download speeds in excess of 1MB/s, External GPS antenna connector, 2x CompactFlash removable data storage ports.
  - More than 400hrs L1 logging at 15s with 6 satellites with 64MB. Recon data collector memory.
  - PC, 150 MHz or faster with 32MB RAM and a 1GB hard drive, SVGA colour 800x600, keyboard with mouse or trackball, CD ROM drive.
  - GPS: L1, L2 & L5 carrier, CA, L1 P, L2 P, L2C; Glonass: L1, L2, L1CA, L2CA, L1 P, L2 P, L2C; Galileo: E2, L1, E1, E5a, E5b; WAAS/EGNOS/MSAS
  - HiPer series, GB series and OdysseyRS are upgradeable to GPS+Glonass+Galileo. Better known as the G3 Upgrade path. This upgrade includes also GPS L5 & L2C.
  - GPS: L1, L2 carrier, CA, L1 P, L2 P I2), Glonass: L1, L2, L1CA, L2CA, L1 P, L2 P; Galileo: G3 Upgrade path I2), WAAS/EGNOS/MSAS.
  - GB-1000: 3 serial, 1 power, USB, Ethernet, PPS, Events / GB500: 3 ser, 1pw; USB, PPS, Events (Lemo, ODU, USB & RJ45 type).
  - GPS L1 C/A Code, L2C, L1/L2/ L51 Full Cycle Carrier: Glonass L1 C/A Code, L1 P Code, L2 P Code, L1/L2 Full Cycle Carrier; SBAS WAAS/EGNOS support.
  - 450 MHz receive only option 10.5hrs with 2 internal batteries, varies with temperature.
  - Not on Receiver. Data collector: Colour, illuminated TFT, daylight-readable touch screen displayed at 320x240 pixels (QVGA), backlight illuminated display.
  - Pentium, 150MHz or faster with 32MB RAM and a 1GB HD, SVGA colour 800x600, keyboard with mouse or trackball, CD ROM drive.
  - Support for USB memory stick and USB hard drives allowing several hundred GB to be stored for applications requiring more memory.

N/A = Not Applicable  
□ = No information received

