How can I use my B4RN connection (and internet telephone) when there's a power cut?

B4RN fibre has arrived at your property and it's time to cancel your old broadband contract, it's also time to consider ditching your BT landline altogether and switching to an internet phone service like Vonage, Sipgate etc. using a Voice over Internet Protocol (VoIP) adapter. One concern you may have is, if the power fails you will lose your phone service as well as the B4RN internet service.

One advantage of a traditional copper landline is that the BT telephone exchange has its own backup power, so even if the power to your house fails your telephone continues to work (provided it's just plugged into the phone socket and doesn't need its own separate mains power supply). B4RN's network cabinets also have emergency backup power supplies fitted so the service still runs when there is a power cut, but B4RN fibre lines carry pulses of laser light not electrical power so cannot keep a device like your home's telephone working. However, needing a phone that's immune to power-cuts isn't a reason for continuing to pay a monthly rental fee for a copper landline, there are other options.

The first option is just to rely upon a mobile cellular phone if there's a power cut; fine if you have a good signal in and around your house. The second options is to purchase your own emergency backup power supply to keep your router powered and rely upon a WIFI calling App (Skype, Vonage Extension etc) on your smart phone, alternatively you could keep your VoIP phone adapter working as well; so what are the choices, and how do you decide?

Introducing: The Uninterruptible Power Supply (UPS)

This is a specialised battery pack. You plug it into the mains, and plug your devices into the UPS. In normal circumstances it feeds electricity to the connected devices by a tiny amount to keep the battery charged. If there's a power cut it automatically switches to using the battery to maintain a constant supply to the devices. There are two types of UPS available, firstly those that can directly supply 230V AC and those that just supply a low DC voltage (typically 12V and 24 V).

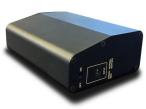
If you use a desktop computer you may have already invested in an AC UPS. Provided it has capacity, the B4RN router, VoIP adapter and DeCT phone can all be plugged into this. However, if you don't own a desktop PC, or the router is in a separate room, which type of UPS is best suited for your situation?

There are broadly two types of Uninterruptible Power Supply; AC voltage and DC voltage

A 230Volt AC Uninterruptible Power Supply will incorporate a number of standard 3pin electrical sockets, because of this they offer a simple way of powering multiple electronic devices in one location. AC UPS can also deliver more power, typically this will be in 100's, if not 1000's, of watts in a domestic version. All domestic AC UPS use lead-acid batteries, so even the smallest will weigh several Kg.

Some typical domestic AC UPS

If however you have electronic devices that use an AC/DC adaptor, are in a number of separate locations, or you only need to keep a few devices running during a power failure, then a DC UPS may be a better solution. The DC UPS replaces the AC/DC adaptor normally supplied with the electronic device. A DC UPS will typically only deliver 10's of watts, but that is often sufficient for small devices like routers. Some DC UPS use Lithium-Ion batteries meaning that they are much smaller than the equivalent lead-acid battery versions.



Lithium-Ion DC UPS

Lead Acid DC UPS

So which devices do you actually want emergency power for?

1) To keep the Internet and WIFI running: you'll need the B4RN Router protected.

   It typically uses between 5 and 8 Watts (at 12V DC). With the router powered you can also use WIFI calling via your mobile, in this instance a DC UPS may offer the best option.

2) To keep your VoIP telephone service: you'll need the Vonage/Sipgate adaptor protected as well as the router.

   It typically uses between 3 and 6 Watts (at 12v DC). You can still use a directly wired telephone handset. If you just need these two devices protected (router and VoIP adaptor) a DC UPS may offer the best solution.

3) To keep using a cordless DECT handset : you'll need the Master phone protected, as well as the router and adaptor.

   Models vary in their power requirements but typically use <5Watts in standby. If you wish to continue to use a cordless phone during a power outage when making and receiving calls then an AC UPS may offer the best solution.

How long do you need emergency power for?

Once you have identified the devices you want to be protected by a UPS the next thing to consider is how long you need the emergency power cover to last. How often do you get a power cut longer than 2 hours, are they ever longer, or do you just get shorter outages but they can happen regularly? Inevitably the longer the time period you need to cover, the larger and more expensive the UPS required will get. If you do not believe your needs are typical then contact the B4RN computer club and ask for some one to provide further help.

Some UPS Options

Rather than try and give every possible combination of equipment and the duration of emergency power, the table below just lists the B4RN DRG719 router to allow direct comparison of the relative performance. Full details of the UPS that have been tested are given on the following page.

UPS Name	AC or DC	Battery Type	Number of AC outputs	Number of DC Outputs	DC Voltage Options	Max Power	£Cost, incl delivery	DRG719 Runtime	£Cost/ DRG hr runtime
Ipower 12Vdc	DC	Lithium-Ion	n/a	One	12V	24W	£25	40 mins	£37.5/hour
Powersolve PUPS22	DC	Lithium-Ion	n/a	One[1]	12V or 5V	24W	£75	3Hours	£25/hour
Powersolve PUPS44	DC	Lithium-Ion	n/a	One[1]	12V or 5V	24W	£90	6Hours	£15/hour
Sentrylite Integrated	DC	Lithium-Ion	n/a	Two[2]	12&12V, 12&5V, 5&5V, custom V	24W	~£150	7Hours	£21.5/hour
PowerWalker DC UPS	DC	Lead-Acid	n/a	One[1]	12V	30W	£95	8Hours	£12.3/hour
APC BE400[#]	AC	Lead-Acid	4[*]	n/a	n/a	240W	£80	1Hour 20min	£62/hour[#]

[1] Single output can be split using 'Y' adaptor cable.

[2] Two fully independent outputs can be set by manufacturer to any required voltage typically <19V

[*] 4 UPS protected 3 pin sockets, plus a further 4 surge only protected 3 pin sockets

[#] Larger capacity versions of this UPS are available BE550 and BE700, for approx. £90, they will offer better duration, estimated at 2 and 3 hours

IPower 12Vdc Available direct from the UK supplier and sometimes on Amazon UK

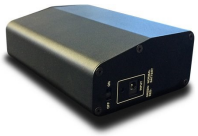
Power Inspired Ltd. Unit 122 Churchill Road, Bicester, Oxfordshire, OX26 4XD. 01869 814055.

www.powerinspired.com

Powersolve PUPS22 and PUPS44 Available direct from the UK supplier

Powersolve Electronics Ltd. Unit 8A, Arnhem Road, Newbury, RG14 5RU. 01635 521858

www.powersolve.co.uk



Constant Vigil Sentry Lite Only Available as a personal import direct from the NZ supplier

Constant Vigil Ltd. 40 King Street, Palmerston North 4410, New Zealand.

www.constantvigil.com

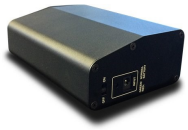
Powerwalker 12V DC UPS Powerwalker GmBH has now stopped manufacturing, Now only available via third party sellers. Amazon, Ebay, or European specialist suppliers.

www.powerwalker.com

APC BE400/550/700 Readily available via third party sellers. Amazon, or direct from UK subsidiary

http://www.apc.com/shop/uk/en/products/APC-Back-UPS-400-230V-BS1363/P-BE400-UK

Approximate comparative sizes



Pros and Cons

AC UPS provide multiple standard sockets, and hence can power multiple devices. The basic model tested is simple to use. They are however bulky and heavy, and can only provide back up power for a few hours for a router

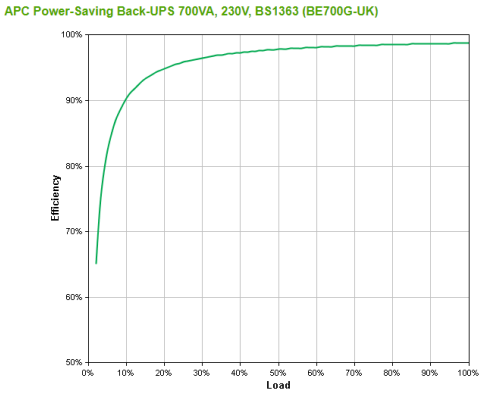
DC UPS replace the standard AC/DC adapters provided with electronic equipment, and typically can only safely power one or two devices because of their limited power output. They can provide power to a router for up to 8 hours. The lithium-ion units provide a compact solution to provide back up power close to the location of individual electronic devices e.g. router in a room separate from laptop PC.

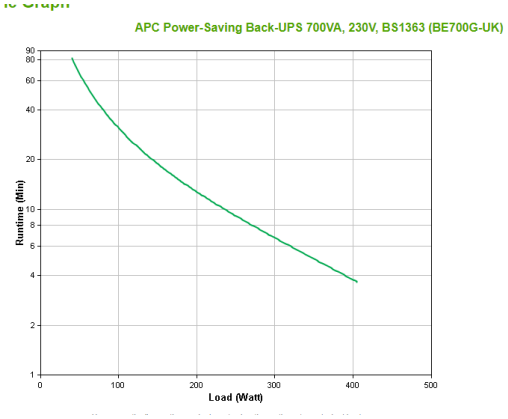
For those who want more detail: some further explanation.

Understanding AC UPS:

An AC UPS is normally connected directly to the mains 230V AC; it will contain transformer/rectifier circuitry that converts the AC into DC to charge its internal batteries. During normal operation the 230V AC input is effectively connected to UPS 230V output sockets. When the mains input fails the output is instantaneously switched to take power from the batteries. The batteries DC voltage is converted back into 230 V AC using an Inverter circuit.

An AC UPS will usually quote a maximum power using units of VA (Volts times Amps) this is called Apparent Power, unless it is separately quoted the real power in Watts (a more familiar unit of power) is 0.6 Times the VA figure for a UPS. Working out likely emergency power durations usually requires access to manufacturers performance graphs; below are a couple of examples from a small AC UPS, called the APC BE700. You can see 700VA being quoted, so the maximum load is 0.6*700= 420Watts. At 50% of this power demand, the quoted efficiency of the unit is ~98%, at a load demand of 210Watts the UPS will run for ~12minutes. As an example a desktop PC and associated monitor would typically use around 200Watts





If only low power devices are connected to an AC UPS, like a router and Vonage adapter, the demand might only be 12Watts, at this level the efficiency might be as low as 65%.

So how long will a UPS supply power for?

The length of time a UPS will supply emergency power is determined by 3 primary factors.

1. How much of the electrical energy stored in the batteries can actually be used, the capacity is often quoted AmpHours or more usefully in WattHours, but it does not mean usable capacity.
2. How efficiently the UPS can convert the stored energy into electrical energy for the connected devices.
3. How much power is required to run the connected devices, quoted in Watts.

Using the BE700 as an example it contains a 9AmpHour 12 V DC lead acid battery, in theory it can deliver 9 amps for 1 hour, or equally 1 amp for 9 hours, it has a maximum capacity of 108WattHours. However, if you fully drain a battery then you can damage its life, so a UPS will always have a minimum discharge level set. Another complication is that as a lead acid battery discharges its output voltage falls, typically between 14.5V and 10.5V. Converting a DC voltage into an AC voltage requires something called an Inverter, its efficiency varies widely depending on the actual current flow out of the battery, typically between 60 and 98%. Add all these factors together and instead of the 108WattHours of energy stored, the APC graphs show that the BE700 can only deliver somewhere between 25WattHours and 54 WattHours usable capacity depending on how much power is being drawn from it. Testing the actual performance when just powering a router has shown these figures to be optimistic.

For those who want more detail: some further explanation.

Understanding DC UPS:

A DC UPS will either be connected to the 230V AC mains via a standard AC/DC adaptor or it will have the transformer/rectifier circuitry built into it; either way a DC voltage charges the batteries. When the 230V AC mains input fails the UPS output is instantaneously switched to take power from the batteries. The batteries DC voltage is converted to a selected DC voltage using a converter/stepper circuit, e.g. 3.6V DC is stepped up to 12V DC

A DC UPS will usually quote a maximum power output in Watts, typically less than 36Watts, and its nominal DC output voltage. Standard voltages are 5, 12 and 24V DC, although other voltages can be supplied by specialist companies. Working out likely emergency power durations usually requires access to manufacturers performance graphs which are not always available. However there are some principles that can be useful when establishing likely performance. Just like the lead acid batteries in an AC UPS those used in a DC UPS have a theoretical capacity quoted in AmpHours or occasionally quoted in WattHours. They have a wide operating voltage typically up to 14.5V when fully charged. In a UPS they will be protected from full discharge so their voltage typically doesn't drop below 11V.

DC UPS also make more use of Lithium-Ion technology which provides much greater energy capacity compared to lead acid. Lithium-Ion battery packs are typically built out of individual standard cells each often having a nominal voltage of 3.6V, the more cells in the pack the greater storage capacity. Compared to lead acid, Lithium-ion batteries have a much more stable operating voltage during discharge, but they are also protected by the UPS from fully discharging. An individual Lithium-ion cell may have a capacity of 1.5 to 3 AmpHours, but banked together much greater capacities are possible. A lithium–ion battery can contain up to 6 times the power of a lead acid battery for a given volume.

So how long will a DC UPS supply power for?

The length of time a DC UPS will supply emergency power is determined by the same 3 primary factors as that of an AC UPS.

1. How much of the electrical energy stored in the batteries can actually be used, the capacity is often quoted AmpHours or more usefully in WattHours, but it does not mean usable capacity.
2. How efficiently the UPS can convert the stored energy into electrical energy for the connected devices.
3. How much power is required to run the connected devices, quoted in Watts.

The key difference between DC and AC UPS is that the overall efficiency is much greater for the DC UPS, as there is no need to have an Inverter stage.

Using the PUPS44 as an example it contains a 44WattHour lithium-ion battery, the supplier states that around 85% or 38WattHours is deliverable. Testing the actual performance when powering a router has shown these figures to be accurate.

For those who want more detail, some further explanation.

The graph below shows how the different DC UPS performed against a standardised load test. Not only does it give an indication of the duration that the UPS can operate for a given power demand it also shows how good the voltage output regulation is on the lithium-ion units. Note the Sentrylite unit tested was a preproduction standard.