



CANADIAN BASIC AMATEUR RADIO EXAM PREPARATION

SECTION 8 **G** INTERFERENCE & SUPPRESSION





**THIS COURSE IS BEING TAUGHT TO THE JULY 15, 2025 UPDATE
OF THE CANADIAN BASIC AMATEUR RADIO EXAM QUESTIONS.**

SECTION 8 QUESTION CATEGORIES:

**B-008-001: RECEIVER OVERLOAD AND INTERMODULATION
INTERFERENCE**

B-008-002: AUDIO RECTIFICATION AND RFI TO HOUSEHOLD DEVICES

**B-008-003: SPURIOUS EMISSIONS AND PARASITIC OSCILLATIONS
FROM TRANSMITTERS**

B-008-004: HARMONIC AND OUT-OF-BAND EMISSIONS

**B-008-005: TYPES AND APPLICATIONS OF FILTERS FOR
INTERFERENCE CONTROL**



QUESTION SECTION B-008-001:

RECEIVER OVERLOAD AND INTERMODULATION INTERFERENCE

B-008-001: RECEIVER OVERLOAD AND INTERMODULATION INTERFERENCE

RECEIVER OVERLOAD

- RECEIVER OVERLOAD (ALSO CALLED FRONT-END OVERLOAD) OCCURS WHEN **A VERY STRONG SIGNAL FROM A NEARBY TRANSMITTER** DRIVES THE RECEIVER'S FRONT-END CIRCUITRY INTO NON-LINEAR OPERATION.
- THIS CAUSES THE RECEIVER TO LOSE SENSITIVITY OR PRODUCE DISTORTION/INTERFERENCE ON DESIRED SIGNALS, EVEN IF THE STRONG SIGNAL IS NOT ON THE EXACT TUNED FREQUENCY.
- IT AFFECTS HF RECEIVERS PARTICULARLY WHEN STRONG AMATEUR OR BROADCAST SIGNALS ARE PRESENT.

B-008-001: RECEIVER OVERLOAD AND INTERMODULATION INTERFERENCE

RECEIVER OVERLOAD

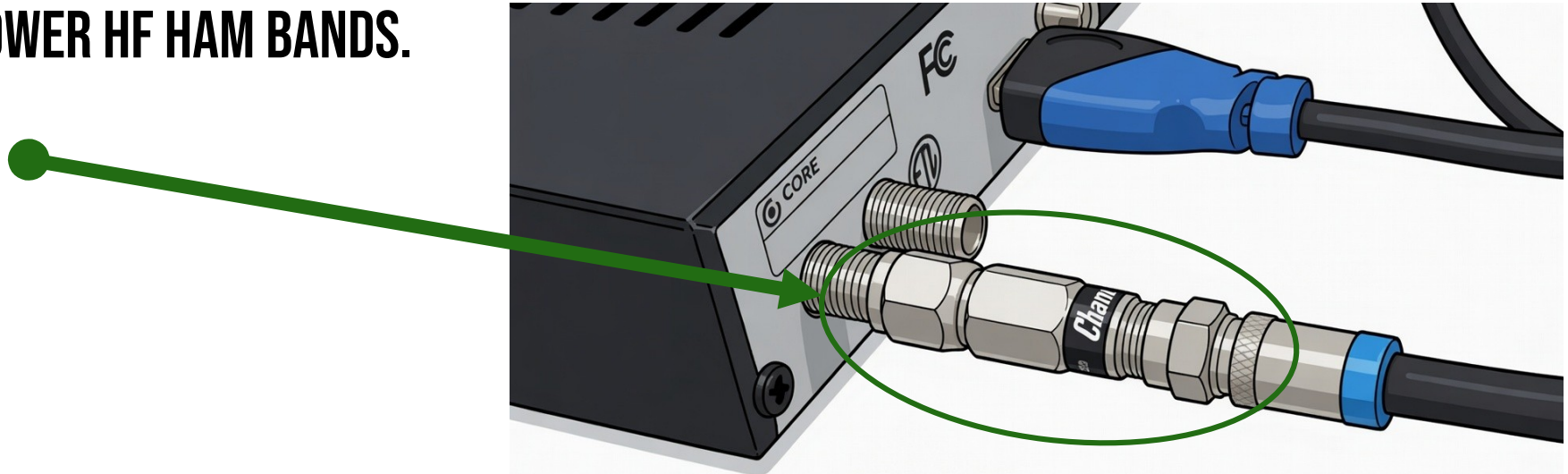
- IF YOUR NEIGHBOUR IS COMPLAINING THAT HE HAS INTERFERENCE ON HIS TELEVISION WHILE YOU TRANSMIT, IT'S PROBABLY **RECEIVER OVERLOAD**.
- THIS WAS MORE COMMON IN THE ANALOGUE TV DAYS. MODERN TECH IS STILL SUSCEPTIBLE TO **RFI (RADIO FREQUENCY INTERFERENCE)**.



B-008-001: RECEIVER OVERLOAD AND INTERMODULATION INTERFERENCE

RECEIVER OVERLOAD

- ONE SOLUTION IS A **HIGH-PASS FILTER** ATTACHED TO THE TV/MEDIA BOX.
- THIS LETS THE HIGHER VHF/UHF FREQUENCIES PASS WHILE BLOCKING/FILTERING OUT THE LOWER HF HAM BANDS.



B-008-001: RECEIVER OVERLOAD AND INTERMODULATION INTERFERENCE

RECEIVER DESENSITIZATION (DESENSE)

- DESENSITIZATION (OR "DESENSE") HAPPENS WHEN A STRONG NEARBY SIGNAL (OFTEN FROM ANOTHER TRANSMITTER ON THE SAME OR CLOSE BAND) **REDUCES THE RECEIVER'S SENSITIVITY, MAKING WEAK DESIRED SIGNALS HARD TO HEAR**. THIS IS COMMON IN MULTI-STATION SETUPS OR WHEN MOBILES/REPEATERS ARE VERY CLOSE.
- A STRONG SIGNAL FROM THE NEARBY CW TRANSMITTER OVERLOADS/DESENSITIZES THE SSB RECEIVER ON THE SAME BAND.
- WHEN MOBILES GET VERY CLOSE, EACH TRANSMITTER'S STRONG SIGNAL DESENSITIZES THE OTHER'S RECEIVER.

B-008-001: RECEIVER OVERLOAD AND INTERMODULATION INTERFERENCE

INTERMODULATION INTERFERENCE (INTERMOD)

- INTERMODULATION OCCURS WHEN **TWO OR MORE STRONG SIGNALS MIX** IN A NON-LINEAR DEVICE (USUALLY THE RECEIVER'S FRONT-END, BUT SOMETIMES EXTERNALLY).
- THIS PRODUCES NEW UNWANTED FREQUENCIES (INTERMOD PRODUCTS) THAT FALL ON THE DESIRED RECEIVE FREQUENCY, **CREATING NOISE, MIXING OF SIGNALS, OR DISTORTION**. IT IS COMMON IN VHF/UHF ENVIRONMENTS WITH MULTIPLE STRONG TRANSMITTERS NEARBY.
- A HIGHER-GAIN ANTENNA BRINGS IN STRONGER OFF-FREQUENCY SIGNALS, WORSENING MIXING IN THE RECEIVER.
- A **BAND-PASS, NOTCH, OR HIGH-PASS FILTER** CAN ATTENUATE ONE OR BOTH STRONG SIGNALS TO PREVENT MIXING.



QUESTION SECTION B-008-002:

AUDIO RECTIFICATION AND RFI TO HOUSEHOLD DEVICES

B-008-002: AUDIO RECTIFICATION AND RFI TO HOUSEHOLD DEVICES

AUDIO RECTIFICATION BASICS

- **AUDIO RECTIFICATION** OCCURS WHEN A STRONG RF SIGNAL (FROM AN AMATEUR TRANSMITTER) ENTERS **AUDIO CIRCUITRY** VIA LONG WIRES ACTING AS ANTENNAS. THE AUDIO STAGES (OFTEN CONTAINING DIODES OR NON-LINEAR JUNCTIONS IN TRANSISTORS/AMPLIFIERS) RECTIFY (DEMODULATE) THE RF, CONVERTING IT INTO **AUDIBLE AUDIO OR NOISE**.
- THIS HAPPENS IN DEVICES WITH **NO INTENTIONAL RF COMPONENTS** (EX: STEREOS, PUBLIC ADDRESS, SYSTEMS, TELEPHONES), MAKING THE INTERFERENCE SOUND LIKE THE TRANSMITTED SIGNAL OR DISTORTED VERSIONS OF IT.
- IT'S COMMON WITH HF TRANSMISSIONS DUE TO THEIR STRENGTH AND WAVELENGTHS THAT COUPLE EASILY INTO WIRING.

B-008-002: AUDIO RECTIFICATION AND RFI TO HOUSEHOLD DEVICES

SYMPTOMS IN DIFFERENT MODES

- THE SOUND OF INTERFERENCE DEPENDS ON THE TRANSMITTED MODE:
 - SSB (VOICE) → DEMODULATES TO **DISTORTED SPEECH**.
 - CW (MORSE) → PRODUCES ON/OFF KEYING SOUNDS LIKE **HUMMING OR CLICKING**.
- THIS HELPS IDENTIFY THE SOURCE DURING TROUBLESHOOTING.



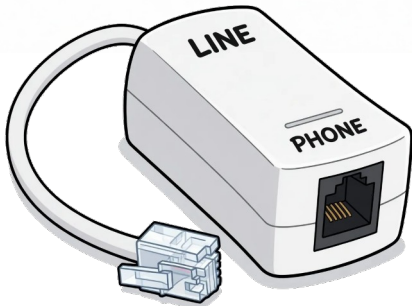
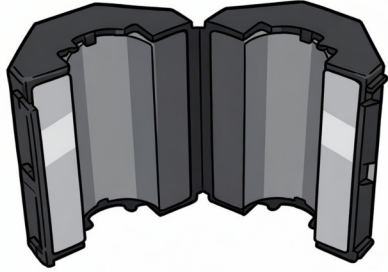
B-008-002: AUDIO RECTIFICATION AND RFI TO HOUSEHOLD DEVICES

MITIGATION TECHNIQUES

- THE PRIMARY FIX IS TO **PREVENT RF** FROM ENTERING AUDIO PATHS:
 - USE **FERRITE CORES** (CHOKES) ON WIRES TO INCREASE IMPEDANCE TO COMMON-MODE RF CURRENTS WHILE PASSING AUDIO/DC.
 - **SHORTEN**/REROUTE WIRES TO REDUCE ANTENNA EFFECT.
 - INSTALL SPECIFIC **FILTERS** (EX: **MODULAR PHONE FILTERS**).

B-008-002: AUDIO RECTIFICATION AND RFI TO HOUSEHOLD DEVICES

MITIGATION TECHNIQUES



FERRITES ARE YOUR FRIENDS!





QUESTION SECTION B-008-003:

SPURIOUS EMISSIONS AND PARASITIC OSCILLATIONS FROM TRANSMITTERS

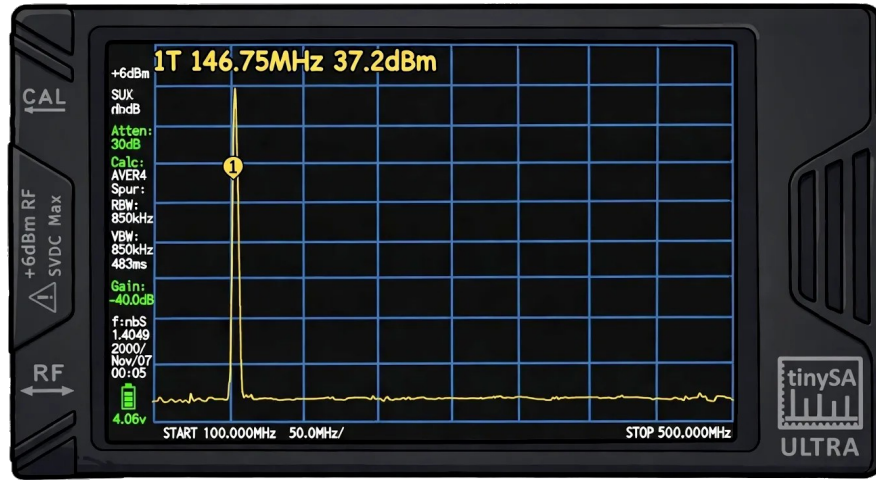
B-008-003: SPURIOUS EMISSIONS AND PARASITIC OSCILLATIONS FROM TRANSMITTERS

INTERMODULATION AND SPURIOUS EMISSIONS

- **INTERMODULATION** IS THE UNDESIREED CREATION OF NEW FREQUENCIES WHEN STRONG SIGNALS MIX IN A NON-LINEAR DEVICE (EX: AN AMPLIFIER DRIVEN TOO HARD).
- IN TRANSMITTERS, THIS CAN PRODUCE SPURIOUS SIGNALS.
- **SPURIOUS EMISSIONS** ARE UNWANTED SIGNALS TRANSMITTED OUTSIDE THE INTENDED FREQUENCY BAND OR MODE, INCLUDING HARMONICS, MIXING PRODUCTS, OR PARASITIC SIGNALS.
- THEY CAN INTERFERE WITH OTHER USERS NEARBY OR ON ADJACENT FREQUENCIES. COMMON CAUSES INCLUDE OVERDRIVE, POOR FILTERING, MISSING SHIELDING, OR FAULTY STAGES.

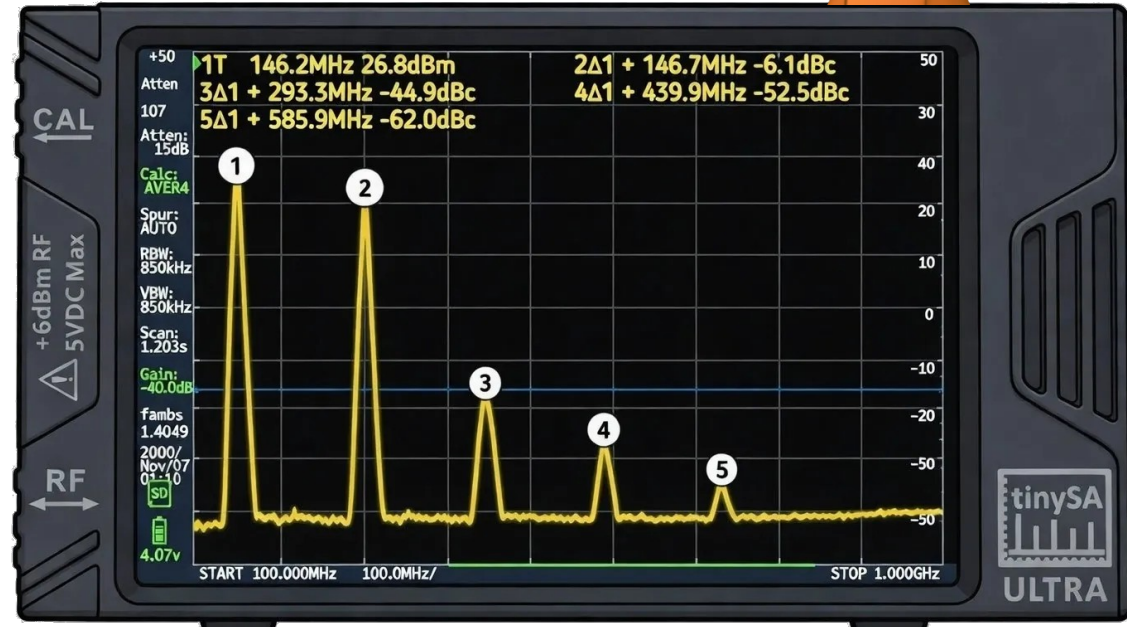
B-008-003: SPURIOUS EMISSIONS AND PARASITIC OSCILLATIONS FROM TRANSMITTERS

SPURIOUS EMISSIONS ON HARMONICS



★ Clean Radio

Dirty Radio



B-008-003: SPURIOUS EMISSIONS AND PARASITIC OSCILLATIONS FROM TRANSMITTERS

KEY CLICKS IN CW (MORSE CODE) TRANSMISSION

- KEY CLICKS ARE SHARP, BROADBAND **RF INTERFERENCE** (OFTEN HEARD AS CLICKS OR POPS) CAUSED BY ABRUPT ON/OFF KEYING OF THE CARRIER. THIS CREATES A VERY WIDE SPECTRUM DUE TO FAST RISE/FALL TIMES, VIOLATING GOOD ENGINEERING PRACTICE AND CAUSING INTERFERENCE FAR FROM YOUR FREQUENCY. CAUSES INCLUDE:
 - SUDDEN **MAKING/BREAKING** OF THE KEY CIRCUIT.
 - **TOO SHARP RISE AND DECAY TIMES** (POOR WAVEFORM SHAPING).
- FIXES INVOLVE ADDING **KEYING FILTERS** (EX: SHAPING CIRCUITS IN THE TRANSMITTER) OR CHECKING **LATER STAGES** FOR PROPER FILTERING.

B-008-003: SPURIOUS EMISSIONS AND PARASITIC OSCILLATIONS FROM TRANSMITTERS

PARASITIC OSCILLATIONS

- **PARASITIC OSCILLATIONS** ARE UNWANTED SELF-SUSTAINING OSCILLATIONS IN AN AMPLIFIER OR OSCILLATOR STAGE, CAUSED BY **UNWANTED POSITIVE FEEDBACK** (EX: STRAY CAPACITANCE/INDUCTANCE COUPLING OUTPUT BACK TO INPUT WITH THE RIGHT PHASE).
- THEY PRODUCE SIGNALS **ABOVE OR BELOW THE TRANSMITTER FREQUENCY**, OFTEN SPURIOUS EMISSIONS THAT INTERFERE WITH OTHERS.
- COMMON IN RF AMPLIFIERS IF NOT PROPERLY NEUTRALIZED, DECOUPLED, OR SHIELDED. PREVENTION INCLUDES GOOD LAYOUT, BYPASSING, NEUTRALIZATION CIRCUITS, AND PROPER SHIELDING.



QUESTION SECTION B-008-004:

HARMONIC AND OUT-OF-BAND EMISSIONS

B-008-004: HARMONIC AND OUT-OF-BAND EMISSIONS

HARMONIC EMISSIONS BASICS

- HARMONIC EMISSIONS ARE **UNWANTED SIGNALS** AT INTEGER MULTIPLES OF YOUR TRANSMITTER'S FUNDAMENTAL (OPERATING) FREQUENCY (EX: $2\times$, $3\times$, ETC.). THEY ARISE FROM NON-LINEAR OPERATION IN AMPLIFIERS (ESPECIALLY IF **OVERDRIVEN**), PRODUCING ENERGY AT HARMONICS THAT CAN RADIATE AND CAUSE INTERFERENCE FAR FROM YOUR INTENDED FREQUENCY.
- HARMONICS ARE A TYPE OF SPURIOUS EMISSION AND ARE UNDESIRABLE BECAUSE THEY CAN **INTERFERE WITH OTHER SERVICES** (EX: BROADCAST TV, OTHER HAMS). PROPER TRANSMITTER DESIGN INCLUDES FILTERING TO SUPPRESS THEM.

B-008-004: HARMONIC AND OUT-OF-BAND EMISSIONS

HARMONIC EMISSIONS BASICS

- B-008-004-010 — AN INTERFERING SIGNAL FROM AN HF TRANSMITTER IS FOUND TO HAVE A FREQUENCY OF 56 MHZ. WHAT COULD BE THE SOURCE? **ANSWER: SECOND HARMONIC OF A 10-METRE TRANSMISSION**
- 10M BAND ~28 MHZ FUNDAMENTAL; $2 \times 28 = 56$ MHZ, WHICH FALLS IN THE VHF TV RANGE.

B-008-004: HARMONIC AND OUT-OF-BAND EMISSIONS

HARMONICS CAUSING TV INTERFERENCE

- WHEN TRANSMITTING ON HF BANDS (ESPECIALLY 15M ~21 MHz), THE SECOND OR THIRD **HARMONIC** CAN FALL DIRECTLY ON LOW VHF TV CHANNELS (EX: CHANNEL 3: 60-66 MHz $\approx 3 \times 21$ MHz; CHANNEL 6: 82-88 MHz $\approx 4 \times 21$ MHz).
- INTERFERENCE APPEARS ONLY ON SPECIFIC CHANNELS MATCHING THE HARMONIC, NOT BROADBAND LIKE OVERLOAD. THE FIX IS USUALLY A **LOW-PASS FILTER** AT THE TRANSMITTER TO SUPPRESS HARMONICS, NOT AT THE TV (WHICH WOULD BLOCK YOUR FUNDAMENTAL IF IT WERE OVERLOAD).
- **HARMONIC EMISSIONS FROM YOUR TRANSMITTER**



B-008-004: HARMONIC AND OUT-OF-BAND EMISSIONS

OUT-OF-BAND EMISSIONS

- **OUT-OF-BAND EMISSIONS** REFER TO ANY UNWANTED RADIO ENERGY TRANSMITTED JUST OUTSIDE THE NECESSARY BANDWIDTH OF YOUR SIGNAL.
- THIS INCLUDES **HARMONICS**, BUT ALSO **SPLATTER** OR OTHER SPURS CLOSE TO YOUR FREQUENCY. THEY WASTE SPECTRUM AND CAUSE ADJACENT-CHANNEL INTERFERENCE.

B-008-004: HARMONIC AND OUT-OF-BAND EMISSIONS

SPLATTER FROM OVERMODULATION

- SPLATTER IS BROADBAND INTERFERENCE (WIDE "SPLASH" ON EITHER SIDE OF YOUR FREQUENCY) CAUSED BY **OVERMODULATION**—PUSHING THE TRANSMITTER BEYOND LINEAR OPERATION, OFTEN FROM **EXCESSIVE MICROPHONE GAIN** OR SPEECH PROCESSING.
- IN SSB, THIS FLATTENS ("FLAT TOPS") THE WAVEFORM, GENERATING STRONG SIDEBANDS FAR OUTSIDE THE NORMAL BANDWIDTH, INTERFERING WITH NEARBY STATIONS. IT'S NOT HARMONICS BUT DISTORTION PRODUCTS FROM NON-LINEARITY.
- TOO MUCH AUDIO DRIVE CAUSES THE MODULATOR/AMPLIFIER TO CLIP, LEADING TO FLAT-TOPPED ENVELOPES → SPLATTER.



QUESTION SECTION B-008-005:

TYPES AND APPLICATIONS OF FILTERS FOR INTERFERENCE CONTROL

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BASIC FILTER TYPES AND RESPONSES

- **FILTERS SELECTIVELY PASS OR ATTENUATE FREQUENCIES:**
 - **LOW-PASS** — PASSES FREQUENCIES BELOW THE CUT-OFF; ATTENUATES ABOVE (USED TO BLOCK HARMONICS OR HIGH-FREQUENCY NOISE).
 - **HIGH-PASS** — PASSES FREQUENCIES ABOVE THE CUT-OFF; ATTENUATES BELOW (USED TO BLOCK LOWER-FREQUENCY OVERLOAD OR BROADCAST SIGNALS).
 - **BAND-PASS** — PASSES A SPECIFIC RANGE (BAND) OF FREQUENCIES; ATTENUATES OUTSIDE IT (IDEAL FOR ISOLATING ONE BAND OF OPERATION).
 - **BAND-REJECT (NOTCH)** — ATTENUATES A NARROW RANGE OF FREQUENCIES; PASSES EVERYTHING ELSE (USED TO ELIMINATE A SINGLE STRONG INTERFERER).

B-008-005: TYPES AND APPLICATIONS OF FILTERS FOR INTERFERENCE CONTROL

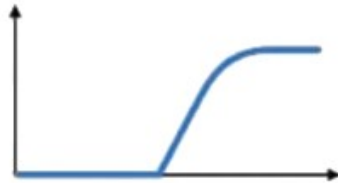


Capacitors:

- As frequency $\uparrow X_c \downarrow$
- Block/Impede Low Frequency Signals
- Allow high frequency signals to pass

Inductors:

- As frequency $\downarrow X_L \uparrow$
- Block/Impede High Frequency Signals
- Allow low frequency signals to pass



High-Pass Filter

Lets high frequencies pass and blocks the ones below the setting.

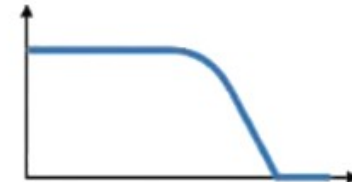


Band-Pass Filter

Passes frequencies within specified band, blocks all else.

Band-Reject is the opposite.

Notch Filter blocks one frequency



Low-Pass Filter

Lets low frequencies pass and blocks the ones above the setting.

Radio Filters

B-008-005: TYPES AND APPLICATIONS OF FILTERS FOR INTERFERENCE CONTROL

NOTCH FILTERS

- A **NOTCH** (BAND-REJECT) FILTER IS HIGHLY SELECTIVE, CREATING A DEEP ATTENUATION "NOTCH" AT ONE SPECIFIC FREQUENCY (OR NARROW BAND) WHILE PASSING SIGNALS ON EITHER SIDE WITH MINIMAL LOSS.
- IT IS THE GO-TO CHOICE FOR ELIMINATING A SINGLE STRONG INTERFERING SIGNAL (EX: A CARRIER, BIRDIE, OR NEARBY STATION) THAT IS VERY CLOSE TO YOUR DESIRED FREQUENCY, WITHOUT AFFECTING THE REST OF THE BAND

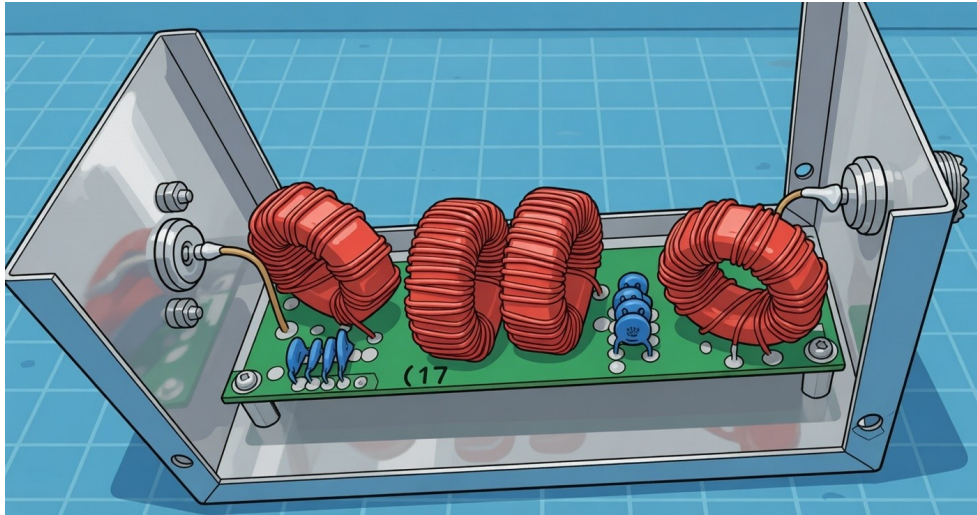
B-008-005: TYPES AND APPLICATIONS OF FILTERS FOR INTERFERENCE CONTROL

APPLICATIONS IN RECEIVERS AND TRANSMITTERS

- **FILTERS ARE PLACED STRATEGICALLY:**
 - **LOW-PASS** AT TRANSMITTER OUTPUT → SUPPRESSES HARMONICS/SPURIOUS EMISSIONS.
 - **LOW-PASS** AT RECEIVER INPUT OR AC LINES → BLOCKS HIGH-FREQUENCY NOISE/RFI.
 - **HIGH-PASS** AT TV RECEIVER → BLOCKS STRONG HF AMATEUR SIGNALS CAUSING OVERLOAD.
 - **BAND-PASS** ON RECEIVER DURING MULTI-BAND OPERATIONS (EX: FIELD DAY) → REDUCES CROSS-BAND INTERFERENCE AND DESENSITIZATION.
 - **BAND-PASS** ON VHF RECEIVER → REJECTS STRONG OUT-OF-BAND SIGNALS CAUSING OVERLOAD.
 - **BAND-REJECT** ON RECEIVER → NOTCHES OUT A STRONG BROADCAST STATION ON A NEARBY BAND.

B-008-005: TYPES AND APPLICATIONS OF FILTERS FOR INTERFERENCE CONTROL

HF BANDPASS FILTER



CIRCUIT THAT ALLOWS SIGNALS WITHIN A SPECIFIC RANGE OF FREQUENCIES (CALLED THE **PASSBAND**) TO PASS THROUGH, WHILE REJECTING OR STRONGLY ATTENUATING FREQUENCIES OUTSIDE THAT RANGE (BOTH LOWER AND HIGHER).



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