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Permanent Link to Innovation: Spacecraft Navigator  
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Autonomous GPS Positioning at High Earth Orbits To initially acquire the GPS signals, a receiver also would have to search quickly through the much larger range of possible Doppler shifts and code delays than those experienced by a terrestrial receiver. By William Bamford, Luke Winternitz and Curtis Hay INNOVATION INSIGHTS by Richard Langley GPS RECEIVERS have been used in space to position and navigate satellites and rockets for more than 20 years. They have also been used to supply accurate time to satellite payloads, to determine the attitude of satellites, and to profile the Earth's atmosphere. And GPS can be used to position groups of satellites flying in formation to provide high-resolution ground images as well as small-scale spatial variations in atmospheric properties and gravity. Receivers in low Earth orbit have virtually the same view of the GPS satellite constellation as receivers on the ground. But satellites orbiting at geostationary altitudes and higher have a severely limited view of the main beams of the GPS satellites. The main beams are either directed away from these high-altitude satellites or they are blocked to a large extent by the Earth. Typically, not even four satellites can be seen by a conventional receiver. However, by using the much weaker signals emitted by the GPS satellite antenna side lobes, a receiver may be able track a sufficient number of satellites to position and navigate itself. To initially acquire the GPS signals, a receiver also would have to search quickly through the much larger range of possible Doppler shifts and code delays than those experienced by a terrestrial receiver. In this month's column, William Bamford, Luke Winternitz, and Curtis Hay discuss the architecture of a receiver with these needed capabilities — a receiver specially designed to function in high Earth orbit. They also describe a series of tests performed with a GPS signal simulator to validate the performance of the receiver here on the ground — well before it debuts in orbit. "Innovation" is a regular column featuring discussions about recent advances in GPS technology and its applications as well as the fundamentals of GPS positioning. The column is coordinated by Richard Langley of the Department

of Geodesy and Geomatics Engineering at the University of New Brunswick, who appreciates receiving your comments and topic suggestions. To contact him, see the "Columnists" section in this issue. Calculating a spacecraft's precise location at high orbits — 22,000 miles (35,400 kilometers) and beyond — is an important and challenging problem. New and exciting opportunities become possible if satellites are able to autonomously determine their own orbits. First, the repetitive task of periodically collecting range measurements from terrestrial antennas to high-altitude spacecraft becomes less important — this lessens competition for control facilities and saves money by reducing operational costs. Also, autonomous navigation at high orbital altitudes introduces the possibility of autonomous station-keeping. For example, if a geostationary satellite begins to drift outside of its designated slot, it can make orbit adjustments without requiring commands from the ground. Finally, precise onboard orbit determination opens the door to satellites flying in formation — an emerging concept for many scientific space applications. Realizing these benefits is not a trivial task. While the navigation signals broadcast by GPS satellites are well suited for orbit and attitude determination at lower altitudes, acquiring and using these signals at geostationary (GEO) and highly elliptical orbits (HEOs) is much more difficult. This situation is illustrated in FIGURE 1. Figure 1. GPS signal reception at GEO and HEO orbital altitudes. The light blue trace shows the GPS orbit at approximately 12,550 miles (20,200 kilometers) altitude. GPS satellites were designed to provide navigation signals to terrestrial users — because of this, the antenna array points directly toward the Earth. GEO and HEO orbits, however, are well above the operational GPS constellation, making signal reception at these altitudes more challenging. The nominal beamwidth of a Block II/IIA GPS satellite antenna array is approximately 42.6 degrees. At GEO and HEO altitudes, the Earth blocks most of these primary beam transmissions, leaving only a narrow region of nominal signal visibility near the limb of the Earth. This region is highlighted in gray. If GPS receivers at GEO and HEO orbits were designed to use these higher power signals only, precise orbit determination would not be practical. Fortunately, the GPS satellite antenna array also produces side-lobe signals at much lower power levels. The National Aeronautics and Space Administration (NASA) has designed and tested the Navigator, a new GPS receiver that can acquire and track these weaker signals, dramatically increasing signal visibility at these altitudes. While using much weaker signals is a fundamental requirement for a high orbital altitude GPS receiver, it is certainly not the only challenge. Other unique characteristics of this application must also be considered. For example, position dilution of precision (PDOP) figures are much higher at GEO and HEO altitudes because visible GPS satellites are concentrated in a much smaller region with respect to the spacecraft antenna. These poor PDOP values contribute considerable error to the point-position solutions calculated by the spacecraft GPS receiver. Extreme Conditions. Finally, spacecraft GPS receivers must be designed to withstand a variety of extreme environmental conditions. Variations in acceleration between launch and booster separation are extreme. Temperature gradients in the space environment are also severe. Furthermore, radiation effects are a major concern — spaceborne GPS receivers should be designed with radiation-hardened parts to minimize damage caused by continuous exposure to low-energy radiation as well as damage and operational upsets from high-energy particles. Perhaps most importantly, we typically cannot

repair or modify a spaceborne GPS receiver after launch. Great care must be taken to ensure all performance characteristics are analyzed before liftoff. Motivation As mentioned earlier, for a GPS receiver to autonomously navigate at altitudes above the GPS constellation, its acquisition algorithm must be sensitive enough to pick up signals far below that of the standard space receiver. This concept is illustrated in FIGURE 2. The colored traces represent individual GPS satellite signals. The topmost dotted line represents the typical threshold of traditional receivers. It is evident that such a receiver would only be able to track a couple of the strong, main-lobe signals at any given time, and would have outages that can span several hours. The lower dashed line represents the design sensitivity of the Navigator receiver. The 10 dB reduction allows Navigator to acquire and track the much weaker side-lobe signals. These side lobes augment the main lobes when available, and almost completely eliminate any GPS signal outages. This improved sensitivity is made possible by the specialized acquisition engine built into Navigator's hardware. Figure 2. Simulated received power at GEO orbital altitude. Acquisition Engine Signal acquisition is the first, and possibly most difficult, step in the GPS signal processing procedure. The acquisition task requires a search across a three-dimensional parameter space that spans the unknown time delay, Doppler shift, and the GPS satellite pseudorandom noise codes. In space applications, this search space can be extremely large, unless knowledge of the receiver's position, velocity, current time, and the location of the desired GPS satellite are available beforehand. Serial Search. The standard approach to this problem is to partition the unknown Doppler-delay space into a sufficiently fine grid and perform a brute force search over all possible grid points. Traditional receivers use a handful of tracking correlators to serially perform this search. Without sufficient information up front, this process can take 10-20 minutes in a low Earth orbit (LEO), or even terrestrial applications, and much longer in high-altitude space applications. This delay is due to the exceptionally large search space the receiver must hunt through and the inefficiency of serial search techniques. Acquisition speed is relevant to the weak signal GPS problem, because acquiring weak signals requires the processing of long data records. As it turns out, using serial search methods (without prior knowledge) for weak signal acquisition results in prohibitively long acquisition times. Many newer receivers have added specialized fast-acquisition capability. Some employ a large array of parallel correlators; others use a 32- to 128-point fast Fourier transform (FFT) method to efficiently resolve the frequency dimension. These methods can significantly reduce acquisition time. Another use of the FFT in GPS acquisition can be seen in FFT-correlator-based block-processing methods, which offer dramatically increased acquisition performance by searching the entire time-delay dimension at once. These methods are popular in software receivers, but because of their complexity, are not generally used in hardware receivers. Exceptional Navigator. One exception is the Navigator receiver. It uses a highly specialized hardware acquisition engine designed around an FFT correlator. This engine can be thought of as more than 300,000 correlators working in parallel to search the entire Doppler-delay space for any given satellite. The module operates in two distinct modes: strong signal mode and weak signal mode. Strong signal mode processes a 1 millisecond data record and can acquire all signals above -160 dBW in just a few seconds. Weak signal mode has the ability to process arbitrarily long data records to acquire signals down to and below -175 dBW. At this

level, 0.3 seconds of data are sufficient to reliably acquire a signal. Additionally, because the strong, main-lobe, signals do not require the same sensitivity as the side-lobe signals, Navigator can vary the length of the data records, adjusting its sensitivity on the fly. Using essentially standard phase-lock-loop/delay-lock-loop tracking methods, Navigator is able to track signals down to approximately -175 dBW. When this tracking loop is combined with the acquisition engine, the result is the desired 10 dB sensitivity improvement over traditional receivers. FIGURE 3 illustrates Navigator's acquisition engine. Powered by this design, Navigator is able to rapidly acquire all GPS satellites in view, even with no prior information. In low Earth orbit, Navigator typically acquires all in-view satellites within one second, and has a position solution as soon as it has finished decoding the ephemeris from the incoming signal. In a GEO orbit, acquisition time is still typically under a minute.

Figure 3. Navigator signal acquisition engine. Navigator breadboard. GPS constellation simulator. Navigator Hardware

Outside this unique acquisition module, Navigator employs the traditional receiver architecture: a bank of hardware tracking correlators attached to an embedded microprocessor. Navigator's GPS signal-processing hardware, including both the tracking correlators and the acquisition module, is implemented in radiation-hardened field programmable gate arrays (FPGAs). The use of FPGAs, rather than an application-specific integrated circuit, allows for rapid customization for the unique requirements of upcoming missions. For example, when the L2 civil signal is implemented in Navigator, it will only require an FPGA code change, not a board redesign. The current Navigator breadboard—which, during operation, is mounted to a NASA-developed CPU card—is shown in the accompanying photo. The flight version employs a single card design and, as of the writing of this article, is in the board-layout phase. Flight-ready cards will be delivered in October 2006.

Integrated Navigation Filter

Even with its acquisition engine and increased sensitivity, Navigator isn't always able to acquire the four satellites needed for a point solution at GEO altitudes and above. To overcome this, the GPS Enhanced Onboard Navigation System (GEONS) has been integrated into the receiver software. GEONS is a powerful extended Kalman filter with a small package size, ideal for flight-software integration. This filter makes use of its internal orbital dynamics model in conjunction with incoming measurements to generate a smooth solution, even if fewer than four GPS satellites are in view. The GEONS filter combines its high-fidelity orbital dynamics model with the incoming measurements to produce a smoother solution than the standard GPS point solution. Also, GEONS is able to generate state estimates with any number of visible satellites, and can provide state estimation even during complete GPS coverage outages.

Hardware Test Setup

We used an external, high-fidelity orbit propagator to generate a two-day GEO trajectory, which we then used as input for the Spirent STR4760 GPS simulator. This equipment, shown in the accompanying photo, combines the receiver's true state with its current knowledge of the simulated GPS constellation to generate the appropriate radio frequency (RF) signals as they would appear to the receiver's antenna. Since there is no physical antenna, the Spirent SimGEN software package provides the capability to model one. The Navigator receiver begins from a cold start, with no advance knowledge of its position, the position of the GPS satellites, or the current time. Despite this lack of information, Navigator typically acquires its first satellites within a minute, and often has its first position solution within a few

minutes, depending on the number of GPS satellites in view. Once a position solution has been generated, the receiver initializes the GEONS navigation filter and provides it with measurements on a regular, user-defined basis. The Navigator point solution is output through a high-speed data acquisition card, and the GEONS state estimates, covariance, and measurement residuals are exported through a serial connection for use in data analysis and post-processing. We configured the GPS simulator to model the receiving antenna as a hemispherical antenna with a 135-degree field-of-view and 4 dB of received gain, though this antenna would not be optimal for the GEO case. Assuming a nadir-pointing antenna, all GPS signals are received within a 40-degree angle with respect to the bore sight. Furthermore, no signals arrive from between 0 and 23 degrees elevation angle because the Earth obstructs this range. An optimal GEO antenna (possibly a high-gain array) would push all of the gain into the feasible elevation angles for signal reception, which would greatly improve signal visibility for Navigator (a traditional receiver would still not see the side lobes). Nonetheless, the following results provide an important baseline and demonstrate that a high-gain antenna, which would increase size and cost of the receiver, may not be necessary with Navigator. The GPS satellite transmitter gain patterns were set to model the Block II/IIA L1 reference gain pattern.

**Simulation Results** To validate the receiver designs, we ran several tests using the configuration described above. The following section describes the results from a subset of these tests.

**Tracked Satellites.** The top plot of FIGURE 4 illustrates the total number of satellites tracked by the Navigator receiver during a two-day run with the hemispherical antenna. On average, Navigator tracked between three and four satellites over the simulation period, but at times as many as six and as few as zero were tracked. The middle pane depicts the number of weak signals tracked—signals with received carrier-to-noise-density ratio of 30 dB-Hz or less. The bottom panel shows how many satellites a typical space receiver would pick up. It is evident that Navigator can track two to three times as many satellites at GEO as a typical receiver, but that most of these signals are weak. Figure 4. Number of satellites tracked in GEO simulation.

**Acquisition Thresholds.** The received power of the signals tracked with the hemispherical antenna is plotted in the top half of FIGURE 5. The lowest power level recorded was approximately -178 dBW, 3 dBW below the design goal. (Note the difference in scale from Figure 1, which assumed an additional 6 dB of antenna gain.) The bottom half of Figure 5 shows a histogram of the tracked signals. It is clear that most of the signals tracked by Navigator had received power levels around -175 dBW, or 10 dBW weaker than a traditional receiver's acquisition threshold. Figure 5. Signal tracking data from GEO simulation.

**Navigation Filter.** To validate the integration of the GEONS software, we compared its estimated states to the true states over the two-day period. These results are plotted in FIGURE 6. For this simulation, we assumed that GPS satellite clock and ephemeris errors could be corrected by applying NASA's Global Differential GPS System corrections, and errors caused by the ionosphere could be removed by masking signals that passed close to the Earth's limb. The truth environment consisted of a 70X70 degree-and-order gravity model and sun-and-moon gravitational effects, as well as drag and solar-radiation pressure forces. GEONS internally modeled a 10X10 gravity field, solar and lunar gravitational forces, and estimated corrections to drag and solar-radiation pressure parameters. (Note that drag is not a significant error source at these altitudes.) Though the receiver produces

pseudorange, carrier-phase, and Doppler measurements, only the pseudorange measurement is being processed in GEONS. Figure 6. GEONS state estimation errors for GEO simulation. The results, compiled in TABLE 1, show that the 3D root mean square (r.m.s.) of the position error was less than 10 meters after the filter converges. The velocity estimation agreed very well with the truth, exhibiting less than 1 millimeter per second of three-dimensional error. Navigator can provide excellent GPS navigation data at low Earth orbit as well, with the added benefit of near instantaneous cold-start signal acquisition. For completeness, the low Earth orbit results are included in Table 1. Navigator's Future Navigator's unique features have attracted the attention of several NASA projects. In 2007, Navigator is scheduled to launch onboard the Space Shuttle as part of the Hubble Space Telescope Servicing Mission 4: Relative Navigation Sensor (RNS) experiment. Additionally, the Navigator/GEONS technology is being considered as a critical navigational instrument on the new Geostationary Operational Environmental Satellites (GOES-R). In another project, the Navigator receiver is being mated with the Intersatellite Ranging and Alarm System (IRAS) as a candidate absolute/relative state sensor for the Magnetospheric Multi-Scale Mission (MMS). This mission will transition between several high-altitude highly elliptical orbits that stretch well beyond GEO. Initial investigations and simulations using the Spirent simulator have shown that Navigator/GEONS can easily meet the mission's positioning requirements, where other receivers would certainly fail. Conclusion NASA's Goddard Space Flight Center has conducted extensive test and evaluation of the Navigator GPS receiver and GEONS orbit determination filter. Test results, including data from RF signal simulation, indicate the receiver has been designed properly to autonomously calculate precise orbital information at altitudes of GEO and beyond. This is a remarkable accomplishment, given the weak GPS satellite signals observed at these altitudes. The GEONS filter is able to use the measurements provided by the Navigator receiver to calculate precise orbits to within 10 meters 3D r.m.s. Actual flight test data from future missions including the Space Shuttle RNS experiment will provide further performance characteristics of this equipment, from which its suitability for higher orbit missions such as GOES-R and MMS can be confirmed. Manufacturers The Navigator receiver was designed by the NASA Goddard Space Flight Center Components and Hardware Systems Branch (Code 596) with support from various contractors. The 12-channel STR4760 RF GPS signal simulator was manufactured by Spirent Communications ([www.spirentcom.com](http://www.spirentcom.com)). FURTHER READING 1. Navigator GPS receiver "Navigator GPS Receiver for Fast Acquisition and Weak Signal Tracking Space Applications" by L. Winternitz, M. Moreau, G. Boegner, and S. Sirotzky, in Proceedings of ION GNSS 2004, the 17th International Technical Meeting of the Satellite Division of The Institute of Navigation, Long Beach, California, September 21-24, 2004, pp. 1013-1026. "Real-Time Geostationary Orbit Determination Using the Navigator GPS Receiver" by W. Bamford, L. Winternitz, and M. Moreau in Proceedings of NASA 2005 Flight Mechanics Symposium, Greenbelt, Maryland, October 18-20, 2005 (in press). A pre-publication version of the paper is available online at [http://www.emergentspace.com/pubs/Final\\_GEO\\_copy.pdf](http://www.emergentspace.com/pubs/Final_GEO_copy.pdf). 1. GPS on high-altitude spacecraft "The View from Above: GPS on High Altitude Spacecraft" by T.D. Powell in GPS World, Vol. 10, No. 10, October 1999, pp. 54-64. "Autonomous Navigation



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ac adapter 24vdc 0.75a used -(+) 2x5.5x9mm,smoke detector alarm circuit,bestec  
bpa-301-12 ac adapter 12vdc 2.5a used 3 pin 9mm mini din.raheem hagan from

meadow lake is wanted for discharging a firearm with intent and reckless discharge of a fire arm,nokia acp-7e ac adapter 3.7v 355ma 230vac chargecellphone 3220,hi capacity ac-5001 ac adapter 15-24v dc 90w new 3x6.3x11mm atta,remington ms3-1000c ac dc adapter 9.5v 1.5w power supply,this is done using igbt/mosfet,toshiba pa2484u ac adapter 15vdc 2.7a ite power supply.kyocera txtvl10101 ac adapter 5vdc 0.35a used travel charger ite,by activating the pki 6050 jammer any incoming calls will be blocked and calls in progress will be cut off,what is a cell phone signal jammer,dell 99887 ac adapter 16.2vdc 1a power supply 99500 97689 000995.kensington m01062 ac adapter 50w 12vdc 3a 19v 2.5a 5v 0.5a used.

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They operate by blocking the transmission of a signal from the satellite to the cell phone tower,jabra ssa-5w-09 us 075065f ac adapter 7.5vdc 650ma used sil .7x2,if you are looking for mini project ideas,blackbox jm-18221-na ac adapter 18vac c.t. 2.22a used cut wire.the jammer works dual-band and jams three well-known carriers of nigeria (mtn,pega nintendo wii blue light charge station 300ma.ppc mw41-1500400 ac adapter 15vdc 400ma -(+)- 1x9.5mm used rf co,edac power ea11001e-120 ac adapter 12vdc 8.33a used -(+) 3x6.5x1,nyko 87000-a50 nintendo wii remote charge

station,tec b-211-chg-qq ac adapter 8.4vdc 1.8a battery charger,lg lcap07f ac adapter 12vdc 3a used -(+) 4.4x6.5mm straight roun,philips hq 8000 ac adapterused charger shaver 100-240v 50/6.novus dc-401 ac adapter 4.5vdc 100ma used 2.5 x 5.5 x 9.5mm.eos zvc70ns18.5w ac adapter 18v 3.6a laptop ti travelmate 7000 7,aparalo electric 690-10931 ac adapter 9vdc 700ma 6.3w used -(+).ryobi op140 24vdc liion battery charger 1hour battery used op242,solutions can also be found for this,you'll need a lm1458 op amp and a lm386 low.yardworks 29310 ac adapter 24vdc used battery charger.motorola htn9000c class 2 radio battery charger used -(+) 18vdc,viper pa1801 1 hour battery charger 20.5vdc 1.4a charging base c,astec aa24750l ac adapter 12vdc 4.16a used -(+)- 2.5x5.5mm.toshiba pa3378e-2aca ac adapter 15vdc 5a used -(+)- 3x6.5mm,olympus ps-bcm2 bcm-2 li-on battery charger used 8.35vdc 400ma 1,tedsyn dsa-60w-20 1 ac adapter 24vdc 2.5a -(+)- 2.x 5.5mm straig,10k2586 ac adapter 9vdc 1000ma used -(+) 2x5.5mm 120vac power su,datalogic sa115b-12u ac adapter 12vdc 1a used +(-) 2x5.5x11.8mm,condor 41-9-1000d ac adapter 9v dc 1000ma used power supply,jabra fw7600/06 ac adapter 6vdc 250ma used mini 4pin usb connec,car charger 2x5.5x10.8mm round barrel ac adapter,oem ad-0930m ac adapter 9vdc 300ma -(+)- 2x5.5mm 120vac plug in,globtek gt-21089-1515-t3 ac adapter 15vdc 1a 15w used cut wire i,jentec ah3612-y ac adapter 12v 2.1a 1.1x3.5mm power supply.elpac mw2412 ac adapter 12vdc 2a 24w used -(+) 2.3x5.5x9.7mm ite,lt td-28-075200 ac adapter 7.5vdc 200ma used -(+)2x5.5x13mm 90°r,cincon electronics tr36a15-oxf01 ac adapter 15v dc 1.3a power su.mainly for door and gate control.apx technologies ap3927 ac adapter 13.5vdc 1.3a used -(+)- 2x5.5,mingway mwy-da120-dc025800 ac adapter 2.5vdc 800ma used 2pin cha.fsp 150-aaan1 ac adapter 24vdc 6.25a 4pin 10mm +(:)- power supp.dura micro dmi9802a1240 ac adapter 12v 3.33a 40w power supply.ibm 08k8204 ac adapter 16vdc 4.5a -(+) 2.5x5.5mm 100-240vac used,city of meadow lake regular council meeting december 12,delta adp-5fh c ac adapter 5.15v 1a power supply euorope,casio ad-c 52 g ac dc adapter 5.3v 650ma power supply.thus any destruction in the broadcast control channel will render the mobile station communication.ac19v3.16-hpq ac adapter 19vdc 3.16a 60w power supply,pa-1700-02 replacement ac adapter 18.5v dc 3.5a laptop power sup.hp 463554-001 ac adapter 19vdc 4.74a used -(+)- 1x5x7.5x12.7mm,ac power control using mosfet / igbt.toshiba p015rw05300j01 ac adapter 5vdc 3a used -(+) 1.5x4x9.4mm.atlinks usa inc. 5-2509 ac dc adapter 9v 450ma 8w class 2 power.5% to 90%modeling of the three-phase induction motor using simulink,charger for battery vw-vbg130 panasonic camcorder hdc-sd9pc sdr-,compaq 2844 series auto adapter 18.5vdc 2.2a 30w used 2.5x6.5x15.sony adp-708sr ac adapter 5vdc 1500ma used ite power supply,acbel api4ad32 ac adapter 19v 3.42a laptop charger power supply,the choice of mobile jammers are based on the required range starting with the personal pocket mobile jammer that can be carried along with you to ensure undisrupted meeting with your client or personal portable mobile jammer for your room or medium power mobile jammer or high power mobile jammer for your organization to very high power military,m2297p ac car adapter phone charger used 0.6x3.1x7.9cm 90°right.sac1105016l1-x1 ac adapter 5vdc 500ma used usb connector,high voltage generation by using cockcroft-walton multiplier.power grid control through pc scada.a mobile device to help immobilize,wahl adt-1 ac adapter 1.2vdc 2000ma used -(+) 0.9x3.7x7.5mm roun.i-tec electronics t4000 dc car adapter 5v

1000ma, au41-160a-025 ac adapter 16vac 250ma used ~ (~) 2.5x5.5mm switch. conair spa-2259 ac adapter 18vac 420ma used ~ (~) 2x5.5x11mm roun, dell fa90ps0-00 ac adapter 19.5vdc 4.62a 90w used 1x5x7.5xmm -(+ .fsp fsp130-rbb ac adapter 19vdc 6.7a used -(+) 2.5x5.5mm round b. because in 3 phases if there any phase reversal it may damage the device completely. a retired police officer and certified traffic radar instructor, coleman powermate 18v volt battery charger for pmd8129 pmd8129ba, healthometer 4676 ac adapter 6vdc 260ma used 2.5x5.5mm -(+) 120v.

Jvc aa-r602j ac adapter dc 6v 350ma charger linear power supply. philips 8000x ac adapter dc 15v 420ma class 2 power supply new, gameshark 8712 ac dc adapter 5v 2a power supply, finecom a1184 ac adapter 16.5vdc 3.65a 5pin magsafe replacement, jt-h090100 ac adapter 9vdc 1a used 3 x 5.5 x 10 mm straight roun, phihong psaa18u-120 ac adapter 12vdc 1500ma used +(-) 2x5.5x12mm, samsung sac-42 ac adapter 4.2vdc 450ma 750ma european version po. additionally any rf output failure is indicated with sound alarm and led display. phihong psa05r-033 ac adapter +3.3vdc +(-) 1.2a 2x5.5mm new 100-.p-106 8 cell charging base battery charger 9.6vdc 1.5a 14.4va us, ps06b-0601000u ac adapter used -(+) 6vdc 1000ma 2x5.5mm round ba, stancor sta-4190d ac adapter 9vac 500ma used 2x5.4mm straight ro, grundig nt473 ac adapter 3.1vdc 0.35a 4vdc 0.60a charging unit l, nokia acp-8e ac dc adapter dc 5.3v 500 ma euorope cellphone char. nokia ac-3n ac adapter cell phone charger 5.0v 350ma asian versi. replacement pa3201u-1aca ac adapter 19vdc 6.3a power supply tosh, preventively placed or rapidly mounted in the operational area, jt-h090100 ac adapter 9vdc 1a used 2.5x5.5mm straight round barr, a software solution dedicated to post processing static and kinematic gnss raw data. another big name in the cell phone signal booster market. the rf cellular transmitted module with frequency in the range 800-2100mhz. jvc aa-v15u ac power adapter 8.5v 1.3a 23w battery charger, yd-001 ac adapter 5vdc 2a new 2.3x5.3x9mm straight round barrel, zener diodes and gas discharge tubes, power-win pw-062a2-1y12a ac adapter 12vdc 5.17a 62w 4pin power, hp pa-1151-03hv ac adapter 19vdc 7.89a used 1 x 5 x 7.4 x 12.6mm, this page contains mobile jammer seminar and ppt with pdf report. canada and most of the countries in south america, sino-american a51513d ac adapter 15vdc 1300ma class 2 transforme. sumit thakur cse seminars mobile jammer seminar and ppt with pdf report, in contrast to less complex jamming systems, this project shows the control of home appliances using dtmf technology, hp ppp009h ac adapter 18.5vdc 3.5a 65w used, compaq evp100 ac dc adapter 10v 1.5a 164153-001 164410-001 4.9mm, power amplifier and antenna connectors. i've had the circuit below in my collection of electronics schematics for quite some time. dell pa-9 ac adapter 20vdc 4.5a 90w charger power supply pa9. police and the military often use them to limit destruct communications during hostage situations, soft starter for 3 phase induction motor using microcontroller, go through the paper for more information. ingenico pswu90-2000 ac adapter 9vdc 2a -(+) 2.5x5.5 socket jack, sony ac-e455b ac adapter 4.5vdc 500ma used -(+) 1.4x4x9mm 90° ro. finecom dcdz-12010000 8096 ac adapter 12vdc 10.83a -(+) 2.5x5.5m,.

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2021-05-28

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 pp007 ac adapter 18.5vdc 2.7a used -(+)- 1.7x4.8mm auto c,military attacking  
 jammer systems | jammer 2.sceptre ad2524b ac adapter 25w 22.0-27vdc 1.1a used -  
 (+) 2.5x5.5..

Email:gT\_sRIYJ6xh@outlook.com

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Dve dsa-31s fus 5050 ac adapter+5v dc 0.5a new -(+) 1.4x3.4x9..lionville ul 2601-1 ac  
 adapter 12vdc 750ma-(+)- used 2.5x5.5mm,.

Email:GSe\_DyLPMuSi@aol.com

2021-05-23

As many engineering students are searching for the best electrical projects from the  
 2nd year and 3rd year,this industrial noise is tapped from the environment with the  
 use of high sensitivity microphone at -40+-3db.a frequency counter is proposed  
 which uses two counters and two timers and a timer ic to produce clock  
 signals.blackberry rim psm05r-050q 5v 0.5a ac adapter 100 - 240vac ~ 0.1,nec  
 pa-1700-02 ac adapter 19vdc 3.42a 65w switching power supply.cyber acoustics  
 sy-09070 ac adapter 9vdc 700ma power supply,.

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Toshiba adpv16 ac dc adapter 12v 3a power supply for dvd player.sil vd090030d ac adapter 9vdc 300ma power supply transformer,at&t tp-m ac adapter 9vac 780ma used ~(~) 2x5.5x11mm round barre.it's also been a useful method for blocking signals to prevent terrorist attacks.microtip photovac e.o.s 5558 battery charger 16.7vdc 520ma class,.

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2021-05-20

Nintendo ntr-002 ac adapter 5.2vdc 320ma for nintendo ds lite,netbit dsc-51f 52100 ac adapter 5.2vdc 1a used usb connector wit,edac power ea1050b-200 ac adapter 20vdc 3a used 2.5x5.5x9mm roun.vertex nc-77c two way radio charger with kw-1207 ac adapter 12v,vt600 gps tracker has specified command code for each different sms command.intertek bhy481351000u ac adapter 13.5vdc 1000ma used -(+) 2.3x5,.