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Zigbee network optimization: a how-to guide for avoiding radio frequency interference + adding Zigbee Router devices (repeaters/extenders) to get a stable Zigbee network mesh with best possible range and coverage by fully utilizing Zigbee mesh networking

Community Guides zigbee zigbee2mqtt zha deconz

Hedda 45 Sep 2024

Who is this guide for?

I have tried to make this guide to be a comprehensive collection of the most basic yet essential tips with a set of actions and best practice steps that should be applicable to all types of Zigbee setups, regardless of what type of Zigbee adapter/gateway/hub/bridge/devices that you are using.

This guide is meant for both those who are new to Zigbee as well as those who been using Zigbee devices for years but might not been aware of the underlying prerequisites to optimize for stability and performance.

It has been written with a point-of-view in mind of Zigbee solutions that use a Zigbee Coordinator adapter locally via USB dongle/stick or remotely using a serial server over a local network, etc. and as such it definitely applies to all users of Home Assistant ZHA integration 421 , Zigbee2MQTT 313 , and deCONZ (Phoscon) 135 .

Other docs

I have also submitted the essence of this guide to upstream ZHA integration and Zigbee2MQTT docs:

- https://www.home-assistant.io/integrations/zha#zigbee-interference-avoidance-and-network-rangecoverage-optimization 899
  - https://skyconnect.home-assistant.io/connectivity/ 238

- https://www.zigbee2mqtt.io/advanced/zigbee/02_improve_network_range_and_stability.html#reduce-wi-fi-interference-by-changing-the-zigbee-channel 1.1k
  - https://www.zigbee2mqtt.io/advanced/zigbee/01_zigbee_network.html 98

What's in this guide?

Below are some basic yet essential tips and best practices for getting a good Zigbee setup starting point to relatively easily achieve the best possible signal quality, improved coverage, and extended range.

Most importantly it specifically covers what to do and what not to do, especially the importance of avoiding electromagnetic interference (EMI) and also adding many Zigbee Router devices (as repeaters/extenders), both of which are crucial to achiing a stable Zigbee network with no delays (i.e. zero dropped messages/packages and low latency).

Following all these optimization tips below should significantly improve the reception of your Zigbee radio adapter. The below insights describe working around the well-known limitations of low-power/low-bandwidth 2.4 GHz digital radios. It can that way resolve or avoid many known issues caused by interference or poor placement of your Zigbee radio adapter or devices.

Zigbee interference avoidance and network range/coverage optimization

Interference

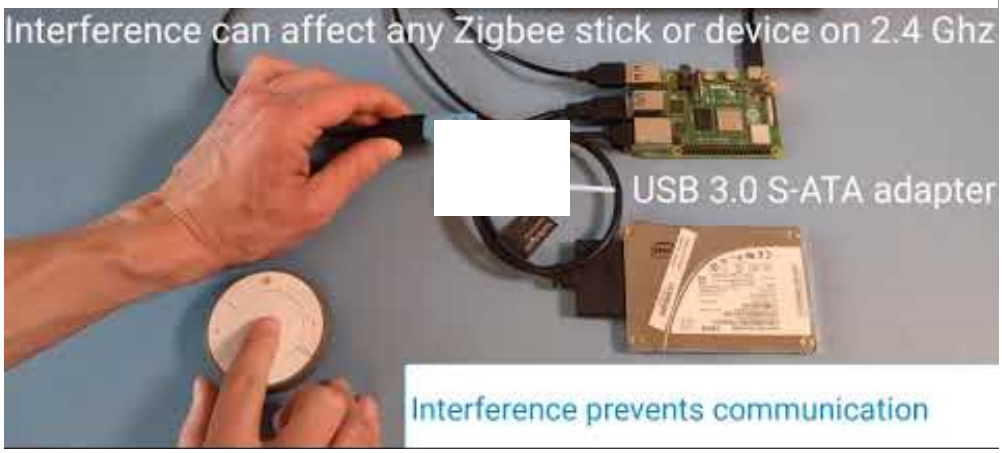
Before you get started with Zigbee, or at least before starting troubleshooting issues/problems with Zigbee any deeper than maybe nessesary, you first need to be aware that all Zigbee devices, and especially the Zigbee Coordinator, can be extremly sensitive to electromagnetic interference (EMI, also known as RMI / Radio-Frequency Interference) 138 , as practically all sources of EMI/RMI are infamously known for sometimes leading to serious Zigbee transmission/reception loss or intermittant connection problems. Therefore you should always take the actions suggested in this guide to avoid keeping any sources of EMF/EMI/RMI interference close to the Zigbee Coordinator adapter or vice versa, (which includes any source with electricity emitting Electromagnetic Fields / EMF).

Symptoms of electromagnetic interference (EMI/RMI)

Symptoms of radio and electromagnetic interference commonly show themselves as reoccurring intermittent failures and errors when sending or receiving Zigbee messages/signals and can cause anything from significant communication problems to weird issues and random degradation in performance that either permanently or temporarily prevent devices from communicating properly with the Zigbee Coordinator, or sometimes even completely block/stops all Zigbee communication.

Home Assistant's video to clearly show Zigbee's symptoms with electromagnetic interference:

Demo: Zigbee interference caused by USB 3.0



Sources of EMI/RMI and EMF

While Wi-Fi routers and WiFi access-point are probably the most well-known sources of interference, you need to understand that all electric devices/appliances, especially computers and computer peripherals, do generate electromagnetic interference (also known as EMI/EMI/RMI, or signal noise in layman's terms) [138] , which can jam or interfere with signals transmissions on the 2.4 GHz radio band frequency, and degrade the wireless communication with your Zigbee adapter/devices.

For example, interference from USB 3.0 ports and unshielded USB peripheral cables are especially infamously known to affect 2.4 GHz radio reception for low-power/low-bandwidth devices. Therefore you should always place your Zigbee adapter far away as possible from any potential sources of EMI/EMI/RMI, preferably by using an adequately long shielded USB extension cable connected to a USB 2.0 port.

Network optimization (optimizing for mesh networking)

You have to understand and remember that each Zigbee device by itself has very limited coverage, short range and their weak signals have poor wall penetration, so to workaround this a Zigbee network technology relies heavily on its use of **mesh networking** 212 architecture which forms "wireless mesh network 19 , where “Zigbee Router” devices (also known as “Zigbee repeaters” or “Zigbee extenders”) will help forward the communication so the messages/packets “hops 9 ” from Zigbee Router to Zigbee Router to rearch its final destination device when the Zigbee Coordinator is not within direct reach or have a week signal reception, and result is that it forms “mesh topology” (a instead of using a more classic “star network 24 ” topology where every device would instead practically only talks directly with a single controller like you usually have in a common WiFi-network, which is a othjer type of network topology 24 where the low-power signals from Zigbee devices do not work well at all).

That means that all devices in a Zigbee network need it to be a “mesh network” and thus really depend heavily on having a swarm of mains-powered “Zigbee Router” devices that are always-on so they can help forward messages within the network, acting both as a signal repeater and range extended by transmitting data over long distances, stengthening the total coverage and distances possible by passing data messages through the Zigbee network mesh of intermediate devices to reach more distant Zigbee devices, (which may or may not have week signals).

Therefore the key to a great and healthy Zigbee network mesh is to add/have many “Zigbee Router” devices relatively close to each other (and always powered on) in order for the Zigbee network as a whole to get good coverage and range, as well as improving the overall robustness and robustness and resilience in the network to handle the loss of some Zigbee Routers in case of failures. So often you more or less just need to add several mains-powered Zigbee devices that can act as “Zigbee Router” devices to get a stable network with good coverage, and keep adding even Zigbee router products to achieve a great Zigbee network.

Simple actions that will improve most Zigbee setups and common root causes of interference

Zigbee adapter hardware

Issue: Bad performance from old/outdated/obsolete Zigbee adapter hardware or poor Zigbee adapter antenna

Action: Buy and use a supported Zigbee USB adapter based on newer/modern chip hardware

Tips:

- Consider a Zigbee adapter that has an external antenna
- While older adapters might work, they could have obsolete hardware or old firmware, which prevents reliable operation

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Issue: Poor or outdated Zigbee adapter firmware on the Zigbee adapter

Action: Update to a later Zigbee chip firmware on the Zigbee adapter. Updating firmware is usually straightforward if the manufacturer or the chip maker provides one

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Zigbee adapters are RFI sensitive and can be very susceptible to all types of EMI/EMF interference

Issue: Poor placement of the Zigbee adapter or wrong orientation of the Zigbee adapter antenna

Actions:

- Use a long USB extension cable to place the Zigbee adapter away from interference and obstacles
- Ensure the USB extension cable is adequately shielded (thick cables usually have this)
- Try different physical placement and orientations of the Zigbee adapter or its antenna

Tips:

- A USB extension cable makes orienting the Zigbee adapter/antenna easier
- The optimal placement of the Zigbee adapter is close to the middle of the house as possible
- Try to place the Zigbee adapter at some distance away from walls, ceilings, and floors
- Try different orientations of the adapter's external antenna (or the whole Zigbee adapter)

Issue: USB 3.0 ports/computers/peripherals are known culprits of RFI/EMI/EMF disruption. (See Ref. 1 [59] and 2 [22])

Action: Make sure to only connect the Zigbee USB adapter to a USB 2.0 port (and not to a USB 3.x port)

Tips:

- If your computer only has a USB 3.x port then buy and connect the adapter via a powered USB 2.0 hub
- Using via USB 2.0 hub will in practice convert USB 3.0 to a USB 2.0 port and thus avoid USB 3.0 EMF
- A USB 2.0 hub that uses an external power supply will ensure power requirements are fulfilled

Action: Shield any unshielded computers/peripherals/devices by adding all-metal enclosures/chassis/casings

Tips:

- Single-board-computers and USB 3.x hard drives are especially known as sources of EMF/EMI/RFI
- Be aware metal casings can decrease the performance of internal/built-in Zigbee adapters
- Also, be sure to use adequately shielded USB cables for any such peripherals/devices too

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Getting better range and coverage

Action: Add more and decrease the distance between Zigbee devices in Zigbee network mesh

Tips:

- Zigbee uses mesh networking 212 and depends on having many “Zigbee Router” devices to extend range and coverage
- Recommendation is to add additional mains-powered Zigbee devices known to be good Zigbee Router devices
- Note that not all mains-powered devices have firmware that makes them act as a Zigbee Router device
- Some brands/models of Zigbee Router devices are known to only work well with the same brand of devices

Action: Buy a few known good dedicated Zigbee Router products and place them strategically as Zigbee repeaters. Personally, I suggest buying and adding at least three such devices.

Tips

- Examples of suitable producets: the “IKEA Tradfri Signal Repeater 3.1k ” and “Aeotec Range Extender Zi 1.4k ” are

products that work very well out-of-the-box, while a more powerful alternative is to make yourself some semi-DIY variant by flashing the correct Zigbee Router firmware to Zigbee Coordinator USB dongles and then using them as stand-alone Zigbee Signal Repeater devices in USB-chargers for power, like, for example, either the Sonoff ZBDongle-E (EFR32MG21 based) or the Sonoff ZBDongle-P (CC2652P) work great as dedicated stand-alone Zigbee Signal Repeaters with recommended firmware.
- Search community forums for more “Zigbee signal repeater” or “Zigbee range extender” Zigbee Router tips
- Buy a few additional new Zigbee USB adapters to use after re-flashing them with Zigbee Router firmware

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Issue: Zigbee could have overlapping frequency ranges with Wi-Fi. Wi-Fi and Zigbee both operate within the same radio frequency range (2.4 GHz) and that means that they can interfere with each other, or rather since Wi-Fi radios use high-power radios its signals can drown out Zigbee’s low-power signals. You can also simply have 2.4 GHz RF Interference (RFI) from Wi-Fi Routers and Wi-Fi Access Points or other devices.

Actions:

- First of all, try to place your Zigbee adapter away from Wi-Fi access points or sources of WiFi
    - Place Zigbee adapters far away from electrical/power wires/cables, power supplies, and household appliances
- Read this article about Zigbee and WiFi coexistence → https://support.metageek.com/hc/en-us/articles/203845040-ZigBee-and-WiFi-Coexistence 2.3k
- Read and follow the ZHA integration and Zigbee2MQTT documentation respectively regarding changing/defining Zigbee channel use, see → https://www.home-assistant.io/integrations/zha#defining-zigbee-channel-to-use 883 and https://www.zigbee2mqtt.io/advanced/zigbee/02_improve_network_range_and_stability.html#reduce-wi-fi-interference-by-changing-the-zigbee-channel 1.1k

Note! ZHA channel selection dialog does mention that interference needs to be addressed before this!

Additional general Zigbee tips not mentioned in the above linked pull request:

- Texas Instruments CC2652P or CC1352P based adapters are recommended for Zigbee2MQTT (while Z2M technically also support ConBee/RaspBee and Silicon Labs adapters but they are not recommended for Zigbee2MQTT as they do not offer full feature-parity, for more information see → Zigbee buyer's guide [310]).

- While both ZHA and Zigbee2MQTT do support older Zigbee Coordinator adapters based on the old Texas Instruments CC253x (CC2530 and CC2531) they are not recommended any longer, so spare yourself the potential grief and instead just buy a newer Zigbee Coordinator adapter from the start.

- Migration from an older Zigbee Coordinator adapter to a new Zigbee Coordinator adapter (with later firmware) a is a nice feature that both ZHA and Zigbee2MQTT have but if you are having problems with your Zigbee network after migration then it is generally recommended to cut your losses instead or troubleshooting and so just reset the new Zigbee Coordinator adapter to factory settings and join/pair devices manually one by one after factory resetting each device.

- Be sure to factory reset devices that have previously been paired/added to another Zigbee gateway/hub/bridge as otherwise, they might not show up during the search when trying to join/pair/add the Zigbee device.
    - https://www.home-assistant.io/integrations/zha#add-philips-hue-bulbs-that-have-previously-been-added-to-another-bridge [114]
- Before adding any devices, check that you have enough Zigbee router devices close to the new device that you want to add if it is not in the same room or within 10 feet from the Zigbee Coordinator adapter.
    - Zigbee router devices are mains-powered devices that are also known as Zigbee signal repeaters or range extenders, and if you do not have any, invest and add some mains-powered devices that will work as Zigbee routers. You use routers to increase the both the range and coverage as well as total number of Zigbee devices that can be used in a Zigbee network. The total number of Zigbee devices that you have on a Zigbee network depends on a few things, but you should know that Zigbee coordinator hardware and firmware only play a larger role in Zigbee networks with a lot of devices. More important is how many directly connected devices (“direct children”) versus how many routers are connected to your Zigbee coordinator.
    - Aim to start out with mains-powered devices before adding battery-operated devices as a “weak” Zigbee network mesh (e.g., the device is too far from the Zigbee coordinator or a Zigbee router) may prevent some devices from being paired. Zigbee router devices are also needed to increase the maximum of devices that can be connected to your Zigbee mesh network.
- If possible try to pair your Zigbee devices in their intended final location, (and not pair it next to the Zigbee coordinator and then need to move it after).
    - Pairing a Zigbee device next to the Zigbee coordinator and then moving it later can result in dropped/lost connections or other issues.
        - If the device you want to add is not brand new and as such never paired before then you always have to make sure to

first manually reset the device to its factory default settings before you will be able to add/pair it.

- Cheap devices like those manufactured by Tuya and Aqara/Xiaomi are infamously known for not following the standard Zigbee specifications and can have issues pairing and sometimes even cause stability issues in a Zigbee network, especially when used either as a Zigbee Router or when it connects via an other Zigbee Router instead of connecting directly to the Zigbee Coordinator.
    - Note that some Zigbee devices are also not fully compatible with all brands of Zigbee router devices. Xiaomi/Aqara devices are for example known not to work with Zigbee router devices from Centralite, General Electrics, Iris, Ledvance/OSRAM, LIGHTIFY/Sylvania, Orvibo, PEQ, Securifi, and SmartThings/Samsung. Better results can usually be achieved by using mains-powered devices IKEA and Nue/3A Home or dedicated DIY routing devices based on Silicon Labs EFR32MGxx, Texas Instruments CC253x/CC26x2, or XBee Series 2/3 Zigbee radios.
- Both ZHA and Zigbee2MQTT require handlers/converters for non-standard Zigbee clusters and attributes so be prepared to either code your own handler/converter or open a new device support request if buying a newly released device or old odd devices that are not commonly used so no one has previously coded handlers/converters for it if it does not follow standard Zigbee clusters and attributes specifications.
    - Such a custom handlers/converters” are scripts that workaround deviations by acting as a translator, translating and converting non-compliant device messages and instead presenting them to the application as coming from a virtual compliant device that parse custom messages to and from Zigbee devices.
        - https://www.home-assistant.io/integrations/zha#zha-exception-and-deviation-handling 79
        - https://www.zigbee2mqtt.io/advanced/support-new-devices/01_support_new_devices.html 46
- Some battery-operated Zigbee devices are known to have problems with pairing if they have Low battery voltage.

    - Some people have reported replacing the battery on their newly received Xiaomi/Aqara devices solved pairing issues.

Rechargeable NiMh batteries each supply 1.2v vs. Alkaline with 1.5v. Some reliability issues are due to lower voltage batteries.

- If joining/pairing do not work properly due to the interview failing try to join/pair the device again and be patient as the pairing of some Zigbee devices may require multiple attempts and you may sometimes need to try again and again.

    - Some devices, like example those from Xiaomi/Aqara, are also known to not be 100% compliant with the standard Zigbee specifications for joining/pairing and may therefore require many paring attempts over 10-20 minutes or even more.

    - If joining/pairing fails try resetting the device to factory default settings.

    - If joining/pairing still fails you can try pairing the device closer to the Zigbee Coordinator adapter but be aware that depending on the device you might not be able to then move it further away as it could be that it will then not automatically re-pair to a Zigbee router device so manual re-pairing will be nessesary.

- General tip to new Zigbee users is that, while there is no official list of supported devices, some ZHA users take comfort that blakadder maintains an unofficial Zigbee Device Compatibility Repository which anyone can submit compatibility reports to, it can be found at zigbee.blakadder.com 556 and currently contains independent compatibility lists and device pairing tips for several home automation gateway/bridge/hub software, including but not limited to open source Zigbee implementations such as; ZHA, Tasmota, Zigbee2MQTT, deCONZ, Zigbee for Domoticz, and ioBroker.

Other reputable guides or tutorials and resources/research related to this topic:

- ZigBee and Wi-Fi Coexistence → https://support.metageek.com/hc/en-us/articles/203845040-ZigBee-and-WiFi-Coexistence 2.3k
- Best practices to avoid pairing and/or connection issues → https://www.home-assistant.io/integrations/zha#best-practices-to-avoid-pairingconnection-difficulties 320

- ZHA info on using Zigbee Router devices (repeaters/extenders) → https://www.home-assistant.io/integrations/zha#using-router-devices 387
- Zigbee interference avoidance and network range/coverage optimization → Zigbee Home Automation - Home Assistant 899
  - Actions to optimize Zigbee Coordinator radio hardware → Zigbee Home Automation - Home Assistant 47
  - Actions to avoid or workaround EMI/EMF/RMI interference → Zigbee Home Automation - Home Assistant 30
- Zigbee2MQTT tips on how to improve network range and stability → https://www.zigbee2mqtt.io/advanced/zigbee/02_improve_network_range_and_stability.html#usb-based-adapter 386
- Hubitat tutorial How to Build a Solid Zigbee Mesh → https://docs.hubitat.com/index.php?title=How_to_Build_a_Solid_Zigbee_Mesh 194
- Xiaomi & Aqara Devices - Pairing & Keeping them connected → https://community.hubitat.com/t/xiaomi-aqara-devices-pairing-keeping-them-connected/623 361
- Zigbee Range: You Must Know The Truth 152
- Radio propagation modeling and real test of ZigBee based indoor wireless sensor networks → https://www.sciencedirect.com/science/article/abs/pii/S138376211400112X 28

PS! Many of the above tips will also apply to Thread and Bluetooth based adapters/devices as well.

- https://www.home-assistant.io/integrations/bluetooth/#bluetooth-interference-with-other-devices 32
- https://www.home-assistant.io/integrations/thread 34

The Home Assistant Cookbook - Index 46 .

5 Replies 100

- Zigbee buyer's guide 310
- The Home Assistant Cookbook - Index 46
- SkyConnect not finding devices 37
- Losing devices with ZHA 21
- Switched from Deconz to ZHA - It was great, now it's not? 21

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tom_l Moderator — Jan 2023

Instead of a USB connected coordinator the use of an Ethernet connected coordinator, like those available from Tubes store. They can get your coordinator even further away from EMI sources and central to your network.

2 Replies | 6

Hedda — 9 — Jan 2023

The most important thing is still to understand that in a true mesh network topology like Zigbee uses it will always be much better to add many weaker Zigbee Router devices than it is to just add only one or two very powerful/strong Zigbee Router devices. That way you can in practice get a redundant fully connected network (with the exception of the Zigbee Coordinator which in Zigbee 3.0 can only be one per Zigbee network). Otherwise, you will risk that powerful/strong Zigbee Router device becoming a single-point-of-failure so any devices that have a single connection link to it and not to multiple Zigbee Router devices will go down if it does.

What you want to achieve is a full “mesh network” with most Zigbee routers having many paths:

https://www.ecstuff4u.com/2018/03/zigbee-topology.html 24

So for a quick no-effort fix I personally normally just recommend that people new to Zigbee who have big houses and large areas or buildings with dense building materials make it easy for themselves and just buy a bunch of “IKEA Trådfri Signal Repeater” devices from the start to get them a good mesh network backbone as a baseline. This is because while not as strong as these Zigbee USB dongles with an external antenna, the “IKEA Trådfri Signal Repeater” comes with good firmware by default and are very inexpensive, so you can make up for them not having the highest performance by simply buying more of them, (and they are still more powerful than almost all other commercial Zigbee products that are not designed to be a dedicated Zigbee Router device).

https://www.google.com/search?q=IKEA+Tradfri+Signal+Repeater 272

However, if you want to get the best setup then the best AND most cost-effective Zigbee Router that money can buy today is just to convert a few of ITead’s “Sonoff Zigbee 3.0 USB Dongle Plus V2” (model “ZBDongle-E” based on Silicon Labs EFR32MG21) into dedicated Zigbee signal repeater / Zigbee range extenders by flashing them with Zigbee Router firmware and powering them with a simply USB-chargers. While maybe not the prettiest solution to look at, if you make sure they are permanently powered then joining/pairing three or more to your Zigbee network and spreading them around in your home will create an extremely stable backbone in your Zigbee network.

https://github.com/itead/Sonoff_Zigbee_Dongle_Firmware/tree/master/Dongle-E/Router 57

https://github.com/xsp1989/zigbeeFirmware/tree/master/firmware/Zigbee3.0_Dongle-NoSigned/RouterForDongle 40

> tom_l:
>
> Instead of a USB connected coordinator the use of an Ethernet connected coordinator like those available from Tubes store …

Yes that is indeed another way to move your Zigbee Coordinator further away from possible sources of interference and place it in a more ideal location like the very centre of your house, (and I personally recommend TubeZB 192 and ZigStar 127 network-attached Zigbee Coordinator solutions for some situations where simply using a long USB extension cable is not enough to get the adapter in an ideal placement).

However, a network-attached Zigbee Coordinator solution does introduce additional complexity and introduce your LAN as another SPOF (Single-Point-Of-Failure) for your Zigbee network setup, and I therefor personally believe that in most use bases it will be easier to just use either up to 5 meters / 15 feet shielded USB extension cable or if even longer USB extension distance is needed you can achieve up to around 30 meters by using inexpensive “USB Ethernet RJ45 Extender Adapter” converters which easily and practically convert any single CAT5e/CAT6 shielded Ethernet cable with RJ45 connectors into a very long USB extension cable, (note that 30 meters or 100 feet

is the recommended maximum length for USB 2.0 data traffic over a passive cable). See for example these USB extension solutions:

amazon.com

Amazon.com: DTECH 15 Feet USB 2.0 Extension Cable USB A Male to A Female Cord -... 143

Buy DTECH 15 Feet USB 2.0 Extension Cable USB A Male to A Female Cord - 5 Meters - Blue: USB Cables - Amazon.com ✓ FREE DELIVERY possible on eligible purchases

or

amazon.com

Amazon.com: USB Extender Over RJ45 Cat 6/5/5e Adapter, RJ45 Ethernet Splitter to... 92

Buy USB Extender Over RJ45 Cat 6/5/5e Adapter, RJ45 Ethernet Splitter to USB Extension UP to 50m/164ft, Compatible with Computers, Mobile Phones, Mice, Keyboards, U Disks, Printers, Cameras: USB Network Adapters - Amazon.com ✓ FREE DELIVERY possible...

Home Assistant SkyConnect / Home Assistant Connect ZBT-1 =… 7

Sonoff motion sensor stuck on "detected" 5

fleskefjes Regular tom_l Jan 2023

One other great use-case for ethernet-based Zigbee adapters is that if you run a virtualized environment (VMware vsphere for example) you could move the HA virtual machine around on different servers during maintenance, set up high availability or replication. Not something that would have a big user base but for people already running virtual environments it’s a big plus.

5

Zigbee hub/dongle and positioning - newbie questions 3

Hedda Jan 2023

> fleskefjes:
>
> One other great use-case for ethernet-based Zigbee adapters is that if you run a virtualized environment (VMware vsphere for example) you could move the HA virtual machine around on different servers during maintenance, set up high availability or replication.

Another possible more advanced flexible solution to get USB or serial adapters into a virtual machine if you need more virtual machines or different types of USB/serial adapter virtualization can to either use a genetic Serial to TCP/IP network proxy application for example which could be a DIY software-based like “ser2net 13 ” on a Raspberry Pi Zero other Serial to Ethernet converter server (such as commercial Serial-Over-IP and USB-Over-IP hardware appliance solutions that do the same, like products from Silex Connectivity Solutions 2 and Digi connectivity solutions such as their AnywhereUSB series 1 as examples). Zigbee2MQTT has a guide for ser2net 13 here that for the server side also works for ZHA:

https://www.zigbee2mqtt.io/how_tos/how_to_connect_to_a_remote_adapter.html 21

> fleskefjes:

> Not something that would have a big user base but for people already running virtual environments it’s a big plus.

Home Assistant Operating System running in a Virtual Machine on a virtualization hypervisor actually has quite a large userbase according to the current analytics statistics which say 34%+ today, though I suspect that most people do not run Home Assistant in a redundant environment with the option to do live-migration of the virtual machine to other hardware for maintenance (e.i. VMotion in VMware vSphere):

https://analytics.home-assistant.io 50

1

fleskefjes Regular Jan 2023

Yeah, but if you consider replication, high availability and so on these are often licenced features (vmware vpshere licence for example). Hence my comment about the not so large user-base

Hedda 1 Jan 2023

Off-topic as not related to interference, stability or range/coverage but another very important general tip is by the way to be sure to store/copy your Zigbee network backups to another secondary storage location so that you can restore backups in case your Zigbee setup becomes corrupt or primary storage fails completely and you need to reinstall ZHA or Zigbee2MQTT and then want to restore your Zigbee network, (if you are using ZHA then the Zigbee network backups should be part of Home Assistant's Backup). Zigbee network backups are important since not all Zigbee network data is stored locally on the Zigbee Coordinator adapter (at least not for Zigbee 3.0 networks).

https://www.home-assistant.io/integrations/zha#zigbee-backup-and-restore-in-zha 11 → https://www.home-assistant.io/integrations/backup/ 2

https://www.zigbee2mqtt.io/guide/faq/#how-do-i-move-my-zigbee2mqtt-instance-to-a-different-environment 19

Common tip to achieve off-site backups is to backup Home Assistant's Backups to Google Drive (cloud):

https://community.home-assistant.io/t/add-on-home-assistant-google-drive-backup/107928 14

2

templeton_nash Jan 2023

Possibly off topic but:

Does anyone know where, in a home assistant backup, the ZigBee coordinator backup is?

If I needed to restore a ZigBee coordinator backup to a new coordinator then where would I find the backup?

Hedda 2 Jan 2023

Zigbee database (zigbee.db) is part of the standard Home Assistant core backup but not exactly sure now that you ask if a complete backup is also done automaically of Zigbee network of APS keys or NWK address tables that are stored in NVRAM on the Zigbee Coordinator adapter, but that is anyway probably more on-topic if asked in this other thread instead → https://community.home-assistant.io/t/zha-integration-to-do-nightly-backup-of-both-zigbee-coordinator-adapter-dongle-stick-and-zigbee-network-database/357558 21

Note that it is at least easy to download latest backup in JASON format via the ZHA GUI (and also option there to migrate to a other adapter which automatically runs a procedure for backup and restore).

25

mikkelzzz3 Jan 2023

Thank you for the guide @Hedda !

I have one question which is not specifically pointed out in the guide. Is there any problems using a USB 3.0 extension cable when it is connected to a USB 2.0 port?

Hedda Jan 2023

> mikkelzzz3:
>
> Is there any problems using a USB 3.0 extension cable when it is connected to a USB 2.0 port?

There is no problem since USB cables are backwards compatible, in fact it is usually better since USB 3.0 cables are normally betted shielded. USB 3.0 cables have the same numbers of wires/pins so in practice the only difference is just that they are better shielded. Shielded cables are better to use for radios and long cable lenghts.

Other than better shielding USB 3.0 cables also have lower resistance and use thicker gage so can therefor be rated to transfer more power and higher data rates but that only matter to USB 3.0 devices and not to USB 2.0 devices.

mikkelzzz3 Jan 2023

Thank you,
I know of the backwards compatibility (since it is what I am currently using). It was mostly if a usb 3 cable connected to usb 2 port could create EMF interference similarly to if it was connected to a usb 3 port. But I guess not

My external SSD is connected to usb 3 port though. I have shielded that cable in tinoil to minimize the interference.

sambolino Veljko Vujcic Jan 2023

Hi, few days ago I've tried to ask something similar on reddit, might go off topic here a bit but it's related.

From what I read here, I should move the dongle few meters away to deal with Zigbee, but what about other devices interfering with each other:

I am about to make a setup with HA running on r4 pi 8gb. I plan to stack two sonoff 4ch pro's and several mini r3's (controlling SSR's

located in the fuse box, which in turn control heating and water boiler) alongside router, switch and pi4 in a large in-wall media box, say 500x500mm
Are there EMI issues here with router-sonoff or sonoff-sonoff or sonoff-pi4 and what would you recommend?

Thanks,
Veljko

New HA setup - how to avoid wifi / zigbee / rasberry interference 3

Hedda Jan 2023

> sambolino:
>
> I plan to stack two sonoff 4ch pro’s and several mini r3’s (controlling SSR’s located in the fuse box, which in turn control heating and water boiler) alongside router, switch and pi4 in a large in-wall media box, say 500x500mm
> Are there EMI issues here with router-sonoff or sonoff-sonoff or sonoff-pi4 and what would you recommend?

First of all, are any of those really Zigbee devices? (Sonoff also make WiFi devices and if they are WiFi devices and not Zigbee devices then it is off-topic here in this specific thread).

If they are Zigbee devices then there should be no problem as long as you have a Zigbee Router devices (such for example an IKEA Trådfri Signal Repeater) close enough but not too close to those devices and still got good connection to the Zigbee network mesh as a whole, like in the same room but not right next to all those sources of EMF.

So the general recommendation is to build out your Zigbee network mesh by adding more Zigbee Router devices.

m4v3r1ck Jan 2023

Thank you @Hedda for this very comprehensive write-up. Much appreciated!

15 days later

Hedda 1 Feb 2023

Does anyone have constructive feedback on how to best rewrite this pull request for the ZHA docs?

https://github.com/home-assistant/home-assistant.io/pull/18864 54

I have already rewritten it many times and now I'm no longer sure how to proceed (or if I even want to).

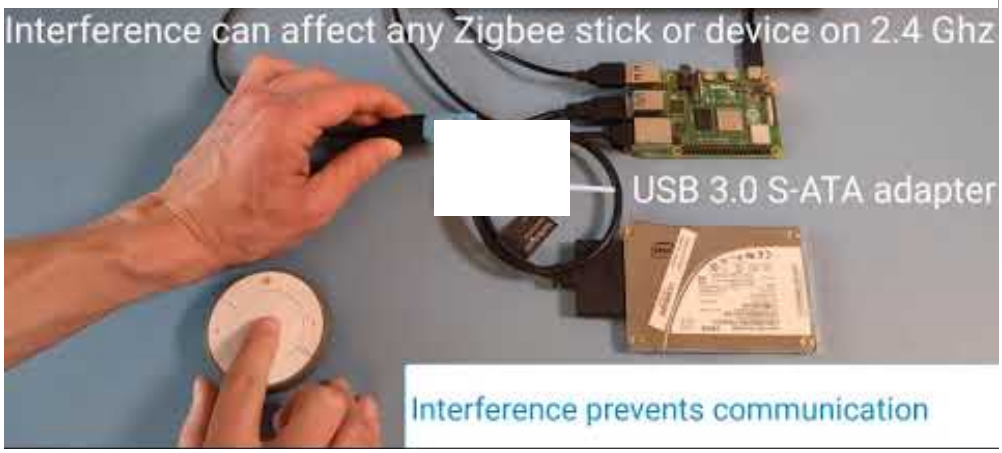
> github.com/home-assistant/home-assistant.io
>
> **Update zha.markdown with tips on improving Zigbee network range** 54
>
> `home-assistant:current ← Hedda:patch-49`
>
> opened Aug 9, 2021 Hedda +48 -0
>
> ```
> ## Proposed change
>
> Update ZHA docs with best practice guidelines for improvin ...
> ```

13 days later

Hedda 2 Feb 2023

Home Assistant posted a video to clearly show Zigbee's symptoms with electromagnetic interference:

Demo: Zigbee interference caused by USB 3.0



That does however not answer the follow-up question of the Home Assistant Skyconnect dongle and the short USB extension cable that it ships with is more susceptible to interference than other dongles and cables, as in do they have good enough shielding or not, nor if it the short length of the included USB extension cable is long enough. That is, the Home Assistant Skyconnect dongle is not EMF shielded and the USB extension cable that it ships is both very short and relatively thin so it could be assumed that it does not have a lot of shielding.

https://community.home-assistant.io/t/home-assistant-skyconnect-usb-stick-announced-will-be-compatible-with-both-zigbee-and-thread-including-matter-chip-over-thread/433594/158

> Home Assistant SkyConnect - official radio USB dongle will be compatible with both Zigbee and OpenThread (including Matter/CHIP over Thread) Hardware
>
> Updated to clarify questions regarding as Home Assistant posted video showing interference symptoms: [Demo: Zigbee interference caused by USB 3.0] @agners since it was released have read/seen quite a few reports from many users saying they specifically have serious issues with electromagnetic interference symtoms with he Home Assistant SkyConnect dongle, even when using the original 0,5-meter long USB extension cable that ships with Home Assistant SkyConnect to a USB 2.0 port as re…

For reference, Home Assistant SkyConnect website and FAQ on webpage where to buy it now contain some of this information:

https://skyconnect.home-assistant.io/connectivity/ 15

https://www.home-assistant.io/skyconnect 3 → FAQs → “*Why include a USB extension cable?*”

- “*USB 3.0 ports (the ones with blue on the inside) are known to cause significant noise and radio interference to any 2.4Ghz wireless devices. This includes Zigbee and Thread. If you do not use the extension cable, it may not work at all, and if it does, it could be flaky at best with intermittent problems (issues with pairing, device dropouts, unreachable devices, timeout errors, etc).*”

Issue with USB 3.0 interference for Zigbee was also mentioned in Home Assistant’s latest newsletter for Building the Open Home:

https://building.open-home.io/assisting-the-open-home/ 10

Zigbee interference caused by USB 3.0

A lot of users build their smart home around a Raspberry Pi. It’s quite popular to expand the storage using an external hard drive connected to the Raspberry Pi via USB 3. What most users don’t know is that USB 3 causes enormous interference with any Zigbee device or stick that comes close, to a point that it no longer works.

Gabriela recently joined the Nabu Casa team as a technical documentation writer and has been focusing on documentation to help users avoid common pitfalls like these. She updated the documentation for the Home Assistant SkyConnect 27 including this 30 second video that shows how bad the issue is:

3

Hedda 1 Feb 2023

> On another topic
>
> Hello, I’ve been looking into zigbee range extenders and seen a lot of your posts on the forum and you seem like you know a lot about it. I have found your information very helpful but it does seem like there is many ways to achieve added range. I’ve narrowed down to about 3 options but was wondering if you could provide your opinion before I make an order. I use a Sonoff Zigbee dongle (P model) straight out of the box as the coordinator and I use ZHA. I am looking at setting up a repeater in a more central location and I’m looking at using either Sonoff Zigbee

> Dongle P or E model, or a CC2531m. The Sonoff dongles are more than double the price of the CC2531. Can you offer any advice? Reliabilty is my main goal here. Thanks

The advice already posted above in a this thread stands as my recommended guidelines for general best practice, and as you can read there my recommendation is that it is better to have many good Zigbee Router devices than a just one or two great Zigbee Router device(s).

So for a small budget I personally suggest buying three of more of the IKEA Trådfri Signal Repeater if the alternative is buying just one or two Zigbee USB dongle(s) to use a dedicated Zigbee Routers for the about the same amount of money instead.

Again, for a stable Zigbee network mesh is much better to have many good Zigbee Router devices which are always on than just a couple of great ones

PS: @bigdogevan posted reply in public thead instead of private message as do not want to offer personal one-to-one support as then no one else have the opertunity to learn and would also have to repeat the same message even more.

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Hedda Feb 2023

> Hedda:
>
> - Zigbee could have overlapping frequency ranges with Wi-Fi.
>   - Wi-Fi and Zigbee both operate within the same radio frequency range (2.4 GHz) and that means that they can interfere with each other, or rather since Wi-Fi radios use high-power radios its signals can drown out Zigbee's low-power signals.
>   - Read this article about Zigbee and WiFi coexistence → https://support.metageek.com/hc/en-us/articles/203845040-ZigBee-and-WiFi-Coexistence
>   - Then follow the ZHA integration and Zigbee2MQTT documentation respectively regarding changing/defining Zigbee channel use, see → https://www.home-assistant.io/integrations/zha#defining-zigbee-

channel-to-use and https://www.zigbee2mqtt.io/advanced/zigbee/02_improve_network_range_and_stability.html#reduce-wi-fi-interference-by-changing-the-zigbee-channel

Related to this, consider voting on ZHA feature request for adding UI options to change Zigbee channel:

https://community.home-assistant.io/t/zha-ui-options-to-perform-zigbee-energy-scan-and-change-zigbee-network-channel/541020 48

> ZHA UI options to perform Zigbee energy scan and change Zigbee network channel? Feature Requests
>
> Request developers of Home Assistant ZHA integration add some UI options to ZHA (Zigbee Home Automation) integration for performing Zigbee energy scan and cthe hanging Zigbee network channel. https://github.com/zigpy/zigpy-cli/blob/dev/README.md#performing-an-energy-scan https://github.com/zigpy/zigpy-cli/blob/dev/README.md#changing-the-network-channel Both actions can today be achieved via zigpy-cli in combination with zha-toolkit custom component https://github.com/mdeweerd/zha-toolkit Th…

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1 month later

Nick4 Nick Guidance Counsellor Apr 2023

Thank you for this extensive write-up!