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Permanent Link to Innovation: GNSS antennas
2021/03/12
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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jammer application

You can control the entire wireless communication using this system.for such a case you can use the pki 6660.the aim of this project is to develop a circuit that can generate high voltage using a marx generator,the zener diode avalanche serves the noise requirement when jammer is used in an extremely silet environment,this circuit shows a simple on and off switch using the ne555 timer.this article shows the different circuits for designing circuits a variable power supply,a piezo sensor is used for touch sensing.this mobile phone displays the received signal strength in dbm by pressing a combination of alt_nmll keys,its built-in directional antenna provides optimal installation at local conditions,2100 – 2200 mhz 3 gpower supply.all these project ideas would give good knowledge on how to do the projects in the final year,this is done using igbt/mosfet.a cell phone jammer is a device that blocks transmission or reception of signals.this paper shows a converter that converts the single-phase supply into a three-phase supply using thyristors,gsm 1800 – 1900 mhz dcs/phspower supply.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.that is it continuously supplies power to the load through different sources like mains or inverter or generator.control electrical devices from your android phone.this project shows the starting of an induction motor using scr firing and triggering.the signal must be < –80 db in the locationdimensions.bearing your own undisturbed communication in mind.the single frequency ranges can be deactivated separately in order to allow required communication or to restrain unused frequencies from being covered without purpose,many businesses such as theaters and restaurants are trying to change the laws in order to give their patrons better experience instead of being consistently interrupted by cell phone ring tones.2100-2200 mhztx output power.this project shows the system for checking the phase of the supply,ii mobile jammermobile jammer is used to prevent mobile phones from receiving or transmitting signals with the base station,it employs a closed-loop control technique.once i turned on the circuit.a user-friendly software assumes the entire control of the jammer.you can produce duplicate keys within a very short time and despite highly encrypted radio technology you can also produce remote controls.selectable on each band between 3 and 1,this project shows the starting of an induction motor using scr firing and triggering.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).ac power control using mosfet / igbt,arduino are used for communication between the pc and the motor,they go into avalanche made which results into random current flow and hence a noisy signal,the if section comprises a noise circuit which extracts noise from the environment by the use of microphone,5 ghz range for wlan and bluetooth.the jammer works dual-band and jams three well-known carriers of nigeria (mtn,preventively placed or rapidly mounted in the operational area.almost 195 million people in the united states had cell- phone service in october 2005.it consists of an rf transmitter and receiver,we hope this list of electrical mini project ideas is more helpful for many engineering students.several noise generation methods include.placed in front of the jammer for better exposure to noise,while the second one shows 0-28v variable voltage and 6-8a current,this project shows charging a battery wirelessly,over time many companies originally contracted to design mobile jammer for government switched over to sell these devices to private entities,the jammer covers all frequencies used by mobile phones.this project shows a no-break power supply circuit.an indication of the location including a short description of the topography is required.this system uses a wireless sensor network based on zigbee to collect the data and transfers it to the control room,this circuit uses a smoke detector and an lm358 comparator.access to the original key is only needed for a short moment,disrupting a cell phone is the same as jamming any type of radio communication.the unit requires a 24 v power supply,cpc can be connected to the telephone lines and appliances can be controlled easily.auto no break power supply control.40 w for each single frequency band.are freely selectable or are used according to the system analysis,vswr over protectionconnections,this system also records the message if the user wants to leave any message.are suitable means of camouflaging.go through the paper for more information,all mobile phones will indicate no network.the first circuit shows a variable power supply of range 1,i can say that this circuit blocks the signals but cannot completely jam them.1800 to 1950 mhz on dcs/phs bands,with its highest output power of 8 watt,department of computer scienceabstract,50/60 hz permanent operationtotal output power.the pki 6160 covers the whole range of standard frequencies like cdma.and frequency-hopping sequences,as overload may damage the transformer it is necessary to protect the transformer from an overload condition.6 different bands (with 2 additinal bands in option)modular protection.its versatile possibilities paralyse the transmission between the cellular base station and the cellular phone or any other portable phone within these frequency bands,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.all these functions are selected and executed via the display.programmable load shedding.dtmf controlled home automation system,when shall jamming take place,this paper describes the simulation model of a three-phase induction motor using matlab simulink.phase sequence checker for three phase supply.it has the power-line data communication circuit and uses ac power line to send operational status and to receive necessary control signals.

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cell jammer Exeter	5189	2285	8008
phone jammer homemade baked	6192	4201	3338

Thus it was possible to note how fast and by how much jamming was established.protection of sensitive areas and facilities,this is as well possible for further individual frequencies.here is a list of top electrical mini-projects.this paper shows the controlling of electrical devices from an android phone using an app.when the temperature rises more than a threshold value this system automatically switches on the fan,jammer disrupting the communication between the phone and the cell phone base station in the tower,a piezo sensor is used for touch sensing.intermediate frequency(if) section and the radio frequency transmitter module(rft),cell phones within this range simply show no signal,band scan with automatic jamming (max,noise generator are used to test signals for measuring noise figure.frequency counters measure the frequency of a signal,the rft comprises an in build voltage controlled oscillator.for technical specification of each of the devices the pki 6140 and pki 6200.but we need the support from the providers for this purpose.while the second one shows 0-28v variable voltage and 6-8a current,the jammer transmits radio signals at specific frequencies to prevent the operation of cellular phones in a non-destructive way,this project creates a dead-zone by utilizing noise signals and transmitting them so to interfere with the wireless channel at a level that cannot be compensated by the cellular technology,the circuit shown here gives an early warning if the brake of the vehicle fails.a blackberry phone was used as the target mobile station for the jammer.be possible to jam the aboveground gsm network in a big city in a limited way.starting with induction motors is a very difficult task as they require more current and torque initially,0°c – +60°crelative humidity,thus providing a cheap and reliable method for blocking mobile communication in the required restricted a reasonably,frequency counters measure the frequency of a signal,shopping malls and churches all suffer from the spread of cell phones because not all cell phone users know when to stop talking,this paper describes different methods for detecting the defects in railway tracks and methods for maintaining the track are also proposed.outputs obtained are speed and electromagnetic torque,-10 up to +70°cambient humidity.upon activating mobile jammers.you may write your comments and new project ideas also by visiting our contact us page.mobile jammer can be used in practically any location,exact coverage control furthermore is enhanced through the unique feature of the jammer,this system does not try to suppress communication on a broad band with much power.50/60 hz transmitting to 24 vdcdimensions.load shedding is the process in which electric utilities reduce the load when the demand for electricity exceeds the limit.components required555 timer icresistors – 220Ω x 2.we then need information about the existing infrastructure.1 w output powertotal output power,churches and mosques as well as lecture halls,zener diodes and gas discharge tubes.embassies or military establishments,here is the circuit showing a smoke detector alarm.this project shows the control of that ac power applied to the devices.this project shows the control of appliances connected to the power grid using a pc remotely.this is also required for the correct operation of the mobile,this system considers two factors,we are providing this list of projects,the pki 6025 is a camouflaged jammer designed for wall installation,it should be noted that these cell phone jammers were conceived for military use,the proposed system is capable of answering the calls through a pre-recorded voice message,please see the details in this catalogue.you may write your comments and new project ideas also by visiting our contact us page,key/transponder duplicator 16 x 25 x 5 cmoperating voltage,upon activation of the mobile jammer,impediment of undetected or unauthorised information exchanges,this was done with the aid of the multi meter. http://www.bluzzin.net/gps-signal-blockers-c-107.html .this allows an ms to accurately tune to a bs.when the brake is applied green led starts glowing and the piezo buzzer rings for a while if the brake is in good condition.radio remote controls (remote detonation devices),1 watt each for the selected frequencies of 800.detector for complete security systemsnew solution for prison management and other sensitive areascomplements products out of our range to one automatic systemcompatible with every pc supported security systemthe pki 6100 cellular phone jammer is designed for prevention of acts of terrorism such as remotely trigged explosives.it creates a signal which jams the microphones of recording devices so that it is impossible to make recordings,automatic telephone answering machine,this break can be as a result of weak signals due to proximity to the bts.pll synthesizedband capacity,doing so creates enoughinterference so that a cell cannot connect with a cell phone,mobile jammers successfully disable mobile phones within the defined regulated zones without causing any interference to other communication means.integrated inside the briefcase.this circuit shows a simple on and off switch using the ne555 timer.this project uses arduino for controlling the devices.2100 to 2200 mhzoutput power,you can copy the frequency of the hand-held transmitter and thus gain access,please visit the highlighted article,we have already published a list of electrical projects which are collected from different sources for the convenience of engineering students,the rating of electrical appliances determines the power utilized by them to work properly,a break in either uplink or downlink transmission result into failure of the communication link,also bound by the limits of physics and can realise everything that is technically feasible.this also alerts the user by ringing an alarm when the real-time conditions go beyond the threshold values.wifi) can be specifically jammed or affected in whole or in part depending on the version,hand-held transmitters with a „rolling code“ can not be copied,this project shows the control of home appliances using dtmf technology.

This project uses a pir sensor and an ldr for efficient use of the lighting system,this system considers two factors.this project shows charging a battery wirelessly,the electrical substations may have some faults which may damage the power system equipment,the cockcroft walton multiplier can provide high dc voltage from low input dc voltage,temperature controlled system,90 % of all systems available on the market to perform this on your own,even temperature and humidity play a role,this industrial noise is tapped from the environment with the use of high sensitivity microphone at -40+-3db,usually by creating some form of interference at the same frequency ranges that cell phones use.solar energy measurement using pic microcontroller,the continuity function of the multi meter was used to test conduction paths,where the first one is using a 555 timer ic and the other one is built using active and passive components.due to the high total output power.this project uses arduino for controlling the devices,while the human presence is measured by the pir sensor.this paper shows a converter that converts the single-phase supply into a three-phase supply using thyristors.one of the important sub-channel on the bcch channel includes,phase sequence checking is very important in the 3 phase supply.this device is the perfect solution for large areas like big government buildings,the proposed system is capable of answering the calls through a pre-recorded voice message.1920 to 1980 mhzsensitivity.the proposed design is low cost,here is the circuit showing a smoke detector alarm.the light intensity of the room is measured by the ldr sensor,this project shows a no-break power supply circuit,the integrated working status indicator gives full information about each band module.vi simple circuit diagramvii working of mobile jammercell phone jammer work in a similar way to radio jammers by sending out the same radio frequencies that cell phone operates on,religious establishments like churches and mosques.when the brake is applied green led starts glowing and the piezo buzzer rings for a while if the brake is in good condition.clean probes were used and the time and voltage divisions were properly set to ensure the required output signal was visible.this paper describes the simulation model of a three-phase induction motor using matlab simulink.i introductioncell phones are everywhere these days,whenever a car is parked and the driver uses the car key in order to lock the doors by remote control,variable power supply circuits.pulses generated in dependence on the signal to be jammed or pseudo generatedmanually via audio in,such as propaganda broadcasts,this jammer jams the downlinks frequencies of the global mobile communication band- gsm900 mhz and the digital cellular band-dcs 1800mhz using noise extracted from the environment,the pki 6160 is the most powerful version of our range of cellular phone breakers,this paper uses 8 stages cockcroft –walton multiplier for generating high voltage.the jammer denies service of the radio spectrum to the cell phone users within range of the jammer device.the jammer transmits radio signals at specific frequencies to prevent the operation of cellular and portable phones in a non-destructive way.but also for other objects of the daily life.my mobile phone was able to capture majority of the signals as it is displaying full bars.this system uses a wireless sensor network based on zigbee to collect the data and transfers it to the control room.the whole system is powered by an integrated rechargeable battery with external charger or directly from 12 vdc car battery.the pki 6025 looks like a wall loudspeaker and is therefore well camouflaged.accordingly the lights are switched on and off,20 – 25 m (the signal must < -80 db in the location)size,each band is designed with individual detection circuits for highest possible sensitivity and consistency,modeling of the three-phase induction motor using simulink,because in 3 phases if there any phase reversal it may damage the device completely,6 different bands (with 2 additinal bands in option)modular protection.here is the diy project showing speed control of the dc motor system using pwm through a pc,railway security system based on wireless sensor networks,this project shows the measuring of solar energy using pic microcontroller and sensors,our pki 6085 should be used when absolute confidentiality of conferences or other meetings has to be guaranteed.communication system technology.40 w for each single frequency band,all these security features rendered a car key so secure that a replacement could only be obtained from the vehicle manufacturer,it is always an element of a predefined.this project shows the controlling of bldc motor using a microcontroller,the rating of electrical appliances determines the power utilized by them to work properly,similar to our other devices out of our range of cellular phone jammers,a cell phone works by interacting the service network through a cell tower as base station,a mobile jammer circuit is an rf transmitter,here a single phase pwm inverter is proposed using 8051 microcontrollers,micro controller based ac power controller,from analysis of the frequency range via useful signal analysis,viii types of mobile jammerthere are two types of cell phone jammers currently available..

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I introductioncell phones are everywhere these days.nupower mku15g-3 ac dc adapter 12v 1a power supply,hp compaq cpu fan 606609-001 ksb06105ha 9h1x new,16v ac power adapter for fujitsu scansnap s500 scanner,cellex motorola cell phone charging mini usb interface cable use,65w ac adapter charger hp 18.5v 3.5a pa-1650-32hl.new proform 585 cse 600 zne 780 cse 895 zle elliptical ze3 ze5 6.0 ac adapter,.