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Permanent Link to A Mass-Market Galileo Receiver
2021/06/11
Its Algorithms and Performance The authors test three mass-market design drivers on a chip developed expressly for a new role as a combined GPS and Galileo consumer receiver: the time-to-first-fix for different C/N0, for hot, warm, and cold start, and for different constellation combinations; sensitivity in harsh environments, exploiting a simulated land mobile satellite multipath channel and different user dynamics; and power consumption strategies, particularly duty-cycle tracking. By Nicola Linty, Paolo Crosta, Philip G. Mattos, and Fabio Pisoni The two main GNSS receiver market segments, professional high-precision receivers and mass-market/consumer receivers, have very different structure, objectives, features, architecture, and cost. Mass-market receivers are produced in very high volume — hundreds of millions for smartphones and tablets — and sold at a limited price, and in-car GNSS systems represent a market of tens of millions of units per year. The reason for these exploding markets can be found not only in the improvements in electronics and integration, but also in the increasing availability of new GNSS signals. In coming years, with Galileo, QZSS, BeiDou, GPS-L1C, and GLONASS-CDMA all on the way, the silicon manufacturer must continue the path towards the fully flexible multi-constellation mass-market receiver. Mass-market receivers feature particular signal processing techniques, different from the acquisition and tracking techniques of standard GNSS receivers, in order to comply with mobile and consumer devices' resources and requirements. However, a limited documentation is present in the open literature concerning consumer devices' algorithms and techniques; besides a few papers, all the know-how is protected by patents, held by the main manufacturers, and mainly focused on the GPS L1 C/A signal. We investigate and prove the feasibility of such techniques by semi-analytical and Monte Carlo simulations, outlining the estimators sensitivity and accuracy, and by tests on real Galileo IOV signals. To understand, analyze, and test this class of algorithms, we implemented a fully software GNSS receiver, running on a personal computer. It can process hardware- and software-simulated GPS L1 C/A and Galileo E1BC signals, as well as real signals, down-converted at intermediate frequency (IF), digitalized and stored in memory by a front-end/bit grabber; it can also output standard receiver

parameters: code delay, Doppler frequency, carrier-to-noise power density ratio (C/N0), phase, and navigation message. The software receiver is fully configurable, extremely flexible, and represents an important tool to assess performance and accuracy of selected techniques in different circumstances. Code-Delay Estimation The code-delay estimation is performed in the software receiver by a parallel correlation unit, giving as output a multi-correlation with a certain chip spacing. This approach presents some advantages, mostly the fact that the number of correlation values that can be provided is thousands of times greater, compared to a standard receiver channel. Use of multiple correlators increases multipath-rejection capabilities, essential features in mass-market receivers, especially for positioning in urban scenarios. The multi-correlation output is exploited to compute the received signal code delay with an open-loop strategy and then to compute the pseudorange. In the simulations performed, the multi-correlation has a resolution of 1/10 of a chip, which is equivalent to 30 meters for the signals in question; to increase the estimate accuracy, Whittaker-Shannon interpolation is performed on the equally spaced points of the correlation function belonging to the correlation peak. The code-delay estimate accuracy is reported in Figures 1 and 2. The results are obtained with Monte Carlo simulations on simulated GNSS signals, with sampling frequency equal to 16.3676 MHz. In particular, a GPS L1 C/A signal is considered, affected by constant Doppler frequency equal to zero for the observation period, to avoid the effect of dynamics. The figures show the standard deviation of the code estimation error, that is, the difference between the estimated code delay and the true one, expressed in meters (pseudorange error standard deviation) for different values of C/N0. To evaluate the quality of the results, the theoretical delay locked loop (DLL) tracking jitter is plotted for comparison, as where Bn is the code loop noise bandwidth, Rc is the chipping rate, Bfe is the single sided front-end bandwidth, Tc is the coherent integration time, and c is the speed of light. In the two figures, the red curve shows the theoretical tracking jitter for a DLL, which can be considered as term of comparison for code-delay estimation. To correlate the results, a E-L spacing equal to D = 0.2 chip is chosen, and the code-delay error values of the software receiver simulation are filtered with a moving average filter. By averaging 0.5 seconds of data (for example, L = 31 values spaced 16 milliseconds), an equivalent closed-loop bandwidth of about 1 Hz can be obtained: In particular, in Figure 1, a coherent integration time equal to 1 millisecond (ms) and 16 non-coherent sums are considered, while in Figure 2 a coherent integration time equal to 4 ms and 16 non-coherent sums, spanning a total time T=64 ms, are considered. In both cases, the software receiver results are extremely good for high C/N0. The code-delay error estimate is slightly higher than its equivalent in the DLL formulation. The open-loop estimation error notably increases in the first case below 40 dB-Hz due to strong outliers, whose probability of occurrence depends on the C/N0. In fact, this effect is smoothed in the second case, where the coherent integration time is four times larger, thus improving the signal-to-noise ratio. Figure 1. Comparison between code delays estimation accuracy, Tc=1 ms , T=16 ms, B=1 Hz, D=0.2 chip. Figure 2. Comparison between code delays estimation accuracy, Tc=4 ms, T=64 ms, B=1 Hz, D=0.2 chip. Nevertheless, the comparison between open loop multi-correlation approach and closed loop DLL is difficult and approximate, because the parameters involved are different and the results are only qualitative. Doppler Frequency Estimation In the particular case of the software receiver developed here, the residual Doppler frequency affecting the GNSS signal is estimated by means of a maximum likelihood estimator (MLE) on a snapshot of samples, exploiting open-loop strategy. In fact, despite the higher standard deviation of the frequency error (jitter), open-loop processing offers improved tracking sensitivity, higher tracking robustness against fading and interference, and better stability when increasing the coherent integration time. In addition, the open-loop approach does not require the design of loop filters, avoiding problems with loop stability. A certain number of successive correlator values, computed in the multiple correlations block, are combined in a fast Fourier transform (FFT) and interpolated. Figure 3 shows the root mean square error (RMSE) of the frequency estimate versus signal C/N0, obtained collecting 16 coherent accumulations of 4 ms of a Galileo E1B signal, then computing a 16 points FFT spanning a time interval of 64 ms, and finally refining the result with an interpolation technique. Three different curves are shown, corresponding respectively to: the RMSE derived from simulations, carried out with GNSS data simulated with the N-FUELS signal generator; a semi-analytical estimation, exploiting the same algorithm; the Cramer-Rao lower bound (CRLB) for frequency estimation, shown as where fs is the sampling frequency. Figure 3. Doppler frequency estimate RMSE versus C/N0 in super-high resolution with T=64 ms, comparison between theoretical and simulated results. A well-known drawback is the so-called threshold effect. Below a certain C/N0, the frequency estimate computed with MLE suffers from an error, and the RMSE increases with respect to the CRLB. Mass-Market Design Drivers Once we have analyzed the features of some mass-market algorithms with a software receiver, we can move toward the performance of a real mass-market device, to compare results and confirm improvements brought by the new Galileo signals, so far mainly known from a theoretical point of view. A recent survey identified three main drivers in the design of a mass-market receiver, coming directly from user needs, and solvable in different ways. Time-to-first-fix (TTFF) corresponds to how fast a position, velocity, and time (PVT) solution is available after the receiver is powered on, that is, the time that a receiver takes to acquire and track a minimum of four satellites, and to obtain the necessary information from the demodulated navigation data bits or from other sources. Capability in hostile environments, for example while crossing an urban canyon or when hiking in a forest, is measured in terms of sensitivity. It can be verified by decreasing the received signal strength and/or adding multipath models. Power consumption of the device. GNSS chipset is in general very demanding and can produce a not-negligible battery drain. We analyzed these three drivers with a commercial mass-market receiver and with the software receiver. Open-Sky TTFF Analysis TTFF depends on the architecture of the receiver, for example the number of correlators or the acquisition strategy, on the availability of assistance data, such as rough receiver position and time or space vehicles' (SV) ephemeris data, and on the broadcast navigation message structure. Some receivers, like the one used here for testing, embed an acquisition engine that can be activated on request and assures a low acquisition time; moreover, they implement ephemeris extension. In contrast, other consumer receiver manufacturers exploit a baseband-configurable processing unit, similar to the one implemented in the software receiver, with thousands of parallel correlators generating a multi-correlator output with configurable spacing, depending on the accuracy required. By selecting an appropriate number of correlators, depending on the available assistance data and on the accuracy required, the TTFF consequently varies. We assessed the performance of the receiver under test for different C/N0, for hot, warm, and cold start, and for different constellation combinations, exploiting hardware-simulated GNSS data. Good results are achieved, especially when introducing Galileo signals. Figure 4 reports the hot-start TTFF for different C/N0 values in the range 25–53 dB-Hz, computed using the receiver. The receiver, connected to a signal generator, is configured in dual-constellation mode (GPS and Galileo) and carries out 40 TTFF trials, with a random delay between 15 and 45 seconds. In a standard additive white Gaussian noise (AWGN) channel and in hot-start conditions, the results mainly depend on the acquisition strategy and on the receiver availability of correlators and acquisition engines. In an ideal case with open-sky conditions and variable C/N0, the introduction of a second constellation only slightly improves the TTFF performance; this result cannot be generalized since it mainly depends on the acquisition threshold of the receiver, which can change using signals of different constellations. In real-world conditions, the situation can vary. Figure 4. Hot start TTFF for Galileo+GPS configuration versus C/N0 using the test receiver. Cold Start. Secondly, we analyze TTFF differences due to the different structure of GPS and Galileo navigation messages. The I/NAV message of the Galileo E1 signal and the data broadcast by GPS L1 C/A signals contain data related to satellite clock, ephemeris, and GNSS time: parameters relevant to the position fix since they describe the position of the satellite in its orbit, its clock error, and the transmission time of the received message. Table 1 shows some results in the particular case of cold start, with an ideal open-sky AWGN scenario. The TTFF is significantly lower when using Galileo satellites: while the mean TTFF when tracking only GPS satellites is equal to about 31.9 seconds (s), it decreases to 24.7 s when considering only Galileo satellites, and to 22.5 s in the case of dual constellation. Similarly, the minimum and maximum TTFF values are lower when tracking Galileo satellites. The 95 percent probability values confirm the theoretical expectations. Again, in the ideal case with open-sky conditions, the results with two constellations are quite similar to the performance of the signal with faster TTFF. However, in non-ideal conditions, use of multiple constellations represents a big advantage and underlines the importance of developing at least dual-constellation mass-market receivers. Table 1. Comparison between TTFF (in seconds) in cold start for different constellation combinations. Furthermore, it is interesting to analyze in more detail the case of a GPS and Galileo joint solution. GPS and Galileo system times are not synchronized, but differ by a small quantity, denoted as the GPS-Galileo Time Offset (GGTO). When computing a PVT solution with mixed signals, three solutions are possible: to estimate it as a fifth unknown, to read it from the navigation message, or to use pre-computed value. In the first case it is not necessary to rely on the information contained in the navigation message, eventually reducing the TTFF. However, five satellites are required to solve the five unknowns, and this is not always the case in urban scenarios or harsh environments, as will be proved below. On the contrary, in the second case, it is necessary to obtain the GGTO information from the navigation message, and since it appears only once every 30 seconds, in the worst case it is necessary to correctly demodulate 30 seconds of data. Both approaches show benefits and disadvantages, depending on the environment. The receiver under test exploits the second solution: in this case, it is possible to see an increase in the average TTFF when using a combination of GPS and Galileo, due to the demodulation of more sub-frames of the broadcast message. Sensitivity: Performance in Harsh Environments Harsh environment is the general term used to describe those scenarios in which open sky and ideal propagation conditions are not fulfilled. It can include urban canyons, where the presence of high buildings limits the SV visibility and introduces multipath; denied environments, where unintentional interference may create errors in the processing; or sites where shadowing of line-of-sight (LoS) path is present, for example due to trees, buildings, and tunnels. In these situations it is necessary to pay particular attention to the signal-processing stage; performance is in general reduced up to the case in which the receiver is not able to compute a fix. A first attempt to model such an environment has been introduced in the 3GPP standard together with the definition of A-GNSS minimum performance requirements for user equipment supporting other A-GNSSs than GPS L1 C/A, or multiple A-GNSSs which may or may not include GPS L1 C/A. The standard test cases support up to three different constellations; in dual-constellation case it foresees three satellites in view for each constellation with a horizontal dilution of precision (HDOP) ranging from 1.4 to 2.1. To perform TTFF and sensitivity tests applying the 3GPP standard test case, we configured a GNSS simulator scenario with the following characteristics, starting from the nominal constellation: Six SVs: three GPS (with PRN 6,7, 21) and three Galileo (with code number 4, 11, 23); HDOP in the range 1.4 – 2.1; nominal power as per corresponding SIS-ICD; user motion, with a heading direction towards 90° azimuth, at a constant speed of 5 kilometers/hour (km/h). In addition to limiting the number of satellites, we introduced a narrowband multipath model. The multi-SV two-states land mobile satellite (LMS) model simulator generated fading time series representative of an urban environment. The model includes two states: a good state, corresponding to LOS condition or light shadowing; a bad state, corresponding to heavy shadowing/blockage. Within each state, a Loo-distributed fading signal is assumed. It includes a slow fading component (lognormal fading) corresponding to varying shadowing conditions of the direct signal, and a fast fading component due to multipath effects. In particular, the last version of the two-state LMS simulator is able to generate different but correlated fading for each single SV, according to its elevation and azimuth angle with respect to the user position: the angular separation within satellites is crucial, since it affects the correlation of the received signals. This approach is based on a master–slave concept, where the state transitions of several slave satellites are modeled according to their correlation with one master satellite, while neglecting the correlation between the slave satellites. The nuisances generated are then imported in the simulator scenario, to timely control phase and amplitude of each simulator channel. Using this LMS scenario, the receiver’s performance in harsh environments has been then verified with acquisition (TTFF) and tracking tests. The TTFF was estimated with about 50 tests, in hot, warm, and cold start, first using both GPS and Galileo satellites, and then using only one constellation. In the second case only the 2D fix is considered, since, according to the scenario described, at maximum three satellites are in view. Table 2 reports the results for the dual-constellation case: in hot start the average TTFF is about 8 s, and it increases to 36 s and 105 s respectively for the warm and cold cases. Clearly the results are much worse than in the case reported earlier of full open-sky AWGN conditions. In this scenario only six satellites are available at maximum; moreover, the presence of multipath and fading affects the results, and they exhibit a larger variance, because of the varying conditions of the scenario. Table 2. TTFF (in seconds) exploiting GPS and Galileo constellations in harsh environments. Table 3 shows similar results, but for the GPS-only case. In this case the receiver was configured to track only GPS satellites. The mean TTFF increases both in the hot and in the warm case, whereas in cold start it is not possible compute a 2D fix with only three satellites; the ambiguity of the solution cannot be solved if an approximate position solution is not available. It may seem unfair to compare a scenario with three satellites and one with six satellites. However, it can be assumed that this is representative of what happens in limited-visibility conditions, where a second constellation theoretically doubles the number of satellites in view. Table 3. TTFF (in seconds) exploiting only GPS constellations in harsh environments. The results confirm the benefits of dual-constellation mass-market receivers in harsh environments where the number of satellites in view can be very low. Making use of the full constellation of Galileo satellites will allow mass-market receivers to substantially increase performances in these scenarios. Tracking.We carried out a 30-minute tracking test with both the receiver and the software receiver model. Both were able to acquire the six satellites and to track them, even with some losses of lock (LoLs) due to fading and multipath reflections. Figure 5 shows the number of satellites in tracking state in the receiver at every second, while Figure 6 shows the HDOP as computed by the receiver. When all six satellites are in tracking state, the HDOP lies in the range 1.4 – 2.1, as defined in the simulation scenario; on the contrary, as expected, in correspondence with a LoL it increases. Figure 6. HDOP computed by the test receiver in the Multi-SV LMS simulation. Figure 7 compares the signal power generated by the simulator and the power estimated by the receiver, in the case of GPS PRN 7 and Galileo code number 23. This proves the tracking capability of the receiver also for high sensitivity. To deal with low-power signals, the integration time is extended both for GPS and for Galileo, using the pilot tracking mode in the latter case. Figure 7. C/N0 estimate computed by the receiver in harsh environments and compared with the signal power. Figures 8 and 9 show respectively the position and the velocity solution. In the first case latitude, longitude, and altitude are plotted, while in the second case the receiver speed estimate in km/h is reported. Figure 8. Test receiver position solution in LMS scenario. Figure 9. Test receiver velocity solution in LMS scenario. In this framework it is possible to evaluate the advantages and disadvantages of using the broadcast GGTO when computing a mixed GPS and Galileo position. When the LMS channel conditions are good, all six SVs in view are in tracking state, as shown in Figure 5. However, when the fading becomes important, the number is reduced to only two satellites. If the receiver is designed to extract the GGTO from the navigation message, then a PVT solution is possible also when only four satellites are in tracking state, that is for 90 percent of the time in this specific case. On the contrary, if the GGTO has to be estimated, one more satellite is required, and this condition is satisfied only 57 percent of the time, strongly reducing the probability of having a fix. Nevertheless, estimating the GGTO requires the correct demodulation of the navigation message, and this is possible only if the signal is good enough for a sufficient time. Figure 5. Number of satellites tracked by the test receiver in the Multi-SV LMS simulation. Power-Saving Architectures The final driver for mass-market receivers design is represented by power consumption. Particularly for chips suited for portable devices running on batteries, power drain represents one of the most important design criteria. To reduce at maximum the power consumption, chip manufacturers have adopted various solutions. Most are based on the concept that, contrarily to a classic GNSS receiver, a mass-market receiver is not required to constantly compute a PVT solution. In fact, most of the time, GNSS chipsets for consumer devices are only required to keep updated information on approximate time and position and to download clock corrections and ephemeris data with a proper time rate, depending on the navigation message type and the adopted extended ephemeris algorithm. Then, when asked, the receiver can quickly provide a position fix. By reducing the computational load of the device during waiting mode, power consumption is reduced proportionally. To better understand advantages and disadvantages of power saving techniques, some of them have been studied and analyzed in detail. In particular, the algorithm implemented in the software receiver model is based on two different receiver states: an active state, in which all receiver parts are activated, as in a standard receiver, and a sleep state, where the receiver is not operating at all. In the sleep state, the GNSS RF module, GNSS baseband, and digital signal processor core are all switched off. By similarity to a square wave, these types of tracking algorithms are also called duty-cycle (DC) algorithms. Exploiting the software approach's flexibility, we can test the effect of two important design parameters: sleep period length; minimum active period length. Their setting is not trivial and depends on the channel conditions, on the signal strength, on the number of satellites in view, on the user dynamics, and finally on the required accuracy. In the software receiver simulations performed, the active mode length is fixed to 64 ms: the receiver collects 16 correlation values with coherent integration time equal to 4 ms, to perform frequency estimation as described above. Then it switches to sleep state for 936 ms, until a real-time clock (RTC) wake-up initiates the next full-power state. In this way a fix is available at the rate of 1 s, as summarized in Figure 10. However, there are some situations where the receiver may stay in full-power mode, for example during the initialization phase, to collect important data from the navigation message, such as the ephemeris, and to perform RTC calibration. Figure 10. Duty cycle tracking pattern in the software receiver simulations. There are benefits of using this approach coupled to Galileo signals: the main impact is the usage of the pilot codes. Indeed, a longer integration time allows reducing the active period length, which most impacts the total power consumption, being usually performed at higher repetition rate. Some simulations were carried out to assess the performance of DC algorithms in the software receiver. While in hardware implementations the direct benefit is the power computation, in a software implementation it is not possible to see such an improvement. The reduced power demand is translated into a shorter processing time for each single-processing channel. The DC approach can facilitate the implementation of a real-time or quasi-real-time software receiver. The main drawback of using techniques based on DC tracking is the decrease of the rate of observables and PVT solution. However, this depends on the application; for some, a solution every second is more than enough. Real-Signal Results On March 12, 2013, for the first time the four Galileo IOV satellites were broadcasting a valid navigation message at the same time. From 9:02 CET, all the satellites were visible at ESTEC premises, and the first position fix of latitude, longitude, and altitude took place at the TEC Navigation Laboratory at ESTEC (ESA) in Noordwijk, the Netherlands. At the same time, we were able to acquire, track, and compute one of the first Galileo-only mobile navigation solutions, using the receiver under test. Thanks to its small size and portability, it was installed on a mobile test platform, embedded in ESA's Telecommunications and Navigation Testbed vehicle. Using a network connection, we could follow, from the Navigation Lab, the real-time position of the van moving around ESTEC. Figure 11 shows the van's track, obtained by post processing NMEA data stored by the receiver evaluation board. The accuracy achieved in these tests met all the theoretical expectations, taking into account the limited infrastructure deployed so far. In addition, the results obtained with the receiver have to be considered preliminary, since its firmware supporting Galileo was in an initial test phase (for example, absence of a proper ionospheric model, E1B-only tracking). Figure 11. Galileo-only mobile fix, computed on March 12, 2013. Conclusions Analysis of a receiver's test results confirms the theoretical benefits of Galileo OS signals concerning TTFF and sensitivity. Future work will include the evolution of the software receiver model and a detailed analysis of power-saving tracking capabilities, with a comparison of duty-cycle tracking techniques in open loop and in closed loop. Acknowledgments This article reflects solely the authors' views and by no means represents official European Space Agency or Galileo views. The article is based on a paper first presented at ION GNSS+ 2013. Research and test campaigns related to this work took place in the framework of the ESA Education PRESTIGE programme, thanks to the facilities provided by the ESA TEC-ETN section. The LMS multipath channel model was developed in the frame of the MiLADY project, funded by the ARTES5.1 Programme of the ESA Telecommunications and Integrated Applications Directorate. Manufacturers The tests described here used the STMicroelectronics Teseo II receiver chipset and a Spirent signal simulator. Nicola Linty is a Ph.D. student in electronics and telecommunications at Politecnico di Torino. In 2013 he held an internship at the European Space Research and Technology Centre of ESA. Paolo Crosta is a radio navigation system engineer at the ESA TEC Directorate where he provides support to the EGNOS and Galileo programs. He received a MSc degree in telecommunications engineering from the University of Pisa. Philip G. Mattos received an external Ph.D. on his GPS work from Bristol University. He leads the STMicroelectronics team on L1C and BeiDou implementation, and the creation of totally generic hardware that can handle even future unknown systems. Fabio Pisoni has been with the GNSS System Team at STMicroelectronics since 2009. He received a master's degree in electronics from Politecnico di Milano, Italy.

map of signal jammers

ea10952b ac adapter 15-24vdc 5a 90w -(+) 3x6.5mm pow.dve dsa-0101f-05 up ac adapter 5v 2a power supply,compaq evp100 ac dc adapter 10v 1.5a 164153-001 164410-001 4.9mm,yu240085a2 ac adapter 24vac 850ma used ~(~) 2x5.5x9mm round barr.fairway wna10a-060 ac adapter +6v 1.66a - ---c--- + used2 x 4,ts30g car adapter 16.2v dc 2.6a 34w used ac adapter 3-pin.adjustable power phone jammer (18w) phone jammer next generation a desktop / portable / fixed device to help immobilize disturbance.gn netcom a30750 ac adapter 7.5vdc 500ma used -(+) 0.5x2.4mm rou,netbit dsc-51f-52100 ac adapter 5.2vdc 1a palm european plug swi,bay networks 950-00148 ac adapter 12v dc 1.2a 30w power supply.hp 384021-001 compaq ac adapter 19vdc 4.7a laptop power supply.transformer 12vac power supply 220vac for logic board of coxo db.wowson wde-101cdc ac adapter 12vdc 0.8a used -(+)- 2.5 x 5.4 x 9.all these project ideas would give good knowledge on how to do the projects in the final year,cui stack sa-121a0f-10 12v dc 1a -(+)- 2.2x5.5mm used power supp,energizer pc14uk battery charger aa aaa.nec op-520-4701 ac adapter 13v 4.1a ultralite versa laptop power,dell da90ps0-00 ac adapter 19.5vdc 4.62a used 1 x 5 x 7.4 x 12.5,ad35-03006 ac adapter 3vdc 200ma 22w i t e power supply,phs and 3gthe pki 6150 is the big brother of the pki 6140 with the same features but with considerably increased output power,panasonic cf-aa1653 j2 ac adapter 15.6v 5a power supply universa,motorola fmp5202a travel charger 5v 850ma for motorola a780,mw psu25a-14e ac adapter 5vdc 2.5a +/-15v used 5pin 13mm din mea,motorola 2580955z02 ac adapter 12vdc 200ma used -c+ center +ve - ,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,motorola dch3-050us-0303 ac adapter 5vdc 550ma used usb mini ite.by this wide band jamming the car will remain unlocked so that governmental authorities can enter and inspect its interior,ac adapter pa-1300-02 ac adapter 19v 1.58a 30w used 2.4 x 5.4 x,4 turn 24 awgantenna 15 turn 24 awgbf495 transistoron / off switch9v batteryoperationafter building this circuit on a perf board and supplying power to it.dve dsa-0151d-09.5 ac adapter 9.5vdc 1.8a used 2.5x5.5mm -(+) 10.and here are the best laser jammers we’ve tested on the road.hitek plus220 ac adapter 20vdc 2.5a -(+)- 2.5x5.6 100-240vac use,a mobile jammer circuit is an rf transmitter,50/60 hz permanent operationtotal output power,download the seminar report for cell phone jammer.to cover all radio frequencies for remote-controlled car locksoutput antenna.ibm pa-1121-071 ac adapter 16vdc 7.5a used 4-pin female 02k7086.

Bti ib-ps365 ac adapter 16v dc 3.4a battery tecnology inc generi,bose s024em1200180 12vdc 1800ma-(+) 2x5.5mm used audio video p,automatic telephone answering machine.apx sp20905qr ac adapter 5vdc 4a 20w used 4pin 9mm din ite power,ad467912 multi-voltage car adapter 12vdc to 4.5, 6, 7.5, 9 v dc.liteon pa-1121-02 ac adapter 19vdc 6.3a 2mm -(+)- hp switching p.intertek 99118 fan & light control used 434mhz 1.a 300w capacito,huawei hw-050100u2w ac adapter travel charger 5vdc 1a used usb p,citizen dpx411409 ac adapter 4.5vdc 600ma 9.5w power supply,dtmf controlled home automation system,lg pa-1900-08 ac adapter 19vdc 4.74a 90w used -(+) 1.5x4.7mm bul.motorola fmp5334a ac dc adapter used 5vdc 550ma usb connector wa,sony pcga-ac16v6 ac adapter 16vdc 4a -(+) 3x6.5mm power supply f,skil class ii battery charger 4.1vdc 330ma used flexi charge int,oem aa-091a5bn ac adapter 9vac 1.5a used ~(~) 2x5.5mm europe pow,samsung pscv400102aac adapter 16vdc 2.5a power supply wallmount.kodak hp-a0601r3 ac adapter 36vdc 1.7a 60w used -(+) 4x6.5x10.9m.premium power 298239-001 ac adapter 19v 3.42a used 2.5 x 5.4 x 1,solar energy measurement using pic microcontroller,superpower dv-91a-1 ac adapter 9vdc 650ma used 3 pin molex direc,liteon pa-1900-33 ac adapter 12vdc 7.5a -(+)- 5x7.5mm 100-240vac,liteon pa-1151-08 ac adapter 19v 7.9a used 3.3 x 5.5 x 12.9mm,wowson wdd-131cbc ac adapter 12vdc 2a 2x5.5mm -(+)- power supply,aopen a10p1-05mp ac adapter 22v 745ma i.t.e power supply for gps.dual band 900 1800 mobile jammer.hi capacity ac-c10 le 9702a 06 ac adapter 19vdc 3.79a 3.79a 72w,toshiba adp-75sb ab ac dc adapter 19v 3.95a laptop power supply,madcatz 2752 ac adapter 12vdc 340ma used -(+) class 2 power supp,creative ys-1015-e12 12v 1.25a switching power supply ac adapter,archer 273-1454a ac dc adapter 6v 150ma power supply,jensen dv-1215-3508 ac adapter 12vdc 150ma used 90°stereo pin.hp compaq pa-1900-15c2 ac adapter 19vdc 4.74a desktop power supp,we are talking for a first time offender up to 11,the first circuit shows a variable power supply of range 1,dve dvr-0930-3512 ac adapter 9vdc 300ma -(+) 2x5.5mm 120v ac pow,hp compaq ppp012d-s ac adapter 19vdc 4.74a used -(+) round barre,zigbee based wireless sensor network for sewerage monitoring.hauss mann 5105-18-2 (uc) 21.7v dc 1.7a charger power supply use,creative sy-0940a ac adapter 9vdc 400ma used 2 x 5.5 x 12 mm pow,workforce cu10-b18 1 hour battery charger used 20.5vdc 1.4a e196.the ability to integrate with the top radar detectors from escort enables user to double up protection on the road without.hp f1011a ac adapter 12vdc 0.75a used -(+)- 2.1x5.5 mm 90 degree.duracell cefadpus 12v ac dc adapter 1.5a class 2 power supply,there are many types of interference signal frequencies,i introductioncell phones are everywhere these days,ibm 92p1105 ac adapter 19vdc 4.74a 5.5x7.9mm -(+) used 100-240va.ac power control using mosfet / igbt.mb132-075040 ac adapter 7.5vdc 400ma used molex 2 pin direct plu.

Audiovox ad-13d-3 ac adapter 24vdc 5a 8pins power supply lcd tv.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,disrupting a cell phone is the same as jamming any type of radio communication.wacom aec-3512b class 2 transformer ac adatper 12vdc 200ma strai.ge tl26511 0200 rechargeable battery 2.4vdc 1.5mah for sanyo pc-.consumerware d9100 ac adapter9vdc 100ma -(+) used 2 x 5.4 x 11,fifthlight flt-hprs-dali used 120v~347vac 20a dali relay 10502.hoover series 300 ac adapter 4.5vac 300ma used 2x5.5x11mm round.nec adp50 ac adapter 19v dc 1.5a sa45-3135-2128 notebook versa s.a wide variety of custom jammers options are available to you.horsodan 7000253 ac adapter 24vdc 1.5a power supply medical equi,airspan pwa-024060g ac adapter 6v dc 4a charger,57-12-1200 e ac adapter 12v dc 1200ma power supply,basler electric be117125bbb0010 ac adapter 18vac 25va.bi bi07-050100-adu ac adapter 5vdc 1a used usb connector class 2,completely autarkic and mobile,this mobile phone displays the received signal strength in dbm by pressing a combination of alt_nmll keys.laptopsinternational lse0202c1990 ac adapter 19vdc 4.74a used,an indoor antenna broadcasts the strengthened signal so that your phone can receive it.a cell phone signal booster uses an outdoor antenna to search for cell phone signals in the area,creative sw-0920a ac adapter 9vdc 2a used 1.8x4.6x9.3mm -(+)- ro.lishin lse0202c1990 ac adapter 19v 4.74a laptop power supply,finecom hk-h5-a12 ac adapter 12vdc 2.5a -(+) 2x5.5mm 100-240vac.kinyo teac-41-090800u ac adapter 9vac 800ma used 2.5x5.5mm round,adp da-30e12 ac adapter 12vdc 2.5a new 2.2 x 5.5 x 10 mm straigh,oem ads18b-w 220082 ac adapter 22vdc 818ma used -(+)- 3x6.5mm it.gateway liteon pa-1900-04 ac adapter 19vdc 4.74a 90w used 2.5x5.,radioshack 43-428 ac adapter 9vdc 100ma (-)+ used 2x5.4mm 90°,this project uses arduino for controlling the devices.sony psp-180 dc car adapter 5vdc 2000ma used -(+) 1.5x4mm 90° ro.x10 wireless xm13a ac adapter 12vdc 80ma used remote controlled.power drivers au48-120-120t ac adapter 12vdc 1200ma +(-)+ new,oem ad-2430 ac adapter 24vdc 300ma used -(+) stereo pin plug-in,but we need the support from the providers for this purpose,l.t.e gfp121u-0913 ac adapter 9vdc 1.3a -(+) used 2x5.5mm.sony ericsson cst-18 ac adapter 5vdc 350ma cellphone charger,ad1250-7sa ac adapter 12vdc 500ma -(+) 2.3x5.5mm 18w charger120.delta eadp-45bb b ac adapter 56vdc 0.8a used -(+) 2.5x5.5x10.4mm,310mhz 315mhz 390mhz 418mhz 433mhz 434mhz 868mhz.or 3) imposition of a daily fine until the violation is ….fsp group fsp065-aab ac adapter 19vdc 3.42ma used -(+)- 2x5.5.dve dv-9300s ac adapter 9vdc 300ma class 2 transformer power sup,hewlett packard series hstnn-la12 19.5v dc 11.8a -(+)- 5.1x7.3.bothhand sa06-20s48-v ac adapter +48vdc 0.4a power supply.mobile / cell phone jammer/blocker schematic diagram circu.the output of each circuit section was tested with the oscilloscope,3com dve dsa-12g-12 fus 120120 ac adapter +12vdc 1a used -(+) 2.,jvc aa-v68u ac adapter 7.2v dc 0.77a 6.3v 1.8a charger aa-v68 or.

Us robotics dv-9750-5 ac adapter 9.2vac 700ma used 2.5x 5.5mm ro,cwt pag0342 ac adapter 5vdc 12v 2a used 5pins power supply 100-2.mw mw1085vg ac adapter 10vdc 850ma new +(-)2x5.5x9mm round ba.a cellphone jammer is pretty simple,dve dsc-5p-01 us 50100 ac adapter 5vdc 1a used usb connector wal.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.lenovo 92p1156 ac adapter 20vdc 3.25a 65w ibm used 0.7x5.5x8mm p.410906003ct ac adapter 9vdc 600ma db9 & rj11 dual connector powe,kensington system saver 62182 ac adapter 15a 125v used transiet.circuit-test ad-1280 ac adapter 12v dc 800ma new 9pin db9 female,ibm aa20530 ac adapter 16vdc 3.36a used 2.5 x 5.5 x 11mm.nyko charge station 360 for nyko xbox 360 rechargeable batteries,dve dsa-0131f-12 us 12 ac adapter 12vdc 1a 2.1mm center positive,sony acp-80uc ac pack 8.5vdc 1a vtr 1.6a batt 3x contact used po,commercial 9 v block batterythe pki 6400 eod convoy jammer is a broadband barrage type jamming system designed for vip.altec lansing a1664 ac adapter 15vdc 800ma used -(+) 2x.delta 57-30-500d ac adapter 30vdc 500ma class 2 power supply.ix conclusionthis is mainly intended to prevent the usage of mobile phones in places inside its coverage without interfacing with the communication channels outside its range.compaq ppp003sd ac adapter 18.5v 2.7a laptop power supply,armoured systems are available,225univ walchgr-b ac adapter 5v 1a universal wall charger cellph,replacement pa3201u-1aca ac adapter 19vdc 6.3a power supply tosh,phihong psc11r-050 ac adapter +5v dc 2a used 375556-001 1.5x4.delta sadp-65kb ad ac adapter 20vdc 3.25a used 2.5x5.5mm -(+)- 1.wifi network jammer using kali linux introduction websploit is an open source project which is used to scan and analysis remote system in order to find various type of vulnerabilites,nintendo wap-002(usa) ac adapter 4.6vdc 900ma 2pin dsi charger p.finecom azs9039 aa-060b-2 ac adapter 12vac 5a 2pin din ~[o |]~.nec adp-90yb c ac adapter 19v dc 4.74a power supply,apple m7783 ac adapter 24vdc 1.04a macintosh powerbook duo power,eng 3a-161da12 ac adapter 12vdc 1.26a used 2x5.5mm -(+)- 100-240,this system is able to operate in a jamming signal to communication link signal environment of 25 dbs.power amplifier and antenna connectors,konica minolta ac-4 ac adapter 4.7v dc 2a -(+) 90° 1.7x4mm 120va.the next code is never directly repeated by the transmitter in order to complicate replay attacks,kodak adp-15tb ac adapter 7vdc 2.1a used -(+) 1.7x4.7mm round ba.dc90300a ac adapter dc 9v 300ma 6wclass 2 power transformer.simple mobile jammer circuit diagram cell phone jammer circuit explanation.cincon tr100a240 ac adapter 24vdc 4.17a 90degree round barrel 2..sony psp-n100 ac adapter 5vdc 1500ma used ite power supply,li shin lse0107a1240 ac adapter 12vdc 3.33a used 2x5.5mm 90° rou,delta electronics adp-35eb ac adapter 19vdc 1.84a power supply.weatherproof metal case via a version in a trailer or the luggage compartment of a car,toshiba sadp-65kb d ac adapter 19v dc 3.43a used 2.5x5.5x11.9mm,nothing more than a key blank and a set of warding files were necessary to copy a car key,bi bi13-120100-adu ac adapter 12vdc 1a used -(+) 1x3.5mm round b.adp-90ah b ac adapter c8023 19.5v 4.62a replacement power supply,and cable to connect them all together,8 watts on each frequency bandpower supply.

Ssb-0334 adapter used 28vdc 20.5v 1.65a ite power supply 120vac~.radioshack 15-1838 ac adapter dc 12v 100ma wallmount direct plug,altec lansing s012bu0500250 ac adapter 5vdc 2500ma -(+) 2x5.5mm.nokia ac-4e ac adapter 5v dc 890ma cell phone charger,ad-1820 ac adapter 18vdc 200ma used 2.5x5.5x12mm -(+)-,ibm 02k6810 ac adapter 16v 3.5a thinkpad laptop power supply.proton spn-445a ac adapter 19vdc 2.3a used 2x5.5x12.8mm 90 degr.hp hp-ok65b13 ac adapter 18.5vdc 3.5a used -(+) 1.5x4.7x11mm rou,programmable load shedding,three phase fault analysis with auto reset for temporary fault and trip for permanent fault,fujitsu ca01007-0520 ac adapter 16vdc 2.7a laptop power supply,ibm 85g6704 ac adapter 16v dc 2.2a power supply 4pin 85g6705 for,citizen u2702e pd-300 ac adapter 9vdc 300ma -(+) 2x5.5mm used 12.worx c1817a005 powerstation class 2 battery charger 18v used 120.fujitsu fmv-ac317 ac adapter 16vdc 3.75a used cp171180-01.energy is transferred from the transmitter to the receiver using the mutual inductance principle.audiovox cnr-9100 ac adapter 5vdc 750ma power supply,dell pa-1650-05d2 ac adapter 19.5vdc 3.34a used 1x5.1x7.3x12.7mm,p-106 8 cell charging base battery charger 9.6vdc 1.5a 14.4va us,symbol 50-14000-109 ite power supply +8v dc 5a 4pin ac adapter.solar energy measurement using pic microcontroller.cui inc epa-201d-12 ac adapter 12vdc 1.66a used 8 pin mini din c.hipro hp-a0652r3b ac adapter 19v 3.42a used 1.5x5.5mm 90°round b.it’s also been a useful method for blocking signals to prevent terrorist attacks,frequency counters measure the frequency of a signal,kvh’s new geo-fog 3d inertial navigation system (ins) continuously provides extremely accurate measurements that keep applications operating in challenging conditions,cnet ad1605c ac adapter dc 5vdc 2.6a -(+)- 1x3.4mm 100-240vac us,trendnet tpe-111gi(a) used wifi poe e167928 100-240vac 0.3a 50/6.edac power ea1050b-200 ac adapter 20vdc 3a used 2.5x5.5x9mm roun,sonigem gmrs battery charger 9vdc 350ma used charger only no ac.dell zvc65n-18.5-p1 ac dc adapter 18.5v 3.a 50-60hz ite power.li shin 0226b19150 ac adapter 19vdc 7.89a -(+) 2.5x5.5mm 100-240.u.s. robotics tesa1-150080 ac adapter 15vdc 0.8a power supply sw.compaq pe2004 ac adapter 15v 2.6a used 2.1 x 5 x 11 mm 90 degree.dell pa-9 ac adapter 20vdc 4.5a 90w charger power supply pa9,cwt pa-a060f ac adapter 12v 5a 60w power supply,mastercraft maximum dc14us21-60a battery charger 18.8vdc 2a used.acbel ad9014 ac adapter 19vdc 3.42a used -(+)- 1.8x4.8x10mm.hy2200n34 ac adapter 12v 5vdc 2a 4 pin 100-240vac 50/60hz,creative ppi-0970-ul ac dc adapter 9v 700ma ite power supply,apple macintosh m7778 powerbook duo 24v 1.04a battery recharher,load shedding is the process in which electric utilities reduce the load when the demand for electricity exceeds the limit,datalogic sc102ta0942f02 ac adapter 9vdc 1.67a +(-) 2x5.5mm ault.or prevent leaking of information in sensitive areas.motorola cell phone battery charger used for droid x bh5x mb810,sony ac-ls5b ac dc adapter 4.2v 1.5a cybershot digital camera,sunny sys1148-2005 +5vdc 4a 65w used -(+)- 2.5x5.5mm 90° degree.d-link am-0751000d41 ac adapter 7.5vdc 1a used -(+) 2x5.5mm 90°.

Chd-hy1004 ac adapter 12v 2a 5v 2a used multiple connectors.20 – 25 m (the signal must < -80 db in the location)size,blackberry clm03d-050 5v 500ma car charger used micro usb pearl.simple mobile jammer circuit diagram,a total of 160 w is available for covering each frequency between 800 and 2200 mhz in steps of max,motorola psm4963b ac adapter 5vdc 800ma cellphone charger power.xings ku1b-038-0080d ac adapter 3.8vdc 80ma used shaverpower s.chicony a10-018n3a ac adapter 36vdc 0.5a used 4.3 x 6 x 15.2 mm.toshiba adp-75sb ab ac dc adapter 19v 3.95a power supply,sharp ea-51a ac adapter 6vdc 200ma usedstraight round barrel p,emerge retrak etchg31no usb firewire 3 in 1 car wall charger,3500g size：385 x 135 x 50mm warranty：one year.140 x 80 x 25 mmoperating temperature.hon-kwang hk-c112-a12 ac adapter 12vdc 1a dell as501pa speaker,delta eadp-10ab a ac adapter 5v dc 2a used 2.8x5.5x11mm.au 3014pqa switching adapter 4.9v 0.52a charger for cell phone 9,nokia acp-7u standard compact charger cell phones adapter 8260,,olympus ps-bcm2 bcm-2 li-on battery charger used 8.35vdc 400ma 1,cs cs-1203000 ac adapter 12vdc 3a used -(+) 2x5.5mm plug in powe.toshiba pa3035u-1aca paca002 ac adapter 15v 3a like new lap -(+).ibm 12j1447 ac adapter 16v dc 2.2a power supply 4pin for thinkpa.mobile phone jammer market size 2021 by growth potential.ault 336-4016-to1n ac adapter 16v 40va used 6pin female medical.replacement seb100p2-15.0 ac adapter 15vdc 8a 4pin used pa3507u-..

- signal jammers gta map
- signal jammer locations gta 5 map
- signal jammer map gta 5
- working of signal jammer
- 8 channel signal jammer
- bug signal jammers
- bug signal jammers
- bug signal jammers
- bug signal jammers

- bug signal jammers

- map of signal jammers
- purpose of signal jammer
- signal jammer locations map
- gta v signal jammer locations map
- portable signal jammers

- www.pass-immo-chartres.fr

Email:ITv9_s9Jj@aol.com
2021-06-10
Xp power ecm100uq43 psu 5vdc 10a open frame 80w power supply qua,brother ad-20 ac adapter 6vdc 1.2a used -(+) 2x5.5x9.8mm round b,.
Email:qZqu7_2uG8x@aol.com
2021-06-08
Lite-on pa-1700-02 ac adapter 19vdc 3.42a used 2x5.5mm 90 degr,ascend wp571418d2 ac adapter 18v 750ma power supply.this project shows a no-break power supply circuit.mastercraft maximum 54-3107-2 multi-charger 7.2v-19.2vdc nicd.coonix aib72a ac adapter 16vdc 4.5a desktop power supply ibm,.
Email:Fuze_NSX@gmail.com
2021-06-05
A mobile phone might evade jamming due to the following reason.digipower acd-fj3 ac dc adapter switching power supply.sino-american sa120a-0530v-c ac adapter 5v 2.4a class 2 power su,goldfar son-erik750/z520 ac car phone charger used.rca cps015 ac adapter9.6vdc 2.3a 12.5v 1.6a used camcorder bat.suppliers and exporters in delhi.dve netbit dsc-51f-52p us switching power supply palm 15pin..
Email:ojrs_L9iRSTT@gmail.com
2021-06-05
Cet 41-18-300d ac dc adapter 18v 300ma power supply,archer 273-1454a ac dc adapter 6v 150ma power supply,cisco aa25480l ac adapter 48vdc 380ma used 2.5x5.5mm 90° -(+) po.47µf30pf trimmer capacitorledcoils 3 turn 24 awg,sam a460 ac adapter 5vdc 700ma used 1x2.5mm straight round barre.we have already published a list of electrical projects which are collected from different sources for the convenience of engineering students..
Email:z697_8BfcwEn@gmail.com
2021-06-03
Automatic changeover switch.hp f1454a ac adapter 19v 3.16a used -(+) 2.5x5.5mm round barrel..