



Reverse Engineering Online Challenge 2023

Disassembling the router NetComm ADSL Wi-Fi N300 Gateway



Team 764A



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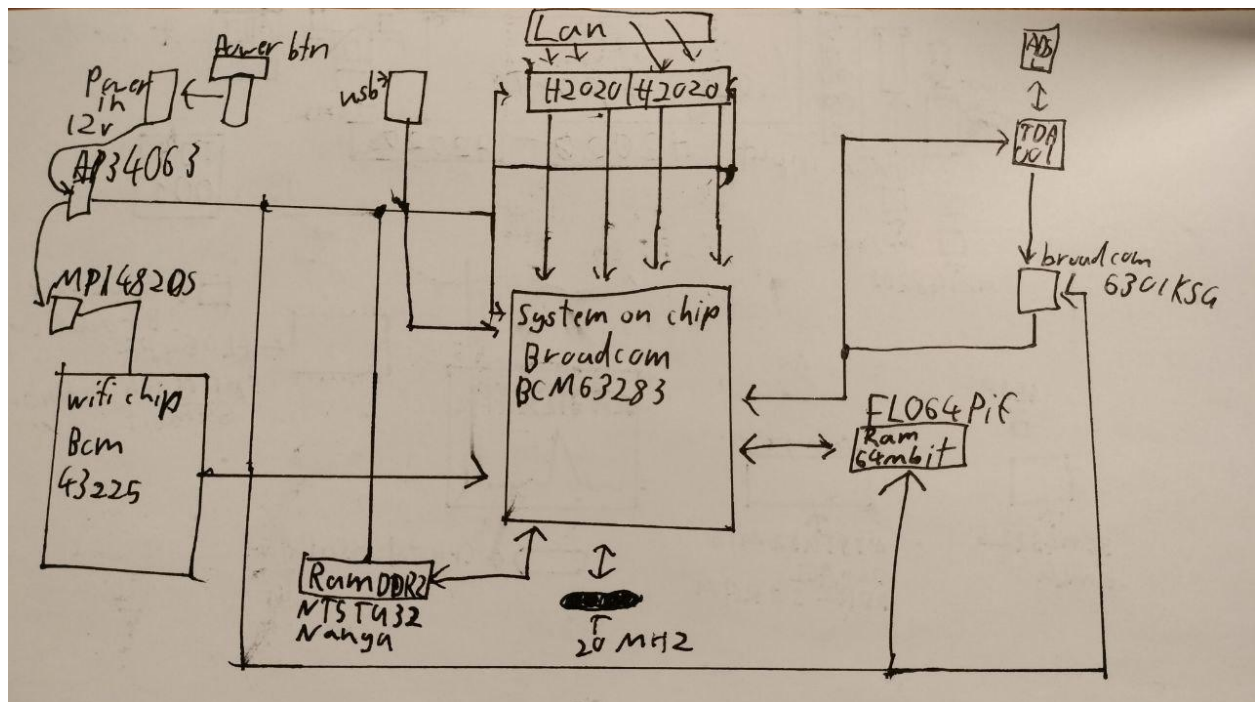
Summary Report

As a team, we asked our parents to collect different electronic devices. We had many devices to select from a remote controller, an internet router, an electronic toy train, electric weights, and a calculator.

It was not easy to select only one device. We looked inside the remote controller as this device was like a Vex IQ controller. But, when we checked, it was very simple and didn't have many elements. The train had an even simpler structure. We all wanted a challenge that we could do together as a team and split the work. We all decided to select a router.

Each of us took time to unscrew the router. The bolts were very tiny and the tools were not as small as needed to remove the bolts. Eventually, we opened the router box and found a board with elements and an antenna. All elements on the board were glued and can't be removed. Each of us tried to remove them without success.

Our next step was to concentrate on the elements board. We decided that we can't find all elements during our Saturday lesson and created a table for homework. Each of us added a description to elements in the table. We were looking for elements, their purpose, and links to the datasheet. Our main challenge was that internet descriptions were complex and not all information was available. We decided to take small steps and create a simplified router picture.



The Wi-Fi chipset (BCM43225) is the system on the chip. It supports Wifi 802.11n also known as Wifi 2. It helps other devices connect to the router without cables.

The system on the chip (BCM63283) is the main element that controls other elements. It's called a processor. It integrates ADSL/ADSL2+ features, routing, and external Wireless NIC. This SoC is widely used by most xDSL platforms in the world.

The Architecture is based on a standard MIPS32 Big Endian Instruction Set. It consists of an integrated 4-port LAN switch as well.

The router has two types of memories. RAM - memory is used to store information when the router is switched off. Flash memory helps to make router devices fast and move a lot of information through them. AP34063 is used to change the power that's coming to the device into the one that is needed inside the device.

The antenna sends out radio waves to other devices and receives them from them.

LAN ports by devices that don't have Wi-Fi. It was an interesting finding as it can help many different devices even those without Wi-Fi. LEDs are used to show when there is internet or when there is no internet. Now we know how to check if there is an Internet at home.

The router reverse engineering process was a fun and one of the most interesting lessons that we ever had in our classroom. We are happy that we selected this device.

Word count 492.

Disassembly Process



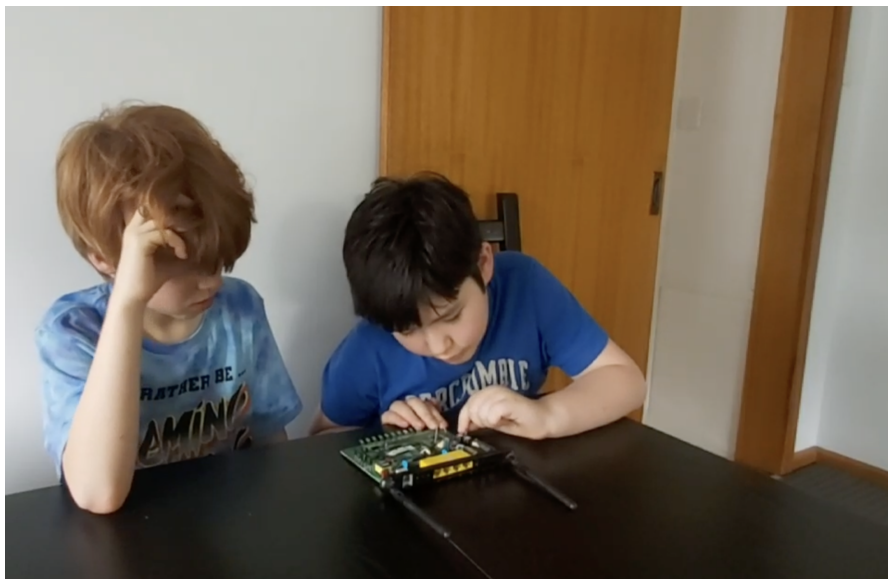
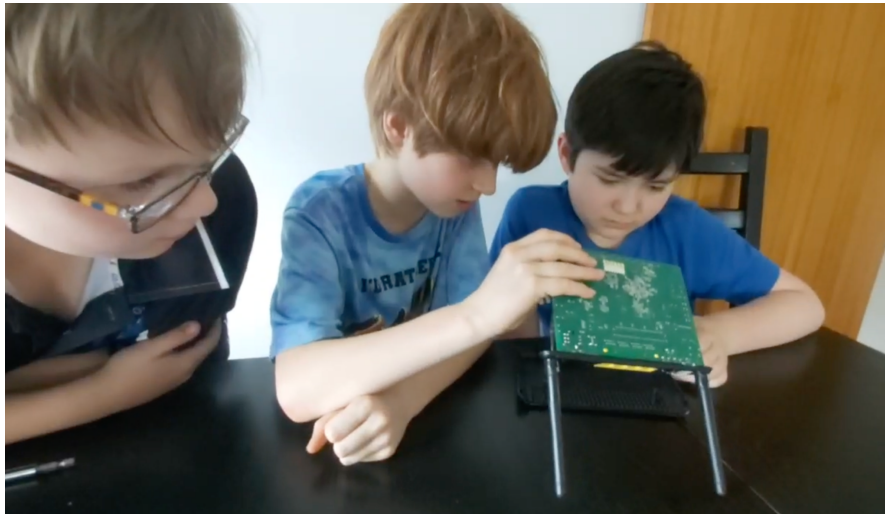
Tim has started disassembling the router.



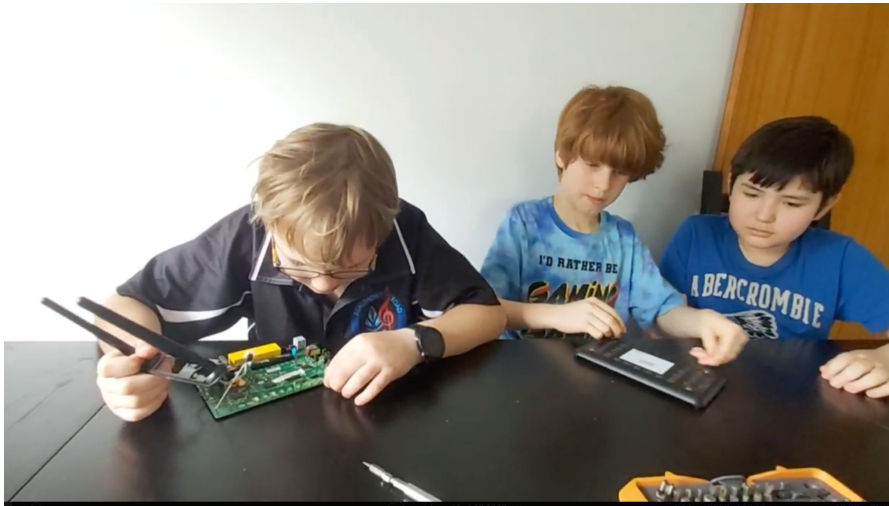
Tim and Maks working together on tool selection.



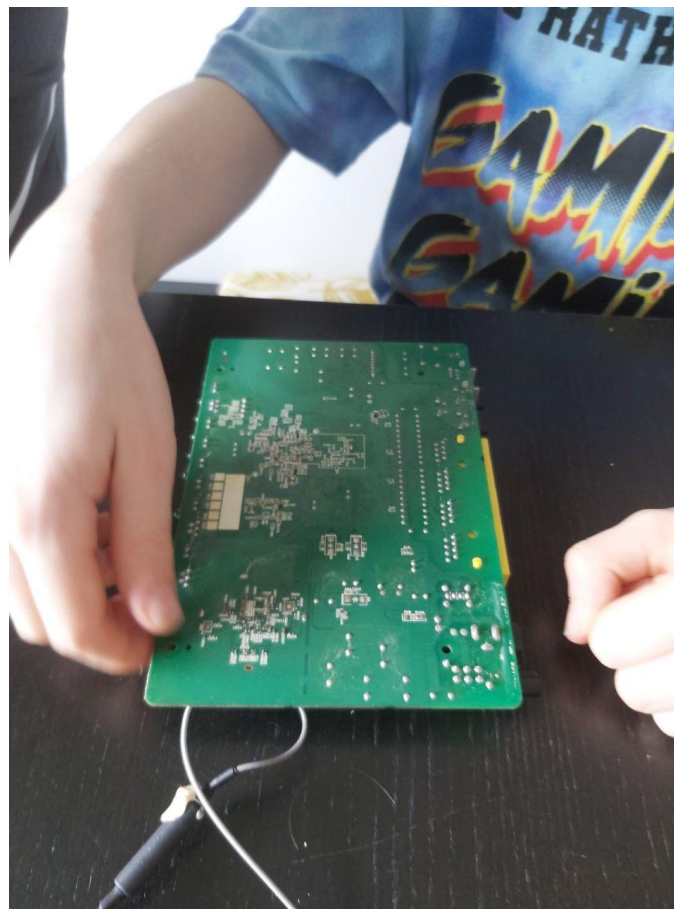
Maksim takes a turn to remove the next bolt.



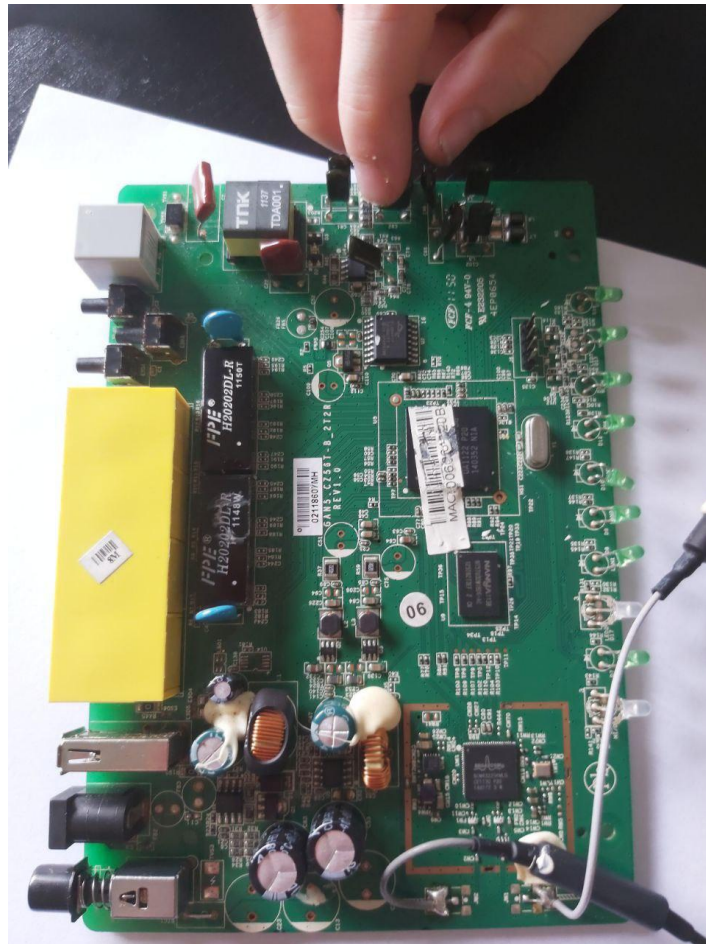
Victor opens the device.



Tim: Some things are obvious from the first look: for example, the antenna is connected to the base and shares the internet with other devices.



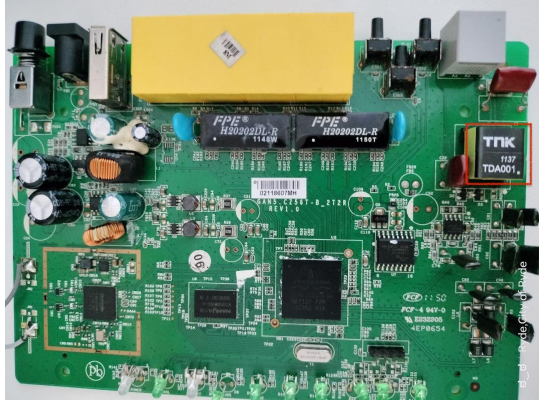
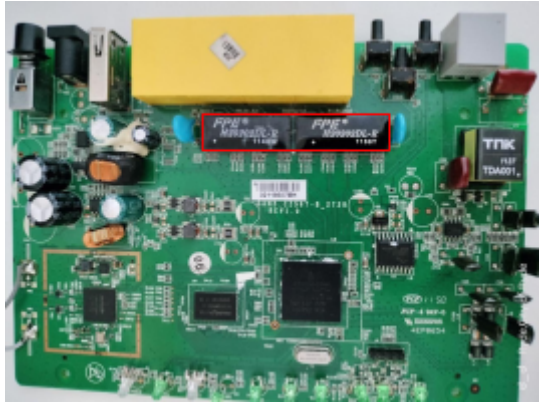
This is the back side of the router with all elements glued to the base.


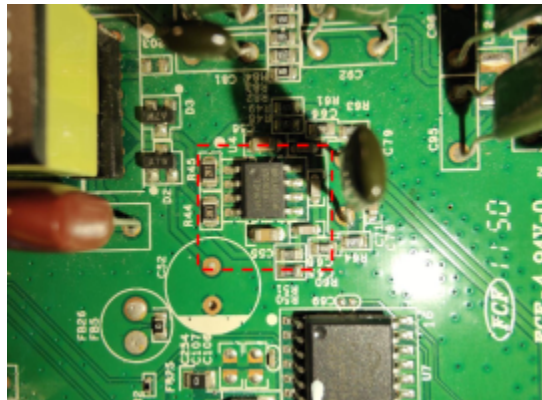


This is the Front Side with all elements.

Elements Analysis

Main Elements

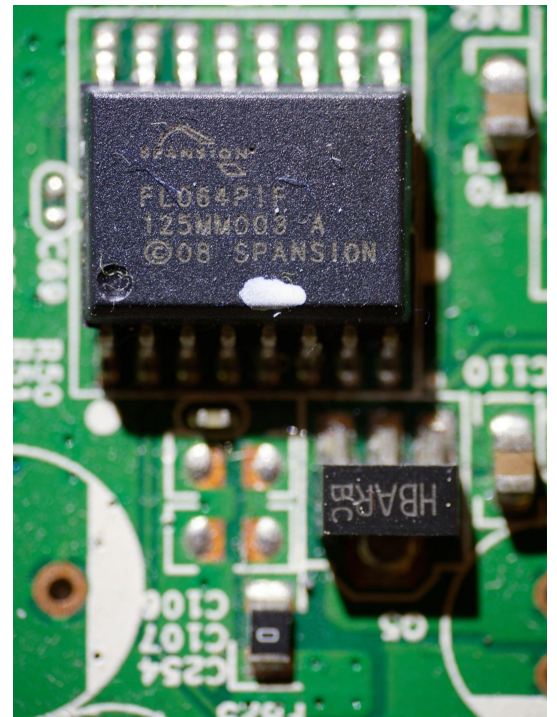
Name	Description	Link	Photo
TDA001	ADSL Line Transformer	https://www.alldatasheet.com/view_datasheet.jsp?Searchword=TDA001	
H20202DL-R (2) 10/100 Base-T Transformer Modules	10/100BASE-T DUAL TRANSFORMER MODULES	https://datasheets.pdf.com/datasheet/H20202DL-R.html	

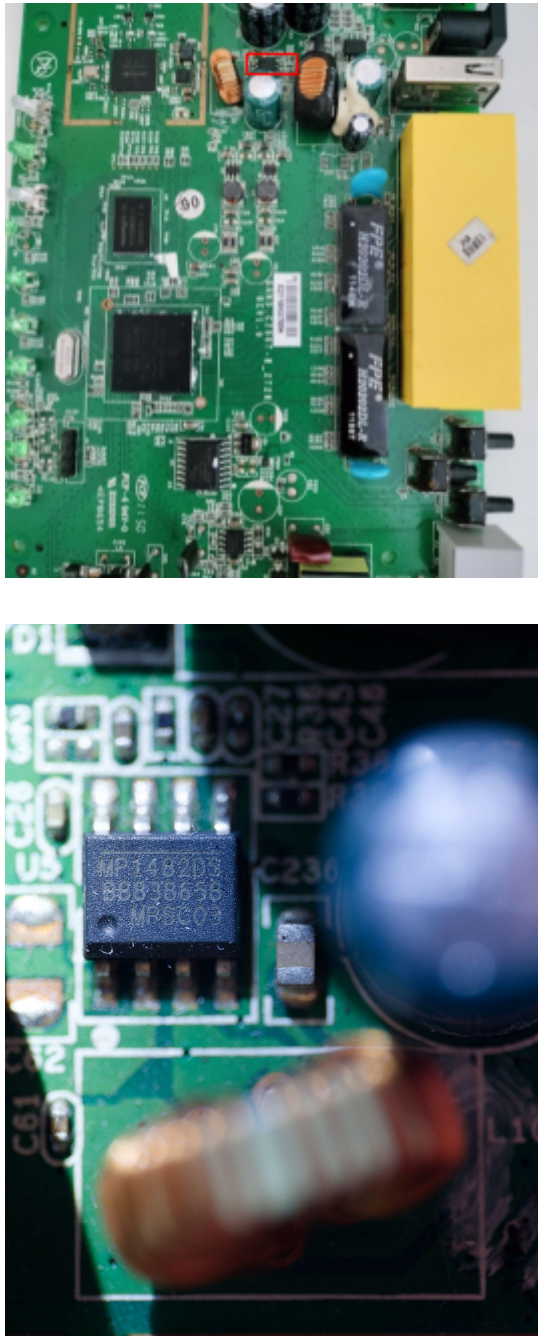
<p>NT5TU32M16 D6-ACI DDR2 SDRAM</p>	<p>Double Data Rate 2 Synchronous Dynamic Random-Access Memory</p>	<p>Not exact element, similar: https://www.alldatasheet.com/datasheet-pdf/pdf/1145620/NANYA/NT5TU32M16EE-ACA.html</p>	
<p>6301KSG BROADCOM</p>	<p>This element monitors the supply voltage of any electronic system, and generates the appropriate Reset signal.</p>	<p>https://www.kynix.com/Detail/259308/MAX6309UK30D4-T.html</p>	


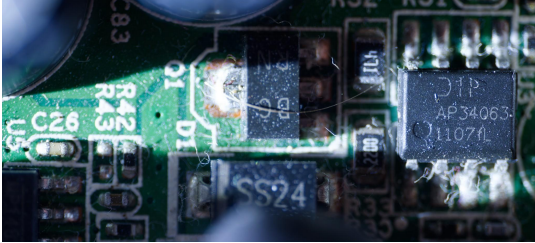

FL064PIF
Spi Flash
Memory
64Mbit.

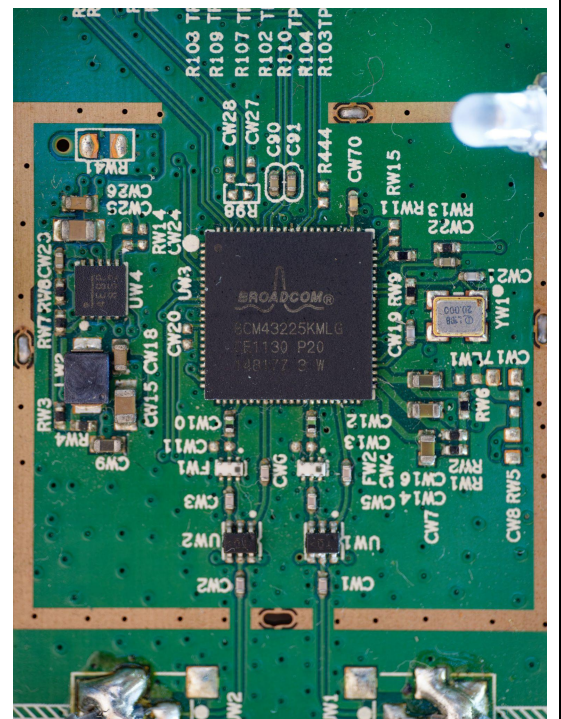
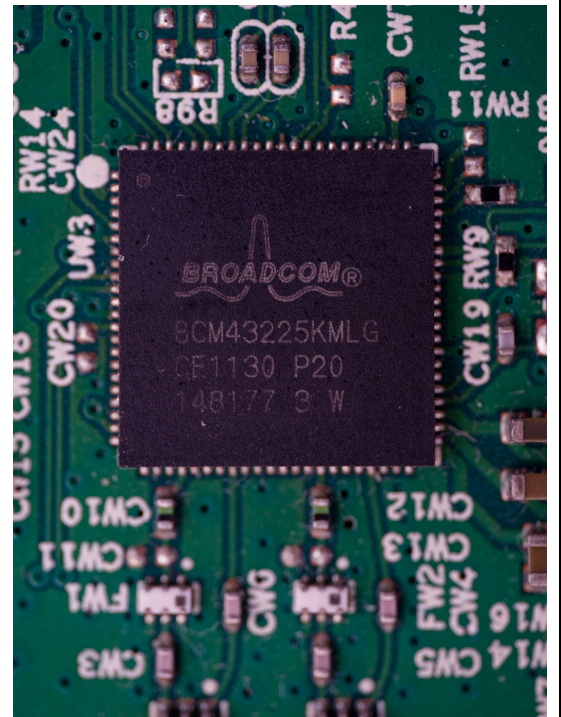
SPI Flash memory, also known as Flash storage, is commonly used for storage and data transfers in portable devices.

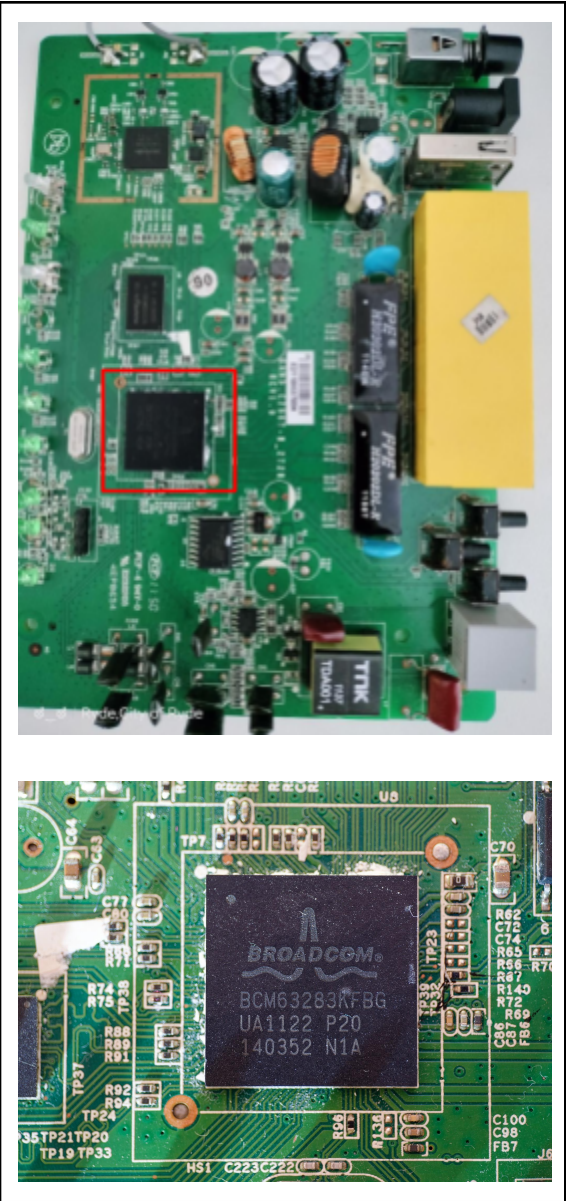
<https://datasheet.pdf.com/datasheet/FL064P.html>



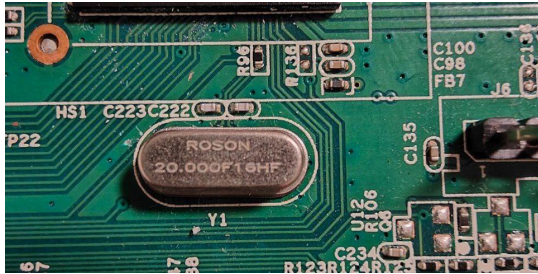


<p>MP1482DS</p> <p>Monolithic Power Systems</p>	<p>Monolithic Power System which steps down voltage (current) from its input (supply) to its output (load). The MP1482 is a monolithic synchronous buck regulator. The device integrates two 130mΩ MOSFETs, and provides 2A of continuous load current over a wide input voltage of 4.75V to 18V. Current mode control provides fast transient response and cycle-by-cycle current limit.</p>	<p>https://www.alldatasheet.com/datasheet-pdf/pdf/551573/MPS/MP1482DS.html</p>	 <p>The top photograph shows a green printed circuit board (PCB) populated with various electronic components. A large yellow electrolytic capacitor is prominent on the right side. A red rectangular box highlights a small component near the top center. The bottom photograph is a close-up view of the MP1482DS integrated circuit (IC) mounted on the PCB. The IC is a square package with multiple pins. The text 'MP1482DS', '88838658', and 'MPSC03' is visible on the top surface of the chip. A large blue electrolytic capacitor is also visible in the background of the close-up.</p>
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AP34063	<p>DC-DC converter is a device that temporarily stores electrical energy for the purpose of converting direct current (DC) from one voltage level to another.</p>	<p>https://www.diod.es.com/assets/Datasheets/products_inactive_data/AP34063.pdf</p>	 
BCM43225 KMLG	<p>Wi-Fi chipset</p> <p>RF System on a Chip - SoC SINGLE-CHIP LOW PCI-E. A system on a chip or system-on-chip (SoC is an integrated circuit that integrates most or all components of a computer or other electronic system. These components almost always include a central processing unit (CPU), memory interfaces, on-chip input/output devices, input/output interfaces, and secondary storage interfaces.</p>	<p>https://www.mouser.com/ProductDetail/Broadcom-Avago/BCM43225KMLG?qs=AsTZqt%2FmegmyxPcknD2wyQ%3D%3D</p>	



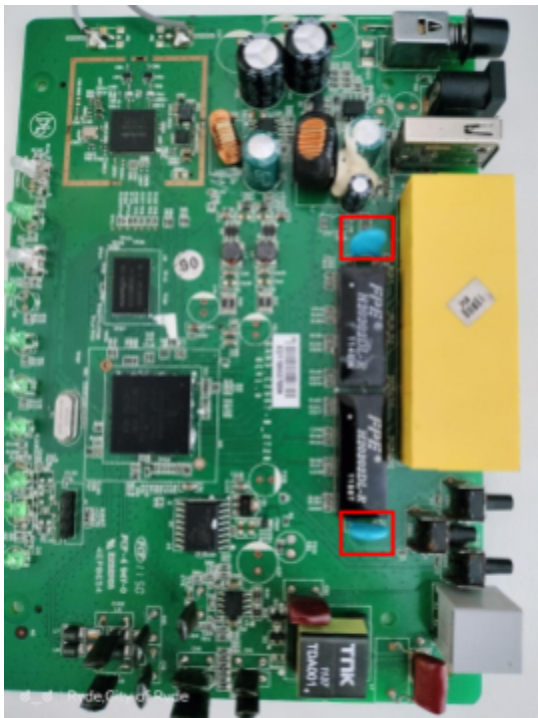

<p>BCM63283KF BG</p>	<p>System on a chip, processor</p>	<p>http://ntcomponents.com/Part-Details/BCM63283KF-BG/1/3037502.html</p>	 <p>The top photograph shows a green printed circuit board (PCB) populated with various electronic components. A red rectangular box highlights a large, dark, square integrated circuit (IC) located in the center of the board. Other visible components include capacitors, resistors, and a yellow heat sink on the right side.</p> <p>The bottom photograph is a close-up view of the IC highlighted in the top photo. The chip is a Broadcom BCM63283KFBG, a System on a Chip (SoC) processor. The text on the chip includes "BROADCOM", "BCM63283KFBG", "UA1122 P20", and "140352 N1A". The chip is mounted on a green PCB with various surface-mount components and test points visible around it.</p>
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Crystal oscillator	<p>Crystal oscillator is used for providing a stable clock signal. This is very important because we want to make sure that the router transfers the correct information. Our research shows that precise time is used for security reasons.</p> <p>Frequency Nom: 20MHz</p>		 



Inductors

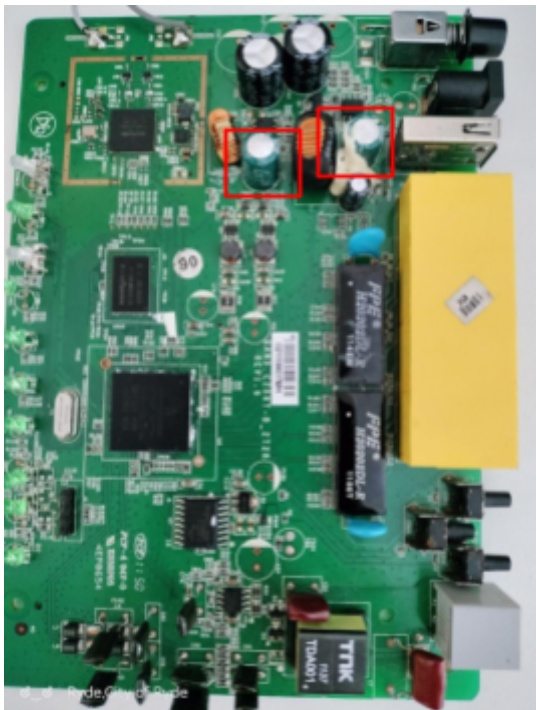
Inductors (2)	<p>An inductor is an electrical component that stores energy in a magnetic field when an electric current flows through it.</p>	<p>https://www.tinyosshop.com/index.php?route=product/product&product_id=584</p>	
Power Inductor 3R3 (2)	<p>Chip inductors thin wires or film-wrapped coils on a core and are used for storing energy.</p>	<p>https://www.alldatasheet.com/datasheet-pdf/pdf/1411747/AITSEMI/3R3.html</p>	

Capacitors

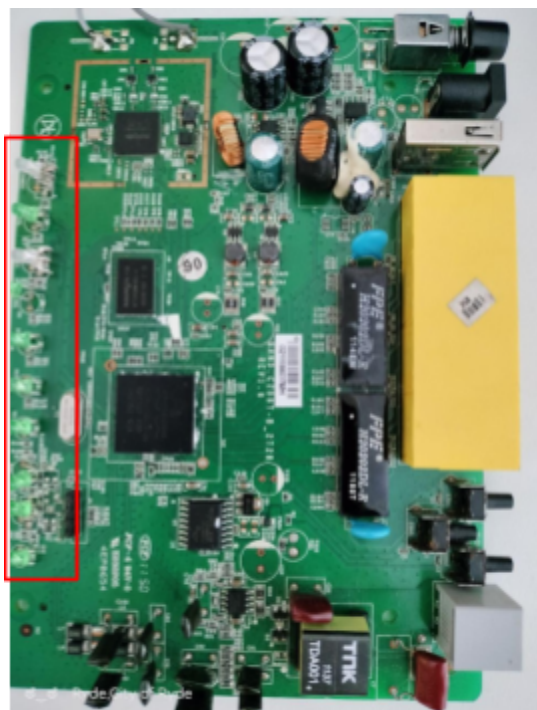
<p>102 3kv Disc Ceramic Capacitors (2)</p>	<p>A ceramic capacitor is a fixed-value capacitor where the ceramic material acts as the dielectric. It is constructed of two or more alternating layers of ceramic and a metal layer acting as the electrodes (A capacitor is a device that stores electrical energy)</p>	<p>https://en.wikipedia.org/wiki/Ceramic_capacitor</p>	
<p>333j 400v Film Capacitor</p>	<p>Film capacitors are electrical capacitors with an insulating plastic film as the dielectric, sometimes combined with paper as the carrier of the electrodes. Film caps can have higher inductance.</p>	<p>https://en.wikipedia.org/wiki/Film_capacitor</p>	



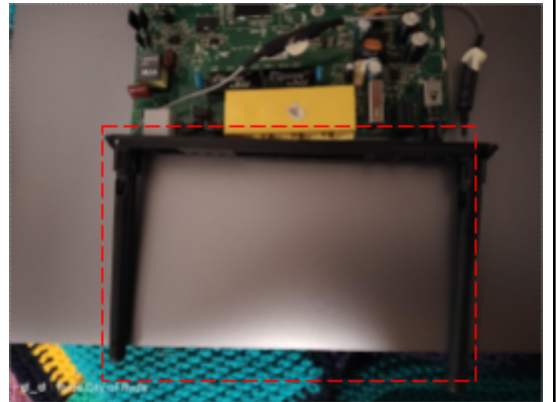
<p>394j 100v Polyester film capacitor</p>	<p>Polyester film capacitors are a type of film capacitors which use polyester as the insulation material.</p>		
<p>Polyester film capacitor 2A393J (2)</p>	<p>Polyester film capacitors are a type of film capacitors which use polyester as the insulation material.</p>	<p>https://pdf1.alldatasheet.com/datasheet-pdf/view/274512/CHEMI-CON/HACD3A393J.html</p>	

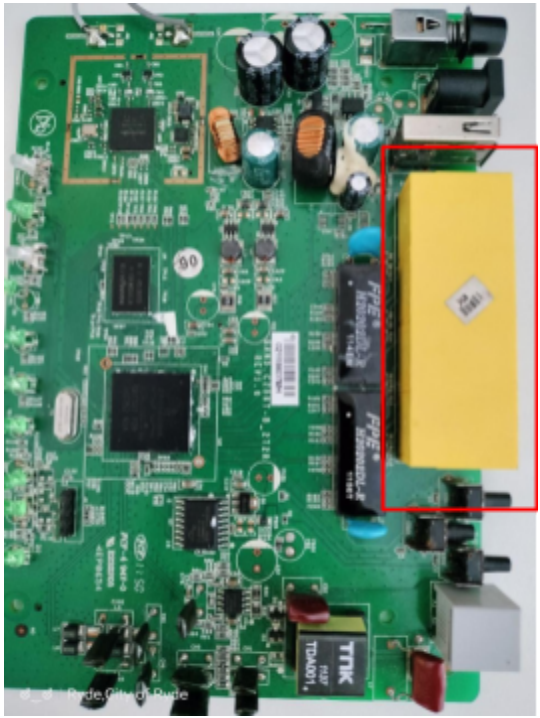

<p>Polyester Film Capacitor 2A332J (7)</p>	<p>Polyester Film Capacitor 100V, similar to capacitors above.</p>		
<p>Capacitor Aishi CD81 PET (2 big and 1 small)</p>	<p>RADIAL LEADED CAPACITOR are designed for low to high capacitance and voltage.</p>	<p>https://aishi.us/#radial-leaded</p>	




<p>Electrolytic Capacitor (2) 4700uF</p>	<p>Radial Aluminium Electrolytic Capacitors are typically used in power supplies and DC-DC converters for smoothing and buffering rectified DC voltages in many electronic devices.</p>	<p>https://projectpoint.in/index.php?route=product/product&product_id=497969983668</p>	
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Communication and Power Elements

<p>LEDs (10)</p>	<p>LEDs on the router indicate the status of the connection between the router and the devices that are connected to it. They also indicate the status of Internet, WiFi, Ethernet.</p>		
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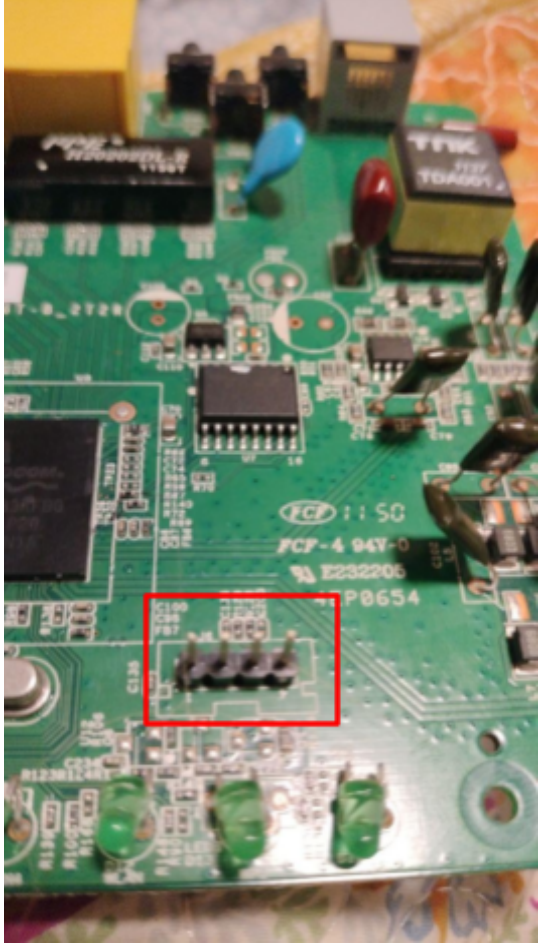
			
ADSL socket	Asymmetric digital subscriber line (ADSL) is a type of digital subscriber line technology, a data communications technology that enables faster data transmission over copper telephone lines than a conventional voiceband modem can provide.	https://en.wikipedia.org/wiki/ADSL	
Antenna (2)	Wi-Fi routers have a transmit and a receive antennas, which are used to communicate wirelessly with other devices.		

<p>LAN (4)</p>	<p>A LAN port is a socket used to connect computers and other devices to the internet.</p>		
<p>Power button</p>	<p>Turns the device on and off</p>		

<p>Power input</p>	<p>Receives energy to power the device.</p>		
<p>Buttons (3)</p>	<p>First button toggle Wi-Fi, the middle button resets the router, the last button enables WPS (Wi-Fi Protected Setup).</p>		<div>  </div> <div>  </div>

<p>USB Port</p>	<p>We think it's possible to connect USB flash drive to the router and then share the content of that USB with other computers. It's called a media or file server.</p>	<p>https://www.gadgetsreview.com/what-is-the-usb-port-on-my-router-for#:~:text=You%20can%20connect%20a%20USB,or%20even%20listening%20to%20music.</p>	
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Unidentified Elements

<p>Unknown element</p>	<p>This element has 4 pins and most likely something can be connected to it.</p>	
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