



COMPANION TO THE EMF HYGIENE QUIZ

The Home Environment Manual

Light · Fields · Wiring · Sleep

Your house is an input. Every hour you spend inside it feeds your biology something. This manual shows you what it's feeding you, and how to change it.

For homeowners, electricians,
builders and architects

hedronemfprotection.com

YOUR QUIZ SCORE

15–24

High exposure.

Your bedroom is working against your sleep.

Start here, in this order

Three steps. Tick each one off as you go.

TODAY

1

Do the 10-Minute Audit.

Ten free fixes. No contractor, no tools.

[Section 4](#)

☐

Done

THIS WEEK

2

Work the bedroom checklist.

Bed placement, bedside, wireless and breakers.

[Section 7.2](#)

☐

Done

THIS MONTH

3

Measure before and after.

Write every reading in the log so you can see what changed.

[Sections 2 and 14](#)

☐

Done

Score today

_____ / 24

In 30 days

_____ / 24

The rest of this manual is reference. Use the contents on the next page to find anything else. Retake the quiz at hedronemfprotection.com/pages/emf-hygiene-quiz

Start here

Find your section. Who it's for:  Homeowner  Electrician  Builder or architect

SEC.	IF YOU WANT TO...	FOR	PAGE
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Not sure where you stand? Take the 2-minute EMF Hygiene Quiz at hedronemfprotection.com/pages/emf-hygiene-quiz. Your score tells you which sections to start with.

Three ways to read this manual

Find yourself below, then read the sections in this order.



A homeowner in an existing home

About 1 hour, then act over weeks

Most readers



The quiz

1

The Frame

4

10-Minute
Audit

3

Light

2

Targets &
Tools

7

Retrofit

12

Trouble-
shooting



Building a new home

About 1 hour, before plans are final

1

The Frame

5/6

New build:
bedrooms or
whole home

6.12

Build timeline

10

Code & Safety

8.9

Give these to
your electrician



The electrician

About 20 minutes

8.1

The goal, on
one page

8.2

Materials

8.3

Tests

9

Spec sheet

10

Code notes

Homeowners: your quiz score picks your first three steps. They're on the first page of this manual.

The Frame

Your house was built for efficiency, not for you.

FOR ALMOST ALL OF HISTORY

Nights were dark and electrically quiet, lit only by fire. Days belonged to the sun: full spectrum, steady and bright.

TODAY

Most people spend over 90% of their lives indoors, under lights that flicker, beside walls full of live wire, surrounded by wireless signals around the clock.

Nobody designed that for human biology. It just happened. This manual undoes it, one layer at a time.

The five inputs

INPUT	WHERE IT COMES FROM	HOW YOU FIX IT
 Light	Bulbs, screens, windows	Change the bulb, change the timing, get outside
 Magnetic fields	Panels, meters, wiring errors, motors, pumps	Distance and correct wiring. Nothing else works.
 Electric fields	Live wiring and cords, even when nothing is switched on	Metal-clad cable, switching circuits off at night
 Radio frequency (RF)	Wi-Fi, phones, smart meters, Bluetooth	Hardwire it, turn it off, move it away
 Dirty electricity	Dimmers, LED drivers, chargers, inverters	Fewer switching devices, better components

THE RULE



Light

→ Fixed by **choice and timing**



Magnetic fields

→ Fixed by **design and wiring**



Electric fields

→ Fixed by **cable and switches**

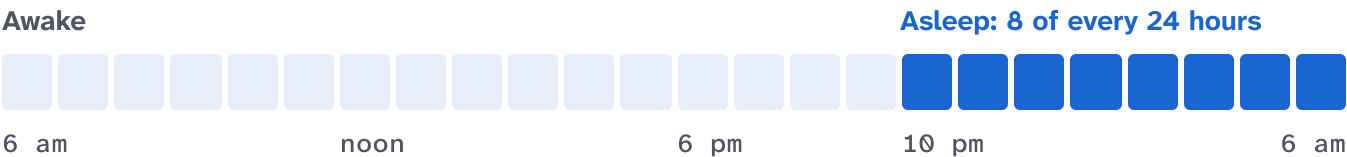


RF

→ Fixed by **behavior first and shielding last**

One room matters most: the bedroom

You spend a third of your life there, lying still in the dark while your body repairs itself. If you fix only one room, fix that one.



Where the science actually stands

Here is an honest summary of the evidence.

Solid



Light timing drives your circadian rhythm. Bright light at night suppresses melatonin, and morning sunlight anchors your body clock. This is well established.

Measurable



Every step in this manual lowers an exposure you can see on a meter.

Still being studied



Science hasn't settled how everyday EMF at home affects health. This manual makes no medical claims. It shows you how to lower what you can measure.

The approach is precautionary and low-regret.

Most of it costs little or nothing, especially at the design stage.

What other countries do

Switzerland

10× stricter antenna limits near homes and schools.

Italy

Tighter limits where people spend 4+ hours a day.

France

No Wi-Fi in daycares for children under 3.

Israel

Limits Wi-Fi in kindergartens and early grades.

Belgium

Banned the sale of phones made for kids under 7.

Netherlands

Advises against new homes and schools by power lines.

Targets & Tools

You can't fix what you don't measure. These are the numbers to aim for where you sleep.

What your numbers mean

	Sleeping areas		
	Green Ideal	Yellow Acceptable	Red Fix it
Magnetic (AC)	Under 0.2 mG	0.2–1 mG	Over 1 mG
Electric (AC)	Under 1 V/m	1–5 V/m	Over 5 V/m
Radio frequency	Under 0.1 $\mu\text{W}/\text{m}^2$	0.1–10 $\mu\text{W}/\text{m}^2$	Over 10 $\mu\text{W}/\text{m}^2$
Light at night	Dark. Red or amber only if you need a light. Blackout is ideal.		

Your practical target is to stay out of the red. These targets come from the Building Biology SBM-2015 guidelines for sleeping areas. They're precautionary, not code, so write them into any contract. Building Biology's own ratings are stricter for electric fields; these bands match this manual's targets.

Your meter may show different units

Magnetic	$1 \text{ mG} = 0.1 \mu\text{T} = 100 \text{ nT}$, so $1 \mu\text{T} = 10 \text{ mG}$.
RF	$1 \mu\text{W}/\text{cm}^2 = 10,000 \mu\text{W}/\text{m}^2$, and $1 \text{ mW}/\text{m}^2 = 1,000 \mu\text{W}/\text{m}^2$. For reference, $10 \mu\text{W}/\text{m}^2$ is about 0.06 V/m .

Next page: the meters you need, and how to take a good reading.

The kit, and a good reading

TOOL	EXAMPLES	WHAT IT'S FOR
Gaussmeter	Trifield TF2, Alphaslab UHS2	Panels, wiring errors, bed locations
Electric field meter	Trifield TF2 (E-mode)	Live wiring in walls near beds
RF meter	Safe and Sound Pro II, Acoustimeter AM-11	Routers, meters, cell towers
Flicker check	Your phone's slow-motion camera, aimed at the bulb	Dark bands or strobing on screen mean the bulb flickers
Light meter (optional)	Lux meter or spectrometer	Brightness by day, darkness by night

How to take a good reading

- 1 Right time.** At night, with the house running normally: HVAC, fridge, well pump and Wi-Fi all doing their usual thing.
- 2 Right spot.** Where your head and chest lie in bed, at pillow height.
- 3 Hold still.** Hold the meter away from your body and wait 5–10 seconds for the number to settle.
- 4 Slow sweep.** Walk the room slowly and note where the numbers climb. The direction they rise points to the source.
- 5 Write it down** in the Measurement Log (Section 14), before and after every change.

Meter tips

- Use a **3-axis** gaussmeter (it reads all directions at once). Single-axis meters under-read unless you rotate them.
- Phone apps are **not** reliable EMF meters.
- For RF, take the **peak** reading. Smart meters and cordless phones pulse, so the average hides them.

Light

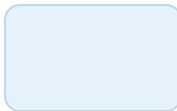
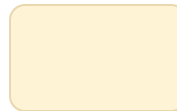
Light tells your body what time it is. Get the real thing by day. Keep nights dim, warm and low.

IN ONE MINUTE

By day	10–30 minutes of outdoor light within an hour of waking, even when it's cloudy.
After sunset	Overheads off. Amber lamps at table height or lower. Screens tinted, dimmed or off.
In bed	Dark. A low red nightlight for bathroom trips.

Bulbs at night, worst to best

worst → best

						
Cool-white LED	Screens at night	Fluorescent / CFL	Warm-white LED	Clear incandescent	Amber incandescent	Red incandescent
5000–6500K	Phone, laptop, tablet	Flicker, mercury	2700K	or halogen	About 2100K	or candle, fire
Avoid	Avoid	Avoid	Okay	Good by day	Evenings	Best at night

Your evening, step by step

Sunset Get outside and watch it if you can.	After dinner Overheads off. Amber lamps, table height or lower.	Wind-down Red or amber only. Screens tinted or off.	In bed Dark. Blackout curtains. Cover device LEDs.	Night trips Low red nightlight near the floor. Never the overhead.
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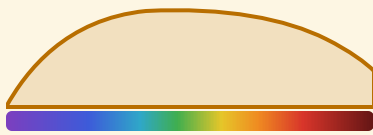
The details follow: why indoor light differs from the sun, screen settings, the bulb buying guide, and dimmers.

Light is a signal

Your eyes and skin read light as information. It tells your body what time it is, when to be alert, when to repair, and when to sleep. Most indoor light sends the wrong signal.

THE SUN

The complete message

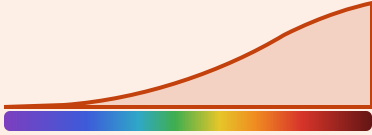


UV visible infrared

Full spectrum, from ultraviolet through every visible color into deep infrared. Steady and bright.

FIRE

The evening message

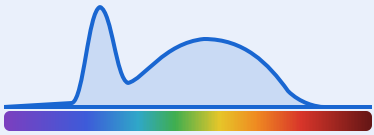


UV visible infrared

Warm and dim, heavy in red and infrared, with almost no blue.

MODERN INDOOR LIGHT

A partial, distorted message



UV visible infrared

Concentrates its energy in blue, with little to no red or infrared. Much of it also **pulses on and off**, faster than you can consciously see.

Native light vs. engineered light

	Native light	Engineered light
Sources	Sun, fire, candle, incandescent filament	LED bulbs, fluorescent tubes, phone, laptop and TV screens
Spectrum	Continuous, rich in red and near-infrared	Narrow blue peak (~450–460 nm), little or no infrared
Output	Steady	Often pulses at 120 Hz (cheap LEDs), or faster on screens that dim by pulsing (PWM)
Effect at night	Warm sources barely register with your body clock	The blue content tells your brain it's midday

What goes wrong indoors

1 Blue without balance

Sunlight pairs its blue with a large dose of red and infrared. Most LEDs and screens deliver the blue alone. At night, that blue is the strongest "stay awake" signal your brain receives.

2 Flicker

Many LED bulbs strobe in step with the AC power cycle, especially cheap and dimmable ones. Many OLED phone screens dim by pulsing. You don't see it, but many people feel it as eye strain, headaches, or that wired-but-tired afternoon.

3 Your windows filter out the good part

Modern low-e glass is designed to keep heat out, so it blocks much of the near-infrared. When you sit by a sunny window, you get the brightness without the full spectrum.

4 The timing is backwards

Most people get too little bright light by day, when they need it. Then they get too much blue light at night, when they don't.

The ranking: worst to best

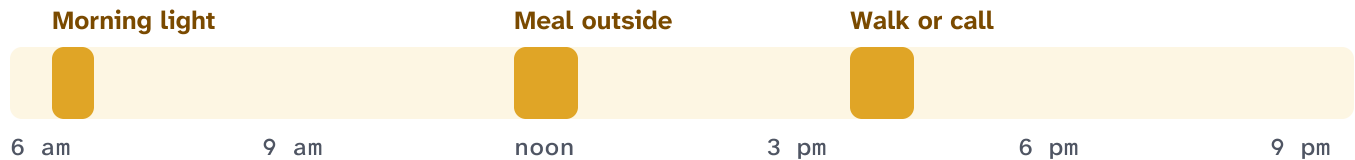
	Cool-white or "daylight" LED (5000–6500K)	Highest blue, no infrared, often flickers	Worst
	Phone, tablet and laptop screens at night	Blue-heavy, close to the eyes, often flicker (PWM)	Avoid
	Fluorescent / CFL	Spiky spectrum, flicker, contains mercury	Avoid
	Warm-white LED (2700K)	Less blue but still no infrared; flicker depends on quality	Caution
	Clear incandescent / halogen	Continuous spectrum, real infrared, virtually no flicker	Good
	Amber incandescent	Warm and low in blue, great for evenings	Good
	Red incandescent, candle, fire	Minimal blue, rich in red and infrared	Best at night
	The sun	Nothing indoors comes close	Best by day

By day: get the real thing

Nothing indoors comes close to the sun.

A good day of light

Aim for 1–2 hours outside



Go outside early.

Get 10–30 minutes of outdoor light within an hour of waking, even when it's cloudy. An overcast sky is still many times brighter than indoor light.

Stack your outdoor time.

Aim for 1–2 hours across the day. Walks, work calls and meals outside all count.

Open the window.

Glass filters the light; an open window doesn't.

Don't wear sunglasses by default.

Save them for when you truly need them: on snow or water, or when driving into glare.

Indoors, go bright and broad.

Use clear incandescent or halogen task lights at the desk, and work near an open window.

Weekends count.

If the workweek keeps you inside, bank long outdoor blocks on your days off.

By night: dim, warm and low, then dark

- 
Sunset

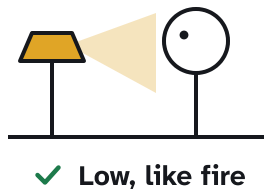
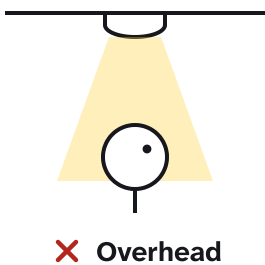
Get outside and watch it if you can. It's a natural evening cue.
- 
After dinner

Turn off the overhead lights. Use amber incandescent lamps at table height or lower.
- 
Wind-down
 1-2 hours before bed

Red or amber incandescent only; candles work too. Screens should be tinted, dimmed or off.
- 
In bed

Keep it dark. Use blackout curtains, and cover or remove device LEDs.
- 
Night bathroom trips

Use a low red nightlight near the floor. Never hit the overhead switch.



Why low matters

Light from overhead lands on the part of the retina that is most sensitive to daytime signals. Lamps at or below eye level are gentler on your body clock, which is also where fire sits.

Screens

Remove the blue, then the flicker.

iPhone / iPad

- 1 Go to Settings → Accessibility → Display & Text Size → Color Filters, and turn it on.
- 2 Choose Color Tint, then push Intensity and Hue toward warm red.
- 3 Set the **Accessibility Shortcut** to Color Filters, so a triple-click toggles it.

Mac

- 1 Go to System Settings → Accessibility → Display → Color Filters, turn it on, and choose Color Tint set warm.
- 2 Also turn on **Night Shift**, scheduled from sunset to sunrise.

Android

Turn on Night Light (or Eye Comfort), set to maximum warmth and scheduled.

Windows

Go to Settings → Display → Night Light, and set it to maximum strength on a schedule.

The catch: a tint fixes the color, not the flicker.

If screens give you headaches, the real fixes are:

- 1 **Less screen after dark.**
- 2 **A warm tint instead of turning the brightness down.** Turning an OLED screen down often makes it pulse more.
- 3 **A flicker-free, blue-light-free device.** Daylight Computer's **DC-1** is a paper-like tablet with a flicker-free (PWM-free) display and an amber backlight (see Section 16).

The incandescent problem

In the U.S., federal efficiency rules that took effect in 2023 pulled most standard household incandescent bulbs off the shelves. **Specialty incandescents are still sold.**

Where to find them

Red heat lamps & reptile basking bulbs

The easiest red incandescent to find, at hardware and pet stores.

Colored & amber incandescents

Sold as party, bug-light or decorative bulbs.

Appliance, rough-service & shatter-resistant bulbs

Including appliance bulbs (A15, 40W, E26).

Halogen & specialty filament bulbs

Availability varies.

Specialty makers

Such as **Daylight Labs** (Section 16).

Buy a stock

Stock changes as the rules evolve, so buy extra when you find a bulb you like.



Mind the heat. Check a bulb's wattage and heat before putting it in a fixture. Heat lamps run hot, so use a ceramic socket or a rated clamp lamp. Keep hot bulbs clear of fabric, and never leave a heat lamp on unattended.

Which bulb, when



Daytime tasks

Clear incandescent or halogen, 60W, A19 or ST64



After dinner

Amber (about 2100K), 40–60W



Wind-down

Deep amber (about 1800K), 25–40W



Bedside & night

Red incandescent, 25–40W; a red heat lamp only in a rated clamp fixture

The bulb buying guide

Get the right one the first time.

Step 1 Check your fixture's base

BASE	WHAT IT IS	WHERE YOU'LL FIND IT
E26 (medium)	The standard U.S. screw base	Almost every lamp and ceiling fixture. This is the one you want.
E12 (candelabra)	Small, skinny screw base	Chandeliers, small decorative sockets
E17 (intermediate)	Between the two	Some ceiling fans and appliances
GU10 / GU24	Pin or twist-lock base	Won't take a screw-in incandescent. Replace the fixture.
E27 (European)	1 mm wider than E26, and usually screws in	Check the voltage. Most E27 bulbs are made for 220–240V and glow dim and orange on U.S. 120V. Only buy E27 bulbs labeled 110–130V.

Also check the fixture's **wattage limit** (it's on a sticker inside the socket). Many are rated 60W maximum, and enclosed fixtures are often rated lower.

Step 2 Read the package the right way

A GOOD LABEL READS

40W • A19 • E26 • Clear • Incandescent • 120V

40W / 60W

The real power draw

A real incandescent wattage.
"60W equivalent" means it's an LED. Skip it.

Lumens

Brightness

40W ≈ 400–450 lm (bedside, evenings); 60W ≈ 800 lm (reading, tasks)

A19, ST64...

The bulb's shape

Whatever fits the fixture and looks right (next page)

E26

The base

Must match your socket

Clear / Amber / Red

Glass color

Clear by day, amber in the evening, red at night

120V

Voltage

Standard. 130V "long-life" bulbs also work and run slightly warmer and dimmer.

Pick the shape

Step 3 Whatever fits the fixture and looks right.



A19

The classic household bulb

Best for: table lamps, general use



A15

Smaller classic bulb, often sold as an "appliance bulb"

Best for: small lamps, fans



ST19 / ST64

Edison style, tapered top

Best for: pendants and bare-bulb fixtures



T45 / T14

Tube

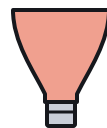
Best for: sconces, low accent light



G25 / G80

Round globe

Best for: vanities, bare-bulb fixtures



BR30 / BR40

Floodlight shape (red heat lamps usually come this way)

Best for: clamp lamps with a ceramic socket

The LED lookalike trap

"Edison" and "filament-style" bulbs are often LEDs built to look like the old bulbs. It's not incandescent if the box:

says "equivalent"

shows a single-digit wattage (like 4–8W)

says "LED" anywhere

Dimmers

Where light meets wiring.

Dimming an LED

The driver chops up the power. That causes flicker and puts high-frequency noise (dirty electricity) on your wiring, so you take two hits.

Dimming an incandescent

The hot filament smooths the output, so flicker stays minimal.

THE RULE

- 1 **No dimmers in bedrooms.**
- 2 If you dim at all, dim incandescent bulbs, with a quality dimmer, in living areas only.
- 3 Better still, use lamps with lower-wattage warm bulbs instead of dimming.

Light: buy / avoid

Buy

- ✓ Clear incandescent or halogen bulbs for daytime task lighting
- ✓ Amber incandescent bulbs for evenings
- ✓ Red incandescent (heat-lamp or reptile type) for bedside and night
- ✓ Low red nightlights for halls and baths
- ✓ Blackout curtains
- ✓ Flicker-free, blue-free devices (Daylight DC-1)

Avoid

- ✗ Cool-white or "daylight" LEDs (5000K+) anywhere you live
- ✗ Dimmable LEDs, especially on dimmers
- ✗ Cheap no-name LEDs, which flicker the worst
- ✗ Integrated-LED fixtures in bedrooms (you can't change the bulb)
- ✗ Blue standby LEDs on bedroom electronics (cover them)
- ✗ Red-light panels as your *only* source of red or infrared (a few narrow wavelengths are not the sun)

The 10-Minute Audit

Do these today. No contractor, no tools.

Today

Free · about 10 minutes · [Sec.](#) = where the details are

- | | | | |
|--------------------------|----|---|-----|
| ☐ | 1 | Walk every room and count the LED bulbs, starting with the bedrooms. | 3 |
| ☐ | 2 | Swap the bedroom lamp to a red or amber incandescent bulb. | 3 |
| ☐ | 3 | Put a low red nightlight in the bathroom and hallway. | 3 |
| ☐ | 4 | Turn on warm Color Filters or Night Shift on your phone and laptop, on a schedule. | 3 |
| ☐ | 5 | Put the Wi-Fi router on a timer so it's off overnight. | 7.2 |
| ☐ | 6 | Charge phones outside the bedroom, or put them in airplane mode. | 7.2 |
| ☐ | 7 | Pull the bed 3 ft away from any wall with outlets, or with the panel or fridge behind it. | 7.2 |
| ☐ | 8 | Unplug everything within arm's reach of the bed. | 7.2 |
| ☐ | 9 | Cover every standby LED in the bedroom with tape. | 3 |
| ☐ | 10 | Put 20 minutes of outdoor morning light on tomorrow's calendar. | 3 |

Tick all ten and your sleep environment will beat nearly every home in the country, before you spend a dollar on anything.

AFTER TODAY

This week

Red or amber bulbs for bedroom lamps. Red nightlights. Blackout curtains. LEDs off dimmers.

[Sections 3, 7.2](#)

This month

Get a gaussmeter and an RF meter. Measure at the pillow, at night. Write it down.

[Sections 2, 14](#)

When you remodel

Wiring fixes, night shutoff switches, metal-clad cable. Pages to hand your electrician.

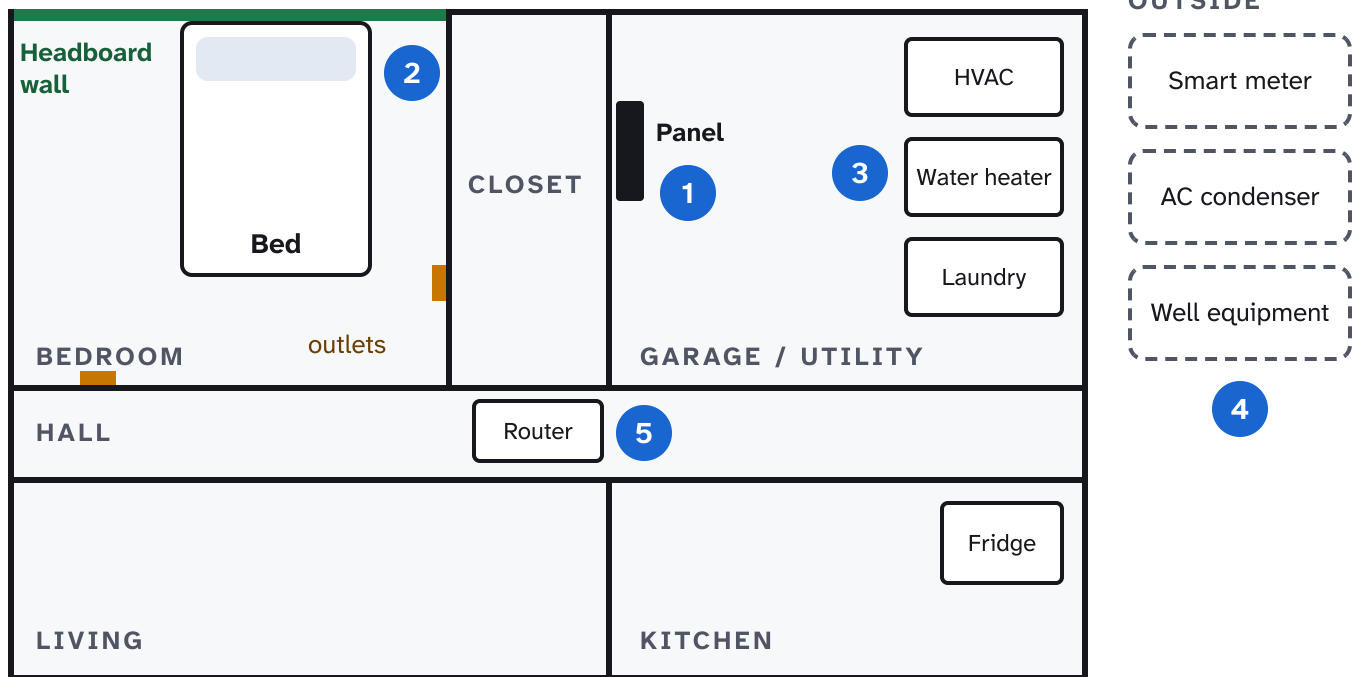
[Sections 7.3, 8, 9](#)

New Build, Bedrooms Only

The budget option, with the biggest return per dollar.

5.1 Layout

Free at the plan stage



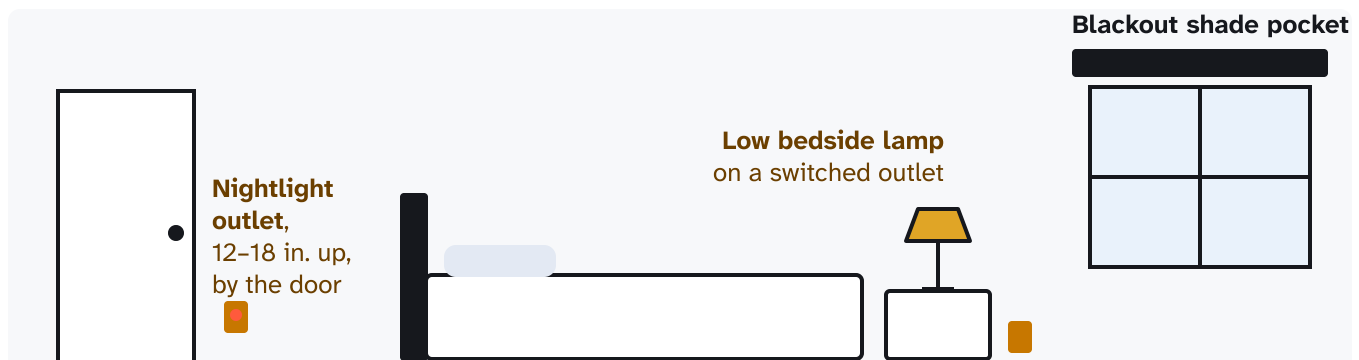
- 1 Panel and meter.** Keep the panel, meter, subpanels and service entrance **off every bedroom wall**. If one can't move, put a closet, bath or hall between it and the bedroom.
- 2 Headboard wall.** No outlets, switches or wiring runs. Put outlets on the side or opposite walls.
- 3 Big appliances.** Keep the fridge, HVAC, water heater and laundry off the other side of bedroom walls.
- 4 Outside equipment.** Put the smart meter, HVAC condenser and well equipment on the side of the house away from the bedrooms.
- 5 Router.** Put the router and network closet centrally, **not** in a bedroom.

Wiring and bedroom lighting

5.2 Wiring

- ☐ Use **MC cable or EMT conduit** for every bedroom circuit, and for any circuit that passes through or next to a bedroom.
- ☐ Give each bedroom its own **dedicated circuit(s)**, with no other rooms on them.
- ☐ Use **dedicated neutrals**, with no shared neutrals.
- ☐ Wire 3-way and 4-way switches with **no net current**.
- ☐ Install a **remote demand switch** or a labeled breaker for each bedroom, so power can be shut off at night. Smoke and CO detectors stay on a separate live circuit, per code.
- ☐ Put **no dimmers** in bedrooms.

5.3 Bedroom lighting



- ☐ Use **standard E26 sockets, not integrated-LED fixtures**, so you control the bulb.
- ☐ Add switched outlets for **low bedside lamps**, since overhead lights are rarely needed at night.
- ☐ Add a location for a **low nightlight**: a switched outlet 12–18 in. off the floor, near the bedroom door and along the path to the bath.
- ☐ Frame in blackout shade pockets or blackout curtain rods.
- ☐ Aim exterior lights away from bedroom windows, and use warm or amber bulbs in them.

Must-dos, and checking your work

5.4 Whole-house items you can't skip

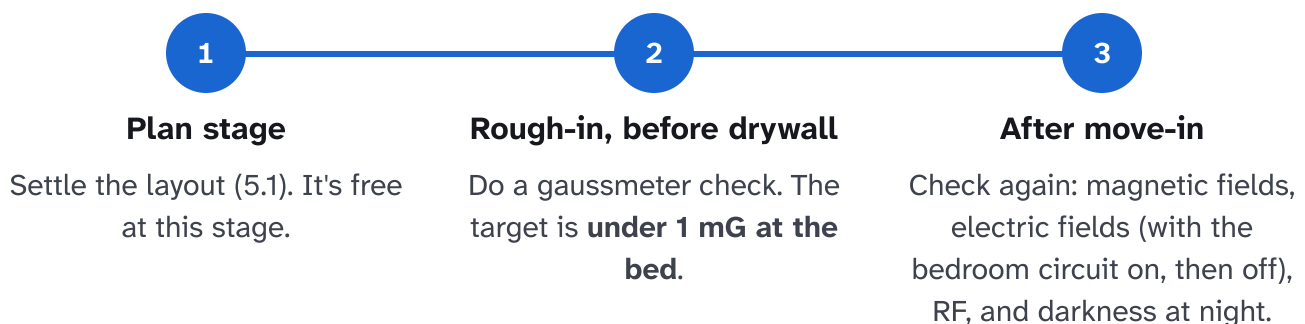
These are cheap, and one error anywhere in the house can put current on the pipes and ground paths under your bedrooms.

- ☐ Bond neutral to ground **at the main disconnect only**.
- ☐ Use a **PEX water supply**, or a dielectric union where metal water pipe enters the house *where permitted* (see Section 10).

5.5 RF readiness

- ☐ Run a shielded **Cat6A** drop to each bedroom.
- ☐ Optional: apply grounded shielding paint (YShield) to a wall facing a smart meter or cell tower (see 6.8).

5.6 Verify

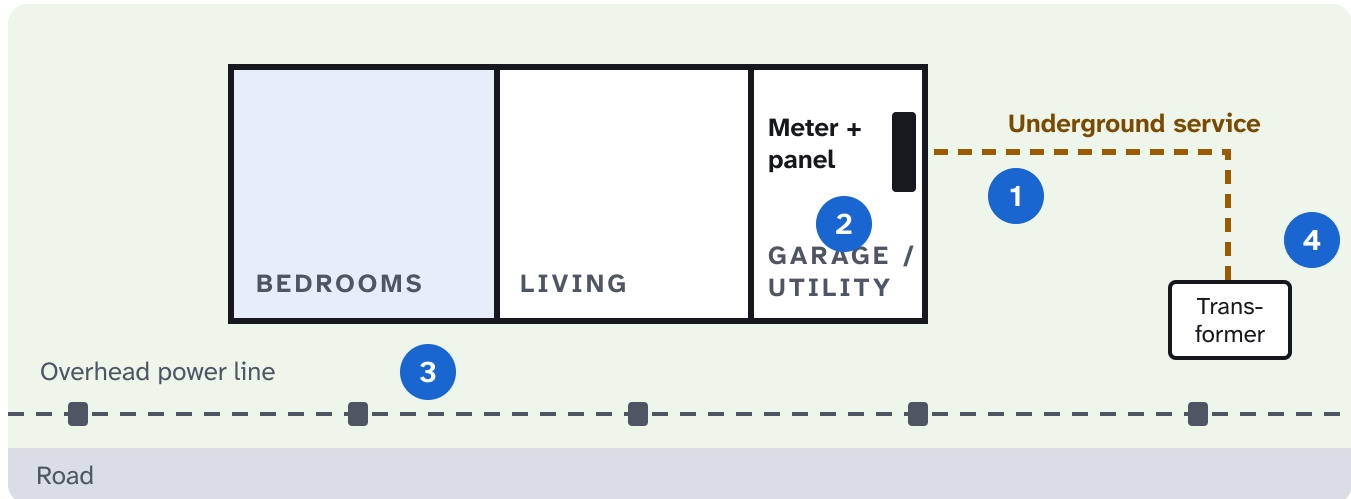


Building the whole house? Section 6 applies everything here house-wide, plus more.

New Build, Complete Home

Everything in Section 5, applied house-wide, plus this.

6.1 Site & service



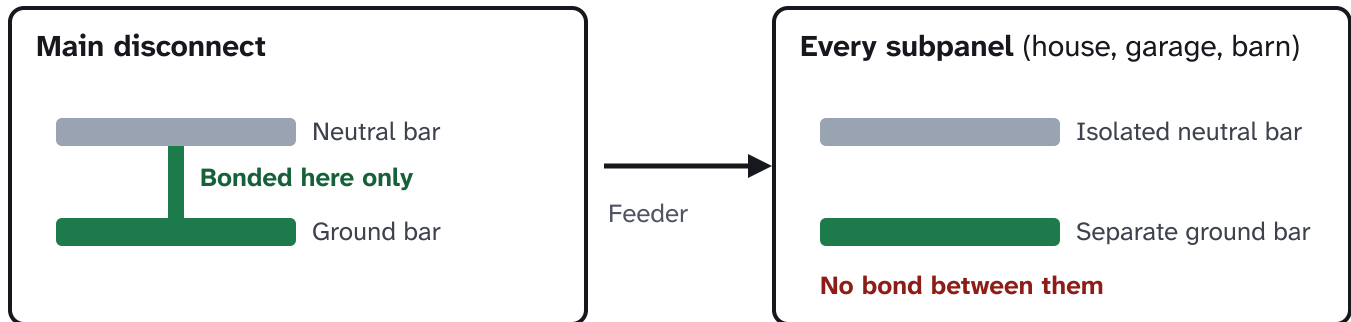
- 1 Run the service **underground**, entering at the end of the house farthest from the bedrooms.
- 2 Put the meter and main panel in the **garage or utility room**, not on a living-space wall.
- 3 Measure for overhead power lines before siting the house.
- 4 Place the transformer as far from the house as the utility allows.

6.2 Wiring method

- ☐ Use **MC cable or EMT throughout**. No NM cable (Romex).
- ☐ Keep each circuit's hot and neutral in the same cable or raceway, always.
- ☐ Give every circuit a dedicated neutral, with no multiwire branch circuits.
- ☐ Wire all 3-way and 4-way switches correctly.
- ☐ Size wire per code (12 AWG for 20A, 14 AWG for 15A). **Wire gauge does not change EMF**; conductor spacing and current do.

Grounding, feeders and motors

6.3 Grounding & bonding



- ☐ Bond neutral to ground at the main disconnect only.
- ☐ Give subpanels isolated neutral bars and separate ground bars.
- ☐ Install the grounding electrode system per NEC 250.
- ☐ Use a PEX water supply, or a dielectric union where metal pipe enters *where permitted* (see Section 10). Bond per code.
- ☐ Bond the gas line per code, with a dielectric fitting where permitted.

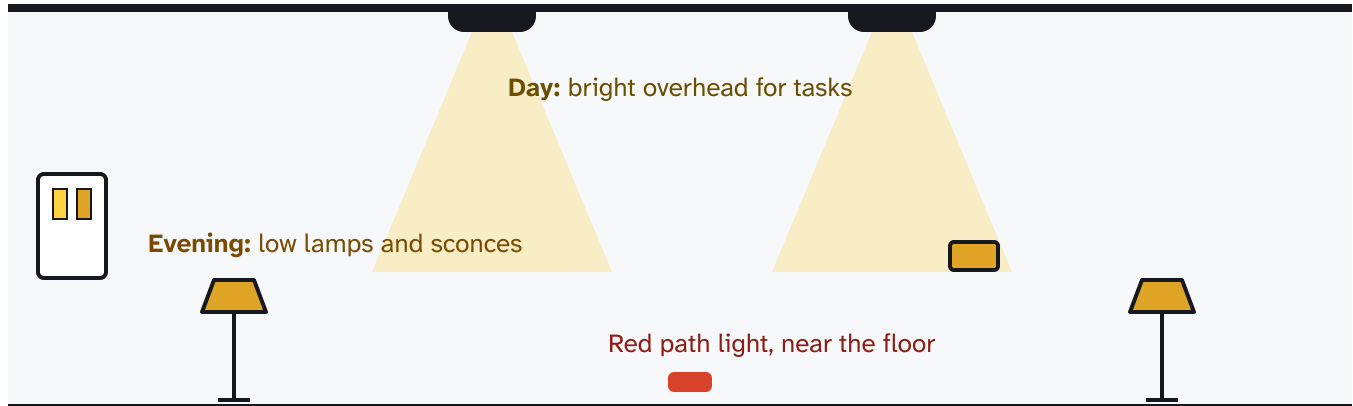
6.4 Feeders, appliances & motors

- ☐ Route the range, dryer, HVAC and EV charger circuits away from bedrooms and sitting areas.
- ☐ Put the EV charger on a garage wall that doesn't back onto a bedroom.
- ☐ **Well pump:** give it a dedicated circuit, bury the feeder and route it away from the house, and keep the pressure tank and controls outside the living space.

Whole-home lighting design

Layer it: bright by day, warm and low by night, on separate switches.

6.5 Lighting



Separate switches: one kills the overheads and leaves the warm, low lighting on.

- ☐ Use **E26 sockets in every living space**, and avoid integrated-LED fixtures anywhere you spend your evenings.
- ☐ **Layer the lighting:** bright overhead light for daytime tasks, plus low lamps and sconces (below eye level) on separate switches for evenings.
- ☐ Put **evening circuits** on their own switches, so one switch kills the overheads and leaves the warm, low lighting on.
- ☐ Use **low red or amber path lights**, mounted near the floor, in halls, stairs and baths.
- ☐ **Keep dimmers to a minimum.** Use them only on incandescent loads in living areas, never in bedrooms.
- ☐ **Kitchen and workspace:** use clear incandescent or halogen task lighting, positioned near windows.
- ☐ **Exterior:** use warm or amber, fully shielded fixtures on motion sensors or timers, aimed away from windows.

Daylight, and wired data

6.6 Windows & daylight

- ☐ Install **operable windows** in the main living spaces and bedrooms. An open window lets the full spectrum in.
- ☐ Glazing: energy code often requires low-e glass. Ask your builder and code official which windows, if any, can use clear glass, and prioritize the spots where you actually sit during the day, like the office, kitchen table or sunroom.
- ☐ Design in **covered outdoor space off the main living area**, such as a porch or patio, so daily outdoor time is easy.
- ☐ Put east-facing windows in the kitchen or breakfast area to catch morning light.
- ☐ Frame every bedroom for blackout coverings.

6.7 Low-voltage & network

- ☐ Run shielded **Cat6A** home runs to every room, plus ceiling drops for optional access points.
- ☐ Put the network closet centrally, away from bedrooms.
- ☐ Hardwire the TVs, office, cameras and doorbell, and choose wired over wireless smart-home gear.
- ☐ Install wired phone jacks and avoid DECT cordless phones.

Shielding, solar and outbuildings

6.8 Shielding (targeted RF only)

- ✓ Use shielding paint (YShield HSF54 or similar) **only** on walls facing a known outside source.
- ✓ The paint **must be grounded** using the manufacturer's grounding plates, installed by the electrician. Topcoat it with standard latex.
- ✗ **Don't shield a room and then use Wi-Fi inside it.** Signals bounce around, and devices transmit harder.
- ✗ **Shielding paint does nothing for magnetic fields.** Magnetic fields from panels and wiring are fixed by distance and design.

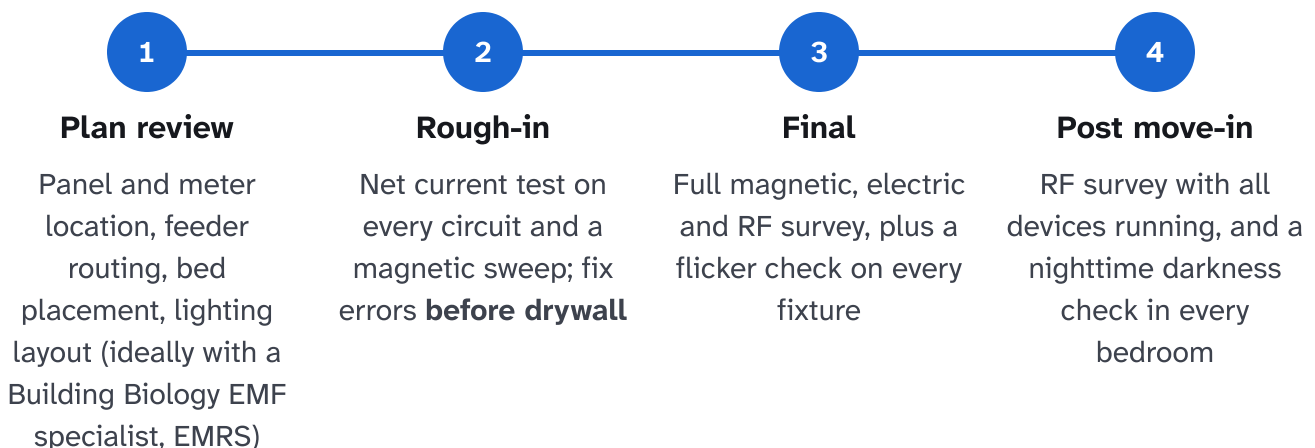
6.9 Solar (if applicable)

- ☐ Put the inverter and batteries on an exterior or garage wall, away from bedrooms.
- ☐ Run DC and AC lines in metal conduit, away from sleeping areas.

6.10 Outbuildings & property

- ☐ Keep the electric fence charger and its ground rods well away from the house and the well head.
- ☐ Bury the feeders to barns and shops, and give each building its own properly bonded panel.

6.11 Verification schedule



Build timeline

What happens when. Most of this is free if it happens at the right phase, and expensive if it's missed.

- 1 Design**

Place the panel and meter away from bedrooms. Mark bed and headboard locations on the plans. Lighting plan (sockets, low lamp circuits, night lights). Network closet. Schedule an optional EMRS plan review.
Owner, architect, electrician
- 2 Utility & site**

Underground service route, and transformer location as far from the house as possible
Utility, electrician, excavator
- 3 Foundation**

Foundation (Ufer) ground, underground service conduit, PEX water service line or well line
Electrician, plumber
- 4 Framing**

Blackout shade pockets. Box locations kept off headboard walls. Space for the network closet.
Framer, GC
- 5 Rough-in**

MC cable or EMT, steel boxes, dedicated bedroom circuits, Cat6A runs, PEX plumbing
Electrician, low-voltage installer, plumber
- 6 Pre-drywall test**

Section 8 Tests A–C. Fix every failure now, then complete sign-off part 1.
Electrician (optional EMRS)
- 7 Insulation & drywall**

Nothing electrical changes after this point without cost.
GC
- 8 Trim-out**

E26 fixtures, mechanical switches, demand switches, shielded jacks. No LED dimmers in bedrooms.
Electrician
- 9 Final**

Section 8 Tests A–F, full sign-off, walkthrough, install evening bulbs
Electrician, owner
- 10 Move-in**

RF survey with all devices running, nighttime darkness check, start the Measurement Log
Owner

Who does what

Each job, and who owns it.

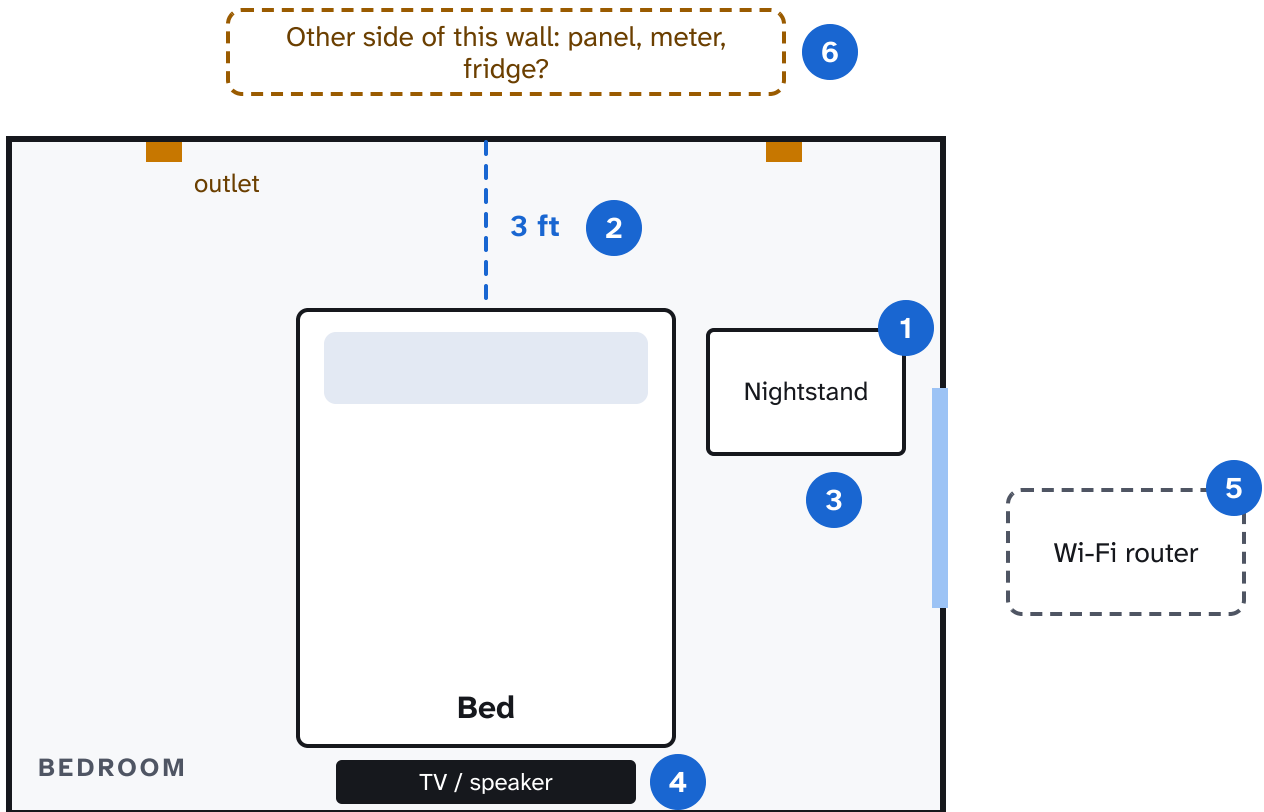
6.13 Who does what

	Owner	Architect / GC	Electrician	Plumber	Low- voltage	Utility
Panel, meter and bed locations	✓ decides	✓ draws	✓ advises			
Underground service & transformer		✓	✓			✓
MC wiring, bonding, circuits			✓			
PEX / dielectric union			✓ bonds	✓ installs		
Cat6A & network closet		✓			✓	
Testing & sign-off	✓ signs		✓ tests			
Lighting & bulbs	✓	✓ plans	✓ installs			

Hand your electrician Sections 8 and 9. They hold the goals, the tests and the spec.

Start with your bedroom

The order: measure, free fixes, wiring errors, relocation, shielding last. Start where you sleep.



1 Phone. Charge it outside the bedroom, or put it in airplane mode. [4](#) • [7.2](#)

3 Bedside. Unplug everything within arm's reach. Switch to a battery clock. [7.2](#)

5 Router. On a timer so it's off overnight, and away from bedrooms. [4](#) • [7.2](#)

2 Bed. Pull it 3 ft from any wall with outlets. [4](#) • [7.2](#)

4 Standby lights. Cover every standby LED with tape. [4](#)

6 The wall behind. Keep the bed off walls shared with the panel, meter, fridge or HVAC. [7.2](#)

The details follow: the survey (7.1), free and cheap fixes (7.2), electrician work (7.3), bigger moves (7.4), shielding last (7.5).

The order

Measure first. Shielding comes last.



7.1 Survey

Week 1

-
- ☐ Buy or rent meters, or hire a Building Biology EMF specialist (EMRS).

 - ☐ Map each bedroom at bed height, recording magnetic, electric and RF readings.

 - ☐ Turn breakers off one at a time to find which circuit drives each reading.

 - ☐ **Magnetic field with no appliance nearby?** Suspect net current or current on the water pipes. See Section 12 (Troubleshooting).

 - ☐ Measure at the water pipe where it enters the house. Your electrician can clamp it too (Section 8, Test B).

 - ☐ Do a light walk-through:
 - Count the LEDs.
 - Check each one for flicker with the slow-motion camera.
 - Note every light source in the bedroom at night.

Free and cheap

7.2 Do these this week.

Light

- ☐ Do the full **10-Minute Audit** (Section 4).
- ☐ Swap bedroom and living-room evening lamps to amber or red incandescent bulbs.
- ☐ Take LED bulbs off any dimmer circuit.
- ☐ Put up blackout curtains.

Wireless

- ☐ Put the router on a timer, and move it out of and away from bedrooms.
- ☐ Replace DECT cordless phones.
- ☐ Use wired baby monitors, or keep them 6+ ft from the crib.
- ☐ Put phones in airplane mode or out of the room, and turn off Bluetooth and Wi-Fi on idle devices.

Placement

- ☐ Move beds 3+ ft away from walls with outlets and wiring, and away from walls shared with the panel, meter, fridge or HVAC.

Breakers

- ☐ Label the breakers, and test turning off bedroom circuits at night. Keep smoke and CO detectors powered.

Bedside

- ☐ Unplug everything near the bed, and switch to battery clocks.

Electrician work

7.3 Moderate cost.

Give your electrician **Sections 8 and 9** and Karl Riley's *Tracing EMFs in Building Wiring and Grounding*.

Wiring errors

- ☐ Find and fix **net current**: shared neutrals, miswired 3-way switches, crossed neutrals.
- ☐ Remove neutral-to-ground bonds at subpanels.

Water line

- ☐ If current is found on the pipes, install a **dielectric union** (or a PEX section) at the water entry, keeping bonding per NEC. First check Section 10: a metal water pipe may be a required grounding electrode.

Switching & lighting

- ☐ Install **remote demand switches** on bedroom circuits.
- ☐ Replace bedroom dimmers with standard switches.
- ☐ Swap integrated-LED bedroom fixtures for fixtures with E26 sockets.
- ☐ Add a switched outlet low on the wall for red nightlights and bedside lamps.

Relocation

- ☐ Move outlets off the headboard wall where practical.

Bigger moves

7.4 When the free and cheap fixes aren't enough.

1

Swap bedrooms. This is often the cheapest big fix: sleep in the room with the lowest readings.

2

Ask your utility about an **analog or opt-out meter** (programs vary by state).

3

Hardwire Ethernet using flat cable, MoCA adapters over existing coax, or in-wall runs during any remodel.

4

Panel on a bedroom wall?

- Add a closet or bookcase as a buffer, or move the bed to the far wall.
- As a last resort, use steel or mu-metal shielding plates.

5

Rewire bedroom circuits in MC cable during any remodel, especially in older homes.

6

If you're replacing windows, choose operable units, and ask about glazing options for the areas where you sit during the day.

Shielding last, then the property

7.5 RF shielding (only after everything above)

- ☐ First, confirm with a meter that there's a real outside source.
- ☐ Apply grounded shielding paint to that wall only, or use a shielding bed canopy as a reversible option.
- ☐ If RF comes through glass, use window film or shielding curtains.
- ☐ Re-measure, and keep wireless devices out of shielded spaces.

7.6 Property

- ☐ Measure around the well pump, pressure tank and their wiring.
- ☐ Check where the electric fence charger and ground rods sit relative to the house.
- ☐ Measure near any overhead power lines.
- ☐ Re-aim or re-bulb exterior lights that shine into bedroom windows.

7.7 Track it

- ☐ Re-measure every bedroom after each phase.
- ☐ Keep a log of the date, room, readings (mG, V/m, $\mu\text{W}/\text{m}^2$), and notes on light and sleep.

Date	Room	mG	V/m	$\mu\text{W}/\text{m}^2$	Light and sleep notes
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The full log page is Section 14. Copy it before you start.

The Electrician's Field Guide

Read this first, if you're the electrician.

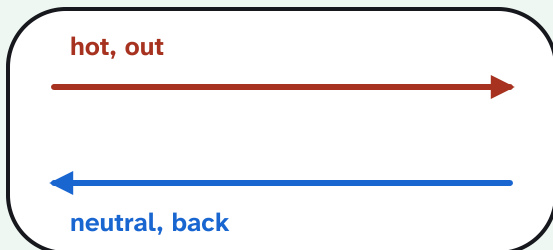
Nothing in this manual asks you to break code. Everything here is **code-compliant wiring done to a tighter standard, then proven with a meter**. The homeowner isn't asking for anything exotic. They're asking for clean workmanship, with numbers to show for it.

IN ONE SENTENCE

Every amp that goes out on a hot conductor comes back on the neutral in the same cable, and nothing flows on grounds, pipes, or armor under normal operation.

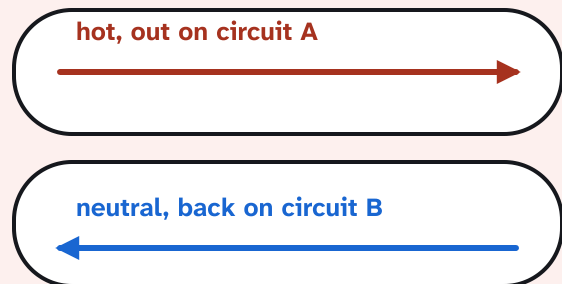
When that's true, the magnetic fields from the wiring cancel themselves out. The only fields left come from equipment, and distance handles those.

Right: zero net current



The fields cancel. Out and back in one cable, the wiring's magnetic fields cancel themselves out.

Wrong: a borrowed neutral



The fields don't cancel. The #1 cause of high readings in a room with no appliance nearby.

Homeowners: start with the cover letter (8.6) and the bid list (8.7) at the end of this section.

The six goals

8.1 In electrician terms, each one proven by a test.

1

Zero net current

Hot and neutral of every circuit run together. No shared neutrals, no borrowed neutrals, no miswired 3-ways.

PROVEN BY

Test A

Leakage clamp test on every circuit (8.3)

2

Quiet grounding system

Neutral bonded to ground only at the service disconnect. The ground carries fault current only.

PROVEN BY

Test B

Clamp test on the grounding electrode conductor, water bond and gas bond

3

Grounded metal around conductors in sleeping areas

MC cable or EMT, listed fittings, steel boxes, all bonded to ground, so electric fields stay inside the wall

PROVEN BY

Test D

Continuity check, plus an E-field reading at the bed

4

Distance from high-current equipment

Panel, meter, feeders and big appliance runs kept away from beds per the plan

PROVEN BY

Test C

Gaussmeter sweep

5

Night shutoff

Bedroom circuits can be de-energized at night. Smoke and CO detectors stay live.

PROVEN BY

Test E

Demand switch test

6

Wireless optional

Wired data to every room, so the owner can turn Wi-Fi off

PROVEN BY

Test F

RF reading at the pillow

Materials

8.2 What to use, why, and what to avoid.

Branch wiring

USE MC cable with an insulated ground (HCF-rated MC is optional, for dual ground paths)

WHY The armor, bonded to ground, contains the electric field, and the conductors are cabled (twisted) by construction, which cancels the magnetic field.

AVOID NM (Romex) in living spaces

Raceway (alternative)

USE EMT with steel fittings, with each circuit's hot and neutral in the same raceway

WHY Grounded steel shields the electric field and adds some magnetic shielding.

AVOID PVC conduit inside living spaces, which gives no shielding

MC terminations

USE Listed MC connectors with anti-short bushings

WHY Keeps the armor bonded, so the shield stays continuous and grounded

AVOID Loose or unlisted fittings, which break the shield

Device boxes

USE Steel boxes, bonded

WHY Keeps the shield continuous at each outlet and switch

AVOID Plastic boxes, which leave a gap in the shield at every device

Subpanels

USE Isolated neutral bar, separate ground bar, bonding screw or strap removed

WHY Keeps neutral current off the ground path

AVOID Bonded neutrals in subpanels

Breakers

USE AFCI and GFCI wherever code requires them (dual-function where both apply)

WHY They're required, and AFCIs also tend to catch shared-neutral mistakes.

AVOID Leaving out code-required protection. This manual never asks for that.

Materials, continued

8.2 Switches, fixtures, water and data.

Switches

- USE** Standard mechanical switches
- WHY** Quiet and reliable
- AVOID** Smart or Wi-Fi switches in bedrooms (they have built-in radios), and dimmers on LED loads

Night shutoff

- USE** UL-listed remote demand switch, or a clearly labeled breaker
- WHY** Lets the bedroom be de-energized at night
- AVOID** Any unlisted device, or putting smoke and CO detectors on the switched circuit

Light fixtures

- USE** E26 socket fixtures
- WHY** The owner controls the bulb.
- AVOID** Integrated-LED fixtures in bedrooms

Water service

- USE** PEX, or a dielectric union at the entry *where permitted* (see Section 10)
- WHY** Keeps stray current from riding the plumbing through the house
- AVOID** Isolating a metal water pipe that serves as a required grounding electrode

Data

- USE** Shielded Cat6A (S/FTP or F/UTP), shielded jacks, drain grounded at the patch-panel end only
- WHY** Makes wired internet the easy default
- AVOID** Unshielded runs laid alongside power cable

Low-voltage mounting

- USE** Low-voltage brackets, with data kept 12 in. or more from parallel power runs
- WHY** Keeps the data runs clean
- AVOID** Bundling data with power

The test protocol

8.3 Measurable pass / fail.

Tools

TOOL	SPEC	EXAMPLES
Leakage clamp meter	AC, 1 mA resolution or better	Fluke 368 or 369 FC, or a similar leakage clamp
Standard clamp meter	AC amps	Any quality clamp meter
Test load	About 12 A resistive load	A 1500 W space heater or hair dryer
Gaussmeter	Resolution of 0.1 mG	Trifield TF2, Alphalab UHS2
E-field meter	Reads in V/m	Trifield TF2 (E-mode)
RF meter	Reads in $\mu\text{W}/\text{m}^2$	Safe and Sound Pro II, Acoustimeter

When: At rough-in (**before insulation and drywall**), and again at final.

The six tests at a glance

Test A

Net current, every branch circuit

Pass: under 0.1 A

Test B

Current on the grounding system

Pass: under 0.1 A on each

Test C

Magnetic field sweep (bedrooms)

Pass: under 1 mG at every bed

Test D

Shield continuity & electric field

Pass: under 5 V/m at the pillow

Test E

Night shutoff

Pass: de-energizes when idle

Test F

RF at the pillow (at final)

Pass: under 10 $\mu\text{W}/\text{m}^2$

Test A: net current

Every branch circuit.

- 1 Plug the test load in at the **farthest outlet** on the circuit and turn it on.
- 2 Confirm the load current: clamp the **hot alone** and expect about 12 A. If the reading is far off, the test isn't valid yet.
- 3 Clamp **around the whole cable**, or around hot and neutral together, where the circuit leaves the panel. This reading is the net current.
- 4 Repeat at several points along the run: at a box, or at a switch leg.
- 5 For every 3-way and 4-way circuit, test **each switch position**.



Step 2: clamp the hot alone.
Expect about 12 A.



Step 3: clamp the whole cable.
This is the net current.

Net current with the load on

Pass	Under 0.1 A (100 mA)
Target	Under 0.02 A (20 mA)
Fail	0.1 A or more. Look for a shared or borrowed neutral, a miswired traveler, or a neutral touching ground.

Why 0.1 A: that much uncanceled current produces roughly 0.2 mG at 3 ft, which is inside the bedroom target. More than that and the wiring itself starts to show up on the meter.

Tests B and C

The grounding system, then the bedrooms.

Test B Current on the grounding system

- 1 Turn on typical loads throughout the house.
- 2 Clamp and record the current on each of these:
 - The grounding electrode conductor
 - The water pipe bond
 - The gas bond
 - Any metal water pipe where it enters the house
- 3 Turn off the main breaker and measure all of them again.

Pass

Under 0.1 A on each, with the main on

Main off

Current still present with the main **off**: the source is outside the house (the utility neutral, or neighbors through shared water lines). Record it and notify the owner. The fix may be a dielectric union where permitted, or a call to the utility.

Fail

Current present with the main **on** that goes away with the main **off**: there's a neutral-to-ground fault inside the house. Find it and fix it.

Test C Magnetic field sweep (bedrooms)

- 1 Run the house normally: HVAC, fridge and well pump cycling.
- 2 Take readings at the bed locations shown on the plan, at pillow height (about 2 ft off the floor), on a 3-ft grid across the sleeping area.
- 3 Take one reading next to the headboard wall.

Pass

Under 1 mG at every bed location

Target

Under 0.2 mG

Fail

Trace the source: a circuit (use Test A), the service, a feeder, or an appliance.

Tests D, E and F

The shield, the night shutoff, and RF.

Test D Shield continuity & electric field

- 1 Check continuity from the armor, conduit and box on each bedroom circuit back to the equipment ground bar. It should read as a solid bond.
- 2 At final, energize all bedroom circuits and read the E-field at the pillow position.

Pass Under 5 V/m at the pillow, with the circuits live

Target Under 1 V/m

Test E Night shutoff

- 1 Turn off every load in the bedroom. Confirm the demand switch cuts power: voltage at the outlet reads near zero, and the E-field drops.
- 2 Turn on a lamp and confirm power returns.
- 3 Confirm the smoke and CO detectors stay powered throughout.

Pass The circuit de-energizes when idle, restores on demand, and the detectors are unaffected.

Test F RF at the pillow (at final)

- 1 Turn off the owner's Wi-Fi, and turn the phones in the room off or to airplane mode.
- 2 Take a reading at the pillow position.

Pass Under 10 $\mu\text{W}/\text{m}^2$. A reading above that points to an outside source, such as a smart meter, a neighbor, or a cell tower. Record it for the owner.

The most common mistakes

8.4 Check these first.

1

A borrowed neutral: the hot comes from one circuit and the neutral returns on another. This is the #1 source of high fields in rooms with no appliance nearby.

2

Miswired 3-way switches: the neutral taken from a different cable than the hot.

3

Multiwire branch circuits that were split up during a remodel.

4

A bonded neutral in a subpanel, including detached garages and barns.

5

A neutral touching ground somewhere in a box: a nicked conductor, or a device wired wrong.

6

Old neutral-to-ground connections at appliances, such as a 3-wire dryer or range cord on a 4-wire circuit.

7

Plastic boxes spliced into an MC run, which breaks the shield.

Sign-off sheet

8.5 Fill in at rough-in and at final.

Project: _____ Electrician: _____ Date: _____

A. Branch circuits

Circuit #	Room / area	Load (A)	Net current (A)	3-way positions OK	Pass / Fail	Initials

B. Grounding system (main ON / main OFF)

Conductor	Main ON (A)	Main OFF (A)	Pass / Fail
Grounding electrode conductor			
Water bond			
Gas bond			
Water pipe at entry			

C–F. Bedrooms

Bedroom	Magnetic (mG)	E-field (V/m)	Demand switch OK	RF ($\mu\text{W}/\text{m}^2$)	Pass / Fail

Electrician signature: _____ Owner signature: _____

A letter to your electrician

8.6 Copy, sign, hand over.

Thanks for taking on this project. We're asking for **standard, code-compliant work done to a tighter standard, then verified with a meter**. Nothing here asks you to skip AFCI or GFCI protection, bonding, or any other code requirement.

The goal: every circuit's current returns on its own cable (zero net current), the grounding system carries no current under normal use, sleeping areas are wired in grounded metal-clad cable, and bedroom circuits can be switched off at night.

What we need from you:

1. Price the items in the attached bid list separately, so we can choose.
2. Run the tests in Section 8.3 at rough-in and at final, and fill in the sign-off sheet (8.5).
3. Tell us **before drywall** about any failure you can't fix, or anything that conflicts with code or the local inspector.

The pass/fail numbers are written into our agreement. If you have a better way to hit them, we want to hear it.

Signed: _____ Date: _____

Bid line items

8.7 Ask for each one priced separately.

#	ITEM	QUANTITY / NOTES	PRICE
1	MC cable (or EMT) instead of NM: whole house or bedroom circuits only	Price both options	_____
2	Steel device boxes in place of plastic	Same scope as #1	_____
3	Dedicated circuit(s) per bedroom	Number of bedrooms	_____
4	UL-listed remote demand switches	Number of bedroom circuits	_____
5	Subpanel isolation (separate neutral and ground bars, bond removed)	Number of subpanels, including barns and shops	_____
6	Water entry bonding and dielectric union (if permitted), coordinated with the plumber	1	_____
7	Shielded Cat6A home runs and network closet termination	Number of drops	_____
8	E26 fixtures and low night-light outlets in bedrooms and halls	Number of locations	_____
9	Testing at rough-in (Tests A–C)	Hours	_____
10	Testing at final (Tests A–F) and sign-off	Hours	_____
11	Corrections of failed tests	Hourly rate, not to exceed \$____	_____
12	Existing homes: net current survey and repair	Hourly rate, not to exceed \$____	_____

Spec sheet 9A: whole house

For a whole-house build or rewire (Section 6).

Hand this sheet to your electrician. All work must meet NEC and local code and be done by a licensed electrician. The targets below are precautionary guidelines written into this contract, not code requirements.

- | | |
|--|---|
| <p>1 Wiring method: MC cable or EMT throughout. No NM cable.</p> <hr/> <p>2 Conductors: Each circuit's hot and neutral in the same cable or raceway.</p> <hr/> <p>3 Neutrals: A dedicated neutral for every circuit. No multiwire branch circuits.</p> <hr/> <p>4 Bonding:</p> <ul style="list-style-type: none"> • Neutral-to-ground bond at the main disconnect only. • Isolated neutral bars in all subpanels. <hr/> <p>5 Switching: 3-way and 4-way switches wired with no net current on travelers.</p> <hr/> <p>6 Service:</p> <ul style="list-style-type: none"> • Underground service. • Meter and main panel located away from bedrooms, per the plan. <hr/> <p>7 Plumbing: PEX supply, or a dielectric union at the metallic entry where permitted. Metal water pipe serving as a grounding electrode (NEC 250.52) is not to be isolated without an approved alternative. Bond per NEC 250.104.</p> <hr/> | <p>8 Routing: Feeders and appliance circuits routed away from bedrooms.</p> <hr/> <p>9 Lighting:</p> <ul style="list-style-type: none"> • E26 sockets in all living spaces and bedrooms. • No integrated-LED fixtures and no dimmers in bedrooms. • Evening lamp circuits switched separately from overhead lights. • Low-mounted switched outlets for night lighting in halls, baths and bedrooms. <hr/> <p>10 Low-voltage: Shielded Cat6A home runs plus ceiling drops, terminating at a central network closet.</p> <hr/> <p>11 Well pump: Dedicated circuit, with the feeder buried and routed away from the house.</p> <hr/> <p>12 Labeling: Every breaker labeled by room.</p> <hr/> <p>13 Verification: Perform Section 8 Tests A–C at rough-in and Tests A–F at final. Net current under 0.1 A per circuit under a 12 A load; grounding conductors under 0.1 A; under 1 mG at bed locations. Correct failures before drywall and complete the Section 8.5 sign-off sheet.</p> <hr/> |
|--|---|

Only upgrading the bedrooms? Use spec sheet 9B on the next page.

Spec sheet 9B: bedrooms only

For the budget option (Section 5).

Hand this sheet to your electrician. All work must meet NEC and local code and be done by a licensed electrician. The targets below are precautionary guidelines written into this contract, not code requirements.

- 1 Wiring method:** MC cable or EMT for all bedroom circuits, and for any circuit that passes through or runs next to a bedroom.
- 2 Circuits:** Dedicated circuit(s) for each bedroom.
- 3 Night shutoff:** A remote demand switch or labeled breaker for each bedroom. Smoke and CO detectors on a separate circuit.
- 4 Neutrals and switching:** Dedicated neutrals and correctly wired 3-way switches, with no net current.
- 5 Layout:**
 - No panels, meters or major feeders on bedroom walls.
 - Headboard wall free of outlets and wiring runs.
- 6 Lighting:**
 - E26 socket fixtures only, with no dimmers.
 - Switched bedside outlets, plus a low-mounted switched outlet for night lighting.
- 7 Low-voltage:** A shielded Cat6A drop to each bedroom.
- 8 Whole-house minimum:**
 - Neutral-to-ground bond at the main disconnect only.
 - PEX or a dielectric union at the water entry.
- 9 Verification:** Section 8 Tests A, C, D and E on bedroom circuits. Net current under 0.1 A; under 1 mG at bed locations. Complete the Section 8.5 sign-off sheet.

Building or rewiring the whole house? Use spec sheet 9A on the previous page.

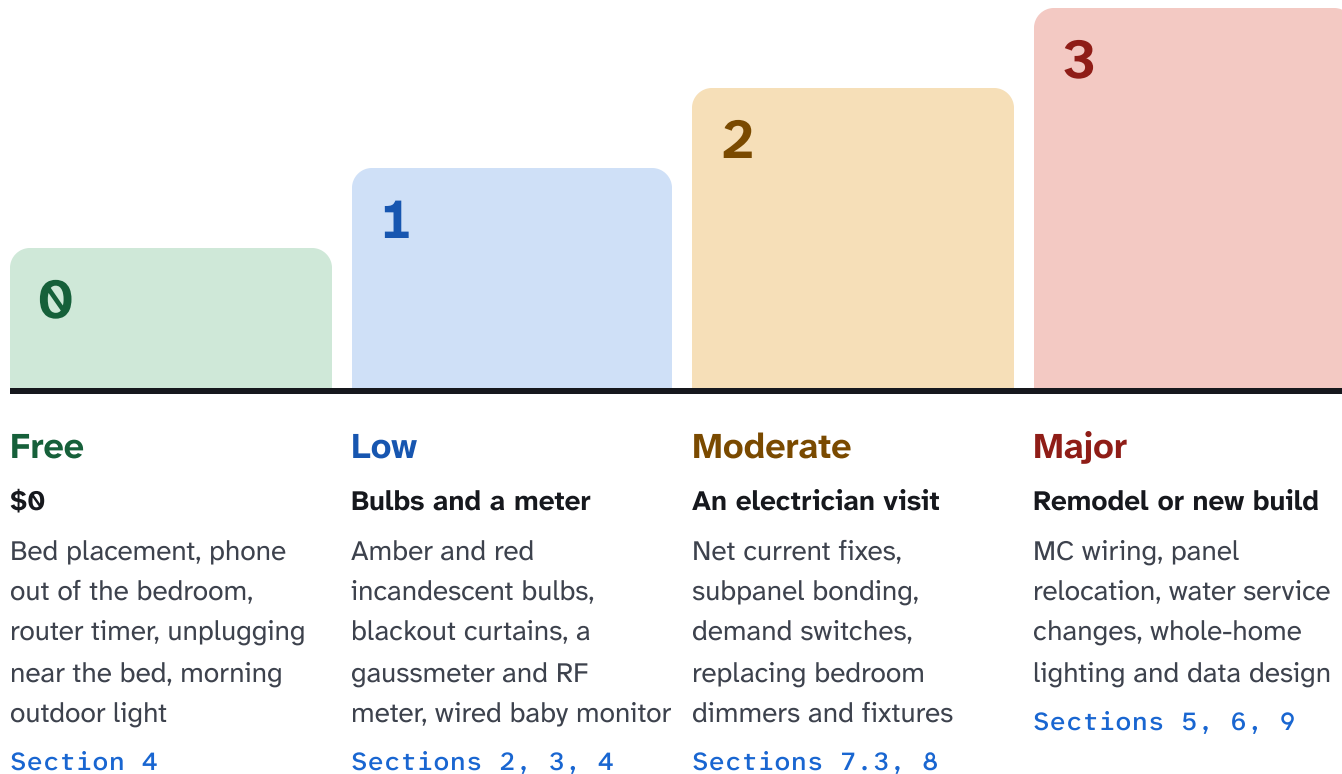
Code & Safety

Where the lines are. Lower exposure never comes at the cost of safety.

AFCI / GFCI protection	These are required by code (NEC 210.12 and 210.8), including on bedroom circuits. Keep them. They're fire and shock protection, and this manual never asks you to remove them.
Smoke & CO detectors	Keep them on their own circuit, always live, and never on a demand switch or a breaker you shut off at night.
Metal water pipe as a grounding electrode	Metal underground water pipe in contact with earth for 10 ft or more is a required grounding electrode (NEC 250.52), and metal piping must be bonded (NEC 250.104). Don't install a dielectric union on it unless your electrician and the local inspector approve another grounding path. With a PEX or plastic service line, as on most private wells, this isn't an issue.
Gas piping	Bond it per code. Dielectric fittings go in only where the gas utility and code allow them.
Shielding paint	It's conductive, so it must be grounded by an electrician using the manufacturer's grounding kit. Keep it away from exposed live parts.
Heat lamps and incandescent bulbs	Use ceramic sockets or rated fixtures, respect the fixture's wattage limit, keep bulbs clear of fabric and bedding, and never leave a heat lamp on unattended. Keep them out of reach of children.
Demand switches	Use UL-listed units only, installed per the manufacturer's instructions.
Permits & inspection	Pull permits. Every item in this manual passes inspection when it's done right.
DIY limits	Homeowners can do the lighting, the bed placement and the wireless changes. Anything inside the panel, and any wiring, is a job for a licensed electrician.

Priorities & Special Cases

Where to start, by budget.



THE RULE

Do Tier 0 this week. Measure before paying for Tier 2 or 3, so the money goes to the problems you actually have.

Special cases (kids and nurseries, home office, renters) are on the next page.

Special cases

Kids & nurseries

- Put the crib or bed on an interior wall. Keep it away from the panel, meter and outlet walls.
- Use a **wired** baby monitor, or place any wireless monitor 6 ft or more from the crib. Avoid monitors that transmit all the time.
- No tablets or phones in the room overnight.
- For night feedings, use a low red nightlight. Skip overhead lights.
- Kids' rooms are the first place to put a demand switch.
- **Heat lamps and hot bulbs stay out of kids' reach.** Use a covered red nightlight instead.

Home office

- Hardwire the computer. Turn off Wi-Fi and Bluetooth on the machine itself.
- Use a wired keyboard, mouse and headset where practical.
- Position the desk near a window you can open, and use a clear incandescent or halogen task lamp.
- Keep the desk off the panel wall, and keep power strips and chargers away from your feet and lap.

Renters & apartments

- Everything in Sections 3 and 4 works without touching the walls.
- Put the bed in the room with the lowest readings.
- Ask the landlord to have an electrician check for net current if a room reads high with no appliance nearby.
- A shielding bed canopy is a reversible option for outside RF. Measure before and after.

Troubleshooting

High reading? Find the source. The meter tells you where. This tells you why.

Magnetic

High magnetic field across a whole room, with no appliance nearby

MOST LIKELY CAUSE

Net current in the wiring, or current on the water pipes

HOW TO CONFIRM

Turn off breakers one at a time and watch the meter. Electrician: Tests A and B.

THE FIX

Correct the wiring (Section 8.4). Dielectric union on the water line where permitted.

Magnetic

High magnetic field near one wall that drops fast as you step away

MOST LIKELY CAUSE

Panel, meter, feeder, or an appliance on the other side of that wall

HOW TO CONFIRM

Map it with the gaussmeter, and check what's behind the wall

THE FIX

Move the bed, reroute the feeder, or add a buffer

Magnetic

Magnetic field that comes and goes

MOST LIKELY CAUSE

Cycling equipment (well pump, HVAC, fridge, electric fence)

HOW TO CONFIRM

Watch the meter while the equipment turns on and off

THE FIX

Move the equipment or its wiring, or move the bed

Magnetic

Magnetic field that stays high with the main breaker OFF

MOST LIKELY CAUSE

Outside source: power lines, the service drop, the utility neutral, or neighbors through shared water pipe

HOW TO CONFIRM

Measure outside, and near the water entry

THE FIX

Dielectric union (where permitted), a call to the utility, or distance

Electric, RF, light and switches

Electric High electric field at the bed

MOST LIKELY CAUSE

Cords, lamps, or unshielded wiring in the wall

HOW TO CONFIRM

Turn off breakers one at a time. The breaker that drops the number is your circuit.

THE FIX

Unplug items, demand switch, MC cable on remodel

RF High RF with your own Wi-Fi off

MOST LIKELY CAUSE

Neighbor's Wi-Fi, smart meter, cell tower, a DECT phone, or a device you forgot

HOW TO CONFIRM

Rotate slowly with the RF meter. The loudest direction points to the source.

THE FIX

Remove the source, move the bed, or targeted shielding

RF RF that spikes every few seconds or minutes

MOST LIKELY CAUSE

Smart meter, DECT base, baby monitor, or a device syncing

HOW TO CONFIRM

Use the meter's audio mode. Each source has its own sound.

THE FIX

Replace, relocate, or ask the utility about an opt-out

Light Light that flickers, or headaches under a lamp

MOST LIKELY CAUSE

LED on a dimmer, or a cheap LED driver

HOW TO CONFIRM

Point your phone's slow-motion camera at the bulb

THE FIX

Incandescent bulb, and remove the dimmer

Switch Demand switch won't cut power

MOST LIKELY CAUSE

Something on the circuit is still drawing current (standby device, clock, or a smoke detector wrongly on this circuit)

HOW TO CONFIRM

Unplug items one by one

THE FIX

Remove the load, or have the electrician move the detector

FAQ

Is any of this against code?

No. Everything here is code-compliant. Section 10 lists the lines you never cross.

Will it cost more?

Some of it. Design choices, like where the panel and beds go, are free. MC cable, demand switches and testing add cost. Ask for the line-item bid (Section 8.7) so you can choose.

Do I have to do everything?

No. Start with the bedrooms and the free fixes (Sections 4 and 11). Measure, then spend money where the meter points.

Does "grounding" everything reduce EMF?

Grounding is for safety, and it's what makes metal cable and shielding paint work. It does **not** reduce magnetic fields. Extra, improper ground connections can actually *create* current paths that raise fields.

Will shielding paint fix my panel wall?

No. Paint blocks RF. Panels create magnetic fields, and those are fixed by distance and correct wiring.

Is my smart meter a problem?

Measure it. It depends on which wall it sits on and how often it transmits. Keep beds off that wall, and ask your utility whether it has an opt-out program.

What about cell towers and 5G?

Measure at the bed. If it's high, the options are distance (moving the bed), targeted shielding, and window film.

Why incandescent bulbs if they use more energy?

You're using a few bulbs, for a few evening hours. The energy cost is small, and your sleep is the priority.

Should I shut off breakers every night?

Only the bedroom circuits, and never the smoke or CO detectors. A demand switch does this automatically.

Can I trust a cheap meter or a phone app?

Use a 3-axis gaussmeter and a real RF meter (Section 2). Phone apps aren't reliable.

How do I know it worked?

The numbers go down. Keep the Measurement Log (Section 14), and track your sleep alongside it.

Measurement Log

Copy this page. Measure at pillow height, at night, with the house running as usual.

[illegible]

Glossary

AFCI

Arc-fault breaker. Code-required fire protection on most living-space circuits.

Bonding

Connecting metal parts together so they sit at the same electrical potential, for safety

Demand switch

A device that cuts power to a circuit when nothing is drawing current, and restores it when you turn something on

Dielectric union

A pipe fitting that electrically separates two sections of pipe

Dirty electricity

High-frequency noise riding on house wiring, created by dimmers, LED drivers and chargers

EMT

Thin-wall steel conduit that the wires are pulled through

EMRS

Electromagnetic Radiation Specialist, a Building Biology-certified EMF consultant

GFCI

Ground-fault breaker or outlet. Shock protection near water.

Grounding electrode

The ground rods, the foundation (Ufer) ground, or the metal water pipe that connect the electrical system to the earth

Kelvin (K)

The color temperature of light. Lower is warmer: 1800K is candle-like, 5000K+ is cold blue-white.

Low-e glass

Energy-efficient window coating that blocks much of the infrared

MC cable

Metal-clad cable. The wires are wrapped in grounded metal armor.

mG (milligauss)

The unit for magnetic field strength

Multiwire branch circuit

Two circuits sharing one neutral. A common source of net current when wired wrong.

Net current

Current that doesn't return on its own cable, so its magnetic field doesn't cancel. It's the main cause of high magnetic fields in homes.

NM (Romex)

Standard plastic-sheathed house cable, with no shielding

PEX

Plastic water pipe. It can't carry electrical current.

PWM

Pulse-width modulation. Dimming by rapidly switching the light on and off, which creates flicker.

RF

Radio frequency: Wi-Fi, cellular, Bluetooth, smart meters

Traveler

The wires that run between 3-way switches

$\mu\text{W}/\text{m}^2$

Microwatts per square meter, the unit for RF power density

V/m

Volts per meter, the unit for electric field strength

Resources

Screens & devices

Daylight Computer (DC-1):

daylightcomputer.com. This is a paper-like tablet with a flicker-free (PWM-free) display and an amber, blue-light-free backlight, readable in direct sun.

Lighting

Daylight Labs (daylightcomputer.com/labs): small-batch incandescent bulbs made for evening and night use.

- **Amber (2100K):** ST64 Edison-style bulb in 40W or 60W, and T45 in 25W. For after-dinner lighting.
- **Deep amber (1800K):** ST64, and T45 in 25W. Close to candlelight, for the wind-down hours.
- **Red incandescent (G80, 1000K):** a low-flicker red bulb for the bedside and pre-bed use.
- **Wood light fixture:** a wooden bulb holder with a grounded plug.

Red heat lamps and reptile basking bulbs: hardware and pet supply stores

Meters & shielding

Leakage clamp meters (Fluke 368 or 369 FC, or similar): for the electrician's net current tests in Section 8

LessEMF.com: gaussmeters, RF meters, shielding paint, grounding kits, bed canopies and magnetic shielding metals

YShield: carbon-based RF shielding paint (HSF54 and others). It must be grounded.

Other paint brands: Woremore, Super Shield, Geovital

Professional help & education

Building Biology Institute

(buildingbiologyinstitute.org): a directory of certified EMF specialists (EMRS) for plan reviews and home surveys

Karl Riley, *Tracing EMFs in Building*

Wiring and Grounding: the electrician's reference for finding net current and grounding errors

Note: This manual is for general educational purposes and is not medical advice. All electrical work must be performed by a licensed electrician and meet NEC and local code.