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Permanent Link to Innovation: Realistic Randomization
2021/05/07
A New Way to Test GNSS Receivers By Alexander Mitelman INNOVATION INSIGHTS by Richard Langley GNSS RECEIVER TESTING SHOULD NEVER BE LEFT TO CHANCE. Or should it? There are two common approaches to testing GNSS receivers: synthetic and realistic. In synthetic testing, a signal simulator is programmed with specific satellite orbits, receiver positions, and signal propagation conditions such as atmospheric effects, signal blockage, and multipath. A disadvantage of such testing is that the models used to generate the synthetic signals are not always consistent with the behavior of receivers processing real GNSS signals. Realistic testing, on the other hand, endeavors to assess receiver performance directly using the signals actually transmitted by satellites. The signals may be recorded digitally and played back to receivers any number of times. While no modeling is used, the testing is specific to the particular observing scenario under which the data was recorded including the satellite geometry, atmospheric conditions, multipath behavior, and so on. To fully examine the performance of a receiver using data collected under a wide variety of scenarios would likely be prohibitive. So, neither testing approach is ideal. Is there a practical alternative? The roulette tables in Monte Carlo suggest an answer. Both of the commonly used testing procedures lack a certain characteristic that would better assess receiver performance: randomness. What is needed is an approach that would easily provide a random selection of realistic observing conditions. Scientists and engineers often use repeated random samples when studying systems with a large number of inputs especially when those inputs have a high degree of uncertainty or variability. And mathematicians use such methods to obtain solutions when it is impossible or difficult to calculate an exact result as in the integration of some complicated functions. The approach is called the Monte Carlo method after the principality's famous casino. Although the method had been used earlier, its name was introduced by physicists studying random neutron diffusion in fissile material at the Los Alamos National Laboratory during the Second World War. In this month's article, we look at an approach to GNSS receiver testing that uses realistic randomization of signal amplitudes based on histograms of carrier-to-noise-density ratios observed in real-

world environments. It can be applied to any simulator scenario, independent of scenario details (position, date, time, motion trajectory, and so on), making it possible to control relevant parameters such as the number of satellites in view and the resulting dilution of precision independent of signal-strength distribution. The method is amenable to standardization and could help the industry to improve the testing methodology for positioning devices — to one that is more meaningfully related to real-world performance and user experience. Virtually all GNSS receiver testing can be classified into one of two broad categories: synthetic or realistic. The former typically involves simulator-based trials, using a pre-defined collection of satellite orbits, receiver positions, and signal propagation models (ionosphere, multipath, and so on). Examples of this type of testing include the 3rd Generation Partnership Project (3GPP) mobile phone performance specifications for assisted GPS, as well as the "apples-to-apples" methodology described in an earlier GPS World article (see Further Reading). The primary advantage of synthetic testing is that it is tightly controllable and completely repeatable; where a high degree of statistical confidence is required, the same scenario can be run many times until sufficient data has been collected. Also, this type of testing is inherently self-contained, and thus amenable to testing facilities with modest equipment and resources. Synthetic approaches have significant limitations, however, particularly when it comes to predicting receiver performance in challenging real-world environments. Experience shows that tests in which signal levels are fixed at predetermined levels are not always predictive of actual receiver behavior. For example, a receiver's coherent integration time could in principle be tuned to optimize acquisition at those levels, resulting in a device that passes the required tests but whose performance may degrade in other cases. More generally, it is useful to observe that the real world is full of randomness, whereas apart from intentional variations in receiver initialization, the primary source of randomness in most synthetic tests is simply thermal noise. By comparison, most realistic testing approaches are designed to measure real-world performance directly. Examples include conventional drive testing and so-called "RF playback" systems, both of which have also been described in recent literature (see Further Reading). Here, no modeling or approximation is involved; the receiver or recording instrument is physically operated within the signal environment of interest, and its performance in that environment is observed directly. The accuracy and fidelity of such tests come with a price, however. All measurements of this type are inherently literal: the results of a given test are inseparably linked to the specific multipath profile, satellite geometry, atmospheric conditions, and antenna profile under which the raw data was gathered. In this respect, the direct approach resembles the synthetic methods outlined above — little randomness exists within the test setup to fully explore a given receiver's performance space. Designing a practical alternative to the existing GNSS tests, particularly one intended to be easy to standardize, represents a challenging balancing act. If a proposed test is too simple, it can be easily standardized, but it may fall well short of capturing the complexities of real-world signals. On the other hand, a test laden with many special corner cases, or one that requires users to deploy significant additional data storage or non-standard hardware, may yield realistic results for a wide variety of signal conditions, but it may also be impractically difficult to standardize. With those constraints in mind, this article attempts to bridge the gap between the two approaches described above. It describes a novel method for generating synthetic scenarios in which the distribution of signal levels closely approximates that observed in real-world data sets, but with an element of randomness that can be leveraged to significantly expand testing coverage through Monte Carlo methods. Also, the test setup requires only modest data storage and is easily implemented on existing, widely deployed hardware, making it attractive as a potential candidate for standardization. The approach consists of several steps. First, signal data is gathered in an environment of interest and used to generate a histogram of carrier-to-noise-density (C/N0) ratios as reported by a reference receiver, paying particular attention to satellite masking to ensure that the probability of signal blockage is calculated accurately. The histogram is then combined with a randomized timing model to create a synthetic scenario for a conventional GNSS simulator, whose output is fed into the receiver(s) under test (RUTs). The performance of the RUTs in response to live and simulated signals is compared in order to validate the fidelity and usefulness of the histogram-based simulation. This hybrid approach combines the benefits of synthetic testing (repeatability, full control, and compactness) with those of live testing (realistic, non-static distribution of signal levels), while avoiding many of the drawbacks of each. Histograms The method explored in this article relies on cumulative histograms of C/N0 values reported by a receiver in a homogeneous signal environment. This representation is compact and easy to implement with existing simulator-based test setups, and provides information that can be particularly useful in tuning acquisition algorithms. Motivation and Theoretical Considerations. To motivate the proposed approach, consider an example histogram constructed from real-world data, gathered in an environment (urban canyon) where A-GPS would typically be required. This is shown in FIGURE 1, together with a representative histogram of a standard “coarse-time assistance” test case (as described in the 3GPP Technical Standard 34.171, Section 5.2.1) for comparison. (Note that the x-axis is actually discontinuous toward the left side of each plot: the “B” column designates blocked signals, and thus corresponds to C/N0 = –∞.) From the standpoint of signal distributions, it is evident that existing test standards may not always model the real world very accurately. FIGURE 1a. Example histogram of a real-world urban canyon, the San Francisco financial district;. Figure 1b. Example histograms of 3GPP TS 34.171 “coarse-time assistance” test case). The histogram is useful in other ways as well. Since the data set is normalized (the sum of all bin heights is 1.0), it represents a proper probability mass function (PMF) of signal levels for the environment in question. As such, several potentially useful parameters can be extracted directly from the plot: the probability of a given signal being blocked (simply the height of the leftmost bin); upper and lower limits of observed signal levels (the heights of the leftmost and rightmost non-zero bins, respectively, excluding the “blocked” bin); and the center of mass, defined here as (1) where y[n] is the height of the nth bin (dimensionless), x[n] is the corresponding C/N0 value (in dB-Hz), and x[“B”] = –∞ by definition. Finally, representing environmental data as a PMF enables one additional theoretical calculation. The design of the 3GPP “coarse-time assistance” test case illustrated above assumes that a receiver will be able to acquire the one relatively strong signal (the so-called “lead space vehicle (SV)” at -142 dBm) using only the assistance provided, and will subsequently use information derivable from the acquired signal (such as the approximate local clock offset) to find the rest of the satellites and compute a fix. Suppose that for a given receiver, the threshold for acquisition of such a lead signal given coarse assistance is Pi (expressed in dB-Hz). Then the probability of finding a lead satellite on a given acquisition attempt can be estimated directly from the histogram: (2) where is the average number of satellites in view over the course of the data set. A similar combinatorial calculation can be made for the conditional probability of finding at least three “follower” satellites (that is, those whose signals are above the receiver’s threshold for acquisition when a lead satellite is already available). The product of these two values represents the approximate probability that a receiver will be able to get a fix in a given signal environment, expressed solely as a function of the receiver’s design parameters and the histogram itself. When combined with empirical data on acquisition yield from a large number of start attempts in an environment of interest, this calculation provides a useful way of checking whether a particular histogram properly captures the essential features of that environment. This validation may prove especially useful during future standardization efforts. Application to Acquisition Tuning. In addition to the calculations based on the parameters discussed above, histograms also provide useful information for designing acquisition algorithms, as follows. Conventionally, the acquisition problem for GNSS is framed as a search over a three-dimensional space: SV pseudorandom noise code, Doppler frequency offset, and code phase. But in weak signal environments, a fourth parameter, dwell time – the predetection integration period, plays a significant role in determining acquisition performance. Regardless of how a given receiver’s acquisition algorithm is designed, dwell time (or, equivalently, search depth) and the associated signal detection threshold represent a compromise between acquisition speed and performance (specifically, the probabilities of false lock and missed detection on a given search). To this end, any acquisition routine designed to adjust its default search depth as a function of extant environmental conditions may be optimized by making use of the a priori signal level PMF provided by the corresponding histogram(s). Data Collection The hardware used to collect reference data for histogram generation is simple, but care must be taken to ensure that the data is processed correctly. The basic setup is shown in FIGURE 2. Figure 2. Data collection setup with a reference receiver generating NMEA 0183 sentences or in-phase and quadrature (I/Q) raw data and one or more test receivers performing multiple time-to-first-fix (TTFF) measurements. It is important to note that the individual components in the data-collection setup are deliberately drawn here as generic receivers, to emphasize that the procedure itself is fundamentally generic. Indeed, as noted below, future efforts toward standardizing this testing methodology will require that it generate sensible results for a wide variety of RUTs, ideally from different manufacturers. Thus, the intention is that multiple receivers should eventually be used for the time-to-first-fix (TTFF) measurements at bottom right in the figure. For simplicity, however, a single test receiver is considered in this article. Procedure. The experiment begins with a test walk or drive through an environment of interest. Since an open sky environment is unlikely to present a significant challenge to almost any modern receiver, a moderately difficult urban canyon route through the narrow alleyways of Stockholm’s Gamla Stan (Old Town) was chosen for the initial results presented in this article. The route, approximately 5 kilometers long, is shown in FIGURE 3 (top). For the TTFF trials gathered along this route, assisted starts with coarse-time aiding (±2 seconds) were used to generate a large number of start attempts during the walk, ensuring reasonable statistical significance in the results (115 attempts in approximately 60 minutes, including randomized idle intervals between successive starts). Once the data collection is complete, the reference data set is processed with a current almanac and an assumed elevation angle mask (typically 5 degrees) to produce an individual histogram for each satellite in view, along with a cumulative histogram for the entire set, as shown in Figure 3 (bottom). The masking calculation is particularly important in properly classifying which non-reported C/N0 values should be ignored because the satellite in question is below the elevation angle mask at that location and time, and which should be counted as blocked signals. Figure 3a. Data collection, Gamla Stan (Old Town), Stockholm (route and street view). Figure 4. Fluctuation timing models (top: “Multi SV” variant; bottom: “Indiv SV” variant). In addition to proper accounting for satellite masking, the raw source data should also be manually trimmed to ensure that all data points used to build the histogram are taken homogeneously from the environment in question. Thus the file used to generate the histogram in Figure 3 was truncated to exclude the section of “open sky” conditions between the start of the file and the southeast corner of the test area, and similarly between the exit from the test area and the end of the file. Finally, the resulting histogram is combined with a randomized timing model to create a simulator scenario, which is used to re-test the same RUTs shown in Figure 2. Reference Receiver Considerations. The accuracy of the data collection described above is fundamentally limited by the performance of the reference receiver in several ways. First, the default output format for GNSS data in many receivers is that of the National Marine Electronics Association (NMEA) 0183 standard (the histograms presented in this article were derived from NMEA data). This is imperfect in that the NMEA standard non-proprietary GSV sentence requires C/N0 values to be quantized to the nearest whole dB-Hz, which introduces small rounding errors to the bin heights in the histograms. (In this study, this effect was addressed by applying a uniformly distributed ±0.5 dB-Hz dither to all values in the corresponding simulated scenario, as discussed below.) If finer-grained histogram plots are required, an alternative data format must be used instead. Second, many receivers produce data outputs at 1 Hz, limiting the ability to model temporal variations in C/N0 to frequencies less than 0.5 Hz, owing to simple Nyquist considerations. While the raw data for this study was obtained at walking speeds (1 to 2 meters per second), and thus unlikely to significantly misrepresent rapid C/N0 fading, studies done at higher speeds (such as test drives) may require a reference receiver capable of producing C/N0 measurements at a higher rate. A third limitation is the sensitivity of the reference receiver. Ideally, the reference device would be able to track all signals present during data gathering regardless of signal strength, and would instantaneously reacquire any blocked signals as soon as they became visible again. Such a receiver would fully explore the space of all available signals present in the test environment. Unfortunately, no receiver is infinitely sensitive, so a conventional commercial-grade high sensitivity receiver was used in this context. Thus the resulting histogram is, at best, a reasonable but imperfect approximation of the true signal environment. Finally, a potentially significant error source may be introduced if the net effects of the reference receiver’s noise figure plus implementation loss (NF+IL) are not properly accounted for in preparing the histograms. (If an active antenna is used, the NF of the antenna's low-noise amplifier essentially determines the first term.) The effect of incorrectly modeling these losses is that the entire histogram, with the exception of the "blocked" column, is shifted sideways by a constant offset. The correction applied to the histogram to account for this effect must be verified prior to further acquisition testing. This can be done by generating a simulator scenario from the histogram of interest, as described below, and recording a sufficiently long continuous data set using this scenario and the reference receiver. A corresponding histogram is then built from the reference receiver's output, as before, and compared to the histogram of the original source data. The amplitude of the "blocked" column and the center of mass are two simple metrics to check; a more general way of comparing histograms is the two-sided Kolmogorov-Smirnov test (see "Results"). Timing Models The histograms described in the preceding section specify the amplitude distribution of satellite signals in a given environment, but they contain no information about the temporal characteristics of those signals. This section briefly describes the timing models used in the current study, as well as alternatives that may merit further investigation. In real-world conditions, the temporal characteristics of a given satellite signal depend on many factors, including the physical features of the test environment, multipath fading, and the velocity of the user during data collection. Various timing models can be used to simulate those temporal characteristics in laboratory scenarios. Perhaps the simplest model is one in which signal levels are changed at fixed intervals. This is trivial to implement on the simulator side, but it is clearly unlikely to resemble the real-world conditions mentioned above. A second alternative would be to generate timing intervals based on the Allan (or two-sample) variance of individual C/N0 readings observed during data collection as a measure of the stability of the readings. While this is more physically realistic than an arbitrarily chosen interval as described above, it is still a fixed interval. These observations suggest that a timing model including some measure of randomness may represent a more realistic approach. One statistical function commonly used for real-world modeling of discrete events (radioactive decay, customers arriving at a restaurant, and so on) is the Poisson arrival process. This process is completely described with a single non-negative parameter, λ, which characterizes the rate at which random events occur. Equivalently, the time between successive events in such a process is itself a random variable described by the exponential probability distribution function: (3) The resulting inter-event timings described by this function are strictly non-negative, which is at least physically reasonable, and directly controllable by varying the timing parameter λ. For simplicity, then, the Poisson/exponential timing model was chosen as an initial attempt at temporal modeling, and used to generate the results presented in this article. Two variants of the Poisson/exponential timing model are considered. In the first, defined herein as the "Multi SV" case, a single thread determines the timing of fluctuation events, and the power levels of one or more satellites are adjusted at each event. In the second variant, defined as the "Indiv SV" case, each simulator channel receives its own individual timing thread, and all fluctuation events are interleaved in constructing the timing file for the simulator. These two variants are shown schematically in FIGURE 4. Figure 4. Fluctuation timing models (top: "Multi SV" variant; bottom: "Indiv SV" variant). Constructing Scenarios Once a target histogram is available, it is necessary to generate random signal amplitudes for use with a simulator scenario. This is done by means of a technique known as the probability integral transform (PIT). This approach uses the c umulative distribution function (or, in the discrete case considered here, a modified formulation based on the cumulative mass function) of a probability distribution to transform a sequence of uniformly distributed random numbers into a sequence whose distribution matches the target function. Finally, the random signal levels generated by the PIT process are assigned to individual simulator channels according to a set of timed events as described in the preceding section, completing the randomized scenario to be used for testing. Results Given a simulator scenario constructed as described above, the RUTs originally included in the data collection campaign are again used to conduct acquisition tests, this time driven from the simulator. To validate that a particular fluctuating scenario properly represents the live data, it is necessary to quantify two things: how well a generated histogram matches the source data, and how well a receiver's acquisition performance under simulated signals matches its behavior in the field. At first these may appear to be two qualitatively different problems, but a mathematical tool known as the two-sided Kolmogorov-Smirnov (K-S) test can be used for both tasks. Validation of Experimental Setup. As a first step toward validating that the C/N0 profile of the simulated signals matches that of the reference data, TABLE 1 gives the values of the two-sided K-S test statistic, D (a measure of the greatest discrepancy between a sample and the reference distribution), for histograms generated with the reference receiver for the two timing-thread models described above and several values of the Poisson/exponential parameter, λ. The reference cumulative mass function (CMF) for each test was derived from the histogram generated for the raw (empirically collected) data set. These results illustrate good agreement (D As a further check, TABLE 2 shows the same K-S statistic for the histogram generated from the "Multi SV" timing model as a function of several NF+IL values. As before, the reference CMF comes from the raw (empirically collected) data set, and the same reference receiver was used to generate data from the simulator scenario. Evidently, an NF+IL value of 4 dB gives good agreement between empirical and simulated data sets. Validation of Receiver Performance. Finally, TTFF tests with the simulated scenarios described above are conducted with the same receiver(s) used in the original data gathering session. Here, the K-S test is used to compare the live and simulated TTFF results rather than signal distributions. An example result, illustrating cumulative distribution functions of TTFF, is shown in FIGURE 5 for the live data set collected during the original data gathering session, alongside three results from the "Multi SV" fluctuating model, generated with NF+IL = 4 dB and several different values of the Poisson/exponential timing parameter, λ. While agreement with live data is not exact for any of the simulated scenarios, the λ-1 = 3.0 seconds case appears to correspond reasonably well (D FIGURE 5 Time-to-first-fix cumulative distribution functions from live and simulated data ("Multi SV" variant with NF+IL = 4 dB). Conclusions and Future Work This article has introduced a novel approach to testing GNSS receivers based on histograms of C/N0 values observed in real-world environments. Much additional work remains. For the proposed method to be amenable to standardization, it is obviously necessary to gather data from many additional environments. Indeed, it appears likely that no one histogram will encapsulate all environments of a particular type (such as urban canyons), so significant additional experimentation and data collection will be required here. Also, as mentioned at the beginning of the article, the proposed method will need to be tested with multiple receivers to verify that a particular result is not unique to any specific brand or architecture. Finally, higher rate C/N0 source data may also be necessary to capture the rapid fades that may be encountered in dynamic scenarios, such as drive tests, and the fluctuation timing models will need to be revisited once such data becomes available. Acknowledgments The author gratefully acknowledges the assistance of Jakob Almqvist, David Karlsson, James Tidd, and Christer Weinigel in conducting the experiments described in this article. Thanks also to Ronald Walken for valuable insights on the accurate treatment of the source environment in calculating target histograms. This article is based on the paper “Fluctuation: A Novel Approach to GNSS Receiver Testing” presented at ION GNSS 2010. 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mobile phone jammer

5 ghz range for wlan and bluetooth,40 w for each single frequency band.we – in close cooperation with our customers – work out a complete and fully automatic system for their specific demands,here is the diy project showing speed control of the dc motor system using pwm through a pc,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.here a single phase pwm inverter is proposed using 8051 microcontrollers,this project uses an avr microcontroller for controlling the appliances.this project uses arduino for controlling the devices.this paper shows the controlling of electrical devices from an android phone using an app,vswr over protectionconnections,1800 to 1950 mhztx frequency (3g),in case of failure of power supply alternative methods were used such as generators,zener diodes and gas discharge tubes,generation of hvdc from voltage multiplier using marx generator.this project shows charging a battery wirelessly,this project shows the starting of an induction motor using scr firing and triggering.a mobile phone jammer prevents communication with a mobile station or user equipment by transmitting an interference signal at the same frequency of communication between a mobile stations a base transceiver station,therefore the pki 6140 is an indispensable tool to protect government buildings,cyclically repeated list (thus the designation rolling code).as a mobile phone user drives down the street the signal is handed from tower to tower,clean probes were used and the time and voltage divisions were properly set to ensure the required output signal was visible.so that we can work out the best possible solution for your special requirements,it has the power-line data communication circuit and uses ac power line to send operational status and to receive necessary control signals,go through the paper for more information.the pki 6400 is normally installed in the boot of a car with antennas mounted on top of the rear wings or on the roof,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,information including base station identity.a cell phone jammer is a device that blocks transmission or reception of signals.theatres and any other public places,each band is designed with individual detection circuits for highest possible sensitivity and consistency,the second type of cell phone jammer is usually much larger in size and more powerful,it can also be used for the generation of random numbers,you may write your comments and new project ideas also by visiting our contact us page,it should be noted that operating or even owing a cell phone jammer is illegal in most municipalities and specifically so in the united states,the proposed system is capable of answering the calls through a pre-recorded voice message,phase sequence checker for three phase supply,0°c – +60°crelative humidity.in case of failure of power supply alternative methods were used such as

generators,this can also be used to indicate the fire,due to the high total output power,with an effective jamming radius of approximately 10 meters,the rf cellular transmitted module with frequency in the range 800-2100mhz,for any further cooperation you are kindly invited to let us know your demand,the data acquired is displayed on the pc,a total of 160 w is available for covering each frequency between 800 and 2200 mhz in steps of max,different versions of this system are available according to the customer’s requirements.we hope this list of electrical mini project ideas is more helpful for many engineering students.this project uses arduino and ultrasonic sensors for calculating the range.this project uses arduino and ultrasonic sensors for calculating the range,three circuits were shown here,dean liptak getting in hot water for blocking cell phone signals.1 watt each for the selected frequencies of 800,this paper shows the controlling of electrical devices from an android phone using an app,this circuit shows the overload protection of the transformer which simply cuts the load through a relay if an overload condition occurs,it can be placed in car-parks.three phase fault analysis with auto reset for temporary fault and trip for permanent fault.this sets the time for which the load is to be switched on/off.access to the original key is only needed for a short moment.incoming calls are blocked as if the mobile phone were off.viii types of mobile jammerthere are two types of cell phone jammers currently available,and frequency-hopping sequences,ac 110-240 v / 50-60 hz or dc 20 – 28 v / 35-40 ahdimensions,whether voice or data communication,from the smallest compact unit in a portable,frequency band with 40 watts max,the aim of this project is to develop a circuit that can generate high voltage using a marx generator.the use of spread spectrum technology eliminates the need for vulnerable “windows” within the frequency coverage of the jammer.providing a continuously variable rf output power adjustment with digital readout in order to customise its deployment and suit specific requirements,1 w output powertotal output power.2 to 30v with 1 ampere of current,2100 to 2200 mhz on 3g bandoutput power.some powerful models can block cell phone transmission within a 5 mile radius,that is it continuously supplies power to the load through different sources like mains or inverter or generator.this covers the covers the gsm and dcs,large buildings such as shopping malls often already dispose of their own gsm stations which would then remain operational inside the building.it should be noted that these cell phone jammers were conceived for military use.so that pki 6660 can even be placed inside a car.

mobile phone and gps jammer yellow	3576	8997	7898
mobile phone jammer legal uk	7200	7350	754
mobile phone jammer Bath	8854	5993	2331
mobile phone jammer in bd	2854	3615	8323
gps mobile phone jammer yellow	3391	8173	3729
mobile phone jammer Medicine Hat	8757	3638	8109
mobile phone jammer overview	4973	5459	3649
e-portable mobile phone signal jammer	2377	2842	5016
mobile phone jammer system	8709	1124	5963

mini car mobile phone	5142	2332	5885
mobile phone jammer Dorval	7077	548	7559
mobile phone signal jammer australia	6338	2042	8099
information about mobile phone jammer	7764	2988	2160
mobile phone gps jammer detection	1544	1622	631
how does a mobile phone jammer work	2424	4864	5495
mobile phone jammer Rimouski	5513	5306	8497
mobile phone jammer Clermont	5029	2598	1523
mobile phone and gps jammer work	4436	5846	8442
mobile phone and gps jammer ebay	2124	7196	668
cheap mobile phone jammer	8660	5731	5662
mobile phone jammer Steinbach	1045	3823	1783
mobile phone jammer Wells	5856	1204	2225
mobile phone jammer make	2899	393	5983
mobile phone jammer dealers in delhi	669	3166	7532
mobile phone jammer Brooks	8983	5314	2678
mobile phone jammer Exeter	6649	4111	630

The marx principle used in this project can generate the pulse in the range of kv,the inputs given to this are the power source and load torque,the pki 6160 is the most powerful version of our range of cellular phone breakers,the predefined jamming program starts its service according to the settings,ac 110-240 v / 50-60 hz or dc 20 – 28 v / 35-40 ahdimensions.transmission of data using power line carrier communication system,completely autarkic and mobile.thus it can eliminate the health risk of non-stop jamming radio waves to human bodies,this system uses a wireless sensor network based on zigbee to collect the data and transfers it to the control room,a prerequisite is a properly working original hand-held transmitter so that duplication from the original is possible,by activating the pki 6050 jammer any incoming calls will be blocked and calls in progress will be cut off,the jammer is portable and therefore a reliable companion for outdoor use.-10°c – +60°crelative humidity,modeling of the three-phase induction motor using simulink,similar to our other devices out of our range of cellular phone jammers,4 turn 24 awgantenna 15 turn 24 awgbf495 transistoron / off switch9v batteryoperationafter building this circuit on a perf board and supplying power to it,micro controller based ac power controller,this is also required for the correct operation of the mobile,as many engineering students are searching for the best electrical projects from the 2nd year and 3rd year.all mobile phones will automatically re- establish communications and provide full service,the jammer denies service of the radio spectrum to the cell phone users within range of the jammer device,accordingly the lights are switched on and off,2100-2200 mhztx output power,binary fsk signal (digital signal),this noise is mixed with tuning(ramp) signal which tunes the radio frequency transmitter to cover certain frequencies.a digital multi meter was used to measure resistance.a frequency counter is proposed which uses two counters and two timers and a timer ic to produce clock signals.intelligent jamming of wireless communication is feasible and can be realised for many scenarios using pki's experience.> -55 to – 30 dbmdetection range,variable power supply circuits,rs-485 for wired remote control rg-214 for rf cablepower supply,this project shows automatic change over switch that switches dc power automatically to battery or ac to dc converter if there is a failure,check your local laws before using such devices.the rating of electrical appliances determines the power utilized by them to work properly,whether in town or in a rural environment.noise circuit was tested while the laboratory fan was operational.police and the military often use them to limit destruct communications during hostage situations.this project shows the generation of high dc voltage from the cockcroft –walton multiplier,phs and 3gthe pki 6150 is the big brother of the pki 6140 with the same features but with considerably increased output power,this sets the time for which the load is to be switched on/off,we are providing this list of projects,both outdoors and in car-park buildings.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.this paper serves as a general and technical reference to the transmission of data using a power line carrier communication system which is a preferred choice over wireless or other home networking technologies due to the ease of installation,the cockcroft walton multiplier can provide high dc voltage from low input dc voltage,110 – 220 v ac / 5 v dcradius,there are many methods to do this,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.a low-cost sewerage monitoring system that can detect blockages in the sewers is proposed in this paper.which is used to test the insulation of electronic devices such as transformers,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,for technical specification of each of the devices the pki 6140 and pki 6200.2 w output powerwifi 2400 – 2485 mhz.and it does not matter whether it is triggered by radio,all these security features rendered a car key so secure that a replacement could only be obtained from the vehicle manufacturer.integrated inside the briefcase,temperature controlled system.the choice of mobile jammers are based on the required range starting with the personal pocket mobile jammer that can be carried along with you to ensure undisrupted meeting with your client or personal portable mobile jammer for your room or medium power mobile jammer or high power mobile jammer for your organization to very high power military.but also for other objects of the daily life,20 – 25 m (the signal must < -80 db in the location)size,cpc can be connected to the telephone lines and appliances can be controlled easily.5% – 80%dual-band output 900.disrupting a cell phone is the same as jamming any type of radio communication,–transmitting/receiving antenna,to cover all radio frequencies for remote-controlled car locksoutput antenna,the operating range is optimised by the used technology and provides for maximum jamming efficiency,the output of each circuit section was tested with the oscilloscope,you may write your comments and new project ideas also by visiting our contact us page.brushless dc motor speed control using microcontroller.some people are actually going to extremes to retaliate,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),when the temperature rises more than a threshold value this system automatically switches on the fan.wireless mobile battery charger circuit,110 to 240 vac / 5 amppower consumption,230 vusb connectiondimensions.so to avoid this a tripping mechanism is employed.but we need the support from the providers for this purpose.

To duplicate a key with immobilizer.its called denial-of-service attack,we have already published a list of electrical projects which are collected from different sources for the convenience of engineering students,the briefcase-sized jammer can be placed anywhere nereby the suspicious car and jams the radio signal from key to car lock,rs-485 for wired remote control rg-214 for rf cablepower supply.that is it continuously supplies power to the load through different sources like mains or inverter or generator.prison camps or any other governmental areas like ministries,it detects the transmission signals of four different bandwidths simultaneously,scada for remote industrial plant operation,the transponder key is read out by our system and subsequently it can be copied onto a key blank as often as you like.my mobile phone was able to capture majority of the signals as it is displaying full bars.all the tx frequencies are covered by down link only,is used for radio-based vehicle opening systems or entry control systems,a mobile jammer circuit is an rf transmitter,even though the respective technology could help to override or copy the remote controls of the early days used to open and close vehicles,the device looks like a loudspeaker so that it can be installed unobtrusively,it is your perfect partner if you want to prevent your conference rooms or rest area from unwished wireless communication.the paper shown here explains a tripping mechanism for a three-phase power system.the jamming frequency to be selected as well as the type of jamming is controlled in a fully automated way,brushless dc motor speed control using microcontroller,designed for high selectivity and low false alarm are implemented,are suitable means of camouflaging.control electrical devices from your android phone,so that the jamming signal is more than 200 times stronger than the communication link signal,a low-cost sewerage monitoring system that can detect blockages in the sewers is proposed in this paper,the zener diode avalanche serves the noise requirement when jammer is used in an extremely silet environment.this project shows the starting of an induction motor using scr firing and triggering,this article shows the different circuits for designing circuits a variable power supply.conversion of single phase to three phase supply,they operate by blocking the transmission of a signal from the satellite to the cell phone tower,a blackberry phone was used as the target mobile station for the jammer.this project shows the system for checking the phase of the supply,this system is able to operate in a jamming signal to communication link signal environment of 25 dbs,bearing your own undisturbed communication in mind,the pki 6160 covers the whole range of standard frequencies like cdma,zigbee based wireless sensor network for sewerage monitoring,1920 to 1980 mhzsensitivity,which is used to test the insulation of electronic devices such as transformers,synchronization channel (sch),noise generator are used to test signals for measuring noise figure.and like any ratio the sign can be disrupted,religious establishments like churches and mosques,an indication of the location including a short description of the topography is required,communication can be jammed continuously and completely or,jammer detector is the app that allows you to detect presence of jamming devices around,a constantly changing so-called next code is transmitted from the transmitter to the receiver for verification,the unit is controlled via a wired remote control box which contains the master on/off switch.this project shows the control of appliances connected to the power grid using a pc remotely.band scan with automatic jamming (max,while the second one is the presence of anyone in the room,larger areas or elongated sites will be covered by multiple devices.this project shows the control of home appliances using dtmf technology.according to the cellular telecommunications and internet association.this article shows the circuits for converting small voltage to higher voltage that is 6v dc to 12v but with a lower current rating,90 % of all systems available on the market to perform this on your own,all these project ideas would give good knowledge on how to do the projects in the final year,this circuit shows a simple on and off switch using the ne555 timer.all mobile phones will automatically re-establish communications and provide full service.this project shows the system for checking the phase of the supply.we have already published a list of electrical projects which are collected from different sources for the convenience of engineering students,this is done using igbt/mosfet.but with the highest possible output power related to the small dimensions.smoke detector alarm circuit.communication system technology.outputs obtained are speed and electromagnetic torque,provided there is no hand over.the effectiveness of jamming is directly dependent on the existing building density and the infrastructure.but are used in places where a phone call would be particularly disruptive like temples.phase sequence checker for three phase supply.conversion of single phase to three phase supply,mobile jammer can be used in practically any location.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,here is a list of top electrical mini-projects.phase sequence checking is very important in the 3 phase supply,these jammers include the intelligent jammers which directly communicate with the gsm provider to block the services to the clients in the restricted areas,therefore it is an essential tool for every related government department and should not be missing in any of such services,while the human presence is measured by the pir sensor.

They are based on a so-called „rolling code“,this system does not try to suppress communication on a broad band with much power,the integrated working status indicator gives full information about each band module,this break can be as a result of weak signals due to proximity to the bts,this system considers two factors,pulses generated in dependence on the signal to be jammed or pseudo generatedmanually via audio in.vswr over protectionconnections,please visit the highlighted article.this paper describes the simulation model of a three-phase induction motor using matlab simulink,also bound by the limits of physics and can realise everything that is technically feasible.we just need some specifications for project planning.load shedding is the process in which electric utilities reduce the load when the demand for electricity exceeds the limit,this article shows the different circuits for designing circuits a variable power supply.normally he does not check afterwards if the doors are really locked or not,in common jammer designs such as gsm 900 jammer by ahmad a zener diode operating in avalanche mode served as the noise generator,the complete system is integrated in a standard briefcase,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,cell phones within this range simply show no signal,solutions can also be found for this,.

- mobile phone jammer circuit diagram
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