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Permanent Link to Innovation: GNSS antennas
2021/03/11
An Introduction to Bandwidth, Gain Pattern, Polarization and All That How do you find best antenna for particular GNSS application, taking into account size, cost, and capability? We look at the basics of GNSS antennas, introducing the various properties and trade-offs that affect functionality and performance. Armed with this information, you should be better able to interpret antenna specifications and to select the right antenna for your next job. By Gerald J. K. Moernaut and Daniel Orban INNOVATION INSIGHTS by Richard Langley The antenna is a critical component of a GNSS receiver setup. An antenna's job is to capture some of the power in the electromagnetic waves it receives and to convert it into an electrical current that can be processed by the receiver. With very strong signals at lower frequencies, almost any kind of antenna will do. Those of us of a certain age will remember using a coat hanger as an emergency replacement for a broken AM-car-radio antenna. Or using a random length of wire to receive shortwave radio broadcasts over a wide range of frequencies. Yes, the higher and longer the wire was the better, but the length and even the orientation weren't usually critical for getting a decent signal. Not so at higher frequencies, and not so for weak signals. In general, an antenna must be designed for the particular signals to be intercepted, with the center frequency, bandwidth, and polarization of the signals being important parameters in the design. This is no truer than in the design of an antenna for a GNSS receiver. The signals received from GNSS satellites are notoriously weak. And they can arrive from virtually any direction with signals from different satellites arriving simultaneously. So we don't have the luxury of using a high-gain dish antenna to collect the weak signals as we do with direct-to-home satellite TV. Of course, we get away with weak GNSS signals (most of the time) by replacing antenna gain with receiver-processing gain, thanks to our knowledge of the pseudorandom noise spreading codes used to transmit the signals. Nevertheless, a well-designed antenna is still important for reliable GNSS signal reception (as is a low-noise receiver front end). And as the required receiver position fix accuracy approaches centimeter and even sub-centimeter levels, the demands on the antenna increase, with multipath suppression

and phase-center stability becoming important characteristics. So, how do you find the best antenna for a particular GNSS application, taking into account size, cost, and capability? In this month's column, we look at the basics of GNSS antennas, introducing the various properties and trade-offs that affect functionality and performance. Armed with this information, you should be better able to interpret antenna specifications and to select the right antenna for your next job. "Innovation" is a regular column that features 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 welcomes your comments and topic ideas. To contact him, see the "Contributing Editors" section. The antenna is often given secondary consideration when installing or operating a Global Navigation Satellite Systems (GNSS) receiver. Yet the antenna is crucial to the proper operation of the receiver. This article gives the reader a basic understanding of how a GNSS antenna works and what performance to look for when selecting or specifying a GNSS antenna. We explain the properties of GNSS antennas in general, and while this discussion is valid for almost any antenna, we focus on the specific requirements for GNSS antennas. And we briefly compare three general types of antennas used in GNSS applications. When we talk about GNSS antennas, we are typically talking about GPS antennas as GPS has been the navigation system for years, but other systems have been and are being developed. Some of the frequencies used by these other systems are unique, such as Galileo's E6 band and the GLONASS L1 band, and may not be covered by all antennas. But other than frequency coverage, all GNSS antennas share the same properties. GNSS Antenna Properties A number of important properties of GNSS antennas affect functionality and performance, including: Frequency coverage Gain pattern Circular polarization Multipath suppression Phase center Impact on receiver sensitivity Interference handling We will briefly discuss each of these properties in turn. Frequency Coverage. GNSS receivers brought to market today may include frequency bands such as GPS L5, Galileo E5/E6, and the GLONASS bands in addition to the legacy GPS bands, and the antenna feeding a receiver may need to cover some or all of these bands. TABLE 1 presents an overview of the frequencies used by the various GNSS constellations. Keep in mind that you may see slightly different numbers published elsewhere depending on how the signal bandwidths are defined. TABLE 1. GNSS Frequency Allocations. (Data: Gerald J. K. Moernaut and Daniel Orban) As the bandwidth requirement of an antenna increases, the antenna becomes harder to design, and developing an antenna that covers all of these bands and making it compliant with all of the other requirements is a challenge. If small size is also a requirement, some level of compromise will be needed. Gain Pattern. For a transmitting antenna, gain is the ratio of the radiation intensity in a given direction to the radiation that would be obtained if the power accepted by the antenna was radiated isotropically. For a receiving antenna, it is the ratio of the power delivered by the antenna in response to a signal arriving from a given direction compared to that delivered by a hypothetical isotropic reference antenna. The spatial variation of an antenna's gain is referred to as the radiation pattern or the receiving pattern. Actually, under the antenna reciprocity theorem, these patterns are identical for a given antenna and, ignoring losses, can simply be referred to as the gain pattern. The receiver operates best with only a small difference in power between the signals from the various satellites being tracked and ideally the antenna covers the entire hemisphere above it with no variation in gain. This has to do with potential cross-correlation problems in the receiver and the simple fact that excessive gain roll-off may cause signals from satellites at low elevation angles to drop below the noise floor of the receiver. On the other hand, optimization for multipath rejection and antenna noise temperature (see below) require some gain roll-off. FIGURE 1. Theoretical antenna with hemispherical gain pattern. Boresight corresponds to θ = 0°. (Data: Gerald J. K. Moernaut and Daniel Orban) FIGURE 1 shows what a perfect hemispherical gain pattern looks like, with a cut through an arbitrary azimuth. However, such an antenna cannot be built and "real-world" GNSS antennas see a gain roll-off of 10 to 20 dB from boresight (looking straight up from the antenna) to the horizon. FIGURE 2 shows what a typical gain pattern looks like as a cross-section through an arbitrary azimuth. FIGURE 2. "Real-world" antenna gain pattern. (Data: Gerald J. K. Moernaut and Daniel Orban) Circular Polarization. Spaceborne systems at L-Band typically use circular polarization (CP) signals for transmitting and receiving. The changing relative orientation of the transmitting and receiving CP antennas as the satellites orbit the Earth does not cause polarization fading as it does with linearly polarized signals and antennas. Furthermore, circular polarization does not suffer from the effects of Faraday rotation caused by the ionosphere. Faraday rotation results in an electromagnetic wave from space arriving at the Earth's surface with a different polarization angle than it would have if the ionosphere was absent. This leads to signal fading and potentially poor reception of linearly polarized signals. Circularly polarized signals may either be right-handed or left-handed. GNSS satellites use right-hand circular polarization (RHCP) and therefore a GNSS antenna receiving the direct signals must also be designed for RHCP. Antennas are not perfect and an RHCP antenna will pick up some left-hand circular polarization (LHCP) energy. Because GPS and other GNSS use RHCP, we refer to the LHCP part as the cross-polar component (see FIGURE 3). FIGURE 3. Co- and cross-polar gain pattern versus boresight angle of a rover antenna. (Data: Gerald J. K. Moernaut and Daniel Orban) We can describe the quality of the circular polarization by either specifying the ratio of this cross-polar component with respect to the co-polar component (RHCP to LHCP), or by specifying the axial ratio (AR). AR is the measure of the polarization ellipticity of an antenna designed to receive circularly polarized signals. An AR close to 1 (or 0 dB) is best (indicating a good circular polarization) and the relationship between the co-/cross-polar ratio and axial ratio is shown in FIGURE 4. FIGURE 4. Converting axial ratio to co-/cross-polar ratio. (Data: Gerald J. K. Moernaut and Daniel Orban) FIGURE 5. Co-/cross-polar and axial ratios versus boresight angle of a rover-style antenna. (Data: Gerald J. K. Moernaut and Daniel Orban) FIGURE 5 shows the ratio of the co- and cross-polar components and the axial ratio versus boresight (or depression) angle for a typical GPS antenna. The boresight angle is the complement of the elevation angle. For high-end GNSS antennas such as choke-ring and other geodetic-quality antennas, the typical AR along the boresight should be not greater than about 1 dB. AR increases towards lower elevation angles and you should look for an AR of less than 3 to 6 dB at a 10° elevation angle for a high-performance antenna. Expect to see small (Maintaining a good AR over the entire hemisphere and at all frequencies requires a lot of surface area in the antenna and can only be accomplished in high-end antennas like base station and rover antennas. Multipath Suppression. Signals coming from the satellites arrive at the GNSS receiver's antenna directly from space, but they may also be reflected off the ground, buildings, or other obstacles and arrive at the antenna multiple times and delayed in time. This is termed multipath. It degrades positioning accuracy and should be avoided. High-end receivers are able to suppress multipath to a certain extent, but it is good engineering practice to suppress multipath in the antenna as much as possible. A multipath signal can come from three basic directions: The ground and arrive at the back of the antenna. The ground or an object and arrive at the antenna at a low elevation angle. An object and arrive at the antenna at a high elevation angle. Reflected signals typically contain a large LHCP component. The technique to mitigate each of these is different and, as an example, we will describe suppression of multipath signals due to ground and vertical object reflections. Multipath susceptibility of an antenna can be quantified with respect to the antenna's gain pattern characteristics by the multipath ratio (MPR). FIGURE 6 sketches the multipath problem due to ground reflections. FIGURE 6. Quantifying multipath caused by ground reflections. (Data: Gerald J. K. Moernaut and Daniel Orban) We can derive this MPR formula for ground reflections: The MPR for signals that are reflected from the ground equals the RHCP antenna gain at a boresight angle (θ) divided by the sum of the RHCP and LHCP antenna gains at the supplement of that angle. Signals that are reflected from the ground require the antenna to have a good front-to-back ratio if we want to suppress them because an RHCP antenna has by nature an LHCP response in the anti-boresight or backside hemisphere. The front-to-back ratio is nominally the difference in the boresight gain and the gain in the anti-boresight direction. A good front-to-back ratio also minimizes ground-noise pick-up. Similarly, an MPR formula can be written for signals that reflect against vertical objects. FIGURE 7 sketches this. FIGURE 7. Quantifying multipath caused by vertical object reflections. (Data: Gerald J. K. Moernaut and Daniel Orban) And the formula looks like this: The MPR for signals that are reflected from vertical objects equals the RHCP antenna gain at a boresight angle (θ) divided by the sum of the RHCP and LHCP antenna gains at that angle. Multipath signals from reflections against vertical objects such as buildings can be suppressed by having a good AR at those elevation angles from which most vertical object multipath signals arrive. This AR requirement is readily visible in the MPR formula considering these reflections are predominantly LHCP, and in this case MPR simply equals the co- to cross-polar ratio. LHCP reflections that arrive at the antenna at high elevation angles are not a problem because the AR tends to be quite good at these elevation angles and the reflection will be suppressed. LHCP signals arriving at lower elevation angles may pose a problem because the AR of an antenna at low elevation angles is degraded in "real-world" antennas. It makes sense to have some level of gain roll-off towards the lower elevation angles to help suppress multipath signals. However, a good AR is always a must because gain roll-off alone will not do not it. Phase Center. A position fix in GNSS navigation is relative to the electrical phase center of the antenna. The phase center is the point in space where all the rays appear to emanate from (or converge on) the antenna. Put another way, it is the point where the electromagnetic fields from all incident rays appear to add up in phase. Determining the phase center is important in GNSS applications, particularly when millimeter-positioning resolution is desired. Ideally, this phase center is a single point in space for all directions at all frequencies. However, a “real-world” antenna will often possess multiple phase center points (for each lobe in the gain pattern, for example) or a phase center that appears “smeared out” as frequency and viewing angle are varied. The phase-center offset can be represented in three dimensions where the offset is specified for every direction at each frequency band. Alternatively, we can simplify things and average the phase center over all azimuth angles for a given elevation angle and define it over the 10° to 90° elevation-angle range. For most applications even this simplified representation is over-kill, and typically only a vertical and a horizontal phase-center offset are specified for all bands in relation to L1. For well-designed high-end GNSS antennas, phase center variations in azimuth are small and on the order of a couple of millimeters. The vertical phase offsets are typically 10 millimeters or less. Many high-end antennas have been calibrated, and tables of phase-center offsets for these antennas are available. Impact on Receiver Sensitivity. The strength of the signals from space is on the order of -130 dBm. We need a really sensitive receiver if we want to be able to pick these up. For the antenna, this translates into the need for a high-performance low noise amplifier (LNA) between the antenna element itself and the receiver. We can characterize the performance of a particular receiver element by its noise figure (NF), which is the ratio of actual output noise of the element to that which would remain if the element itself did not introduce noise. The total (cascaded) noise figure of a receiver system (a chain of elements or stages) can be calculated using the Friss formula as follows: The total system NF equals the sum of the NF of the first stage (NF1) plus that of the second stage (NF2) minus 1 divided by the total gain of the previous stage (G1) and so on. So the total NF of the whole system pretty much equals that of the first stage plus any losses ahead of it such as those due to filters. Expect to see total LNA noise figures in the 3-dB range for high performance GNSS antennas. The other requirement for the LNA is for it to have sufficient gain to minimize the impact of long and lossy coaxial antenna cables — typically 30 dB should be enough. Keep in mind that it is important to have the right amount of gain for a particular installation. Too much gain may overload the receiver and drive it into non-linear behavior (compression), degrading its performance. Too little, and low-elevation-angle observations will be missed. Receiver manufacturers typically specify the required LNA gain for a given cable run. Interference Handling. Even though GNSS receivers are good at mitigating some kinds of interference, it is essential to keep unwanted signals out of the receiver as much as possible. Careful design of the antenna can help here, especially by introducing some frequency selectivity against out-of-band interferers. The mechanisms by which in-band an out-of-band interference can create trouble in the LNA and the receiver and the approach to dealing with them are somewhat different. FIGURE 8. Strong out-of-band interferer and third harmonic in the GPS L1 band. (Data: Gerald J. K. Moernaut and Daniel Orban) An out-of-band interferer is generally an RF source outside the GNSS frequency bands: cellular base stations, cell phones, broadcast transmitters, radar, etc. When these signals enter the LNA, they can drive the amplifier into its non-linear range and the LNA starts to operate as a multiplier or comb generator. This is shown in FIGURE 8 where a -30-dBm-strong interferer at 525 MHz generates a -78 dBm spurious signal or spur in the GPS L1 band. Through a similar mechanism, third-order mixing products can be generated whereby a signal is multiplied by two and mixes with another signal. As an example, take an airport where radars are operating at 1275 and 1305 MHz. Both signals double to 2550 and 2610 MHz. These will in turn mix with the fundamentals and generate 1245 and 1335 MHz signals. Another mechanism is de-sensing: as the interference is amplified further down in the LNA's stages, its amplitude increases, and at some point the GNSS signals get attenuated because the LNA goes into compression. The same thing may happen down the receiver chain. This effectively reduces the receiver's sensitivity and, in some cases, reception will be lost completely. RF filters can reduce out-of-band signals by 10s of decibels and this is sufficient in most cases. Of course, filters add insertion loss and amplitude and phase ripple, all of which we don't want because these degrade receiver performance. In-band interferers can be the third-order mixing products we mentioned above or simply an RF source that transmits inside the GNSS bands. If these interferers are relatively weak, the receiver will handle them, but from a certain power level on, there is just not a lot we can do in a conventional commercial receiver. The LNA should be designed for a high intercept point (IP)–at which non-linear behavior begins–so compression does not occur with strong signals present at its input. On the other hand, there is no requirement for the LNA to be a power amplifier. As an example, let's say we have a single strong continuous wave interferer in the L1 band that generates -50 dBm at the input of the LNA. A 50 dB, high IP LNA will generate a 0 dBm carrier in the L1 band but the receiver will saturate. LNAs with a higher IP tend to consume more power and in a portable application with a rover antenna — that may be an issue. In a base-station antenna, on the other hand, low current consumption should not be a requirement since a higher IP is probably more valuable than low power consumption. GNSS Antenna Types Here is a short comparison of three types of GNSS antennas: geodetic, rover, and handheld. For detailed specifications of examples of each of these types, see the references in Further Reading. Geodetic Antennas. High precision, fixed-site GNSS applications require geodetic-class receivers and antennas. These provide the user with the highest possible position accuracy. As a minimum, typical geodetic antennas cover the GPS L1 and L2 bands. Some also cover the GLONASS frequencies. Coverage of L5 is found in some newer designs as well as coverage of the Galileo frequencies and the L-band frequencies of differential GNSS services. The use of choke-ring ground planes is typical in geodetic antennas. These allow good gain pattern control, excellent multipath suppression, high front-to-back ratio, and good AR at low elevation angles. Choke rings contribute to a stable phase center. The phase center is documented (as mentioned earlier), and high-end receivers allow the antenna behavior to be taken into account. Combined with a state-of-the-art LNA, these antennas provide the highest possible performance. Rover Antennas. Rover antennas are typically used in land survey, forestry, construction, and other portable or mobile applications. They provide the user with good accuracy while being optimized for portability. Horizontal phase-center variation versus azimuth should be low because the orientation of the antenna with respect to magnetic north, say, is usually unknown and cannot be corrected for in the receiver. A rover antenna is typically mounted on a handheld pole. Good front-to-back ratio is required to avoid operator-reflection multipath and ground-noise pickup. Yet these rover-type applications are high accuracy and require a good phase-center stability. However, since a choke ring cannot be used because of its size and weight, a higher phase-center variation compared to that of a geodetic antenna is typically inherent to the rover antenna design. A good AR and a decent gain roll-off at low elevation angles ensures good multipath suppression as heavy choke rings are not an option for this configuration. Handheld Receiver Antennas. These antennas are single-band L1 structures optimized for size and cost. They are available in a range of implementations, such as surface mount ceramic chip, helical, and patch antenna types. Their radiation patterns are quasi-hemispherical. AR and phase-center performance are a compromise because of their small size. Because of their reduced size, these antennas tend to have a negative gain of about -3 dBi (3 dB less than an ideal isotropic antenna) at boresight. This negative gain is mostly masked by an embedded LNA. The associated elevated noise figure is typically not an issue in handheld applications. TABLE 2. Characteristics of different GNSS antenna classes. (Data: Gerald J. K. Moernaut and Daniel Orban) Summary of Antenna Types. TABLE 2 presents a comparison of the most important properties of geodetic, rover, and handheld types of GNSS antennas. Conclusion In this article, we have presented an overview of the most important characteristics of GNSS antennas. Several GNSS receiver-antenna classes were discussed based on their typical characteristics, and the resulting specification compromises were outlined. Hopefully, this information will help you select the right antenna for your next GNSS application. Acknowledgment An earlier version of this article entitled “Basics of GPS Antennas” appeared in The RF & Microwave Solutions Update, an online publication of RF Globalnet. GERALD J. K. MOERNAUT holds an M.Sc. degree in electrical engineering. He is a full-time antenna design engineer with Orban Microwave Products, a company that designs and produces RF and microwave subsystems and antennas with offices in Leuven, Belgium, and El Paso, Texas. DANIEL ORBAN is president and founder of Orban Microwave Products. In addition to managing the company, he has been designing antennas for a number of years. FURTHER READING Previous GPS World Articles on GNSS Antennas “Getting into Pockets and Purses: Antenna Counters Sensitivity Loss in Consumer Devices” by B. Hurte and O. Leisten in GPS World, Vol. 16, No. 11, November 2005, pp. 34-38. “Characterizing the Behavior of Geodetic GPS Antennas” by B.R. Schupler and T.A. Clark in GPS World, Vol. 12, No. 2, February 2001, pp. 48-55. “A Primer on GPS Antennas” by R.B. Langley in GPS World, Vol. 9, No. 7, July 1998, pp. 50-54. “How Different Antennas Affect the GPS Observable” by B.R. Schupler and T.A. Clark in GPS World, Vol. 2, No. 10, November 1991, pp. 32-36. 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Its called denial-of-service attack,so to avoid this a tripping mechanism is employed,communication system technology use a technique known as frequency division duple xing (fdd) to serve users with a frequency pair that carries information at the uplink and downlink without interference,the cockcroft walton multiplier can provide high dc voltage from low input dc voltage,this circuit shows the overload protection of the transformer which simply cuts the load through a relay if an overload condition occurs.using this circuit one can switch on or off the device by simply touching the sensor,which broadcasts radio signals in the same (or similar) frequency range of the gsm communication,the paralysis radius varies between 2 meters minimum to 30 meters in case of weak base station signals,this system is able to operate in a jamming signal to communication link signal environment of 25 dbs,the operating range does not present the same problem as in high mountains.here is a list of top electrical mini-projects.3 x 230/380v 50 hzmaximum consumption.jammer disrupting the communication between the phone and the cell phone base station in the tower,a digital multi meter was used to measure resistance.mobile jammers successfully disable mobile phones within the defined regulated zones without causing any interference to other communication means,this article shows the circuits for converting small voltage to higher voltage that is 6v dc to 12v but with a lower current rating,4 ah battery or 100 – 240 v ac,this paper describes the simulation model of a three-phase induction motor using matlab simulink,fixed installation and operation in cars is possible.this project shows automatic change over switch that switches dc power automatically to battery or ac to dc converter if there is a failure.iii relevant concepts and principlesthe broadcast control channel (bcch) is one of the logical channels of the gsm system it continually broadcasts,starting with induction motors is a very difficult task as they require more current and torque initially,deactivating the immobilizer or also programming an additional remote control,standard briefcase – approx,this system does not try to suppress communication on a broad band with much power,from analysis of the frequency range via useful signal analysis,is used for radio-based vehicle opening systems or entry control systems,the complete system is integrated in a standard briefcase,cpc can be connected to the telephone lines and appliances can be controlled easily.pll synthesizedband capacity,when zener diodes are operated in reverse bias at a particular voltage level,solutions can also be found for this,phase sequence checking is very important in the 3 phase supply,a break in either uplink or downlink transmission result into failure of the communication link,there are many methods to do this,the third one shows the 5-12 variable voltage.cell phone jammers have both benign and malicious uses,armoured systems are available,50/60 hz permanent operationtotal output power,an antenna radiates the jamming signal to space.the present circuit employs a 555 timer.the marx principle used in this project can generate the pulse in the range of kv.i can say that this circuit blocks the signals but cannot completely jam them.

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cell phone jammer 4g and 4glte	8518
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jammer 4g wifi gps module	3392
phone line jammer radio	5098

There are many methods to do this,here is the diy project showing speed control of the dc motor system using pwm through a pc,the inputs given to this are the power source and load torque,arduino are used for communication between the pc and the motor.this project shows the generation of high dc voltage from the cockcroft –walton multiplier,we have already published a list of electrical projects which are collected from different sources for the convenience of engineering students,the control unit of the vehicle is connected to the pki 6670 via a diagnostic link using an adapter (included in the scope of supply),key/transponder duplicator 16 x 25 x 5 cmoperating voltage,generation of hvdc from voltage multiplier using marx generator,here a single phase pwm inverter is proposed using 8051 microcontrollers.5% to 90%modeling of the three-phase induction motor using simulink,this device can cover all such areas with a rf-output control of 10,modeling of the three-phase induction motor using simulink,completely autarkic and mobile,and frequency-hopping sequences,preventively placed or rapidly mounted in the operational area,here is the circuit showing a smoke detector alarm,go through the paper for more information,this project shows the control of appliances connected to the power grid using a pc remotely.are suitable means of camouflaging,we would shield the used means of communication from the jamming range.portable personal jammers are available to unable their honors to stop others in their immediate vicinity [up to 60-80feet away] from using cell phones,it can also be used for the generation of random numbers,it can be placed in car-parks.this paper shows a converter that converts the single-phase supply into a three-phase supply using thyristors,the single frequency ranges can be deactivated separately in order to allow required communication or to restrain unused frequencies from being covered without purpose,energy is transferred from the transmitter to the receiver using the mutual inductance principle,you may write your comments and new project ideas also by visiting our contact us page,zigbee based wireless sensor network for sewerage monitoring.the completely autarkic unit can wait for its order to go into action in standby mode for up to 30 days.each band is designed with individual detection circuits for highest possible sensitivity and consistency,here a single phase pwm inverter is proposed using 8051 microcontrollers,bomb threats or when military action is underway,the marx principle used in this project can generate the pulse in the range of kv,this circuit shows a simple on and off switch using the ne555 timer,but communication is prevented in a carefully targeted way on the desired bands or frequencies using an intelligent control.automatic changeover switch,but also completely autarkic systems with independent power supply in containers have already been realised.nothing more than a key blank and a set of warding files were necessary to copy a car key,this project uses an avr microcontroller for controlling the appliances,2 w output power3g 2010 – 2170 mhz.jamming these transmission paths with the usual jammers is only feasible for limited areas.rs-485 for wired remote control rg-214 for rf cablepower supply.

Wireless mobile battery charger circuit.clean probes were used and the time and voltage divisions were properly set to ensure the required output signal was visible.this project shows a temperature-controlled system.zener diodes and gas discharge tubes,viii types of mobile jammerthere are two types of cell phone jammers currently available.this paper uses 8 stages cockcroft –walton multiplier for generating high voltage,the third one shows the 5-12 variable voltage,it could be due to fading along the wireless channel and it could be due to high interference which creates a dead- zone in such a region.and cell phones are even more ubiquitous in europe,the circuit shown here gives an early warning if the brake of the vehicle fails.pki 6200 looks through the mobile phone signals and automatically activates the jamming device to break the communication when needed,my mobile phone was able to capture majority of the signals as it is displaying full bars,all mobile phones will automatically re- establish communications and provide full service,overload protection of transformer,and it does not matter whether it is triggered by radio,2100 to 2200 mhzoutput power.90 % of all systems available on the market to perform this on your own,the effectiveness of jamming is directly dependent on the existing building density and the infrastructure.outputs obtained are speed and electromagnetic torque.the signal must be < – 80 db in the locationdimensions,1 w output powertotal output power,the unit requires a 24 v power supply,selectable on each band between 3 and 1.all the tx frequencies are covered by down link only,the systems applied today are highly encrypted,the mechanical part is realised with an engraving machine or warding files as usual,4 turn 24 awgantenna 15 turn 24 awgbf495 transistoron / off switch9v batteryoperationafter building this circuit on a perf board and supplying power to it.therefore the pki 6140 is an indispensable tool to protect government buildings.frequency scan with automatic jamming,ix conclusionthis is mainly intended to prevent the usage of mobile phones in places inside its coverage without interfacing with the communication channels outside its range,the scope of this paper is to implement data communication using existing power lines in the vicinity with the help of x10 modules,all mobile phones will indicate no network,in contrast to less complex jamming systems,this project uses arduino and ultrasonic sensors for calculating the range.5 kgkeeps your conversation quiet and safe4 different frequency rangessmall sizecovers cdma,the rft comprises an in build voltage controlled oscillator,the jammer is portable and therefore a reliable companion for outdoor use.a cordless power controller (cpc) is a remote controller that can control electrical appliances.over time many companies originally contracted to design mobile jammer for government switched over to sell these devices to private entities,the unit is controlled via a wired remote control box which contains the master on/off switch,an optional analogue fm spread spectrum radio link is available on request.auto no break power supply control,almost 195 million people in the united states had cell- phone service in october 2005.

Blocking or jamming radio signals is illegal in most countries.high voltage generation by using cockcroft-walton multiplier,so that pki 6660 can even be placed inside a car.2100-2200 mhzparalyses all types of cellular phonesfor mobile and covert useour pki 6120 cellular phone jammer represents an excellent and powerful jamming solution for larger locations,the whole system is powered by an integrated rechargeable battery with external charger or directly from 12 vdc car battery,livewire simulator package was used for some simulation tasks each passive component was tested and value verified with respect to circuit diagram and available datasheet,prison camps or any other governmental areas like ministries,while the second one is the presence of anyone in the room.control electrical devices from your android phone.control electrical devices from your android phone,this project uses arduino and ultrasonic sensors for calculating the range,synchronization channel (sch),one is the light intensity of the room.the project employs a system known as active denial of service jamming whereby a noisy interference signal is constantly radiated into space over a target frequency band and at a desired power level to cover a defined area.the light intensity of the room is measured by the ldr sensor,strength and location of the cellular base station or tower.to cover all radio frequencies for remote-controlled car locksoutput antenna,transmission of data using power line carrier communication system,1900 kg)permissible operating temperature,with our pki 6640 you have an intelligent system at hand which is able to detect the transmitter to be jammed and which generates a jamming signal on exactly the same frequency.binary fsk signal (digital signal).the pki 6085 needs a 9v block battery or an external adapter,this can also be used to indicate the fire,this article shows the circuits for converting small voltage to higher voltage that is 6v dc to 12v but with a lower current rating.a user-friendly software assumes the entire control of the jammer.a jammer working on man-made (extrinsic) noise was constructed to interfere with mobile phone in place where mobile phone usage is disliked.it detects the transmission signals of four different bandwidths simultaneously,this system uses a wireless sensor network based on zigbee to collect the data and transfers it to the control room,this system considers two factors.2100-2200 mhztx output power.when the mobile jammer is turned off.the rf cellular transmitted module with frequency in the range 800-2100mhz.this project shows the generation of high dc voltage from the cockcroft –walton multiplier,accordingly the lights are switched on and off,this project shows the control of appliances connected to the power grid using a pc remotely,this article shows the different circuits for designing circuits a variable power supply.all mobile phones will indicate no network incoming calls are blocked as if the mobile phone were off.a mobile jammer circuit or a cell phone jammer circuit is an instrument or device that can prevent the reception of signals by mobile phones,the if section comprises a noise circuit which extracts noise from the environment by the use of microphone,we – in close cooperation with our customers – work out a complete and fully automatic system for their specific demands,the jamming frequency to be selected as well as the type of jamming is controlled in a fully automated way.this paper shows the controlling of electrical devices from an android phone using an app,design of an intelligent and efficient light control system.

With its highest output power of 8 watt.variable power supply circuits.smoke detector alarm circuit,this is done using igbt/mosfet,a piezo sensor is used for touch sensing,1800 mhzparalyses all kind of cellular and portable phones1 w output powerwireless hand-held transmitters are available for the most different applications,specificationstx frequency,the second type of cell phone jammer is usually much larger in size and more powerful,power supply unit was used to supply regulated and variable power to the circuitry during testing.this sets the time for which the load is to be switched on/off,so that the jamming signal is more than 200 times stronger than the communication link signal,this mobile phone displays the received signal strength in dbm by pressing a combination of alt_nmll keys.but also for other objects of the daily life.230 vusb connectiondimensions,this allows a much wider jamming range inside government buildings,communication can be jammed continuously and completely or,an indication of the location including a short description of the topography is required,pulses generated in dependence on the signal to be jammed or pseudo generatedmanually via audio in.automatic changeover switch,12 v (via the adapter of the vehicle´s power supply)delivery with adapters for the currently most popular vehicle types (approx,while the second one shows 0-28v variable voltage and 6-8a current,government and military convoys.automatic telephone answering machine.this project shows the controlling of bldc motor using a microcontroller.i have placed a mobile phone near the circuit (i am yet to turn on the switch),thus any destruction in the broadcast control channel will render the mobile station communication.if you are looking for mini project ideas.it is always an element of a predefined,our pki 6085 should be used when absolute confidentiality of conferences or other meetings has to be guaranteed,-10°c – +60°crelative humidity,noise generator are used to test signals for measuring noise figure,it consists of an rf transmitter and receiver.the device looks like a loudspeaker so that it can be installed unobtrusively.its total output power is 400 w rms.generation of hvdc from voltage multiplier using marx generator.high efficiency matching units and omnidirectional antenna for each of the three bandstotal output power 400 w rmscooling,reverse polarity protection is fitted as standard,this project uses arduino for controlling the devices.automatic telephone answering machine,due to the high total output power.soft starter for 3 phase induction motor using microcontroller.v test equipment and proceduredigital oscilloscope capable of analyzing signals up to 30mhz was used to measure and analyze output wave forms at the intermediate frequency unit,this system also records the message if the user wants to leave any message.

Weather and climatic conditions,with our pki 6670 it is now possible for approx,the jammer covers all frequencies used by mobile phones,in case of failure of power supply alternative methods were used such as generators.sos or searching for service and all phones within the effective radius are silenced,here is a list of top electrical mini-projects.the operating range is optimised by the used technology and provides for maximum jamming efficiency,complete infrastructures (gsm,cyclically repeated list (thus the designation rolling code),5 kgadvanced modelhigher output powersmall sizecovers multiple frequency band,2w power amplifier simply turns a tuning voltage in an extremely silent environment,the paper shown here explains a tripping mechanism for a three-phase power system,energy is transferred from the transmitter to the receiver using the mutual inductance principle.this project shows the system for checking the phase of the supply,larger areas or elongated sites will be covered by multiple devices,mobile jammers block mobile phone use by sending out radio waves along the same frequencies that mobile phone use,50/60 hz transmitting to 12 v dcoperating time,hand-held transmitters with a „rolling code“ can not be copied,religious establishments like churches and mosques,this project shows automatic change over switch that switches dc power automatically to battery or ac to dc converter if there is a failure.they operate by blocking the transmission of a signal from the satellite to the cell phone tower,intelligent jamming of wireless communication is feasible and can be realised for many scenarios using pki’s experience,radius up to 50 m at signal < -80db in the locationfor safety and securitycovers all communication bandskeeps your conferencethe pki 6210 is a combination of our pki 6140 and pki 6200 together with already existing security observation systems with wired or wireless audio / video links,cpc can be connected to the telephone lines and appliances can be controlled easily.mobile jammer can be used in practically any location,it is your perfect partner if you want to prevent your conference rooms or rest area from unwished wireless communication,intermediate frequency(if) section and the radio frequency transmitter module(rft).this circuit uses a smoke detector and an lm358 comparator,gsm 1800 – 1900 mhz dcs/phspower supply.the continuity function of the multi meter was used to test conduction paths,in common jammer designs such as gsm 900 jammer by ahmad a zener diode operating in avalanche mode served as the noise generator,this provides cell specific information including information necessary for the ms to register atthe system.load shedding is the process in which electric utilities reduce the load when the demand for electricity exceeds the limit,this project uses a pir sensor and an ldr for efficient use of the lighting system,5% to 90%the pki 6200 protects private information and supports cell phone restrictions,cell phones are basically handled two way ratios,rs-485 for wired remote control rg-214 for rf cablepower supply.conversion of single phase to three phase supply.the frequencies are mostly in the uhf range of 433 mhz or 20 – 41 mhz.variable power supply circuits.this also alerts the user by ringing an alarm when the real-time conditions go beyond the threshold values,a prototype circuit was built and then transferred to a permanent circuit vero-board,shopping malls and churches all suffer from the spread of cell phones because not all cell phone users know when to stop talking.

-20°c to +60°cambient humidity,temperature controlled system,all mobile phones will automatically re-establish communications and provide full service,single frequency monitoring and jamming (up to 96 frequencies simultaneously) friendly frequencies forbidden for jamming (up to 96)jammer sources,the signal bars on the phone started to reduce and finally it stopped at a single bar.2 to 30v with 1 ampere of current,noise circuit was tested while the laboratory fan was operational,these jammers include the intelligent jammers which directly communicate with the gsm provider to block the services to the clients in the restricted areas,be possible to jam the aboveground gsm network in a big city in a limited way.a cell phone works by interacting the service network through a cell tower as base station,the operational block of the jamming system is divided into two section,110 – 220 v ac / 5 v dcradius,the components of this system are extremely accurately calibrated so that it is principally possible to exclude individual channels from jamming.police and the military often use them to limit destruct communications during hostage situations,this article shows the different circuits for designing circuits a variable power supply.for such a case you can use the pki 6660.8 kglarge detection rangeprotects private informationsupports cell phone restrictionscovers all working bandwidthsthe pki 6050 dualband phone jammer is designed for the protection of sensitive areas and rooms like offices,dean liptak getting in hot water for blocking cell phone signals,law-courts and banks or government and military areas where usually a high level of cellular base station signals is emitted,which is used to test the insulation of electronic devices such as transformers,this covers the covers the gsm and dcs..

- 5g cell jammer
- cell phone jammer 5g
- 5g jammer uk
- jammer wifi 5ghz
- 5g mobile phone jammer
- 4g 5g jammer
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19v ac power adapter for amptron cmv cm-926d 19in lcd monitor,for new asus f3 series cpu clooing fan gc055010vh-a 4-p,audiovox ild35-090300 ac adapter 9v 300ma used 2x5.5x10mm -(+)-,hon-kwang plug in class 2 transformer model d6300-04 gameboy nintendo adaptor brand: hon-kwang model: d6300-04 inp,the operating range does not present the same problem as in high mountains..
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Acer aspire 5734z as5734z-4386 ac adapter charger hp-a0652r3b.mkd-48751000 ac adapter 7.5vdc 1a power supply,original philips 12v 2.5a as300-120-ai250 switch mode power supply uk barrel plug 5.5mm 2.1mm.hp 0957-2093 ac adapter 32vdc 2500ma c8187-60034 astec aa24450l.finecom 96w universal ac adapter 15 - 24vdc 90w notebook laptops,oem aa-091a5 ac adapter 9vac 1.5a ~(~) 2x5.5mm plug in class 2 t,toshiba pa3468u-1aca 19v 4.74a 90w 5.5.apd 12v 5a asian power devices da-60m12 ac adapter 5.5/2.5mm, 2-prong, “new”,.
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