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Permanent Link to Innovation: Scintillating Statistics

2021/03/11

A Look at High-Latitude and Equatorial Ionospheric Disturbances of GPS Signals By Yu Jiao, Yu (Jade) Morton, Steve Taylor, and Wouter Pelgrum INNOVATION INSIGHTS by Richard Langley THE EARTH'S IONOSPHERE. It's both a blessing and a curse. Together with the magnetosphere, it helps to protect life on our planet from the damaging outpour of particle and electromagnetic radiation from the sun. In particular, it absorbs a lot of the extreme-ultraviolet (EUV) radiation arriving at the Earth. In fact, that is primarily how the ionosphere is formed. The EUV energy strips off the outer electrons of atmospheric gases producing a plasma of free electrons and ions. The ionosphere has another beneficial role in that it permits long distance radio communication using high-frequency (HF) or shortwave signals. Although its use is in decline since the advent of the Internet, HF is still in use by some broadcasters and military organizations and is indispensable during natural disasters when electricity grids and network links go down. But the ionosphere can be a pain, too, particularly for GNSS users. The signals from GNSS satellites must travel through the ionosphere on their way to receivers on or near the Earth's surface. The signals are perturbed by the presence of the free electrons causing an advance in the phase of a signal's carrier and a delay in the arrival of the pseudorandom noise code modulation (due to the refractive index being frequency dependent or dispersive) and so there is a contribution to carrier-phase and pseudorange (code) measurements, which must be accounted for when determining positions, velocities, and time (PVT) from the measurements. Again, since the ionosphere is a dispersive medium, by linearly combining simultaneous measurements (either pseudoranges or carrier phases) on two frequencies such as the GPS L1 and L2 frequencies, an observable virtually free of ionospheric effects can be constructed and used for PVT determinations. This approach does require, however, a dual- or multi-frequency receiver. Single-frequency receivers (or the post-processing of single-frequency data) require the use of a model to account for the ionospheric biases as much as possible. The GPS navigation message, for example, includes values of the parameters of a simple ionospheric model. But, on average, its accuracy is only around 50%. More accurate

ionospheric corrections can be acquired from elsewhere, even in real time, such as those from satellite-based augmentation systems. But there is another ionospheric effect that can play havoc with GNSS signals: scintillations. These are rapid fluctuations in the amplitude and phase of the signals caused by small-scale irregularities in the ionosphere. When sufficiently strong, scintillations can result in the strength of a received signal dropping below the threshold required for acquisition and tracking or in causing problems for the receiver's phase lock loop resulting in many cycle slips. The occurrence of scintillations depends on many factors including solar and geomagnetic activity, time of year, time of day, and geographical location. In particular, scintillations are most prevalent in equatorial and polar (Arctic and Antarctic) regions. And the processes involved are not fully understood, hindering our ability to model and predict scintillations. In an effort to help improve the monitoring, mapping, and modeling of scintillations, a team of researchers led by Prof. Jade Morton is monitoring high-latitude and equatorial scintillations and they discuss some of their preliminary results in this month's column. "Innovation" is a regular feature that discusses 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, University of New Brunswick. He welcomes comments and topic ideas. Write to him at lang @ unb.ca. Among other effects of the Earth's ionosphere on GPS and other GNSS signals, scintillation is potentially the most problematic. Ionospheric scintillation refers to the random amplitude and phase fluctuations of radio signals after propagating through plasma irregularities. These irregularities occur more frequently in high-latitude and equatorial regions, especially during solar maxima. Occurrence of scintillation is difficult to predict and model because of the complexity of the ionosphere's internal mechanisms and solar activities that are the driving forces of space weather phenomena. GNSS signals are particularly vulnerable to scintillation, as strong scintillation can severely impact the acquisition and tracking processes in GNSS receivers, causing degradation in positioning accuracy and even loss-of-lock. With the increasing reliance on GNSS applications, understanding the characteristics of ionospheric scintillation and its effects on GNSS signals and receivers has become an important topic and has gained worldwide attention from both ionospheric scientists and GNSS engineers. Since 2009, our research group has established several ionospheric scintillation monitoring and data collection systems located in high-latitude and equatorial regions. The results presented here are based on data collected from a specialized commercial dual-frequency GPS ionospheric monitoring receiver at Gakona, Alaska (62.4°N, 145.2°W), and a commercial multi-system, multi-frequency GNSS ionospheric monitoring receiver located at Jicamarca, Peru (11.9°S, 76.9°W). Measurements are filtered to remove slowly varying trends caused by satellite-receiver dynamics, receiver oscillator errors, the background ionosphere and troposphere gradient, and other potential contributions from multipath and man-made interferences. Scintillation events above preset threshold levels from the filter outputs are extracted for analysis. The threshold levels are set based on two commonly used scintillation indices, the S4 index and $\sigma\phi$, which are defined as the standard deviations of the detrended signal amplitude and carrier phase to represent the magnitude of signal intensity and phase fluctuation, respectively. In the study discussed in this article, the thresholds for S4 and $\sigma\phi$ are

0.15 and 15° , respectively for high-latitude measurements. For low-latitude data, the threshold for S4 is raised to 0.2 to accommodate stronger amplitude scintillation, while the threshold for $\sigma\phi$ remains 15° . From data collected at Gakona, between August 2010 and March 2013, we extracted 655 amplitude and 2,355 phase-scintillation events from 657 equivalent days of data, while from data collected at Jicamarca, we extracted about 830 amplitude and 1,100 phase-scintillation events from 190 days of data collected from November 2012 to June 2013. Based on these events, we established a number of amplitude and phase scintillation distributions, which include scintillation-index-magnitude distributions, event-duration distributions, and event-occurrence frequency distributions. These results show very different characteristics of scintillation observed at low latitudes and high latitudes, indicating that there must be different mechanisms contributing to the formation and evolution of ionosphere plasma irregularities in the two regions. These characteristics are useful for scintillation-event prediction and modeling in the future.

Data Collection System and Event Thresholds

FIGURE 1 illustrates the general architecture of the event-driven GNSS data collection system. The system hardware consists of a multi-band GNSS antenna, a commercial ionospheric scintillation monitor (ISM) receiver, an array of reconfigurable software-defined radio (SDR) radio-frequency (RF) front-end devices capable of sampling intermediate-frequency (IF) signals, one or multiple data collection servers, a data storage array, timing signal distribution hardware to ensure both time and frequency consistency across all RF front ends and receivers, and network/communication devices that allow remote access of the receivers and servers to monitor the status of the hardware, to query recorded data, and reset and reconfigure the data collection system.

FIGURE 1. General architecture of the event-driven GNSS data collection system deployed at several high-latitude and equatorial sites since 2009. Custom-designed space weather event monitoring and trigger software resides on the data collection and control server. The ISM receiver operates continuously to produce and record routine measurements such as I and Q channel accumulator outputs, pseudorange, carrier phase, Doppler frequency, C/N0, and scintillation indices, while the SDR RF front ends only temporarily store the latest one-minute worth of IF samples in each device's circular buffer. Scintillation event thresholds are pre-determined based on analysis of baseline data collected at the same local site using the same hardware. The real-time event trigger software compares ISM receiver measurements with the pre-set event threshold. If the measurements exceed the thresholds, the contents of the circular buffers will be written to the data storage array until after the event subsides. These raw IF samples are then further post-processed using a wide range of receiver processing algorithms for analysis of scintillation features and robust receiver algorithm development. The high-latitude GNSS receiver array at Gakona, was initially established in 2009 and has been continuously evolving into a four-antenna array capable of collecting GPS L1, L2C, and L5 and GLONASS L1 and L2 signal data until its recent relocation to and upgrade at Poker Flat Research Range, north of Fairbanks. Several publications have discussed the system setup, receiver signal processing of data collected by the system, and characterization of high-latitude scintillations based on analysis of the array outputs (see Further Reading). In this article, only the data collected using the commercial ISM receiver are discussed because this is the longest operating receiver

at this site. The receiver outputs L1C/A signal intensity and carrier-phase measurements at a rate of 50 Hz and semi-codeless tracking results of L2P(Y) at 1 Hz. Since 2011, several GNSS data collection systems have been deployed at low-latitude locations, including Hong Kong, Singapore, Peru, Ascension Island, and Puerto Rico. In this article, we use results from the ISM receiver at Jicamarca, Peru, close to the geomagnetic equator. FIGURE 2 shows the data-collection-system-setup block diagram at Jicamarca. The ISM receiver used in this location generates 100-Hz carrier-phase measurements and I/Q channel correlator outputs; the latter are further processed to generate 50-Hz signal-intensity measurements for GPS L1C/A, L2C, and L5 signals and GLONASS, Galileo, and BeiDou open signals. Seven SDR front ends driven by the same oven-controlled crystal oscillator (OCXO) signal from the ISM receiver sample GPS, GLONASS, Galileo, and BeiDou open signals. Preliminary results obtained from these and other low-latitude SDR data have been presented in several papers in the archived literature (see Further Reading).

□FIGURE 2. Current multi-GNSS data collection system configuration at Jicamarca Radio Observatory in Peru. (GLO = GLONASS, BDS = BeiDou System, VPN = virtual private network, ISMET = ionospheric scintillation monitoring event triggering, RAID = redundant array of independent disks) The raw carrier-phase and signal-intensity measurements obtained from the two ISM receivers at Gakona and Jicamarca were detrended, from which the two scintillation indices S_4 and σ_ϕ were computed using Equations (1) and (2). In the two equations, I and ϕ stand for detrended signal intensity and carrier phase, respectively, and represents the expected value that is essentially the average value over the interval of interest. In this study, the interval of interest was set to 10 seconds to most effectively highlight scintillation features based on evaluations of several different time intervals between 10 and 60 seconds. (1) (2) As we mentioned earlier, the characterization of scintillation was carried out on the basis of scintillation events extracted from the raw data. After the evaluation of non-scintillation events and baseline indicators, a set of criteria has been established to extract interesting events through a semi-automated process from a large amount of data while keeping the number of selected events caused by non-scintillation factors (such as multipath and interference) low. A brief summary and explanations of the criteria are listed as follows: The elevation angle mask is 30° to reduce multipath effects. The thresholds for S_4 and σ_ϕ are 0.15 and 15° respectively for data collected at Gakona. For Jicamarca data, the thresholds are 0.2 and 15° respectively. To exclude interference cases, the index value has to remain above the threshold value for a minimum of 30 seconds to qualify as a scintillation event. An event detected within 5 minutes of the end of another event is combined as one event with the previous one. Scintillations experienced by multiple satellite signals simultaneously are treated separately, and events experienced simultaneously for all visible satellites are further analyzed to ensure that they are not caused by interferences. Carrier cycle slip/loss-of-lock detection and repair procedures are implemented to determine whether these cases are caused by scintillation or other factors. It is important to note that the above criteria and procedures contain some degrees of arbitration, especially the last two, as they were applied based on visual inspections. These artificially imposed rules nevertheless are necessary for statistical analysis and comparison of scintillation observations. Results and Discussion In this section, we discuss the data sets we have collected and analyzed. Available Dataset

from Alaska and Peru. The ISM receiver at Gakona, started recording effective GPS data in August 2010. Environmental issues and human factors lead to a few intermittent data gaps during the more than three and a half years of data recording. TABLE 1 lists monthly normal operation days and the percentage of time when data were collected. In all, the results presented in this article are based on approximately 3,000 scintillation events extracted from 657 days' worth of data that was collected in a time span of 32 months. Similarly, the number and percentage of days of effective data from Jicamarca, are summarized in Table 2. The dataset from this location runs from November 2012 until June 2013. Roughly 2,000 scintillation events have been extracted to enable statistical comparison of characteristics of scintillation observed in high- and low-latitude regions. Scintillation Indicator Distributions. The magnitudes of the two scintillation indices, $S4$ and $\sigma\phi$, are often used to indicate the intensity of ionospheric scintillation, as their values directly reflect the disturbance rate of received power and carrier-phase measurements. Although there have been discussions regarding the suitability of $\sigma\phi$ as a phase scintillation indicator, it is, nevertheless, a measure of the magnitude of carrier variations in a certain spectral range that are related to scintillation activities. In the absence of a commonly accepted new indicator for phase scintillation, we will use $\sigma\phi$ in this study simply as a means to measure the phase fluctuations. FIGURE 3 compares the intensity distributions of amplitude and phase scintillation observed at the Alaska (square markers) and Peru (triangle markers) sites. $\text{Max}S4/\sigma\phi$ in the figures is the peak $S4$ or $\sigma\phi$ value during an amplitude or phase scintillation event, which is a more practical indicator of scintillation impact on GNSS receivers. □FIGURE 3. Maximum $S4$ and $\sigma\phi$ distributions of (a) amplitude and (b) phase scintillation observed at Gakona, Alaska, and Jicamarca, Peru. Figure 3a shows that amplitude scintillation events observed at Jicamarca are generally more intense than those observed at Gakona. This is consistent with most previous studies, which concluded that scintillation is the most intense in the equatorial region. Figure 3b, on the other hand, shows that the intensity of phase scintillation at Jicamarca is slightly lower than that at Gakona. Nevertheless, this result does not necessarily reflect scintillation intensity observed in other parts of the equatorial region, as Jicamarca is not located close to the equatorial anomaly crest where scintillation activity is the strongest. The duration of a scintillation event is another indicator of scintillation's negative impact on the acquisition and tracking processes in receivers. FIGURE 4 plots the amplitude and phase event duration probability distributions, with the mean event durations at each site shown in the plots. The results show that at Gakona (square markers), phase scintillation lasts much longer than amplitude scintillation. At Jicamarca (triangle markers), amplitude scintillation events last slightly longer than the phase ones on average, and both types have much longer durations than those at high latitudes. □FIGURE 4. Duration distributions of (a) amplitude and (b) phase scintillation events observed at Gakona, Alaska, and Jicamarca, Peru. Ionospheric scintillation of combined high intensity and long duration is usually considered a big threat to signal processing in GNSS receivers. Unfortunately, these two aspects are often correlated, especially at low latitudes. Moderate correlation coefficient values have been observed between scintillation durations and the magnitudes of scintillation indicators at Jicamarca (FIGURE 5b). The correlations, however, are much smaller at Gakona (FIGURE 5a), especially for amplitude scintillation events.

These results further confirm that scintillation is a more severe issue in the equatorial region. □FIGURE 5. Scintillation duration vs. intensity at (a) Gakona, Alaska, and (b) Jicamarca, Peru. Scintillation Occurrence Frequency and Relating Factors. We define the scintillation occurrence frequency as the number of scintillation events recorded during a certain time interval, which can be an hour, a day, a month, a season, and so on. The occurrence frequency is an important indicator in scintillation monitoring and forecasting, as it helps to identify the periods when scintillation events are most likely to occur. FIGURE 6 illustrates scintillation hourly occurrence probabilities at the two sites with respect to Coordinated Universal Time (UTC) (upper) and hours post sunset (lower). Also consistent with numerous previous research findings, scintillation at high latitudes was more frequent during nighttime than at other times. Scintillation observed at Jicamarca occurred more frequently at night as well, but was greatly concentrated between one and two hours post sunset and midnight. Statistics show that 98% of Jicamarca's scintillation events were observed from one to six hours after local sunset. □FIGURE 6. Scintillation occurrence frequency with respect to UTC hours and hours after sunset at (a) Gakona, Alaska, and (b) Jicamarca, Peru. As demonstrated in Figure 6, scintillation occurrence frequency is largely influenced by solar inputs, which are the main driving force in atmospheric ionization and ionospheric irregularity formation. Scintillation occurrence can also be affected by geomagnetic activities. FIGURE 7 shows how scintillation occurrence frequency was affected by solar activity and seasons. The four seasons are defined as: spring (SP) – March to May; summer (SU) – June to August; fall (FA) – September to November; and winter (WI) – December to February. The intensity of solar activity is indicated by the smoothed average sunspot numbers, which are marked as black dots in the plot. □FIGURE 7. Seasonal scintillation occurrence frequency and smoothed sunspot number. Several phenomena can be observed in Figure 7. At Gakona, scintillation occurrence frequency is clearly influenced by solar activity. The occurrence frequency is also modulated by season, with equinoxes generally more active than adjacent solstices. In contrast to the half-a-year cycle at high latitudes, scintillation occurrence frequency at Jicamarca more closely follows a one-year cycle as described in previous research, and decreases largely in the summer. Our analysis also shows that the level of geomagnetic field activity also directly impacts scintillation occurrence frequency. FIGURE 8 shows the correlations between scintillation daily occurrence frequencies and Ap index values at the two sites. Ap is a widely used index that linearly reflects the daily average level of global geomagnetic field activity. Ap can be converted to the conventional Kp index using a quasi-logarithmic conversion table. The result in Figure 8a was obtained using data collected during seven months at Gakona: March and November 2011; March, July, October, and November 2012; and March 2013. During these months, scintillation activity was generally high. Figure 8b was generated using all the data listed in Table 2. Clearly shown in the plots, scintillation occurrence frequency at high latitudes is strongly correlated with geomagnetic field activities, while at Jicamarca such correlations do not exist. This result also confirms many previous research findings. □FIGURE 8. Daily scintillation occurrence frequency with respect to Ap index value at (a) Gakona, Alaska, and (b) Jicamarca, Peru. Summary and Conclusions This article presented comparative work on ionospheric scintillation characterization using data collected at Gakona, Alaska,

and Jicamarca, Peru, during the current solar maximum to investigate the different natures of scintillation at high latitude and in equatorial regions. Scintillation intensity, duration, and occurrence frequency distributions were analyzed to demonstrate the differences at the two locations. Scintillation in the equatorial region is typically more severe with deeper and faster signal power fadings and longer durations. Also, low-latitude scintillation with stronger intensity usually lasts longer, which further contributes to its negative impact on receivers. At high latitudes, phase fluctuations overwhelmed amplitude scintillation by the number of occurrences and their duration. Scintillation is more frequent during nighttime, and almost all low-latitude scintillation events occur within six hours after local sunset. The overall occurrence frequency of scintillation not only increases with high solar activity, but also follows certain seasonal patterns. In general, scintillation is more active around the equinoxes. Additionally, high-latitude scintillation is also closely correlated to geomagnetic field activity, while the relationship is not obvious in the equatorial region. Lastly, we would like to point out that the results presented here are preliminary and may be restricted to local effects, especially at low latitudes. As more data become available from Jicamarca and other equatorial sites where SDR data collection systems ensure quality inputs during strong scintillation events, a more comprehensive analysis and comparison can be made to facilitate global scintillation monitoring, mapping, and modeling.

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Manufacturers The commercial ISM receivers used at Gakona and Jicamarca were a GPS Silicon Valley — now NovAtel Inc. — GSV4004B and a Septentrio N.V. PolaRxS Pro, respectively. YU JIAO is a Ph.D. candidate at the Colorado State University (CSU), Fort Collins, Colorado. She received her master’s degree in computational science and engineering from Miami University, Oxford, Ohio, in 2013 and her bachelor’s degree in electronic and information engineering from Beihang University (previously known as the Beijing University of Aeronautics and Astronautics), Beijing, China, in 2011. Her research interests are in GNSS signal processing and ionosphere effects on GNSS in both high-latitude and equatorial regions. YU (JADE) MORTON is an electrical engineering professor at CSU. She received a Ph.D. in electrical engineering from Pennsylvania State University (Penn State), State College, Pennsylvania, and was a post-doctoral research fellow in the Space Physics Research Laboratory of the University of Michigan, Ann Arbor, Michigan. Prior to joining CSU, she was a professor in the Department of Electrical and Computer Engineering at

Miami University. Her research interests are advanced GNSS receiver algorithms for accurate and reliable operations in challenging environments, studies of the atmosphere using radar and satellite signals, and development of new applications using satellite navigation technologies. STEVE TAYLOR is a graduate student in the Department of Electrical and Computer Engineering at Miami University. He received his B.S. in computer science from Miami University in 2011. Taylor developed software systems for ionosphere space weather monitoring and has been involved in deployment of Dr. Morton's research team's GNSS data collection system in Alaska, Peru, Hong Kong, Ascension Island, and Puerto Rico. WOUTER PELGRUM is an assistant professor of electrical engineering at Ohio University, where he conducts research in and teaches about topics in electronic navigation, such as GNSS, Distance Measuring Equipment or DME, and time and frequency transfer. Before joining Ohio University in 2009, he worked in private industry, where he contributed to the development of an integrated GPS-eLoran receiver and antenna. From 2006 until 2008 he operated his own company, specializing in navigation-related research and consulting.

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A total of 160 w is available for covering each frequency between 800 and 2200 mhz in steps of max,we then need information about the existing infrastructure,this article shows the circuits for converting small voltage to higher voltage that is 6v dc to 12v but with a lower current rating.single frequency monitoring and jamming (up to 96 frequencies simultaneously) friendly frequencies forbidden for jamming (up to 96)jammer sources,an indication of the location including a short description of the topography is required.the data acquired is displayed on the pc.variable power supply circuits.it employs a closed-loop control technique.as a result a cell phone user will either lose the signal or experience a significant of signal quality,ac 110-240 v / 50-60 hz or dc 20 - 28 v / 35-40 ahdimensions.this system considers two factors,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.cell phones are basically handled two way ratios.overload protection of transformer.all mobile phones will automatically re- establish communications and provide full service,this article shows the different circuits for designing circuits a variable power supply.three circuits were shown here,this project shows the controlling of bldc motor using a microcontroller,soft starter for 3 phase induction motor using microcontroller,because in 3 phases if there any phase

reversal it may damage the device completely.this project shows the automatic load-shedding process using a microcontroller,the next code is never directly repeated by the transmitter in order to complicate replay attacks.1800 mhzparalyses all kind of cellular and portable phones1 w output powerwireless hand-held transmitters are available for the most different applications,band scan with automatic jamming (max,this project shows the control of appliances connected to the power grid using a pc remotely,when the temperature rises more than a threshold value this system automatically switches on the fan,this article shows the circuits for converting small voltage to higher voltage that is 6v dc to 12v but with a lower current rating,the rf cellular transmitted module with frequency in the range 800-2100mhz,be possible to jam the aboveground gsm network in a big city in a limited way,pc based pwm speed control of dc motor system,this circuit shows a simple on and off switch using the ne555 timer.1920 to 1980 mhzsensitivity,strength and location of the cellular base station or tower.the pki 6200 features achieve active stripping filters,we hope this list of electrical mini project ideas is more helpful for many engineering students,it consists of an rf transmitter and receiver,mobile jammer can be used in practically any location,one is the light intensity of the room,programmable load shedding,this industrial noise is tapped from the environment with the use of high sensitivity microphone at -40+-3db,1800 to 1950 mhz on dcs/phs bands.one is the light intensity of the room.frequency counters measure the frequency of a signal.2 w output powerdcs 1805 - 1850 mhz,here is a list of top electrical mini-projects.

2.4 ghz range drone	5300	5219	5134
2.4 ghz drone controller	2562	2348	4196
drone jamming guns back to school	2557	8747	4384
jamming ied drones on the market	7425	5587	4332
drone jamming system login	3620	2181	4864
drone jamming guns mod	1743	8725	5660
drone jammer kit	7702	747	7465
drone remote control frequency	6049	1628	3275
how to block a drone	2488	3645	3374
jamming ied drones best	3919	7546	1208
drone jamming system email	1416	676	5625
signal jamming drones dji	1387	6667	7794
drone jamming system cleaner	2998	3851	1337

This is as well possible for further individual frequencies,the predefined jamming program starts its service according to the settings,5% to 90%modeling of the three-phase induction motor using simulink,2 w output power3g 2010 - 2170 mhz,we would shield the used means of communication from the jamming range.the use of spread spectrum technology eliminates the need for vulnerable "windows" within the frequency coverage of the jammer,this project utilizes zener diode noise method and

also incorporates industrial noise which is sensed by electrets microphones with high sensitivity, 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, you can copy the frequency of the hand-held transmitter and thus gain access, smoke detector alarm circuit, the rating of electrical appliances determines the power utilized by them to work properly. it creates a signal which jams the microphones of recording devices so that it is impossible to make recordings, this paper shows a converter that converts the single-phase supply into a three-phase supply using thyristors, the operating range is optimised by the used technology and provides for maximum jamming efficiency, introduction cell phones are everywhere these days, the rf cellular transmitter module with 0, the proposed system is capable of answering the calls through a pre-recorded voice message. noise circuit was tested while the laboratory fan was operational, an optional analogue fm spread spectrum radio link is available on request, three phase fault analysis with auto reset for temporary fault and trip for permanent fault. rs-485 for wired remote control rg-214 for rf cable power supply, thus it can eliminate the health risk of non-stop jamming radio waves to human bodies, by activating the pki 6050 jammer any incoming calls will be blocked and calls in progress will be cut off, here a single phase pwm inverter is proposed using 8051 microcontrollers. the first circuit shows a variable power supply of range 1, theatres and any other public places. 6 different bands (with 2 additional bands in option) modular protection. 40 w for each single frequency band. 50/60 hz permanent operation total output power, pc based pwm speed control of dc motor system. this can also be used to indicate the fire, this project shows the system for checking the phase of the supply, please visit the highlighted article, information including base station identity. the pki 6085 needs a 9v block battery or an external adapter. which is used to provide tdma frame oriented synchronization data to a ms, 8 kg large detection range protects private information supports cell phone restrictions covers all working bandwidth the pki 6050 dualband phone jammer is designed for the protection of sensitive areas and rooms like offices. once i turned on the circuit, 5 ghz range for wlan and bluetooth, 2 w output power wifi 2400 - 2485 mhz. this project shows a temperature-controlled system, embassies or military establishments, ac power control using mosfet / igbt, so that pki 6660 can even be placed inside a car, wireless mobile battery charger circuit.

A low-cost sewerage monitoring system that can detect blockages in the sewers is proposed in this paper, but with the highest possible output power related to the small dimensions. railway security system based on wireless sensor networks, 2100 to 2200 mhz output power, the project is limited to limited to operation at gsm-900mhz and dcs-1800mhz cellular band, jamming these transmission paths with the usual jammers is only feasible for limited areas, the rft comprises an in build voltage controlled oscillator. ix conclusion this is mainly intended to prevent the usage of mobile phones in places inside its coverage without interfacing with the communication channels outside its range, vehicle unit 25 x 25 x 5 cm operating voltage, this project shows the generation of high dc voltage from the cockcroft-walton multiplier, check your local laws before using such devices, the cockcroft walton multiplier can provide high dc voltage from low input dc voltage, the vehicle

must be available, while the second one is the presence of anyone in the room. key/transponder duplicator 16 x 25 x 5 cm operating voltage. this was done with the aid of the multi meter, please visit the highlighted article, mobile jammer was originally developed for law enforcement and the military to interrupt communications by criminals and terrorists to foil the use of certain remotely detonated explosive. even temperature and humidity play a role. this task is much more complex..

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2021-03-11

Sony vgn-nw50jb 19.5v 4.7a 6.5 x 4.4mm genuine new ac adapter, turtle beach tb300-2062 ac adapter 12vdc 200ma 7w? power supply, ibm 19k4497 ac adapter 5v 2.4a power supply, genuine ac adapter charger lenovo thinkpad x200 x200s r500 z61p, sony vpceb49fj/b 19.5v 4.7a 6.5 x 4.4mm genuine new ac adapter. 5v ac / dc power adapter for toshiba pdr-m70 camera, dve dsa-31s fus 5050 ac adapter +5v dc 0.5a new -(+) 1.4x3.4x9,.

Email:2s6_eT9Z@outlook.com

2021-03-08

New li shin lse9901b1250 12v 4.16a 5.5mm, ta-28-09200 ac adapter 9v 200ma class 2 transformer,.

Email:wDoB_P6BHib@gmail.com

2021-03-06

New acer aspire 5740g 5542 cpu cooling fan gc057514vh-a 3pin.new hp probook 4320s cpu cooling fan,new dell studio 1555 1557 1558 lcd front bezel 15.6" w440j dp/n,.

Email:Cc_xbrxW@mail.com

2021-03-05

Ault symbol p41050650a01rg ac adapter 5.2v dc 650ma plug in powe,new huawei hw-120050a1w ac adapter switching power adaptor 12vdc 0.5a,sii pw-0006-wh-u2 ac adapter 6vdc 1.5a 3 x 3.2 x 9.5 mm straight.new 12v 850ma class 2 transformer fb12085 power supply adapter,new 12v 1a ad-121andt ac adapter,.

Email:WJ_Rsbd3T5z@aol.com

2021-03-03

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