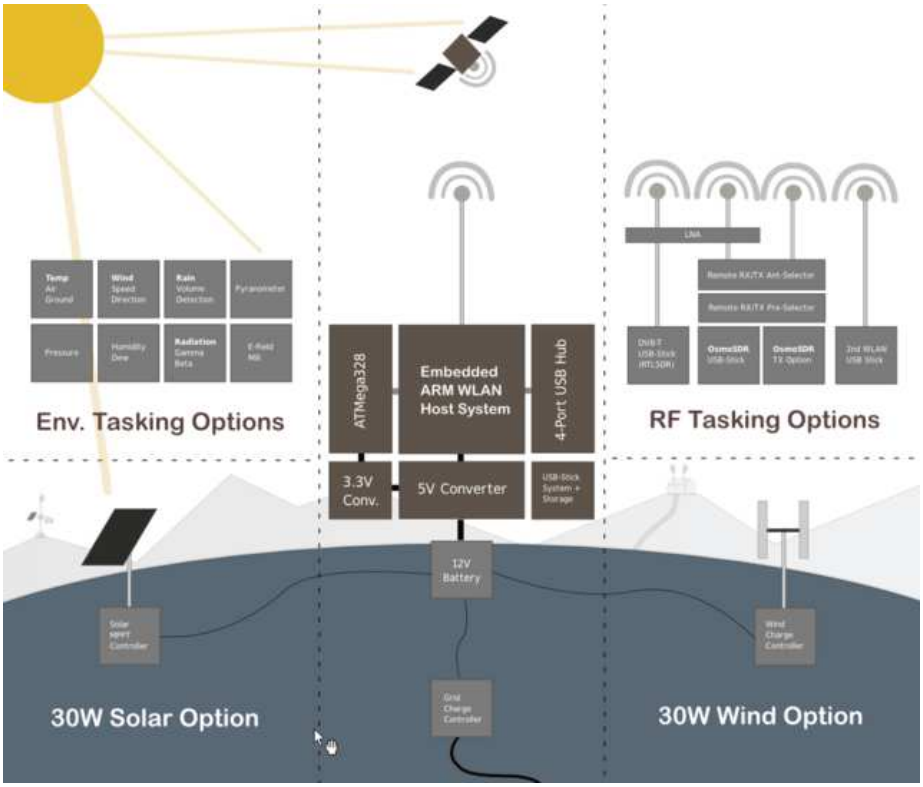
Argus

This is an early draft proposal for a solid, modular and distributed communication/monitoring system shared and operated by communities (not everyone needs his own equipment in a neighboring area). It will offer services locally for community members and the nodes should be interconnected worldwide to create a global network of free-to-access Communication- & Monitoring-Nodes (CMN).



Overview of Argus modular architecture and possible infrastructure

Each node can be configured for individual needs and available budget. A basic node will only provide connectivity features, a fully equipped node will offer complete communication and RF-/Environmental-Monitoring options (distributed com/weather grid). Ideally, the ATMega, a low-power 4-Port USB Hub Controller and the power converters should be assembled together, on a matching daughterboard, to easily combine the Host and the supporting infrastructure.

Use-Cases

- Data Delivery and Tracker Platform for DSpace
- Environmental monitoring
- WLAN mesh networking
  - Possible hosting platform for Freifunk [http://global.freifunk.net/]
- Distributed SDR Grid (combined with RTL/OsmoSDR/UmTtrx)
  - Combined Aperture Array Radio Telescope
  - Distributed Cube/PicoSAT monitoring
  - Possible hosting platform for HGG (Hacker Global Grid) [http://shackspace.de/wiki/doku.php?id=project:hgg]
  - Autonomous APT/NOAA reception
  - ADS-B Grid reception
  - POCSAG broadcasting
  - DVB-T broadcasting :)
- Open/Free Signal/GEO-Locating
- Authentication via SpaceFED [https://spacefed.net/wiki/index.php/SpaceFED]
- Data-Sharing (Wireless Dead-Drops) like the PirateBox [http://daviddarts.com/piratebox-diy-openwrt/?title=PirateBox_DIY_OpenWrt]

Host

After searching a while for a suitable WLAN capable host system the project looked pretty busted since it seemed impossible to find an embedded WLAN system that draws less than 7W. Although 7W might not sound like much, it's the 24/7 operational state that kills the application because it would require at least 50/75W solar panels and big batteries. Even at *only* 7W, the total power consumption would sum up to 168Wh per day, just for the base system without any modules.

TP-Link TL-MR3020

The TP-Link TL-MR3020 by itself consumes a maximum of **1.25W**. That totals at 30Wh per day and is, for the moment that is, the perfect choice for an independent, self-sustainable embedded Linux system with built-in WLAN capability. It will be interesting to see, what the RaspberryPi with additional WLAN (USB?) is going to consume, but for now, the MR3020 will be the host of choice.

Specs		
CPU	Atheros AR9330 rev 1	
Model	MIPS 24Kc V7.4	
Board	TP-LINK TL-MR3020	
RAM	32MB	
NAND	4MB	
PCB Size	58x59mm	
Full Assembly Size	60x62x17mm (incl. USB/LAN ports)	
Orig. Case Size	67x74x22mm	

Power & Performance Analysis

The following table shows early measurements of the basic TL-MR3020 itself (measuring the 5V DC supply in order to mitigate measurement errors due to AC/DC conversion losses), more measurements with an USB HUB and a HAMA Nano (rtlsdr) will follow soon. The results also show, that the device consumes less power with OpenWRT instead of the original firmware.

Condition	**TP-LINK FW**	**Open-WRT**
Boot	150mA	100mA
Idle	125mA	68mA
Idle + LAN	155mA	108mA
Idle + WLAN	125mA	105mA
Idle + LAN + WLAN	155mA	148mA
Idle + LAN + WLAN + USB	210mA	205mA
Active Download + LAN + WLAN + USB	260mA	255mA
AP + Monitor + Dump on USB + LAN + WLAN + USB	N/A	230mA

The power analysis has shown that the TL-MR3020 is indeed a very suitable platform for this approach since it's within the realm of a solar or wind powered system. Although probably many nodes can/will have access to grid power, the goal of this design should be to draw as little power as possible to keep remote/independent deployment as an option and to make it more attractive for people to deploy a node connected to their grid, since the costs won't be a significant factor.

Modifications

External WLAN Antenna Hack

The only major drawback of the TL-MR3020 is the lack of an external antenna connector, this however can be easily hacked in a couple of simple steps and takes less than 15 minutes. The OpenWRT-Wiki [http://wiki.openwrt.org/toh/tp-link/tl-mr3020] for the TL-MR3020 has a good manual on how to open the case, it worked well here.

Although it appears as if the AR9330 has two symmetric antenna outputs on-board and the TL-MR3020 has two etched antennas on the PCB, the route to Antenna1 is actually going to Antenna2. The route originally going to Antenna2 is only partly equipped (probably termination) and not connected to any antenna.

The lack of available datasheets for the AR9330 made this a guess and test hack and although the first approach (see below) worked for us, it unfortunately introduced EM related problems for some other people. This is the revisited hack, using a PCB edge RP-SMA connector to either use an antenna directly or connect better coax cable with less loss to the antenna. You should try to get these types of connectors, specifically designed to be attached to the side/edge of a PCB:

Of course there is also an example for a pigtail as well.

HOWTO:

- **If you've already done the old hack**:

  Unsolder the pigtail and re-solder a 0-Ohm resistor at J4 or create a solder bridge.

- **Mechanical PCB modification**

  Cut/file the edge of the PCB as shown in the image. Make sure that there is no connection left between the two golden strips at the edge.

- **If you want to use a Pigtail**:

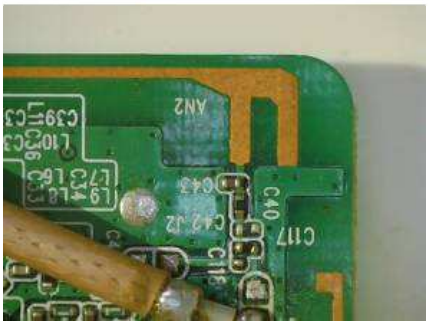
  Solder the center of RG-174 (or the like) coax cable to the left pad (connected to C43 - see Image) and the braid/shield of the coax to the right strip (GND).

- **If you want to use a PCB Edge RP-SMA connector**:

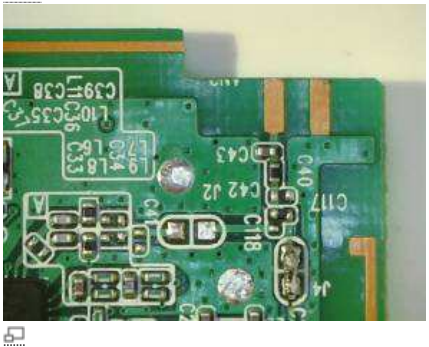
  Solder the center pin (round) to the left pad (connected to C43 - see Image) and the right pin of the connector to the right pad (GND).

- **Finishing Up**:

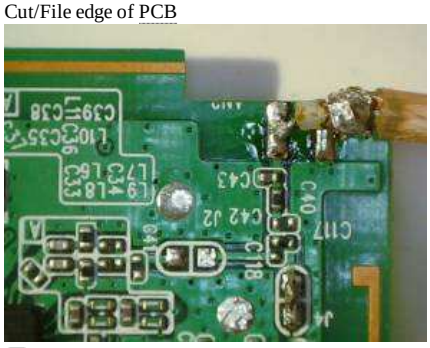
  Use hot glue or something like it to fix the cable/connector right in front of the soldered points to prevent the pads from breaking off the PCB due to lift forces from the cable. If you want to use the original case, drill a hole for the RP-SMA connector to stick out.



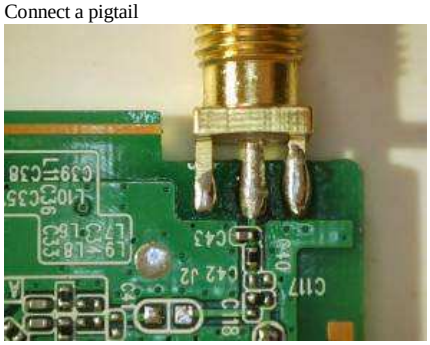
PCB/Antenna before



Cut/File edge of PCB



Connect a pigtail

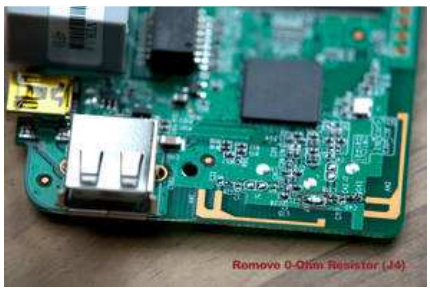


Mount RPSMA PCB Edge Connector

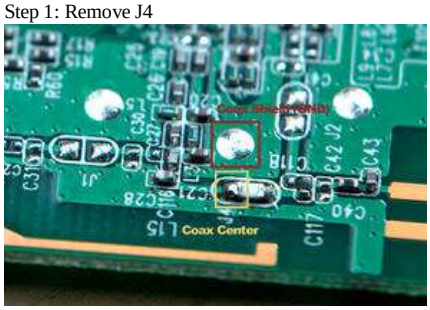
Special thanks go to cosmo, for donating this device as a guinea pig to make this hack possible.

If anyone has the datasheets and could share some insight on the AR9330's antenna configuration, to enable the 2nd antenna for MIMO/Diversity, please drop a note.

There have been reports of EM related damage to MR3020 routers that have been hacked the way shown below. It seems that the cut off capacitors after J4 were put there for EM protection rather than matching the antenna. **Please follow the method shown above to have proper EM protection for your router's external antenna. The following images are only left as a reference for now**

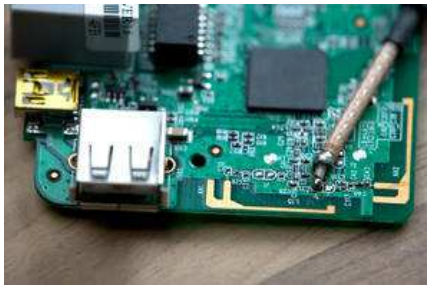


Step 1: Remove J4



Step 2 & 3: Connect coax cable

Detail of coax connection



Final Overview

Microcontroller

- ATMega328 based system control/monitoring and SPI/I2C data acquisition.
- Modularized Firmware in C (one module per tasking option)
- Serial communication to Host
- Monitoring & controlling battery supply/low power shut down of Host

RF Tasking

Combined with a cheap USB DVB-T Stick like the HAMA Nano or any other Elonics E4000/RTL2832 based device or better yet an OsmoSDR, the node can offer the raw IQ datastream (maybe even as IPv6 multicast) so that anyone can connect his local GNURadio instance to remote control and source the stream from any distant node. This would also allow more software nerds to hack on SDR software who don't want or can't get the hardware locally.

Environmental Tasking

Temperature & Relative Humidity

WMO guidelines

- SHT75
- 19.5 x 5.1 x 3.1 mm
- 2.4 - 5.5 V
- 0.15 mW
- -40 - +125 °C
- 0 - 100 % rF
- (0.3 °C) ± 1.8 %

40EUR

http://www.mikrocontroller.net/mc-project/Pages/Projekte/Wetterstation/sensors/SHT75/SHT75.html [http://www.mikrocontroller.net/mc-project/Pages/Projekte/Wetterstation/sensors/SHT75/SHT75.html] http://www.mikrocontroller.net/topic/145736#1705005 [http://www.mikrocontroller.net/topic/145736#1705005]

Ground Temperature

WMO guidelines

DS18S20

5cm above Ground

WMO guidelines

DS18S20

Pressure

Absolute Pressure

Bosch BMP086 High Precision Sensor

Wind

Wind-Speed

Anemometer

Radius	68mm
Cup-Diameter	30mm
Cup-Depth	15mm
Shaft Diameter	4mm

Wind-Direction

Arrow-Fin

Length	225mm
Dist-Tip-to-Center	90mm
Dist-Center-to-Vane-End	135mm
Cup-Diameter	48mm
Cup-Height	28mm
Shaft Diameter	4mm

Experimental UltraSonic Anemometer

http://www.sander-electronic.de/be00007.html [http://www.sander-electronic.de/be00007.html]

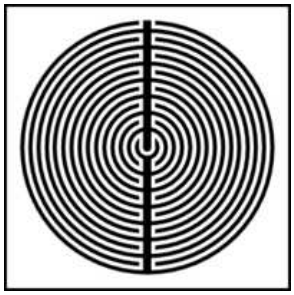
Rain

Rain-Detection

(fast response)

Conventional heated Rain Detection sensor

- heated surface
- draws a lot of power



Alternative new Rain Detection sensor

In time the heated sensor should be replaced by a new type of rain detection sensor that matches the following points:

- no heated elements
- low power consumtion
- acurate and fast rain-on and rain-off detection
- maintenance free

Rain-Volume

Solar Radiation

Pyranometer

http://www.umnicom.de/Elektronik/Projekte/Wetterstation/Sensoren/Pyranometer/Pyranometer.htm [http://www.umnicom.de/Elektronik/Projekte/Wetterstation/Sensoren/Pyranometer/Pyranometer.htm]

PV Reference Module

E-Field Mill

http://www.qsl.net/dh1stf/ [http://www.qsl.net/dh1stf/]

Beta/Gamma Radiation

Having the ability to freely access a global network of distributed ionizing radiation sensors will help to identify areas with elevated radiation levels in case of accidents,

catastrophes or natural disasters. This is another step to free ourselves from corporate/governmental media spinning.

Humans will have to continue to use *dangerous* substances which - if handled poorly - may have devastating effects on the environment habitable to us and of course are also very harmful to our bodies if we come into direct contact. Unfortunately, most of them we simply can't see, touch, hear or smell, which makes them somewhat unreal to our *primitive* brain when it comes to assessing danger.

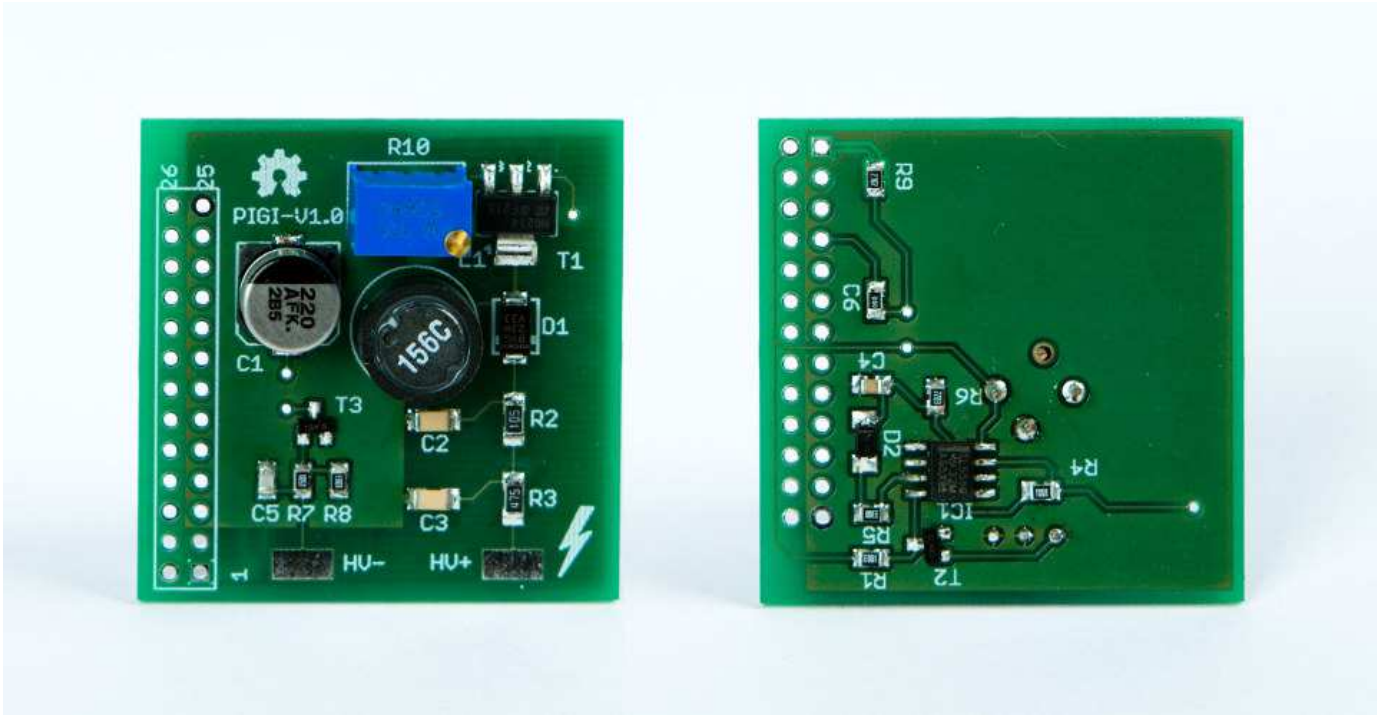
Accidents like the Three Mile Island and catastrophes like Chernobyl and Fukushima have shown that official numbers for the radiation levels always seem to be tweaked/faked, to keep people calm.

Counting Tubes

The following alpha/beta/gamma geiger-müller tubes have been obtained and tested:

- Frieseke & Hoepfner FHZ 76 V 0-1 r/h (low dose beta/gamma counting)
- Frieseke & Hoepfner FHZ 74 V 0-50 r/h (high dose beta/gamma counting)
- LND 712 (alpha/beta/gamma counting)

Using the PiGI Interface



The PiGI - Raspberry Pi Geiger-Müller Interface was designed in such a universal way, that it can be used for Argus as well. It creates the required high voltage for the tubes and inverts the counting impulses of the tube into falling edges, captured by interrupt driven software on the sensor controller.

You can watch live data on the Aquarius HAB (Indoor) VFCC Dashboard [https://apollo.open-resource.org/flight-control/vfcc/#/dashboard/db/aquarius-hab-environment-indoor]

Other implementations done before

- https://sites.google.com/site/diygeigercounter/software [https://sites.google.com/site/diygeigercounter/software]
- http://www.dc3yc.homepage.t-online.de/geigersensor.htm [http://www.dc3yc.homepage.t-online.de/geigersensor.htm]
- http://www.umnicom.de/Elektronik/Projekte/Wetterstation/Sensoren/GammaDetektor/GammaDetektor.htm [http://www.umnicom.de/Elektronik/Projekte/Wetterstation/Sensoren/GammaDetektor/GammaDetektor.htm]

Power Supply

According to WMO guidelines, the external Environmental Monitoring Station (EMS) has to be placed at a specific minimum distance (see WMO guidelines) from any structure that might influence the measurement results (especially wind/temperature). Therefore the unit has to be equipped with its own solar power supply. The following calculations will be a first estimate to design the system at 12V nominal voltage with a 1-day reserve (i.e. no sun at all):

Estimated Power consumption

As of now it seems impossible to me to predict the average power consumption. I can only assume that the base consumption level will have to cover the uC and the fan, the uC will consume 20mA worst case, the fan about 40-50mA, the sensors may not exceed 5mA altogether. The unpredictable part is rain, because the rain detector must heat the plate up, when it's raining and will draw significantly more power (and the sun isn't shining when it rains, so all heating power will be drawn from the battery. My best avg. guess (and slightly skewed downwards in favor of “do it anyways”) will be an average power consumption of about 150mA :) Alternatively it would be wise to come up with a new, reliable scheme for fast and accurate low power rain detection that won't need to burn energy (evaporating the water on the sensors surface in order to detect “no more rain” more quickly) for its basic mode of operation.

Estimated average Power consumption for 24h operation:

$$12\,V \times 150\,mA = 1.8\,W \times 24\,h \approx 44\,Wh + 10\,\%\,Losses \approx 50\,Wh$$

Calculation for 1-day reserve:

$$50\ Wh + 30\ \%\ reserve\ margin\ \approx 65\ Wh$$

Estimated Battery capacity:

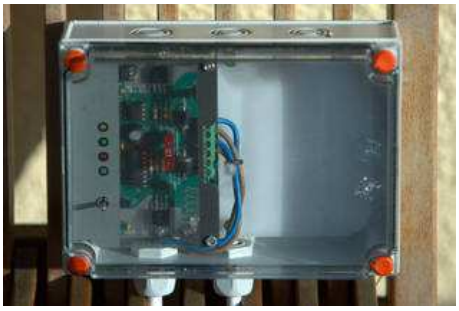
Due to the cyclic nature of this system, the battery must not be drained more than 50% of its capacity, in order to get at least 800-1k cycles out of it. The goal should be at least 3 years here - batteries take up a lot of resources to get produced - so one should consider giving them a long life. The estimated capacity (6Ah) has to be doubled to 12Ah to accommodate this.

$$\frac{65\ Wh}{12\ V} \approx 6\ Ah \times 2 = 12\ Ah$$

Solar panel estimation:

$$30\ Wp \times 4\ h = 120\ Wh$$

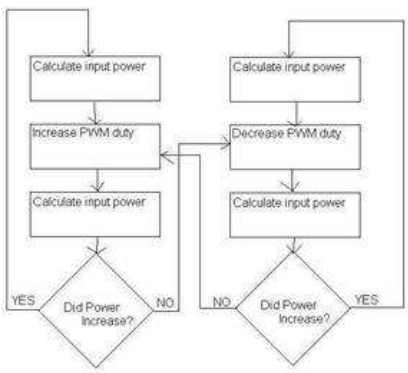
So, a 30Wp panel should cover the system easily, I got lucky and shot a new mono 30Wp Panel for about 30Eur at ebay, so there should be plenty of capacity for extensions.


MPPT Charge Controller

In order to get familiar with MPPT battery charge controller I plan to build an ATmega based controller to handle peak power tracking to suck every mW of obtainable energy out of it. → Fork Subproject

```
Basic MPPT Algorithm:

void FindMPP(void)
{
   PWM++;
   newpower = rawW;

   if(newpower == oldpower){
      PWM = PWM-INC;
   }

   if(newpower > oldpower && direction == UP && PWM < MAX){
      PWM = PWM+INC;
   }

   else if(newpower > oldpower && direction == DOWN && PWM > MIN){
      PWM = PWM-INC;
   }

   if(newpower < oldpower && direction == UP){
      PWM = PWM-INC;
      direction = DOWN;
   }

   else if(newpower < oldpower && direction == DOWN){
      PWM = PWM+INC;
      direction = UP;
   }

   oldpower = newpower;
}
```



Power Converter

5V System Supply

Based on LM-2672M5.0 (1A Simple Switcher Buck Converter) with >90% efficiency.

Supply for MR3020 Wireless LAN Node

3.3V System Supply

For ATmega and Sensors

Controller

Atmega 328p

Fuses: low=0xFF high=0xD9

```
read fuses: avrdude -pm328p -cavrisp2 -Pusb -v -U hfuse:r:-:i
write fueses: avrdude -p m328p -c stk500v2 -P /dev/ttyUSB0 -v -U lfuse:w:0xFF:m
```

wlan tp-link tl-mr3020 argus research antenna hack network openwrt node drone

Linkbacks

Use the following URL for manually sending trackbacks: https://apollo.open-resource.org/lib/plugins/linkback/exe/trackback.php/lab:argus

Discussion

m0e42
2013/04/11 10:41

> Nice Hack you doing there. Found an other blog Post about the Antenna thing. http://blagg.tadkom.net/2012/09/15/better-wr703n-antenna-mod/comment-page-1/#comment-351 [http://blagg.tadkom.net/2012/09/15/better-wr703n-antenna-mod/comment-page-1/#comment-351]
>
> There is a little tricky Problem when you unsolder th J1 resistor. Then you break up connection to C29, C31. This will result in a really poor signal quality. Hope this helps a bit improving your nice Project.
>
> so far… m0e

chrono
2013/04/11 22:04

> Thanks for the feedback, it was certainly the other way around when I tested it back then and I didn't encounter any problems or inferior performance with this hack. However, a long time has passed since then, so maybe alternative hacks may even perform better, so I'll have a look into it and try to take another one apart, so that we can compare both approaches directly.
>
> The only components that are cut off by this hack are C42 and C43 (for the TL-MR3020) directly at the “foot-point” of onboard-antenna 2. So I guess you're referring to the config of the WR703 (C29,C31)?
>
> One question still remains: What is the purpose of these capacitors? I presumed these were to match the impedance of the onboard-antenna to the 50 ohm stripline which wouldn't be necessary when connecting to an external 50 ohm antenna with coax.
>
> Time to compare! :)

Ivan
2013/07/24 11:27

> Hello What s the type of coax cable to antenna? Thanks for article.

chrono
2013/07/24 12:28

> This one is RG-316 but you can also use RG-174. If you keep the length below 25cm the loss is less than 0.5dB in both cases.

Ben West
2013/09/12 18:53

> Those two caps are probably used for tuning impedenace on the patch antenna integrated into the PCB. It should be noted that dead-bugging on the coax pigtail to accommodate an external antenna is not going to have as ideal of impedance control as the integrated antenna. In effect, this mod is expecting the increased gain of the external antenna to compensate for signal loss occurring from the reduced impedane matching.

I've modded a couple TL-MR3020's as shown to support external 7dB dipole duck antennas. However, one of the APs does seem to have noticeably less receive sensitivity, despite the mods being identical.

chrono
2013/10/15 08:29

Yeah, my guess exactly. The SoC has 50 ohm impedance and should present those 50 ohms to the antenna connector. I am not sure how good modern PCB antenna simulators have become so that it might be possible to design the antenna directly to match 50 ohm at the feedpoint.

At the moment I am using this particular setup productively with a simple external 1/4 dipole antenna. There is a solid 72MBit RX/TX 802.11n link to another 3020 (Hacked 3020 + external ANT (Client Mode) → Regular 3020 (AP Mode).

```
rx bytes:       4156061
rx packets:     52615
tx bytes:       22038702
tx packets:     44138
tx retries:     185
tx failed:      140
signal:         -49 [-49] dBm
signal avg:     -48 [-48] dBm
tx bitrate:     72.2 MBit/s MCS 7 short GI
rx bitrate:     72.2 MBit/s MCS 7 short GI
authorized:     yes
authenticated:  yes
preamble:       short
WMM/WME:        yes
```

However, of course this hack only really makes sense if you want to use a directional or stocked omni antenna, either for backhauling or specific targeting in a noisy environment when the system gain outweighs the losses introduced by the additional connection.

Mitar
2014/01/19 23:35

Comment from Adrian on on the mailing list concerning AR9330 (https://lists.sudoroom.org/pipermail/mesh/2014-January/000765.html [https://lists.sudoroom.org/pipermail/mesh/2014-January/000765.html]):

The AR9330 is a 1×1, single radio chain device. It's not doing MIMO. It's doing classic fast diversity and antenna signal mixing, rather than MIMO.

That is, there's an antenna switch that selects antenna A or antenna B. The software can program which one to default to, and if it has time it'll try sampling the preamble signal level on both antenna A and antenna B before choosing which is “better”.

The slow diversity (slowdiv / antcomb in the ath9k source) is where the LNA inputs can be mixed in certain ways before being sent to the baseband for RX processing. The configurations (from memory) are A, B, A+B, A-B. It's not doing MIMO - there's only one radio chain and the mixing is done via a real bonafide analog mixer. (MIMO here is where there's much more signal analysis and correlation done in the digital domain.)

You can actually do both on the AR9330 if you know what you're doing and if the board is wired up the right way.

Yes, if someone pops up on the ath9k-devel mailing list and asks, I'll do my best to make it happen.

chrono
2014/01/20 11:00

Sweet, thanks for sharing, if you're on the ML, why don't you ping Adrian about it, otherwise I'll join the ath9k and ask him myself :) I'd also be willing to send one of our 3020 to him to have a specific board to tinker with. Since we've got a surplus board after cosmo sponsored one more 3020 we can easily afford to give one away for research in this direction.

Mitar
2014/01/20 17:47

I think it would be best if I would not be a messenger here.

chrono
2014/02/09 09:43

Fair enough :)

Ariful
2014/02/09 09:25

I don't understand, J4 and the ground that you've said is connected actually, then connected antennas core and the shield like you've said is same as make them short,

please explain

chrono
2014/02/09 09:36

How is J4 connected to GND? I mean, is it on your particular board? When I look at the picture above, I can see J4 clearly being routed in between the groundplane, left side coming from the AR right side going to the PCB antenna but no actual connection. The only thing I think I could imagine you mean is that the onboard pcb antenna itself provides a connection to GND again. When you remove J4 and solder the coax cable to the left part of J4 it's not a problem anymore since you disconnected the rest of it by removing J4. Also, although it might look funny, in terms of HF/antennae it's a valid construct and not a simple short circuit :)

Ariful
2014/02/09 22:32

I have removed my J4 but both of its land still connected, that's why I confused, is my board wrong or J4 has no use. Both of pcb antennas still connected with or without J4. Anyway thanks :)

Ben West
2014/02/10 00:06

Do note that the “inverted-F” patch antennas on the MR3020 circuit board are actually extensions of the ground plane. So, with the J4 0ohm resistor still populated, the traces for the antenna signal will appear to be shorted to ground when measured with an ohmmeter, which is normal. http://www.antenna-theory.com/antennas/aperture/ifa.php [http://www.antenna-theory.com/antennas/aperture/ifa.php]

You would need to cut traces forming the two arms of the antenna's “F” shape to remove that connection to the ground plane.

Ben West
2014/02/10 00:18

I modified a couple MR3020's per these instructions, i.e. de-popping J4 resistor and soldering the inner conductor of a pigtail to the exposed pad. However, this appears to expose the device to excessive electrical discharges that can damage the transmit power amplifier inside the Atheros chip. On two occasions, a couple MR3020's so modded and placed at indoor locations appeared to lose ~50% of their transmit power after a lightning storm passed over.

I've since modded a MR3020 and also a WR703N per these instructions below, which involved cutting the “arms” of the interted-F patch antenna and attaching the pigtail there. No removal of J4. This approach does preserve the filtering / matching components on the antenna's circuit, which could have an additional effect of blocking electrical discharges from external sources. So far, no more apparent losses to lightning. https://forum.openwrt.org/viewtopic.php?id=46543 [https://forum.openwrt.org/viewtopic.php?id=46543] https://app.box.com/s/cispknq8b9zgog8k5vxn [https://app.box.com/s/cispknq8b9zgog8k5vxn]

chrono
2014/02/10 09:14

Thanks for coming back with this analysis even though it is unfortunate. It seems the modded routers here have been lucky and never had to withstand strong EM so it never appeared as a problem. I'll put up a warning so that others know. This mod had the charm of not having to mechanically alter the PCB but the purpose of the capacitors that were cut off remained unclear. So although it might work flawlessly we're putting our MR3020's at a higher risk of EM related bricking. According to your comment I'd conclude they're not for matching, but filtering/protecting. I wanted to come up with a more simple approach anyways so I'll update the howto and pics as soon as possible. Just cutting of the long part of the F and using an RP-SMA PCB connector (not even a pigtail) soldered in place should come out nicely and leaving the protective circuit also in place :)

Ben, I am not familiar with this capacitor only based filter/protector design, do you know anything about it and if so, could you elaborate a bit? :)

Ben West
2014/02/10 16:39

I'm afraid I can't shed much light on the precise nature of the various passive components on the antenna path between J4 and the actual patch antenna (or pigtail). The PDF I linked to, which was written by a nice (and thorough!) gentleman in Australia, does show a reverse-engineered schematic for the antenna circuit on a WR703N. That schematic shows in detail the filtering / matching components on the WR703N, so I'm assuming it is very similar on the MR3020.

As for filter components, there is a PI impedance-matching circuit immediately before the F (also shown on the WR703N schematic above), and likely also various inductors and resistors scattered about. They just all look the same at such small-scale SMD. :)

http://en.wikipedia.org/wiki/Antenna_tuner#Pi_network [http://en.wikipedia.org/wiki/Antenna_tuner#Pi_network]

chrono
2014/02/24 10:07

Thanks again for supplying more information about this issue. It wouldn't be fun if it wasn't a learning experience as well :) I've put the revisited MR3020 antenna hack online now. Hopefully, this will do much better :)

Ed
2014/05/11 21:04

Thanks for the guides. Actually there is a datasheet link for AR9331 chipset under Hardware Summary Section.

Ál
2014/05/16 14:23

Thanks a lot for your post!

I want to ask you how put router in idle mode (or is it just doing nothing?)

chrono
2014/05/16 16:55

Yeah, idle is just the basic hardware/network/operating system online, with all mandatory services running but no “active” sessions on the router and no traffic going through it.

Roger
2014/08/22 07:37

You mention low power ARM CPU, and embedded ARM, but actually the mr-3020 uses a MIPS CPU (which is lower power that the ARM equivalent). It's also worth mentioning the MR3040 which is the same SoC but has a battery pack built in. Simple portable projects this gives about 5 hours of battery life.

Roger.

chrono
2014/08/22 08:48

Fixed. Thanks. The original draft was on a different (ARM) platform which later became just a meta term for *“The embedded SoC I picked because it was available/cheap/best suited for my use case and I really don't care whether it's ARM or MIPS since GNU/Linux and everything else relevant can be compiled to run on both”* and I forgot to change it in the text. But yeah, talking a lot about ARM and then listing a MIPS device makes no sense at all. The MR3040 sounds sweet, I'll have to have a look :)