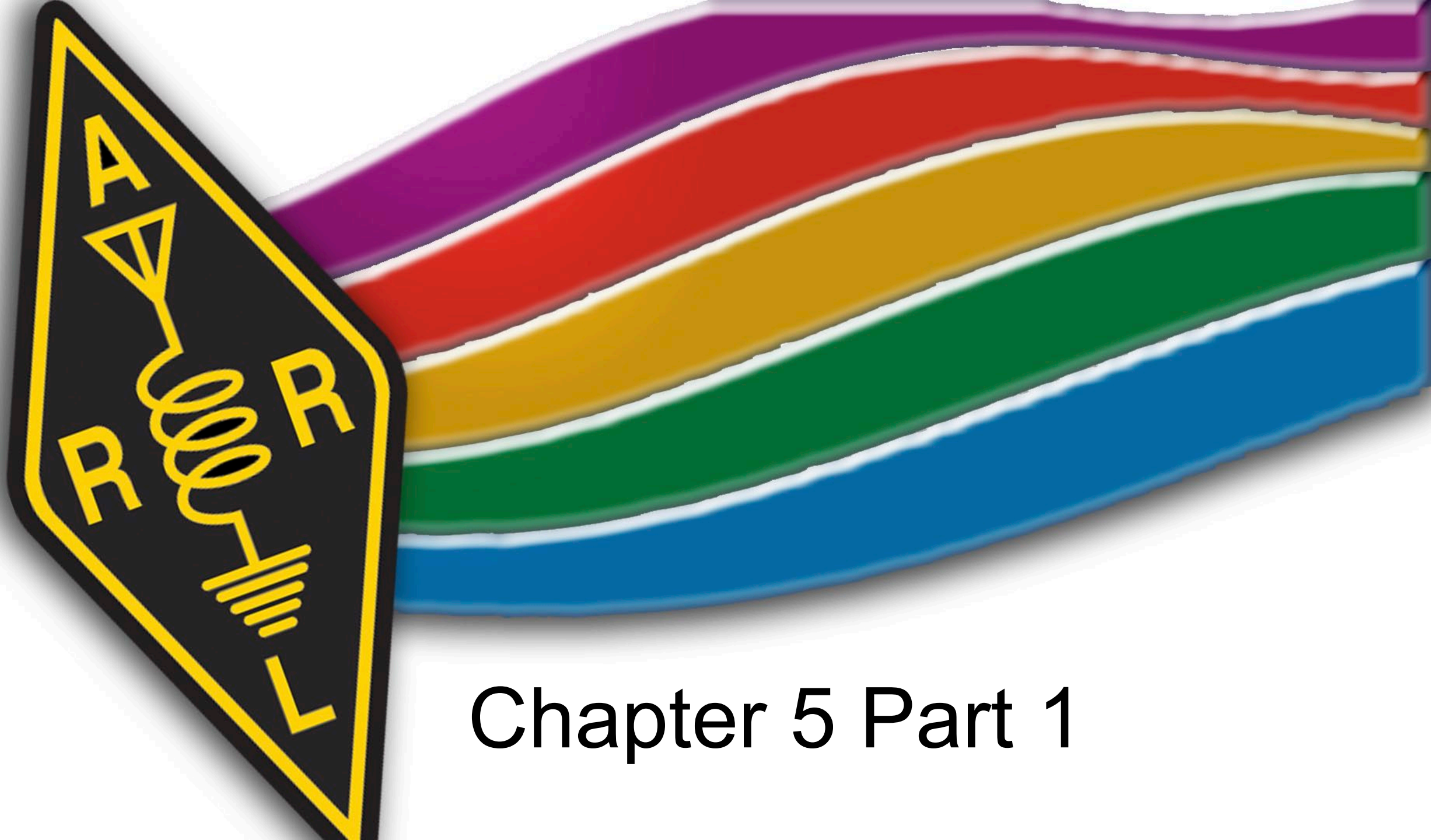




Technician License Course



Chapter 5 Part 1



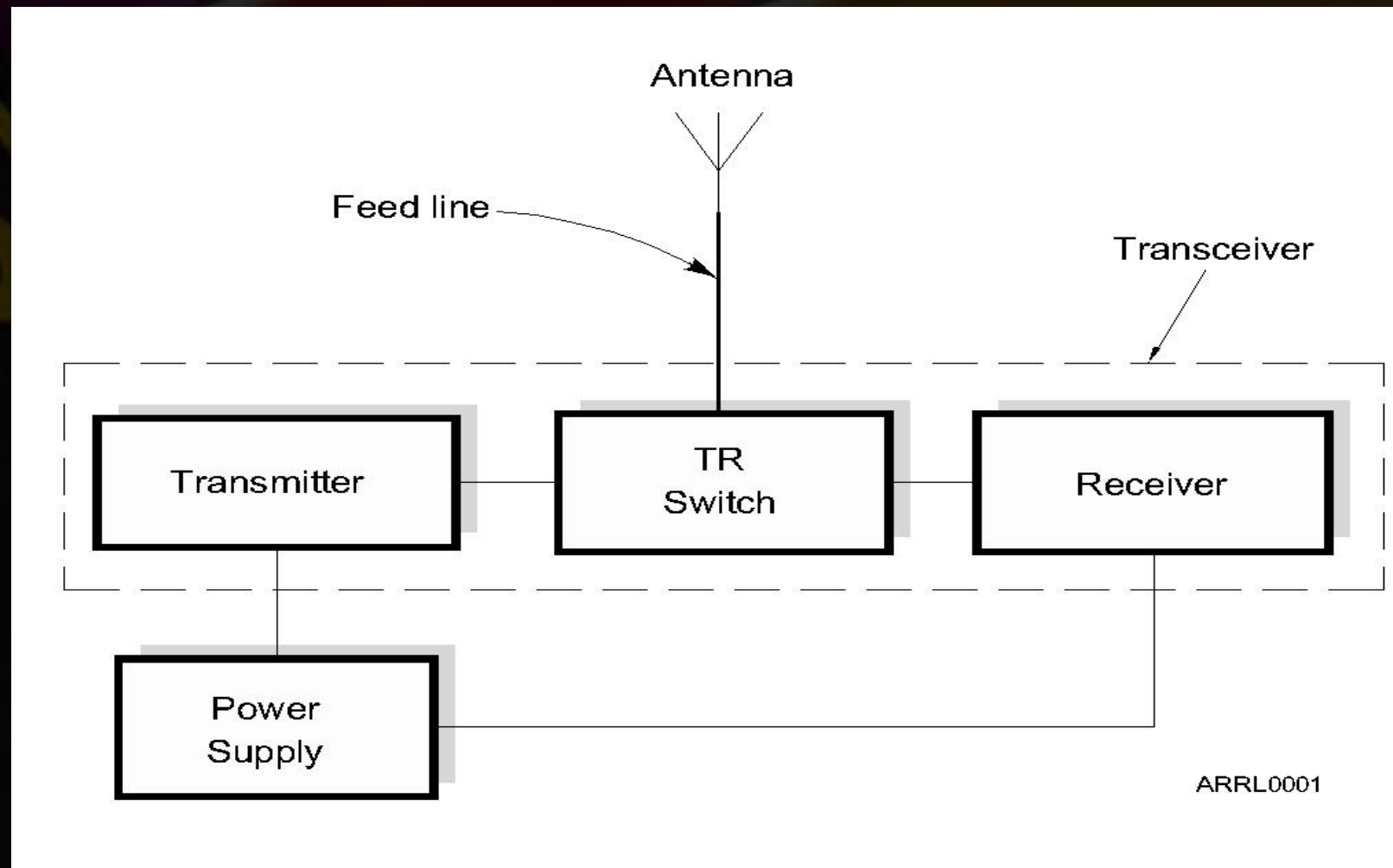
Technician License Course

Chapter 2

Lesson Plan Module - 3

Modulation & Bandwidth

The Basic Radio Station

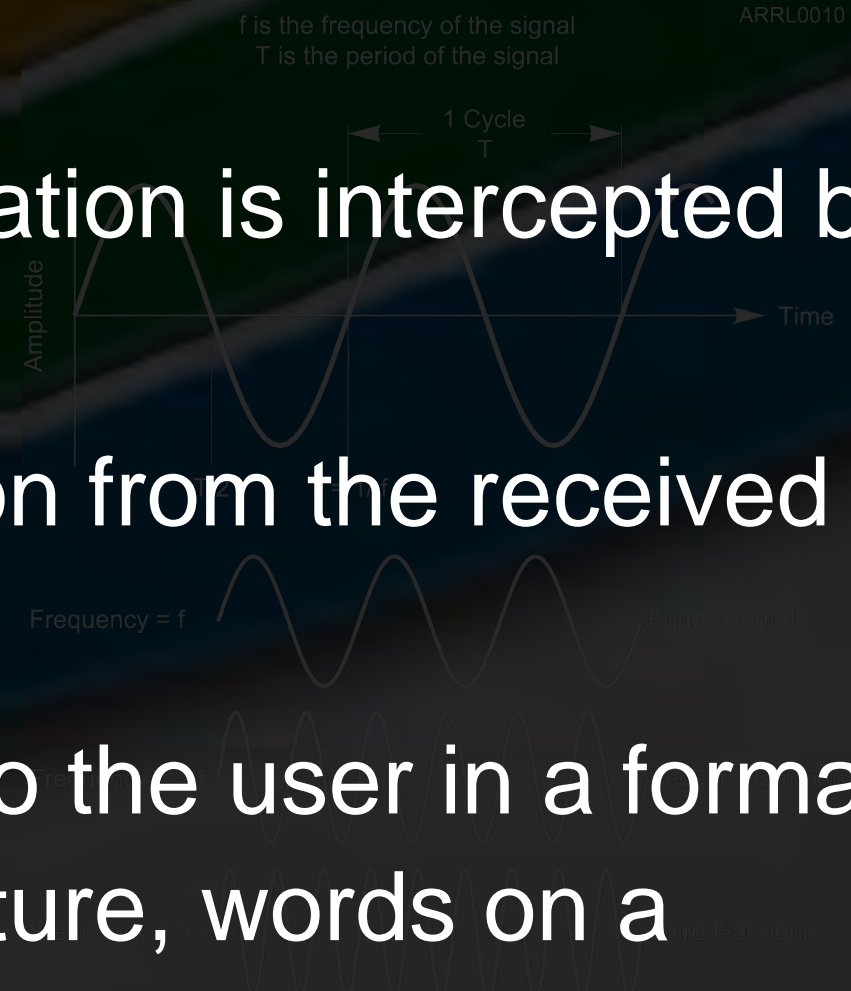


What Happens During Radio Communication?

- Transmitting (sending a signal):
 - Information (voice, data, video, commands, etc.) is converted to electronic form.
 - The information in electronic form is added to a radio wave.
 - The radio wave carrying the information is sent from the station antenna into space.

What Happens During Radio Communication?

- Receiving:
 - The radio wave carrying the information is intercepted by the receiving station's antenna.
 - The receiver extracts the information from the received wave.
 - The information is then presented to the user in a format that can be understood (sound, picture, words on a computer screen, response to a command, etc.).

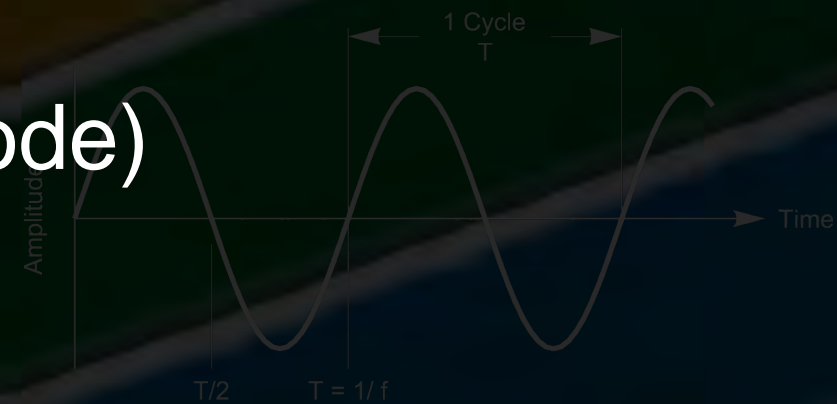


What Happens During Radio Communication?

- Adding and extracting the information can be simple or complex.
- This makes ham radio fun...learning all about how radios work.
- Don't be intimidated. You will be required to only know the basics, but you can learn as much about the “art and science” of radio as you want.

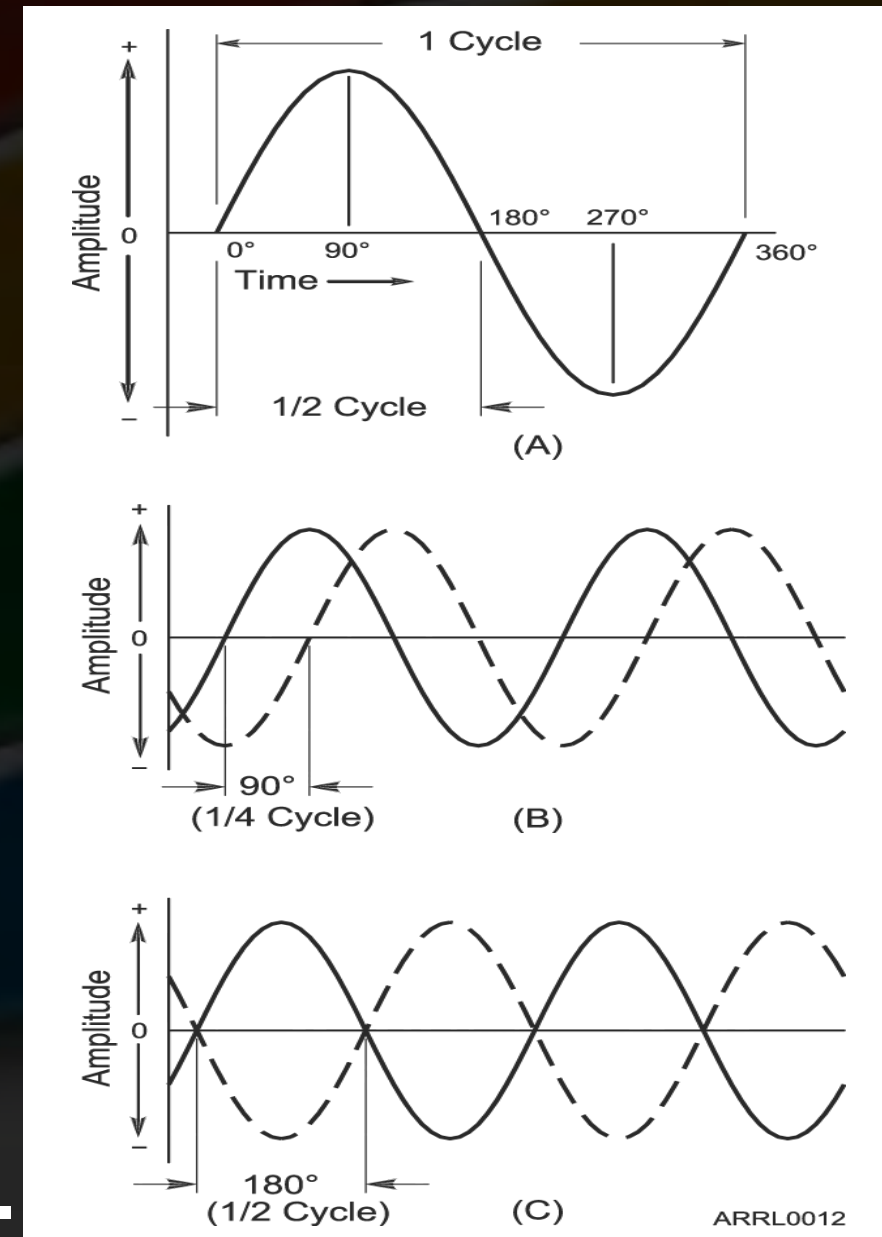
Adding Information – Modulation

- When we add some information to the radio wave, (the *carrier*) we *modulate* the wave.
- Turn the wave on and off (Morse code)
- Speech or music
- Data
- Different modulation techniques vary different properties of the wave to add the information:
 - Amplitude, frequency, or phase

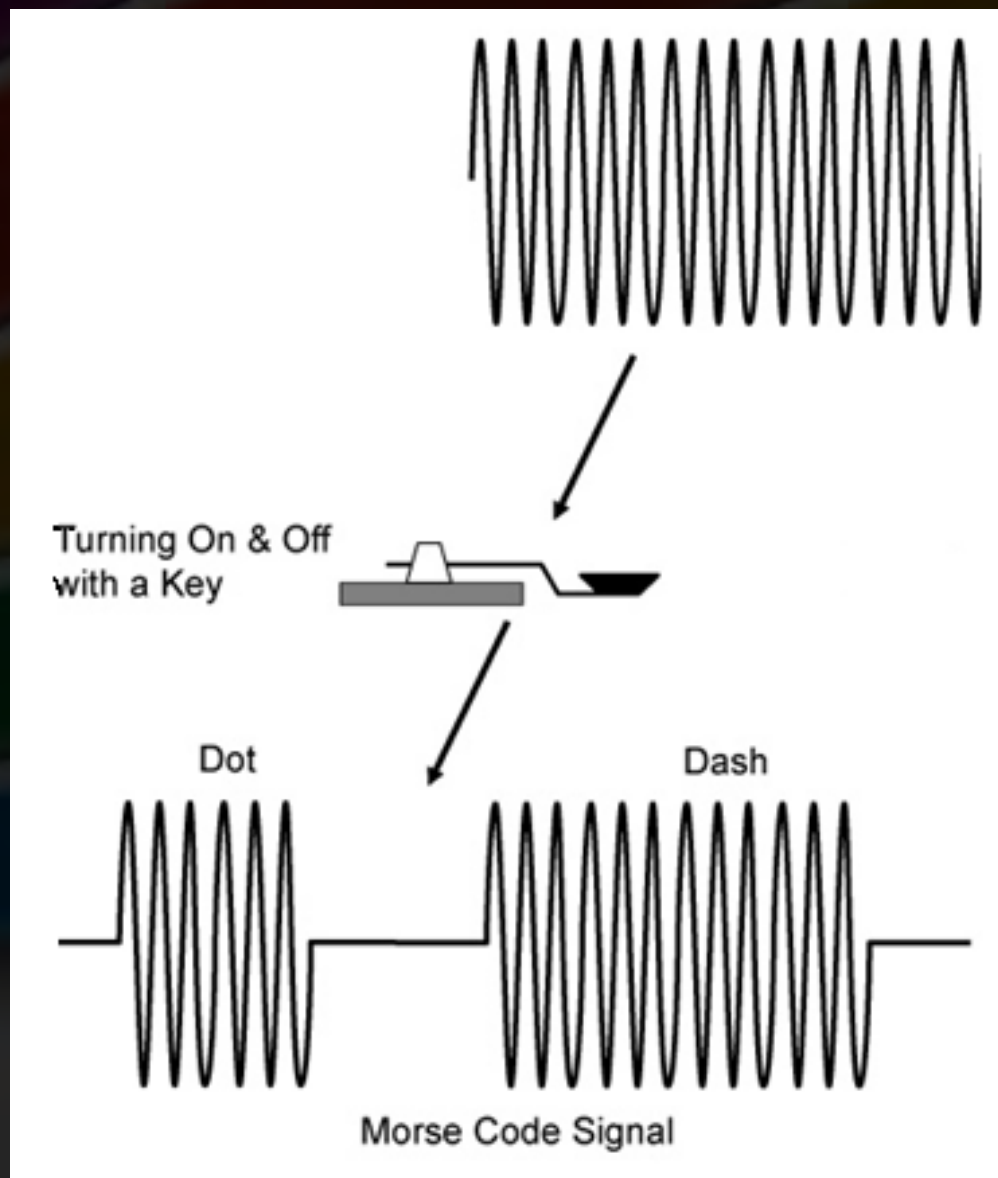


Phase

- Along with frequency and period, another important property of waves is *phase*.
- Phase is a position within a cycle.
- Phase is also a relative position between two waves.

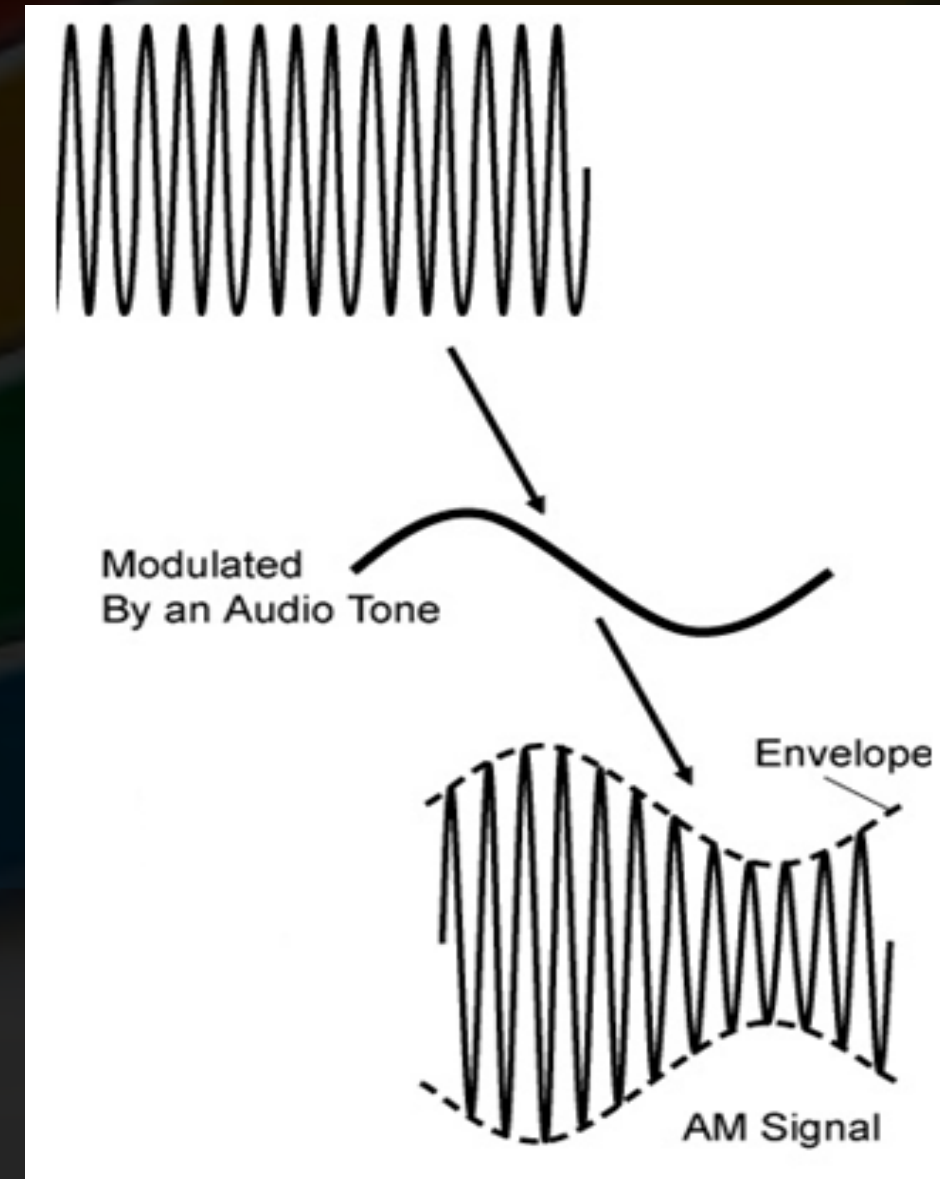


CW - Morse Code – On and Off



Amplitude Modulation (AM)

- In AM, the amplitude of the carrier wave is modified in step with the waveform of the information (the tone shown here).



Composite Signals

- The process of adding information to an unmodulated radio wave creates additional signals called *sidebands*.
- The sidebands and carrier work together to carry the information.
- The combination of carrier and sidebands creates a *composite signal*.

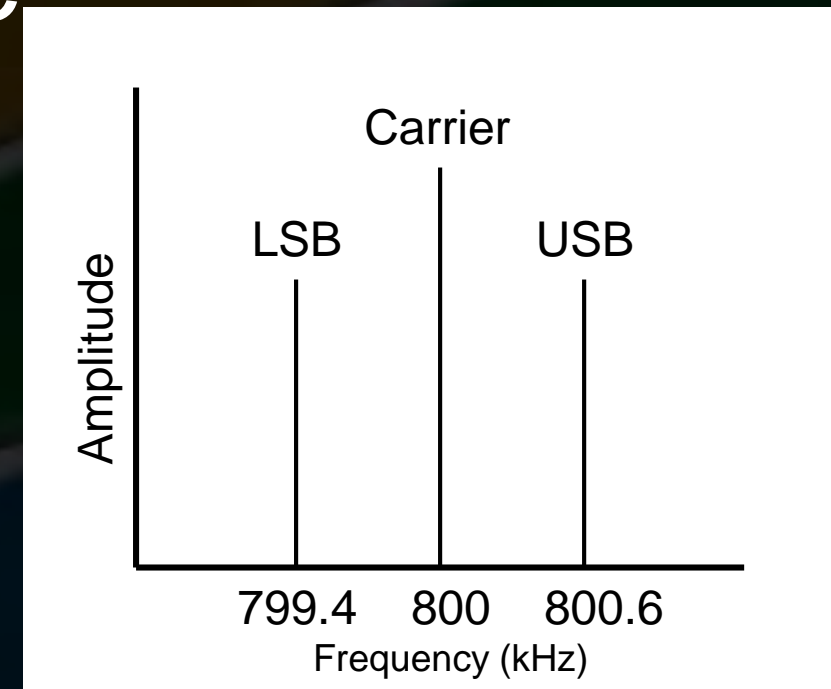
Bandwidth

- The carrier and sidebands have different frequencies, occupying a range of spectrum space.
- The occupied range is the composite signal's *bandwidth*.
- Different types of modulation and information result in different signal bandwidths.

Characteristics of Voice AM

AM signals consist of three components:

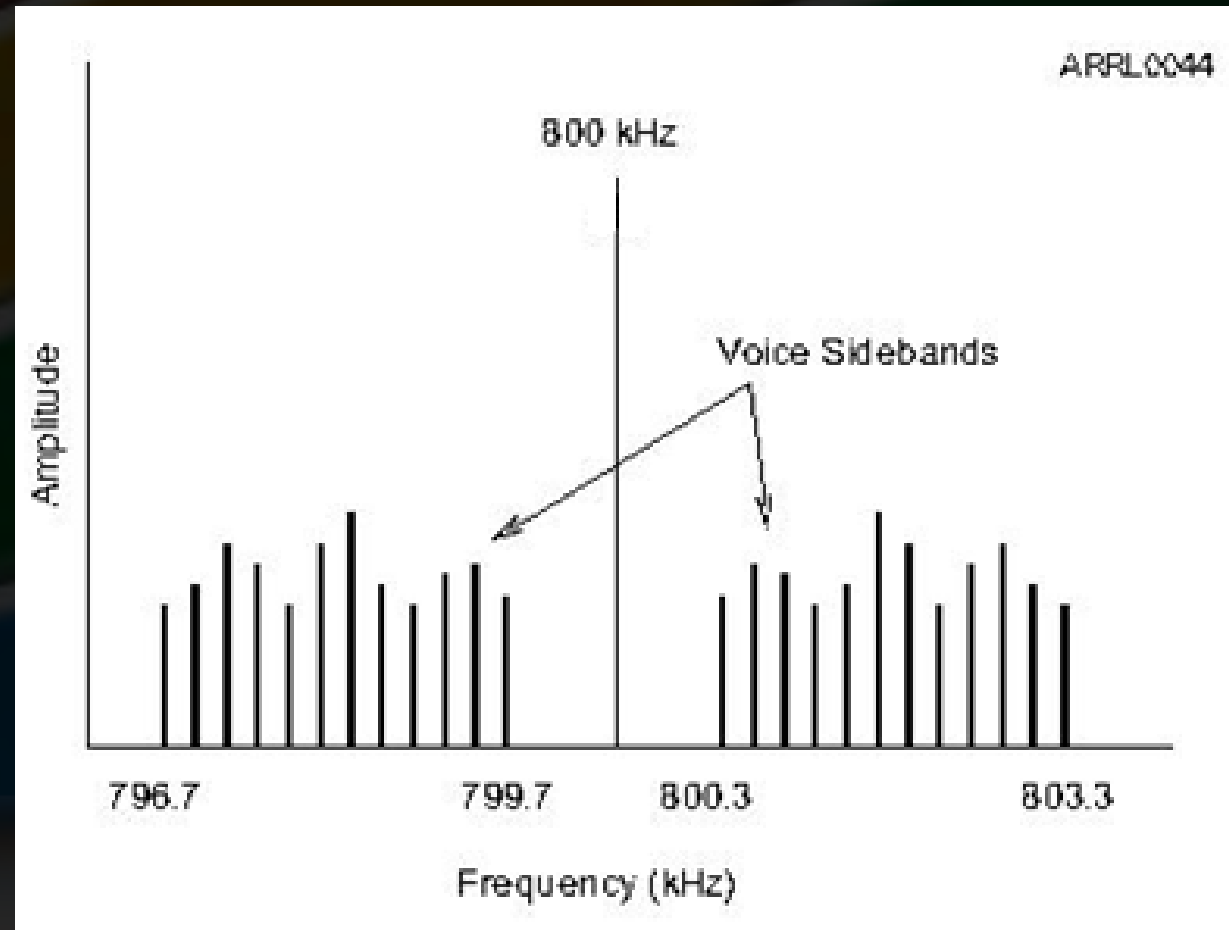
- Carrier
- Lower sideband (LSB)
- Upper sideband (USB)
- AM bandwidth is twice the information bandwidth.



AM signal being modulated by a 600 Hz tone

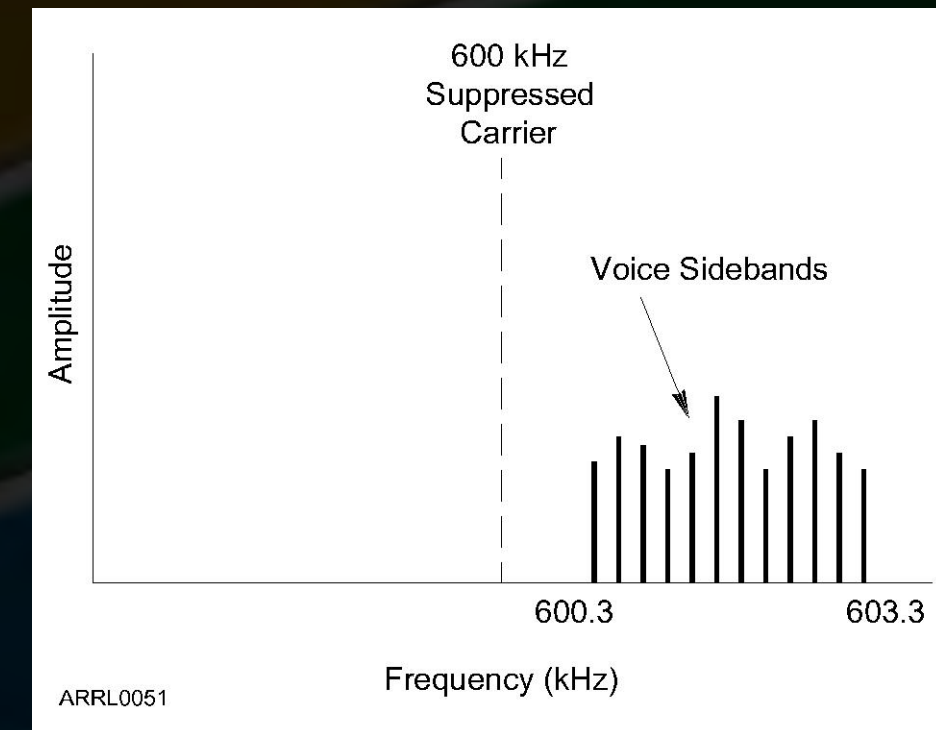
Characteristics of Voice Information

- Sounds that make up voice are a complex mixture of multiple frequencies from 300–3000 Hz
- Two mirror-image sets of sidebands are created, each up to 3000 Hz wide.
- AM voice signal bandwidth $2 \times 3000 \text{ Hz} = 6000 \text{ Hz}$



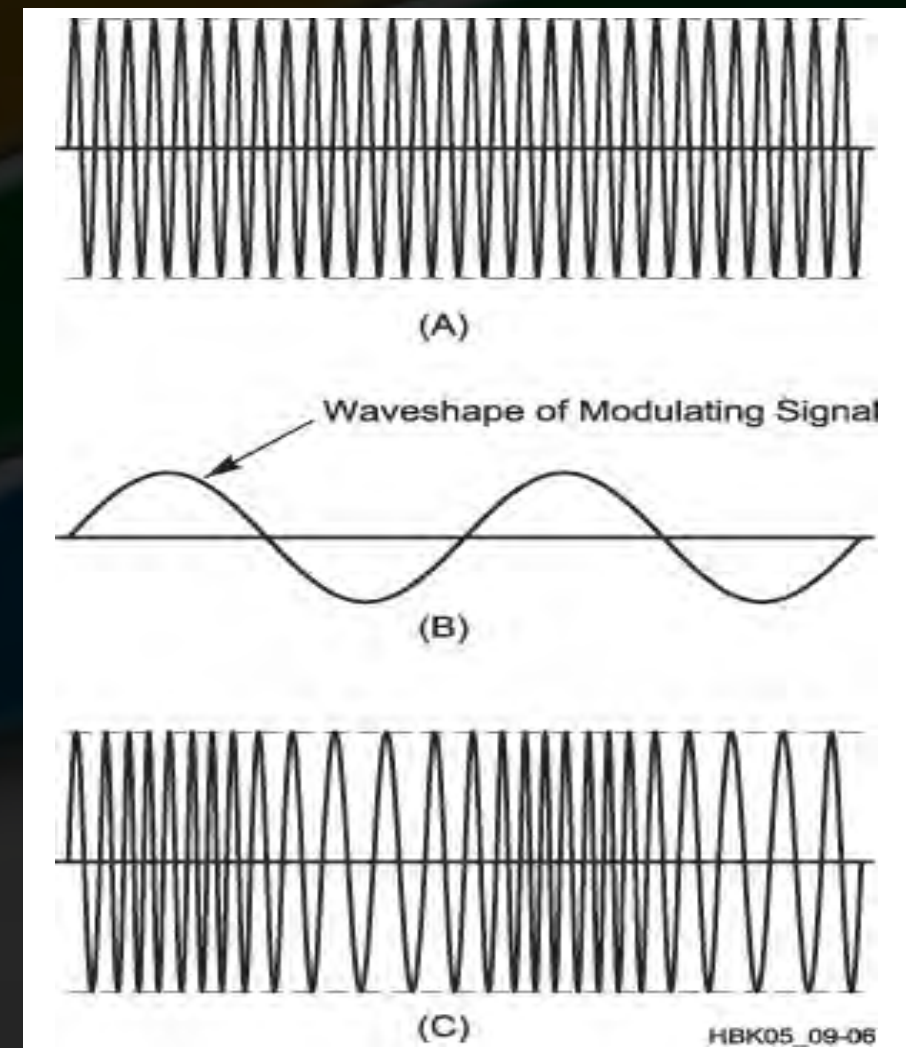
Single Sideband Modulation (SSB)

- The two sets of voice sidebands carry duplicate information.
- We can improve efficiency by transmitting only one sideband and reconstructing the missing carrier in the receiver.
- SSB bandwidth is only 3000 Hz for voice signals.



Frequency and Phase Modulation (FM and PM)

- Instead of varying amplitude, if we use the information to vary the carrier's frequency, *frequency modulation (FM)* is produced.
- FM bandwidth (for voice) is between 5 and 15 kHz.
- We can also shift the signal's phase back and forth, creating *phase modulation (PM)* that is very similar to FM.



Typical Signal Bandwidths

Signal Bandwidths

Type of Signal

Typical Bandwidth

AM voice

6 kHz

AM broadcast

10 kHz

Commercial video broadcast

6 MHz

SSB voice

2 to 3 kHz

SSB digital

500 to 3000 Hz (0.5 to 3 kHz)

CW

150 Hz (0.15 kHz)

FM voice

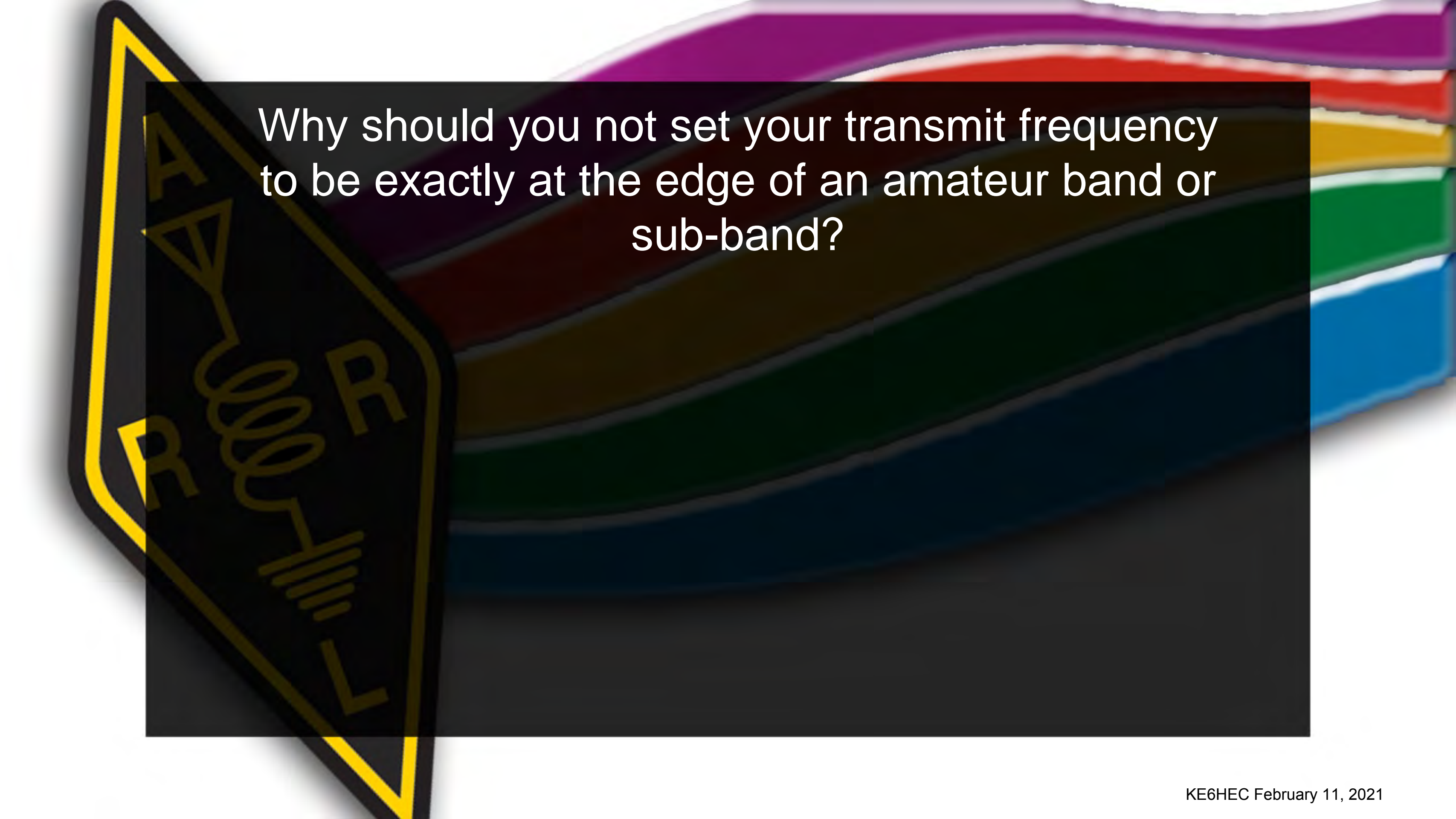
10 to 15 kHz

FM broadcast

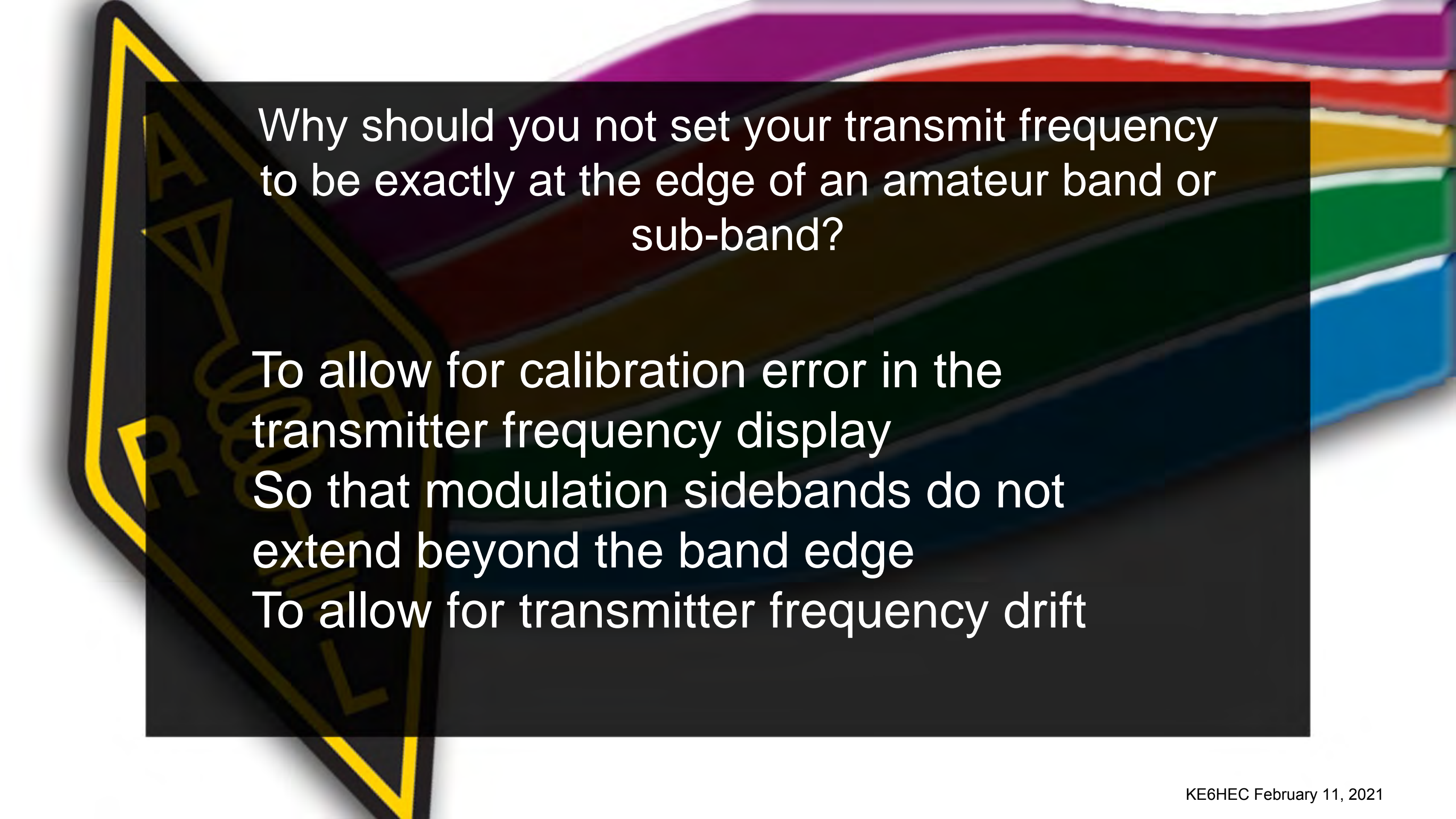
150 kHz



Practice Questions


The background features a vibrant, multi-colored rainbow with wavy, horizontal bands of purple, red, orange, yellow, green, and blue. On the left side, there is a stylized logo for a ham radio. It consists of a yellow triangle with a black border, containing the letters 'A', 'V', and 'R' in a stylized font. Below the letters is a coiled spring representing an antenna, and at the bottom is a battery symbol. The text 'Why should you not set your transmit frequency to be exactly at the edge of an amateur band or sub-band?' is overlaid in white on a dark, semi-transparent rectangular area in the upper center of the image.

Why should you not set your transmit frequency to be exactly at the edge of an amateur band or sub-band?

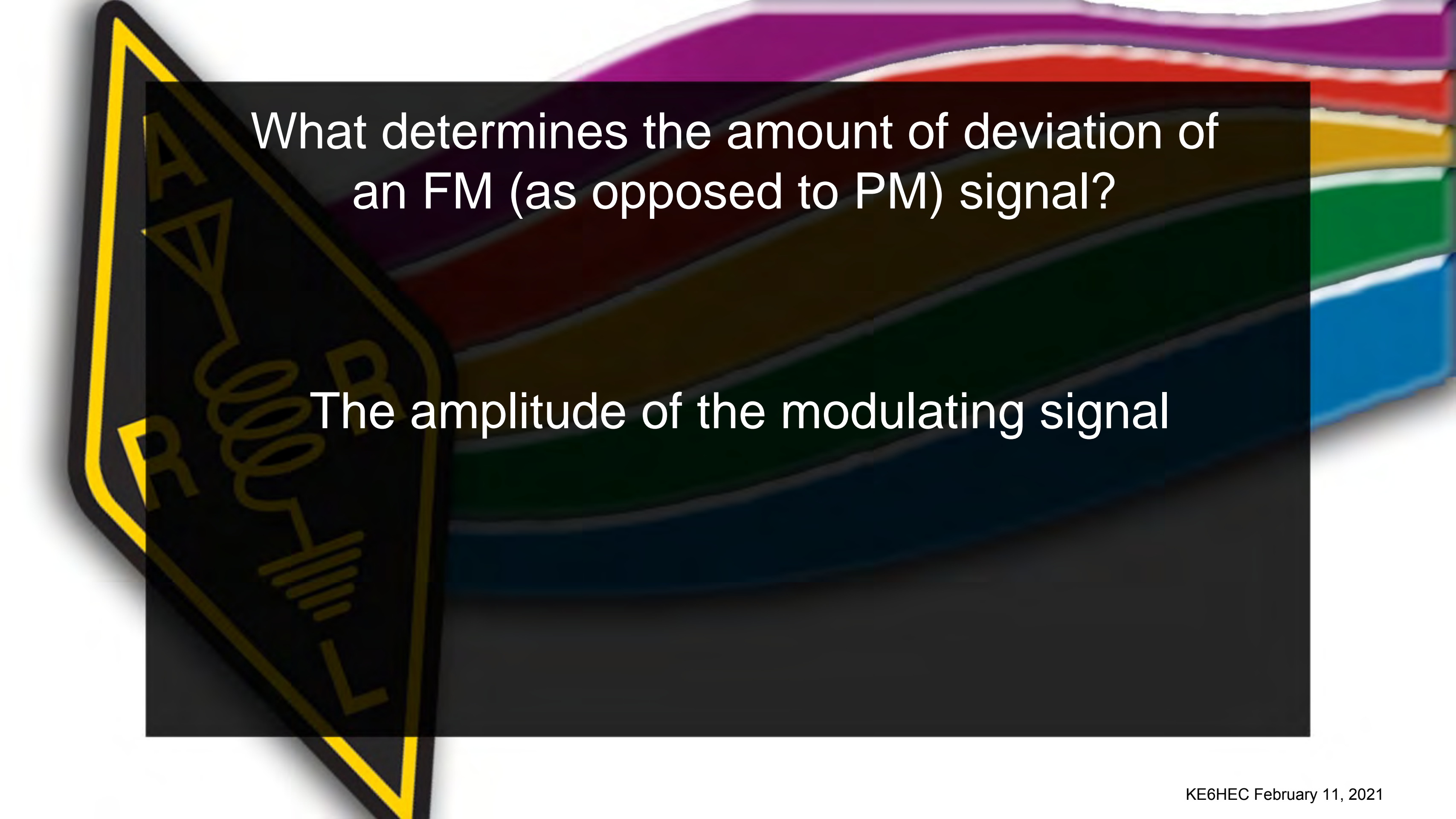


Why should you not set your transmit frequency to be exactly at the edge of an amateur band or sub-band?

To allow for calibration error in the transmitter frequency display
So that modulation sidebands do not extend beyond the band edge
To allow for transmitter frequency drift


The background of the slide features a vibrant, multi-colored rainbow on the right side, with colors transitioning from purple at the top to red, orange, yellow, green, and blue at the bottom. On the left side, there is a dark, semi-transparent graphic of a radio circuit diagram. This diagram includes a yellow-outlined triangle at the top, a series of coils representing inductors, and a battery symbol at the bottom. The text "A" and "R" are visible within the diagram's components.

What determines the amount of deviation of
an FM (as opposed to PM) signal?




What determines the amount of deviation of
an FM (as opposed to PM) signal?

The amplitude of the modulating signal


The background features a vibrant, multi-colored rainbow on the right side, with colors transitioning from purple at the top to red, orange, yellow, green, and blue at the bottom. On the left side, there is a stylized yellow-outlined triangle containing a schematic diagram of a radio circuit. The diagram includes a coil labeled 'R', a battery symbol, and other electronic components. The text 'What happens when the deviation of an FM transmitter is increased?' is centered in the upper half of the image in a white, sans-serif font.

What happens when the deviation of an FM transmitter is increased?

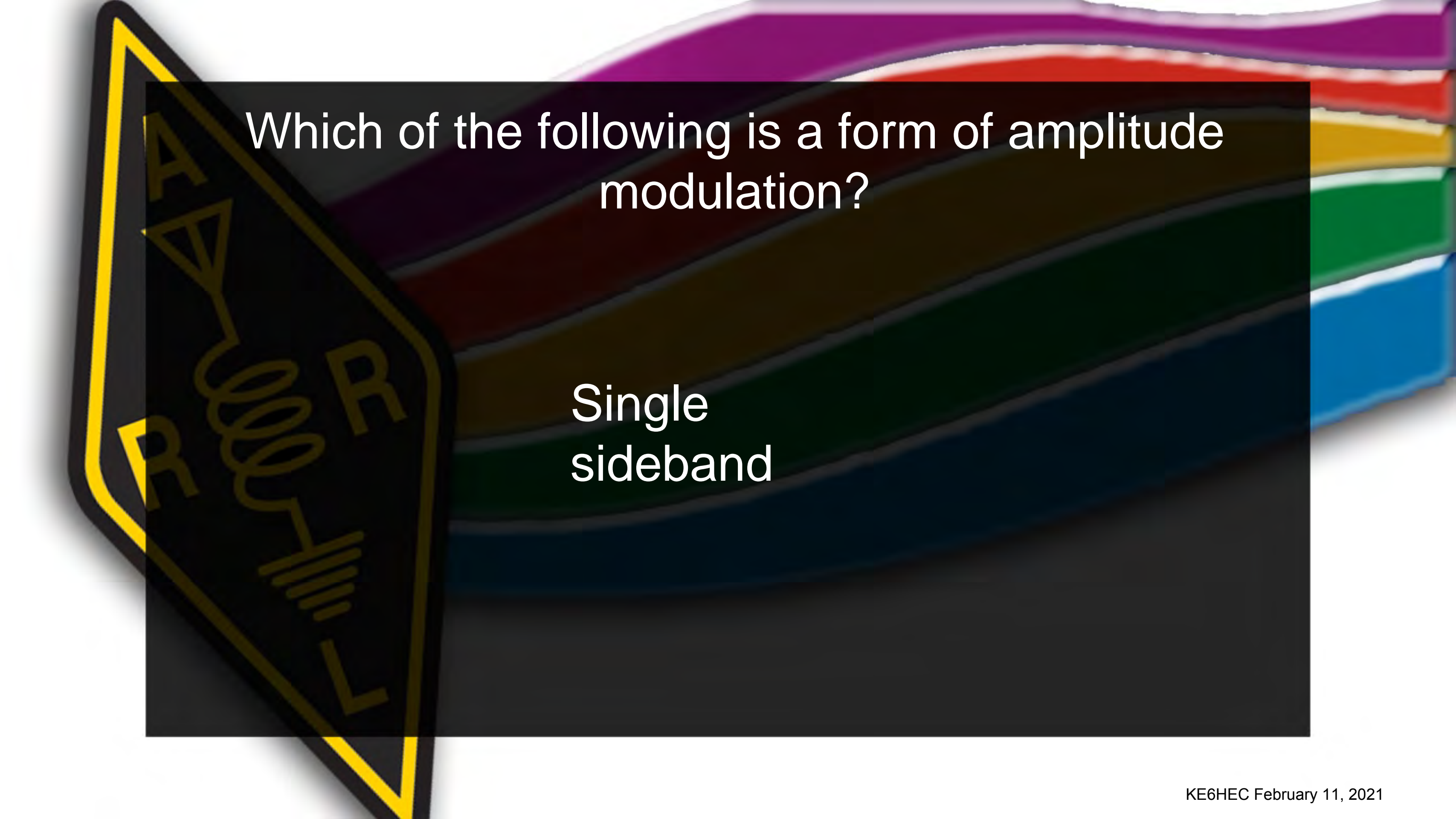
The background features a vibrant, multi-colored rainbow on the right side, transitioning from purple at the top to red, orange, yellow, green, and blue. On the left side, there is a dark, semi-transparent graphic of a radio circuit schematic, including a coil and a battery symbol, with the letters 'A', 'B', and 'C' visible. A large, dark rectangular area in the center serves as a backdrop for the text.

What happens when the deviation of an FM transmitter is increased?

Its signal occupies more bandwidth

The background features a vibrant, multi-colored rainbow-like wave pattern on the right side, transitioning from purple at the top to blue at the bottom. On the left side, there is a stylized yellow-outlined triangle containing a black circuit diagram. The diagram includes a resistor symbol (zigzag line) labeled 'R', an inductor symbol (coiled line) labeled 'L', and a capacitor symbol (two parallel lines) labeled 'C'. The text "Which of the following is a form of amplitude modulation?" is centered in white over a dark grey rectangular area.

Which of the following is a form of amplitude modulation?



Which of the following is a form of amplitude modulation?

Single
sideband

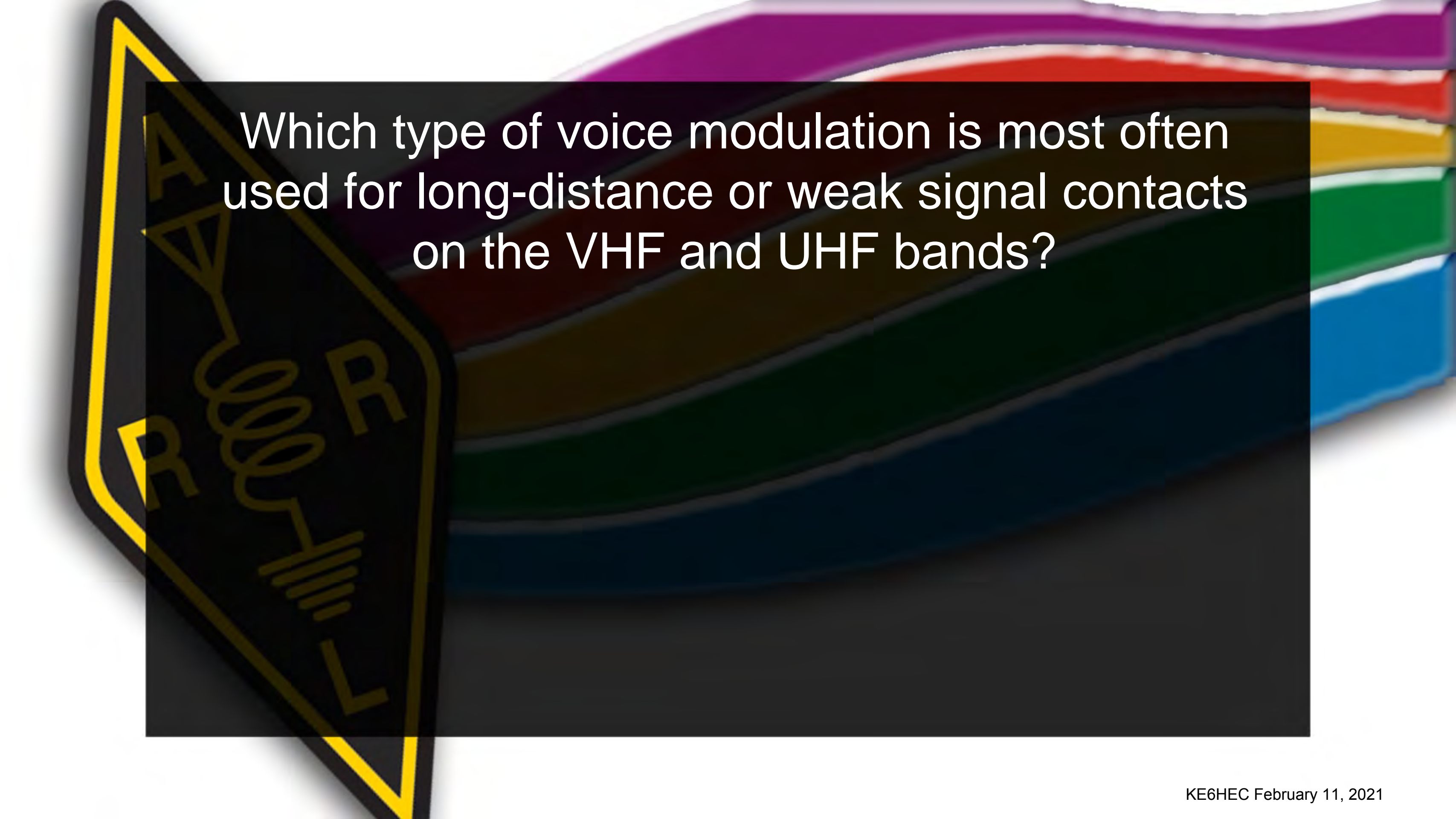
The background features a vibrant, multi-colored rainbow with wavy, horizontal bands of purple, red, orange, yellow, green, and blue. On the left side, there is a large, dark grey, irregularly shaped graphic that resembles a radio symbol or a stylized letter 'A'. It has a yellow border and contains a coiled line representing an antenna and a series of horizontal lines representing a speaker or sound waves.

What type of modulation is most commonly used for VHF packet radio transmissions?

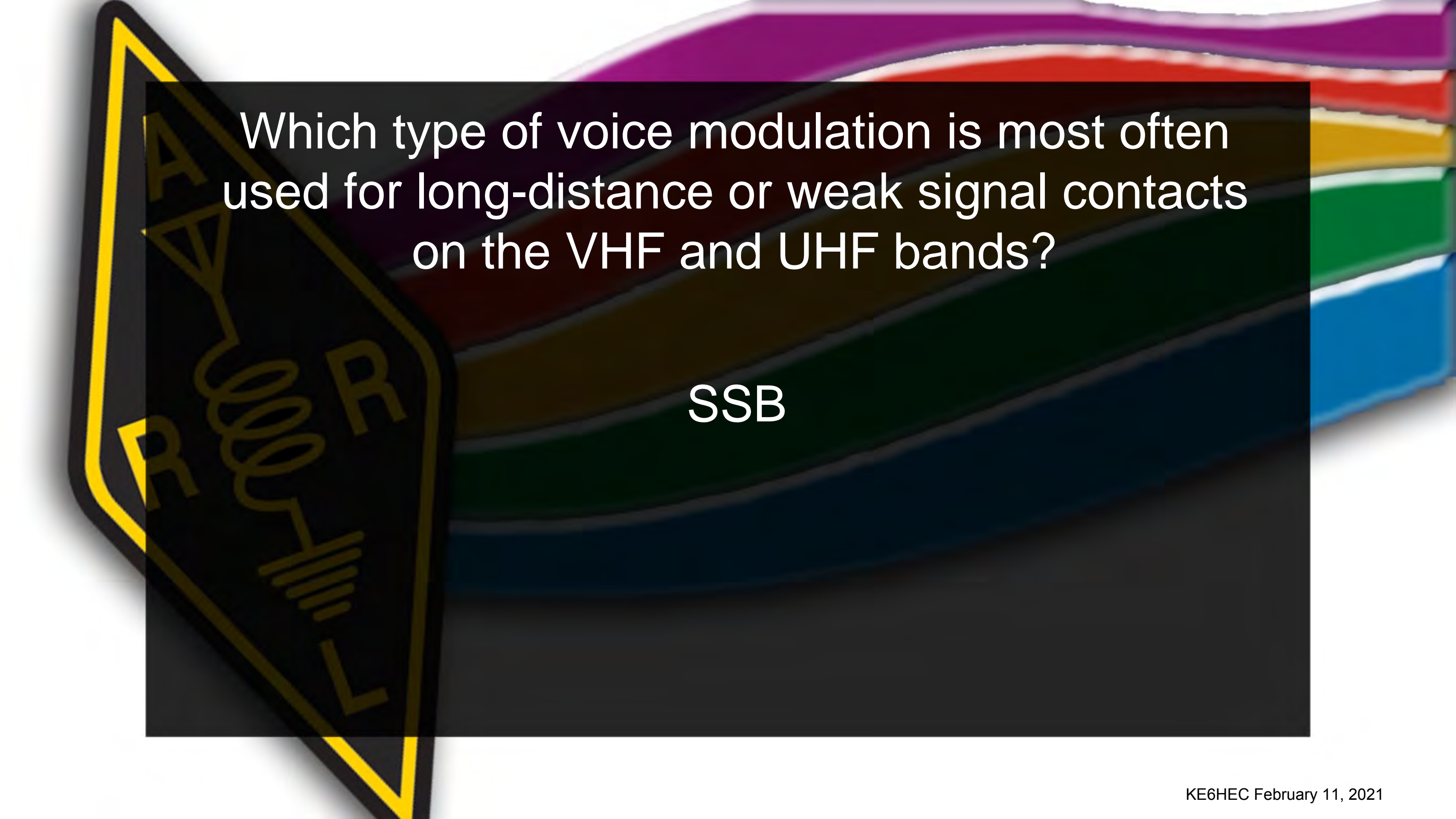
The background features a vibrant, multi-colored rainbow with wavy, horizontal bands of purple, red, orange, yellow, green, and blue. On the left side, there is a large, stylized yellow-outlined triangle containing a black silhouette of a radio antenna and the letters 'A', 'R', and 'R' in a bold, sans-serif font. A dark, semi-transparent rectangular box is positioned in the upper-middle section of the image, serving as a backdrop for the main text.

What type of modulation is most commonly
used for VHF packet radio transmissions?

FM

The background features a vibrant, multi-colored rainbow-like wave pattern in shades of purple, red, orange, yellow, green, and blue. On the left side, there is a stylized graphic of a radio symbol, consisting of a yellow outline of a radio with a black interior, a yellow antenna, and a yellow speaker grille. The text is centered in the upper half of the image, overlaid on a dark, semi-transparent rectangular area.

Which type of voice modulation is most often used for long-distance or weak signal contacts on the VHF and UHF bands?

The background features a vibrant, multi-colored rainbow-like wave pattern in shades of purple, red, orange, yellow, green, and blue. On the left side, there is a stylized graphic of a radio circuit schematic, including a coil and a capacitor, enclosed within a yellow-bordered shape that resembles a call sign or logo.

Which type of voice modulation is most often
used for long-distance or weak signal contacts
on the VHF and UHF bands?

SSB

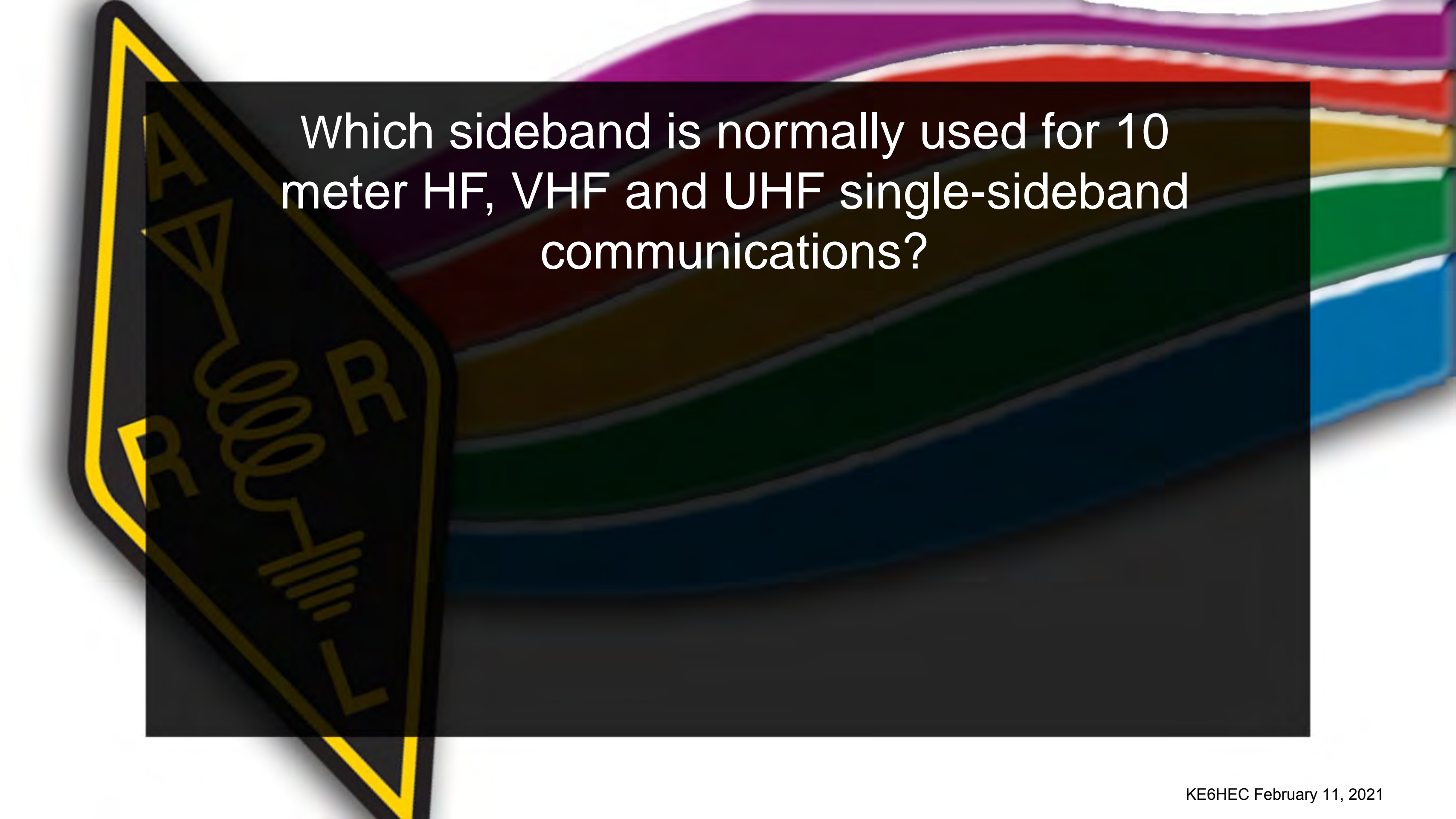
The background features a vibrant, multi-colored rainbow with wavy, horizontal bands of purple, red, orange, yellow, green, and blue. On the left side, there is a stylized graphic of a radio circuit schematic, including a coil and a battery symbol, enclosed within a yellow-bordered shape that resembles a call sign or a logo.

Which type of modulation is most commonly used for VHF and UHF voice repeaters?

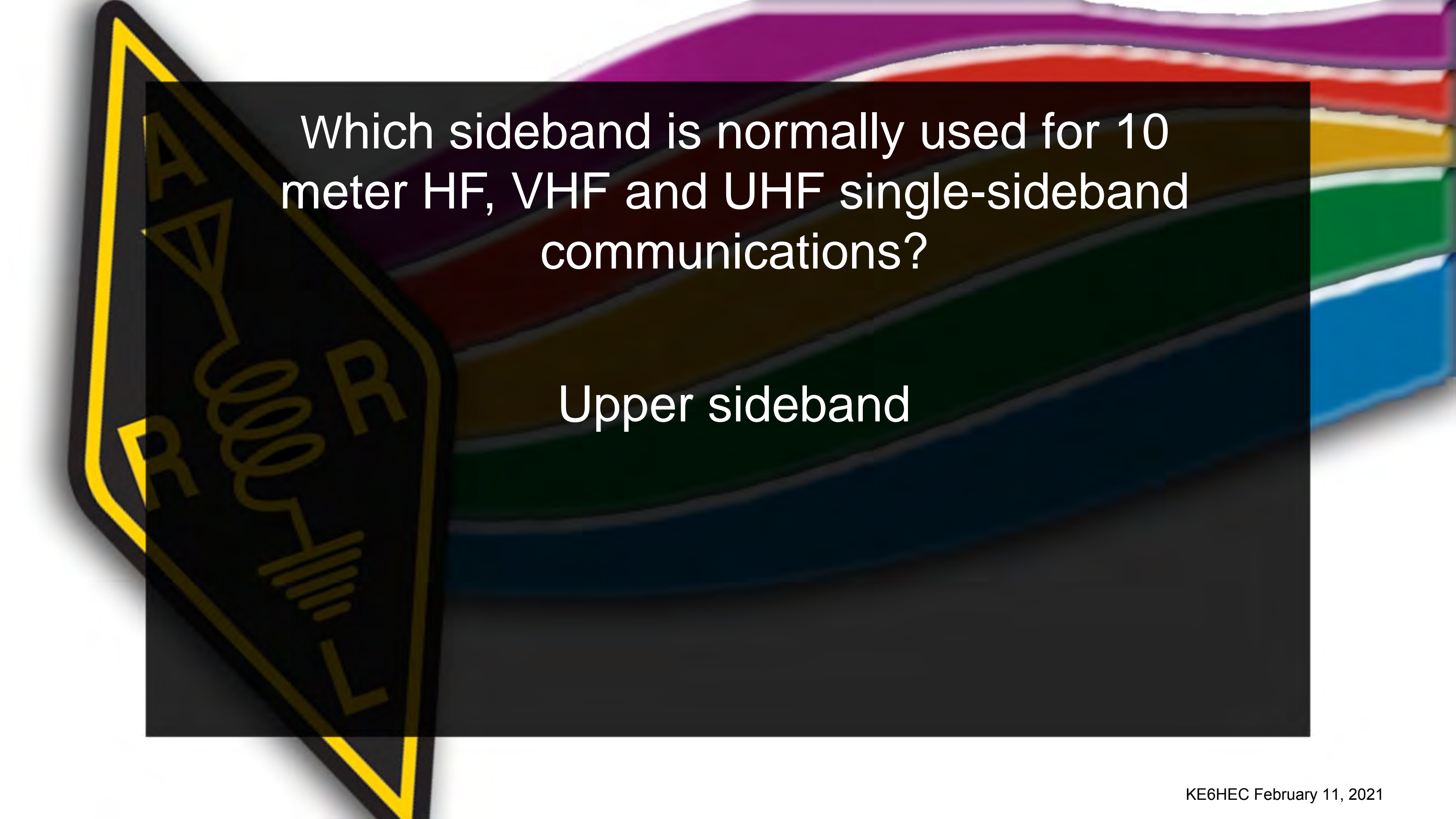


Which type of modulation is most commonly used for VHF and UHF voice repeaters?

FM


The background features a vibrant, multi-colored rainbow with wavy, horizontal bands of purple, red, orange, yellow, green, and blue. On the left side, there is a dark, triangular logo with a yellow border. Inside the logo, the letters 'A' and 'R' are visible, along with a stylized graphic of a radio antenna and a battery symbol. The text '10M' is also partially visible.

Which sideband is normally used for 10
meter HF, VHF and UHF single-sideband
communications?

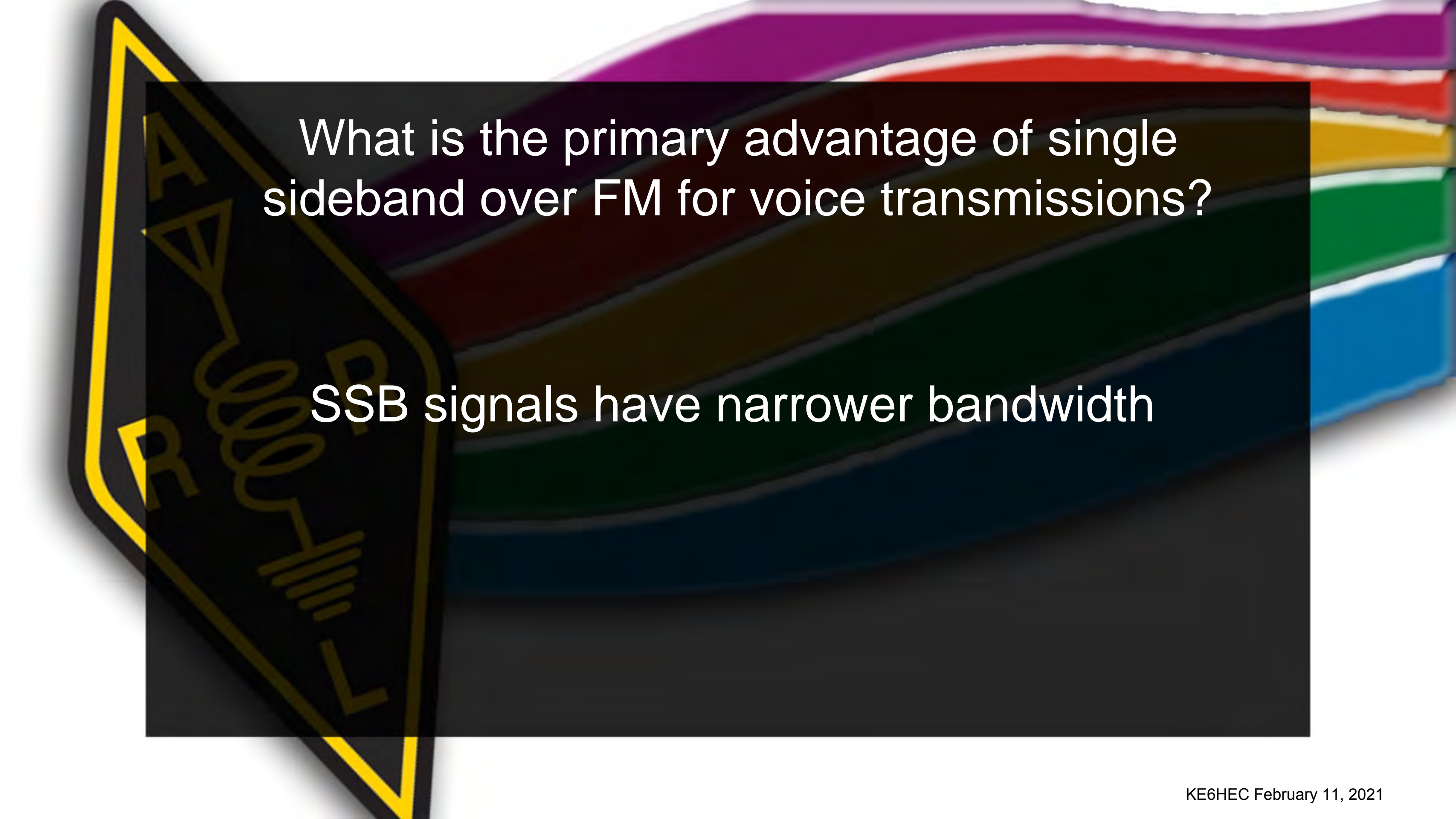
The background features a vibrant, multi-colored rainbow with wavy, horizontal bands of purple, red, orange, yellow, green, and blue. On the left side, there is a dark, semi-transparent graphic of a ham radio call sign logo. The logo is shaped like a shield with a yellow border and contains the letters 'A', 'R', and 'R' in a stylized font, along with a coiled spring and a battery symbol.

Which sideband is normally used for 10
meter HF, VHF and UHF single-sideband
communications?

Upper sideband


The background features a vibrant, multi-colored rainbow with wavy, layered bands of purple, red, orange, yellow, green, and blue. On the left side, there is a dark, semi-transparent overlay containing a yellow-outlined logo. The logo is a triangular shape with a yellow border, featuring a stylized 'A' at the top, a 'V' in the middle, and a 'W' at the bottom, with a horizontal line and a small 'R' to the right. The text 'What is the primary advantage of single sideband over FM for voice transmissions?' is centered in white, sans-serif font over the dark overlay.

What is the primary advantage of single sideband over FM for voice transmissions?


The background features a vibrant, multi-colored rainbow with wavy, horizontal bands of purple, red, orange, yellow, green, and blue. On the left side, there is a dark, semi-transparent overlay containing a yellow-outlined logo. The logo is a triangular shape with a stylized 'A' at the top, a 'V' in the middle, and a 'P' at the bottom, with a coiled cable and a battery symbol below the 'P'.

What is the primary advantage of single sideband over FM for voice transmissions?

SSB signals have narrower bandwidth

The background features a vibrant, multi-colored rainbow with distinct bands of purple, red, orange, yellow, green, and blue. On the left side, there is a stylized graphic of a radio symbol, consisting of a yellow triangle with a black border, containing a black coil and a battery symbol. Overlaid on the center of the image is a dark gray rectangular box with white text.

What is the approximate bandwidth of a VHF
repeater FM phone signal?

The background features a vibrant, multi-colored rainbow-like wave pattern in shades of purple, red, orange, yellow, green, and blue. On the left side, there is a large, stylized yellow-outlined triangle containing a black silhouette of a radio circuit, including a coil and a battery. Overlaid on this is a dark grey rectangular box containing white text.

What is the approximate bandwidth of a VHF
repeater FM phone signal?

Between 10 and 15 kHz

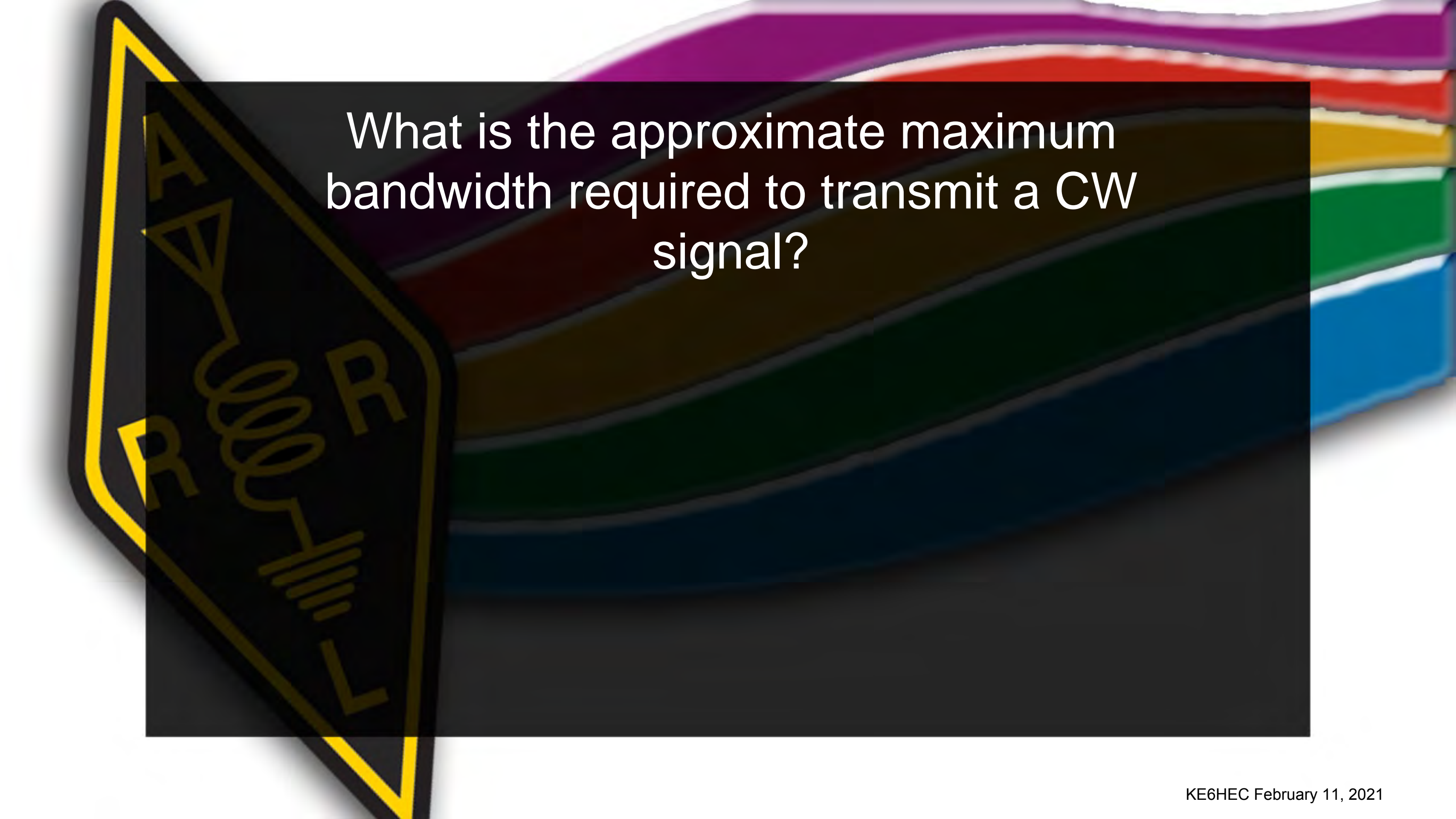
The background features a vibrant, multi-colored rainbow with distinct bands of purple, red, orange, yellow, green, and blue. On the left side, there is a stylized logo for a ham radio. It consists of a yellow triangle with a black border, containing the letters 'A', 'V', and 'R' in a stylized font. Below the letters is a coiled spring and a battery symbol. The text 'HAM RADIO' is written in a curved path around the central elements.

What is the typical bandwidth of analog fast-scan TV transmissions on the 70 cm band?

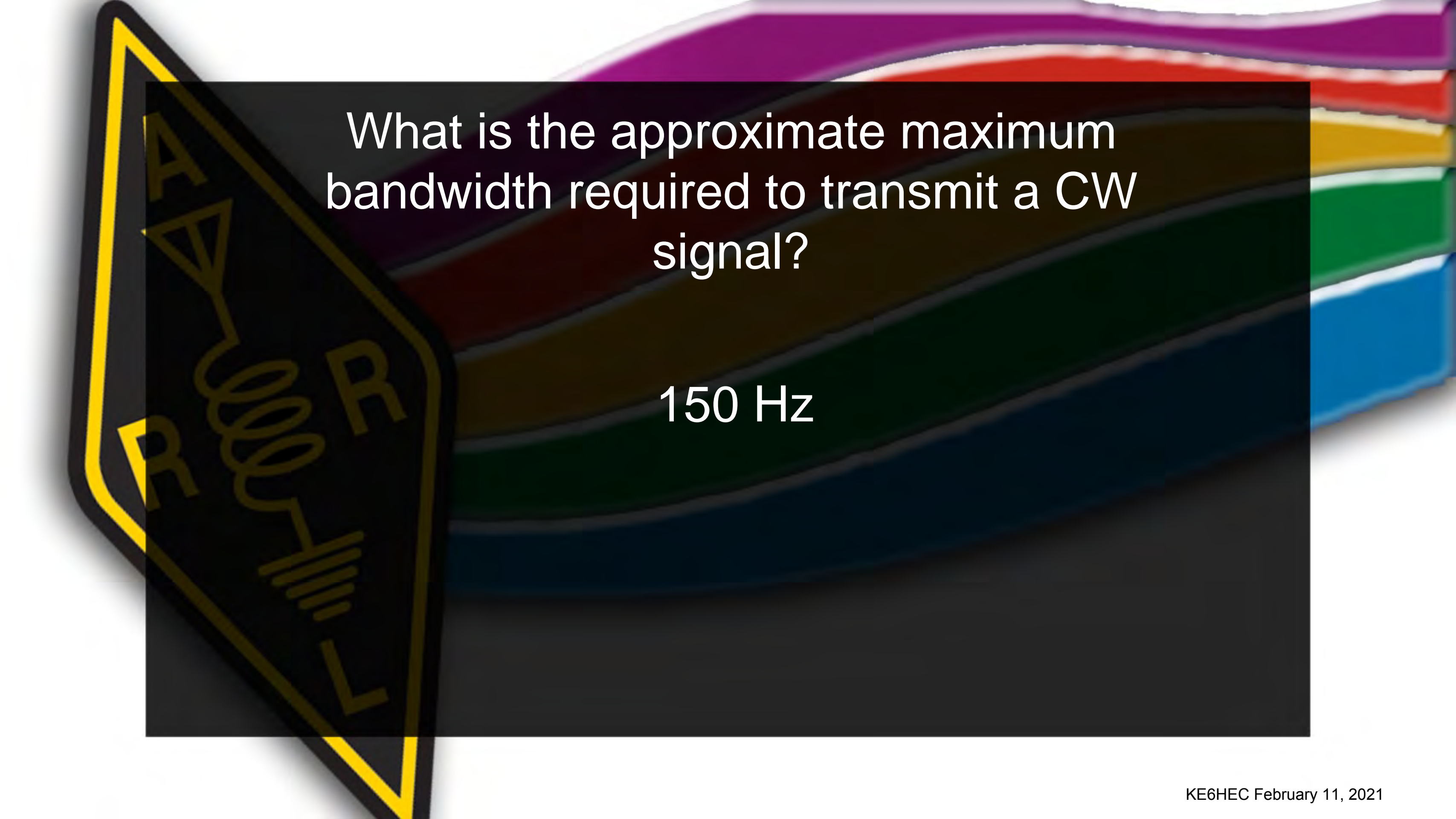
The background features a vibrant, multi-colored wavy pattern resembling a rainbow or liquid paint in shades of purple, red, orange, yellow, green, and blue. On the left side, there is a dark, semi-transparent overlay containing a yellow-outlined logo. The logo is a shield-like shape with the letters 'A' and 'R' at the top, a stylized antenna in the center, and the letters 'R' and 'L' at the bottom.

What is the typical bandwidth of analog fast-scan TV transmissions on the 70 cm band?

About 6 MHz

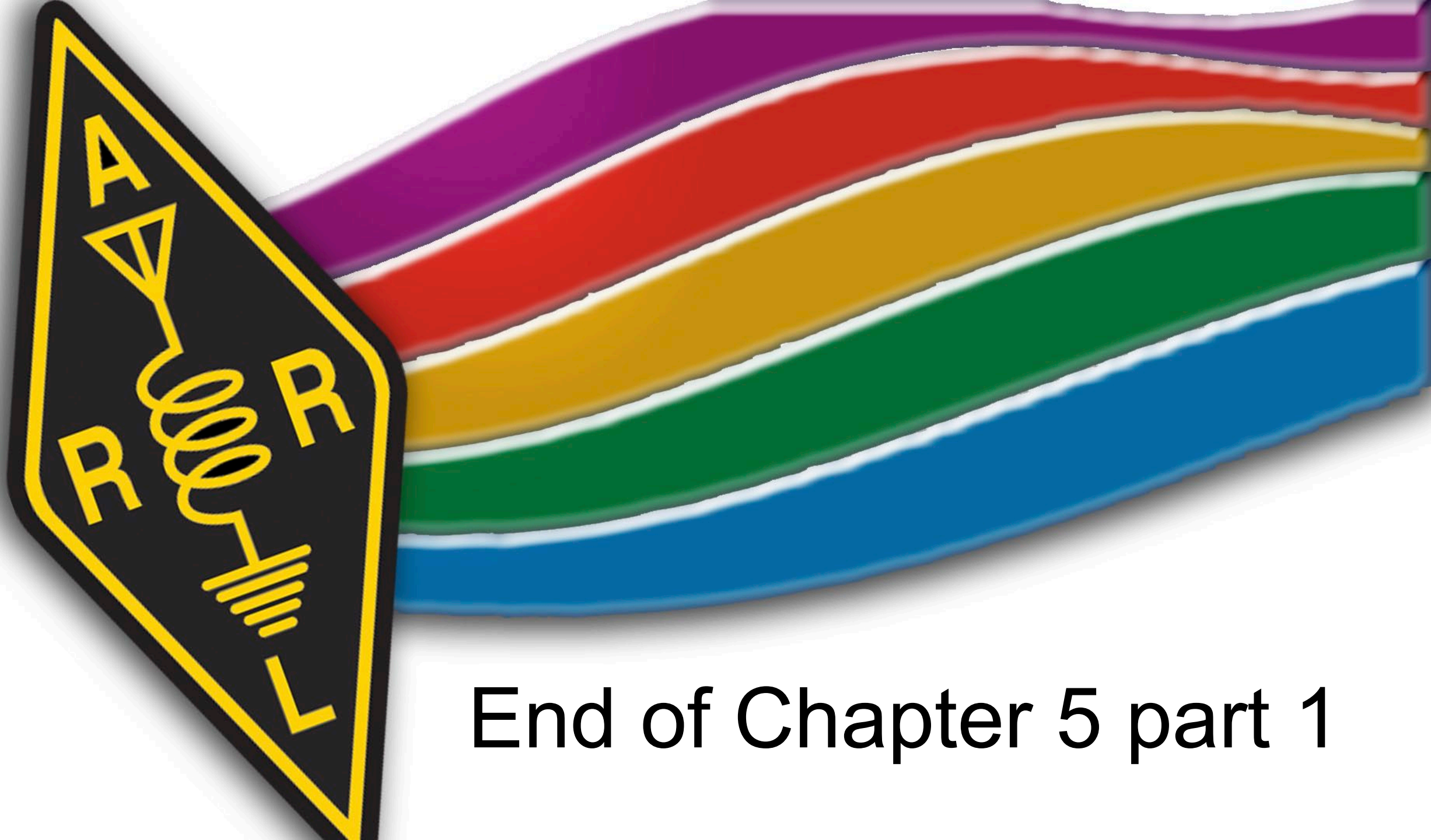
The background features a vibrant rainbow with wavy, layered bands of color (purple, red, orange, yellow, green, blue) on the right side. On the left, there is a dark, semi-transparent rectangular area containing a yellow-outlined logo. The logo is a diamond shape with a thick yellow border, containing a stylized 'A' at the top, a 'V' in the middle, and a 'W' at the bottom, with a coiled wire and a battery symbol below the 'W'.

What is the approximate maximum
bandwidth required to transmit a CW
signal?



What is the approximate maximum
bandwidth required to transmit a CW
signal?

150 Hz



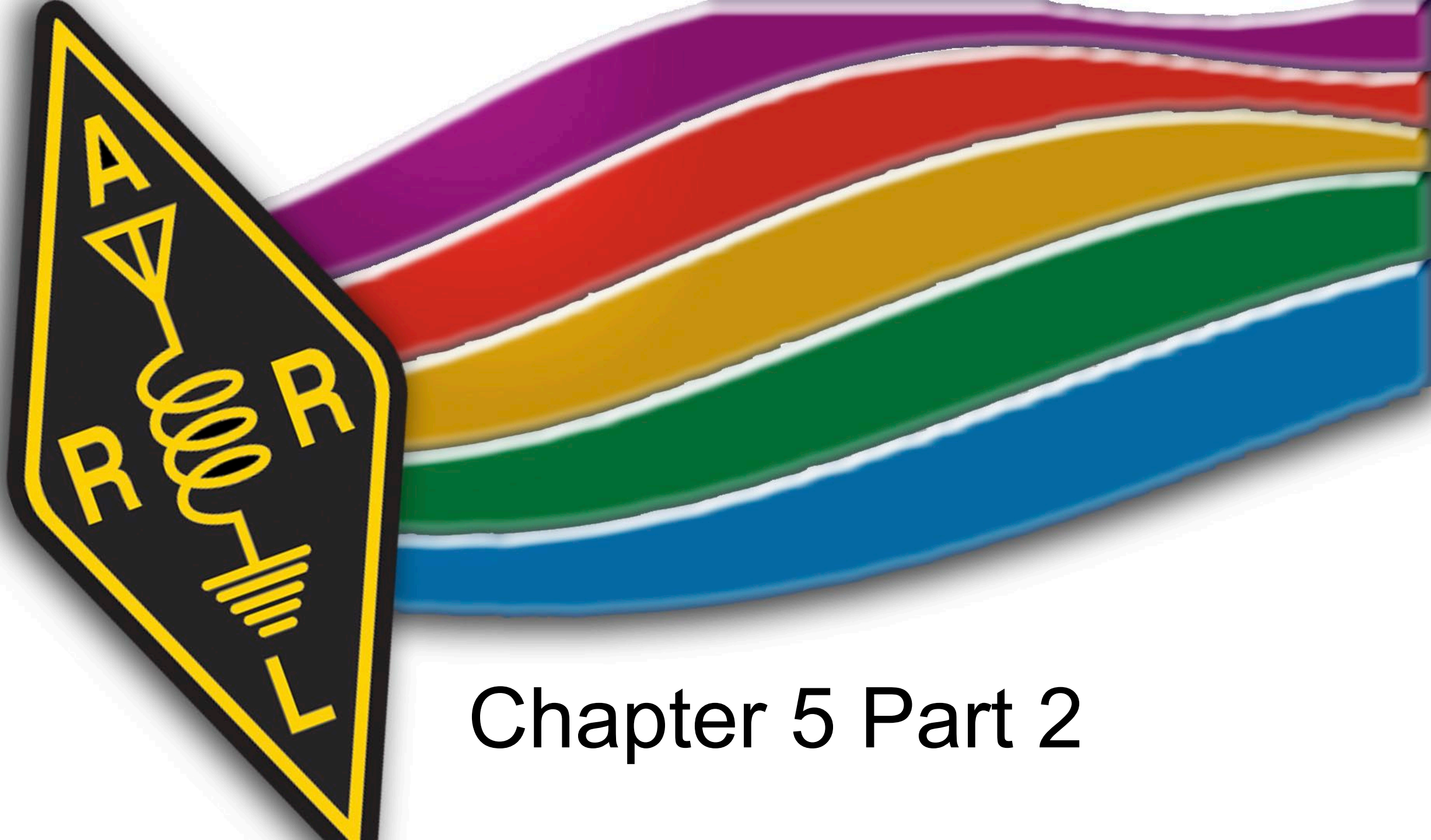
End of Chapter 5 part 1



End of Module 3



Technician License Course



Chapter 5 Part 2



Technician License Course

Chapter 5

Lesson Plan Module - 11

Transmitters, Receivers and Transceivers

Band and Frequency Selection

- Fundamental to all amateur transceivers
- Can set by VFO (continuously variable) or by keypad “direct” entry
- Memories can generally store:
 - Frequency
 - Mode
 - Filter and similar settings
 - Alphanumeric labels

Transmitter Controls and Functions

- Main tuning display (both TX and RX):
 - Controls the frequency selection via the variable frequency oscillator (VFO).
 - Frequency can be set with a knob or keypad or programmed channels.
 - Variable frequency step size (tuning rate, resolution).
 - Rigs can usually store the information for two operating frequencies (VFO A and VFO B).

Transmitter Controls and Functions

- Mode selector (both TX and RX for multimode rigs).
 - AM/FM/SSB (LSB or USB)
 - CW
 - Data (RTTY or PSK)
- Could be automatic based on recognized band plan.

Transmitter Controls and Functions

- Microphone controls
 - Gain
 - Controls transmitter sensitivity to your voice
 - Speech Compressor or Speech Processor
 - Increases microphone gain at lower sound levels to increase overall signal strength or “punch”

Transmitter Controls and Functions

– Too much gain or compression can cause problems

- Splatter
- Over-deviation
- Over-modulation

Transmitter Controls and Functions

- Automatic Level Control (ALC)
 - Automatically limits speech modulation, reducing transmitter over-drive
 - Causes some speech distortion
 - Do NOT use for data modes like PSK
- Also prevents overdrive to external power amplifier

Microphones and Keys

- Microphones (mic)
 - Hand mics
 - Desk mics
 - Preamplified desk mics
 - Speaker-mics
 - Headsets or boom-sets
 - Internal mics
- Speak *across* the mic, not into the mic

Microphones and Keys

- Transmitter ON/OFF or “keying”
 - Push-to-Talk (PTT)
 - Voice-Operated Transmission (VOX)
- VOX Gain
- VOX Delay
- Anti-VOX

Microphones and Keys

- Key jack
- Manually-Operating Transmission (MOX or SEND - varies with manufacturer)
- Morse code
 - Straight key
 - Electronic keyer and paddle
 - Semi-automatic (Bug)

Receiver Controls and Functions

- AF Gain or Volume
 - Controls the audio level to the speaker or headphones
- RF Gain
 - Controls the gain of the receiver's input amplifiers
- Attenuator
 - Reduces signal at the receiver input

Receiver Controls and Functions

- Automatic Gain Control (AGC)
 - Automatically limits the incoming signals during signal (voice) peaks to maintain even volume
 - Keeps strong signals from blasting the listener
 - Different time response settings:
 - Fast setting for CW
 - Slow settings for SSB and AM

Receiver Controls and Functions

- Filters (can be electronic modules or DSP)
 - IF filter
 - Used to narrow the width of signal that is passed.
 - Can attenuate adjacent signals.
 - Notch filter
 - Very narrow filter that can be moved over an interfering signal to attenuate it.

Receiver Controls and Functions

- Noise blanker (NB)
 - Removes signal pulses that are frequently associated with random naturally generated noise
 - Can cause problems if strong signals are present
- Noise reduction (NR)
 - DSP function to remove noise from signal
- Noise limiter (NL)

Receiver Controls and Functions

- Preamplifier
 - Increases sensitivity but can cause overload
- Reception and Transmission Meter
 - In transmit, indicates output power or ALC or other functions as selected by switch setting
 - In receive, indicates signal strength
 - In “S” units S1 through S9 – S9 is strongest
 - Above S9, meter is calibrated in dB (i.e. S9+10 dB)

Receiver Controls and Functions

- Receivers can be limited to ham bands or can cover other parts of the spectrum.
- General coverage receivers cover a wide area of the spectrum and can be used for shortwave listening (SWL).

Data Modes

- Computer-to-computer communication
- Specialized modems
 - Terminal Node Controller (TNC)
 - Multiple Protocol Controller (MPC)
- Computer sound card software
 - Requires radio interface

Popular Digital Modes & Systems

Error detection

Yes: Packet radio, MFSK

No: RTTY, PSK31

Error correction

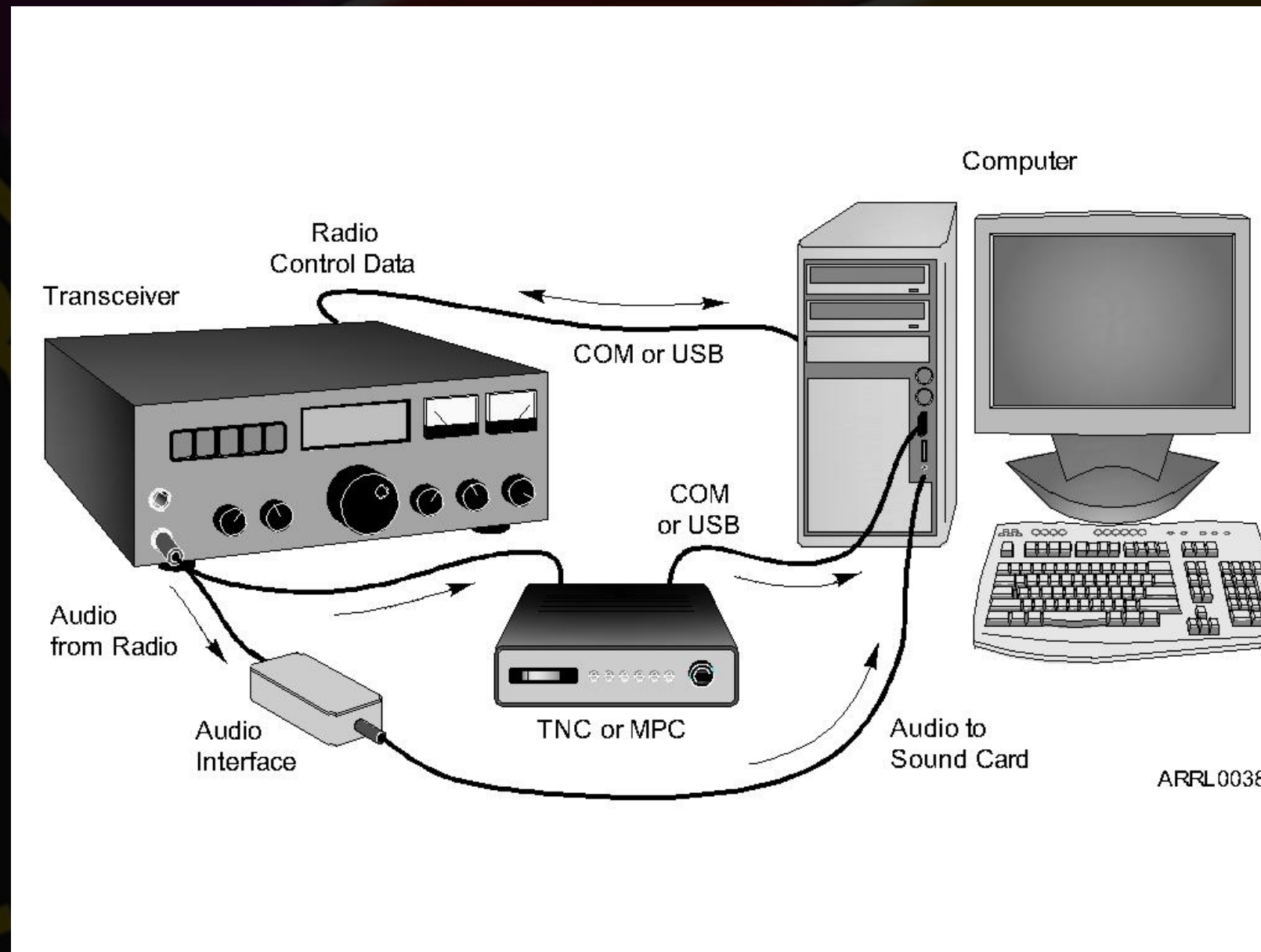
MFSK (forward error correction or FEC)

Packet radio

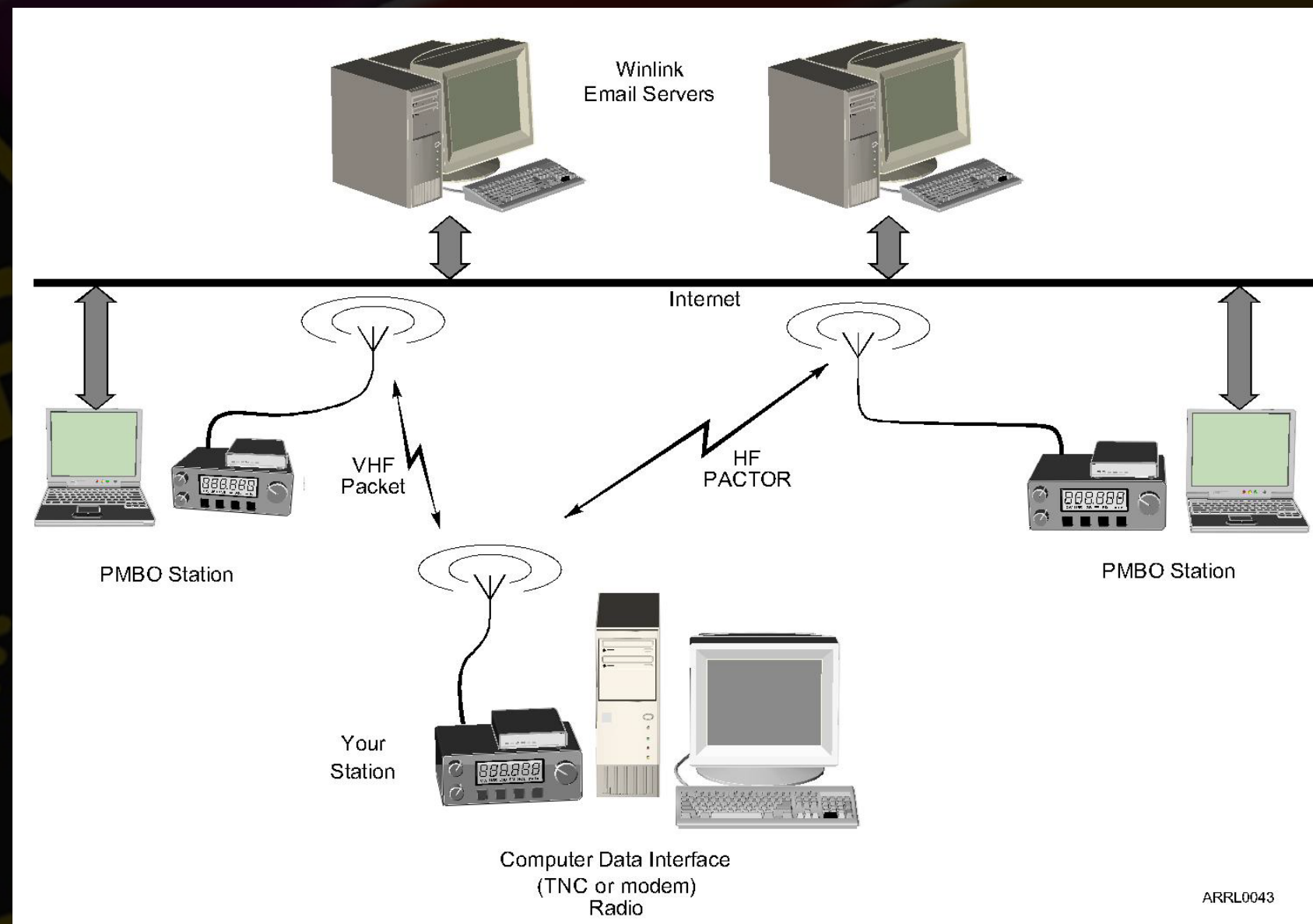
Checksums and call signs

Retransmission or ARQ

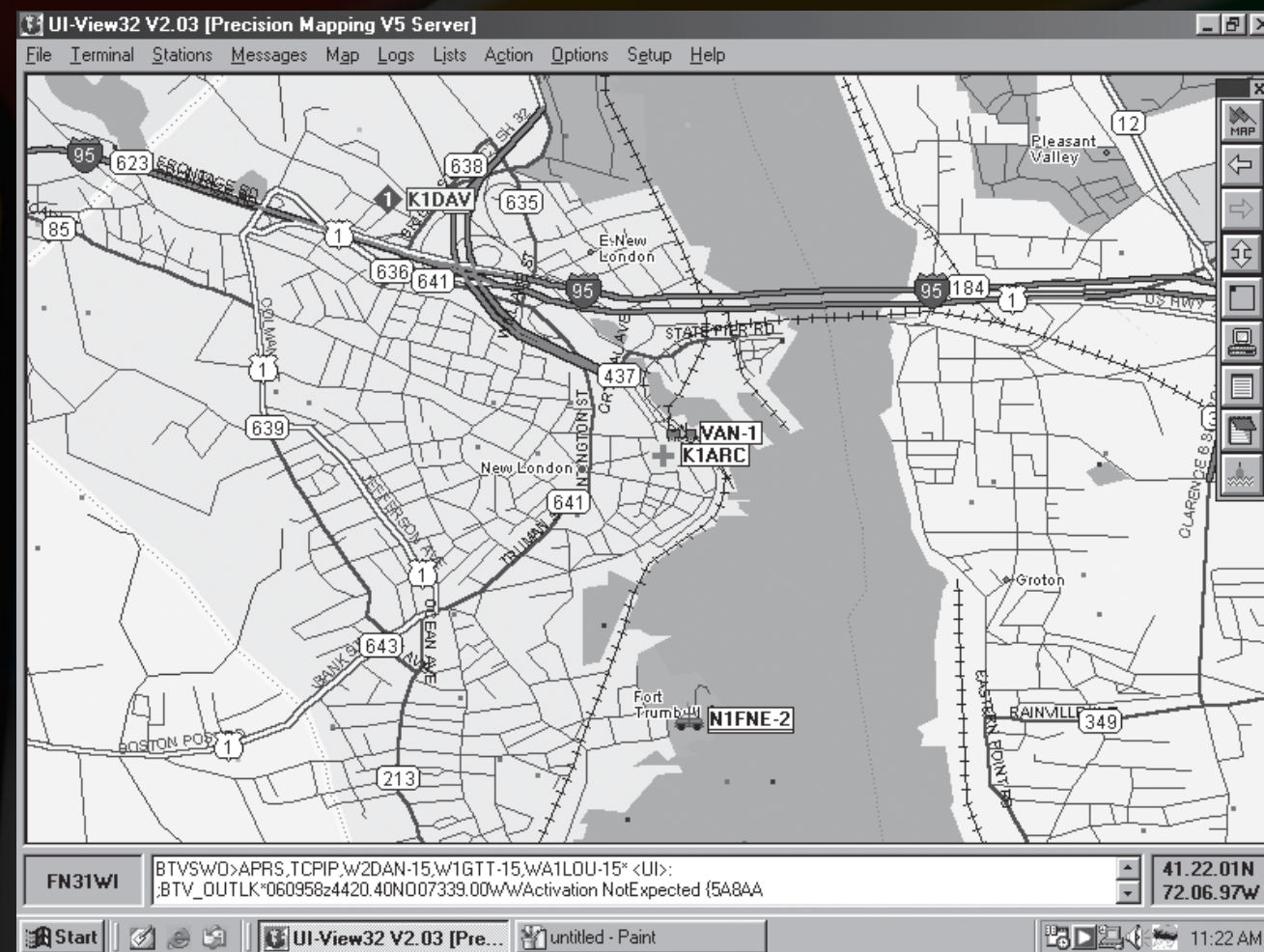
Data Station Setup

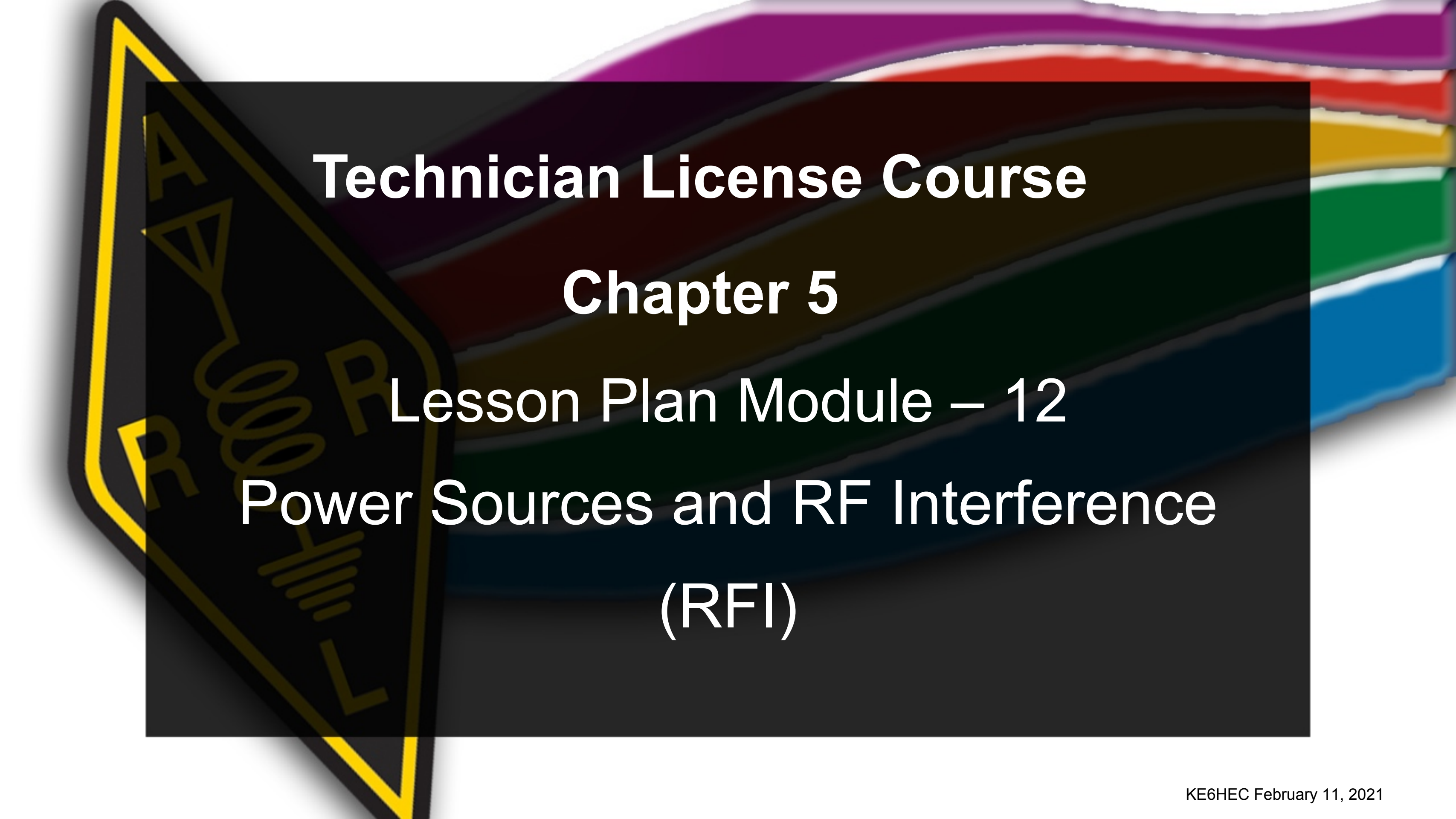


Internet Gateway



Automatic Position Reporting System (APRS)





Technician License Course

Chapter 5

Lesson Plan Module – 12

Power Sources and RF Interference (RFI)

Power Supplies

- Most modern radio equipment runs from 12 volts dc.
 - Actual preferred voltage is 13.8 volts.
- Household ac power is 120 volts ac.
- Power supplies convert 120 volts ac to regulated, filtered dc.
 - If you use a lab-type 12 volt power supply, be sure it is adjustable to 13.8 volts.

Types of Power Supplies

- Linear:
 - Use iron transformers
 - Heavy (physically)
 - Do not emit RF, generally immune to strong RF
- Switching:
 - Electronics instead of transformers
 - Lightweight and small
 - Can emit RF if not properly filtered
 - Check product reviews

Power Supply Ratings - Voltage and Current

- Continuous duty – how much current can be supplied continuously.
- Intermittent duty – how much current can be supplied for short surges, such as on voice peaks.
- Regulation – how well the power supply maintains a constant output voltage.

Mobile Power Wiring Safety

- Car batteries hold lots of energy – shorting a battery could cause a fire.
- Special requirements for safe car wiring:
 - Use grommets or protective sleeves to protect wires.
 - Don't assume all metal in the car is grounded; modern cars are as much plastic as metal.

Batteries

- Create current through a chemical reaction
 - Individual cells connected in series or parallel
 - Cell chemistry determines voltage per cell
- Battery types
 - Disposable (primary batteries)
 - Rechargeable (secondary batteries)
 - Storage

Batteries

- Energy capabilities rated in Ampere-hours
 - Amps X time (at a constant voltage)

Battery Charging

- Some batteries can be recharged, some cannot.
- Use the proper charger for the battery being charged.
- Batteries will lose capacity with each cycle.
- Best if batteries are maintained fully charged.
 - Over-charging will cause heating and could damage the battery.

Battery Charging

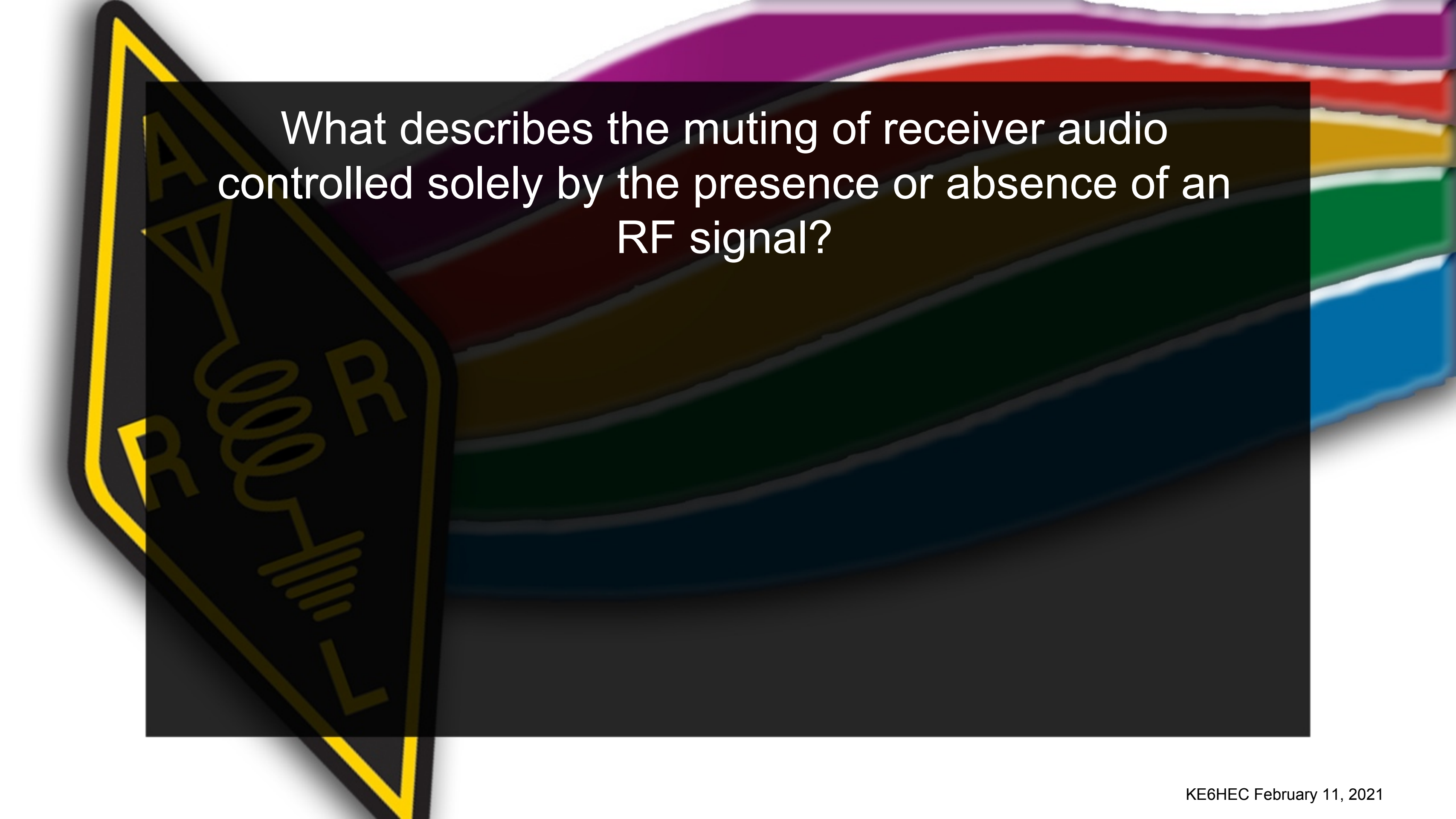
- Lead-acid batteries release explosive hydrogen during charging or rapid discharge so adequate ventilation is required.
- Automobiles can be a good emergency power source by recharging batteries
- A 12-volt lead-acid station battery can be recharged by connecting it to an automobile's electrical system

Battery Charging

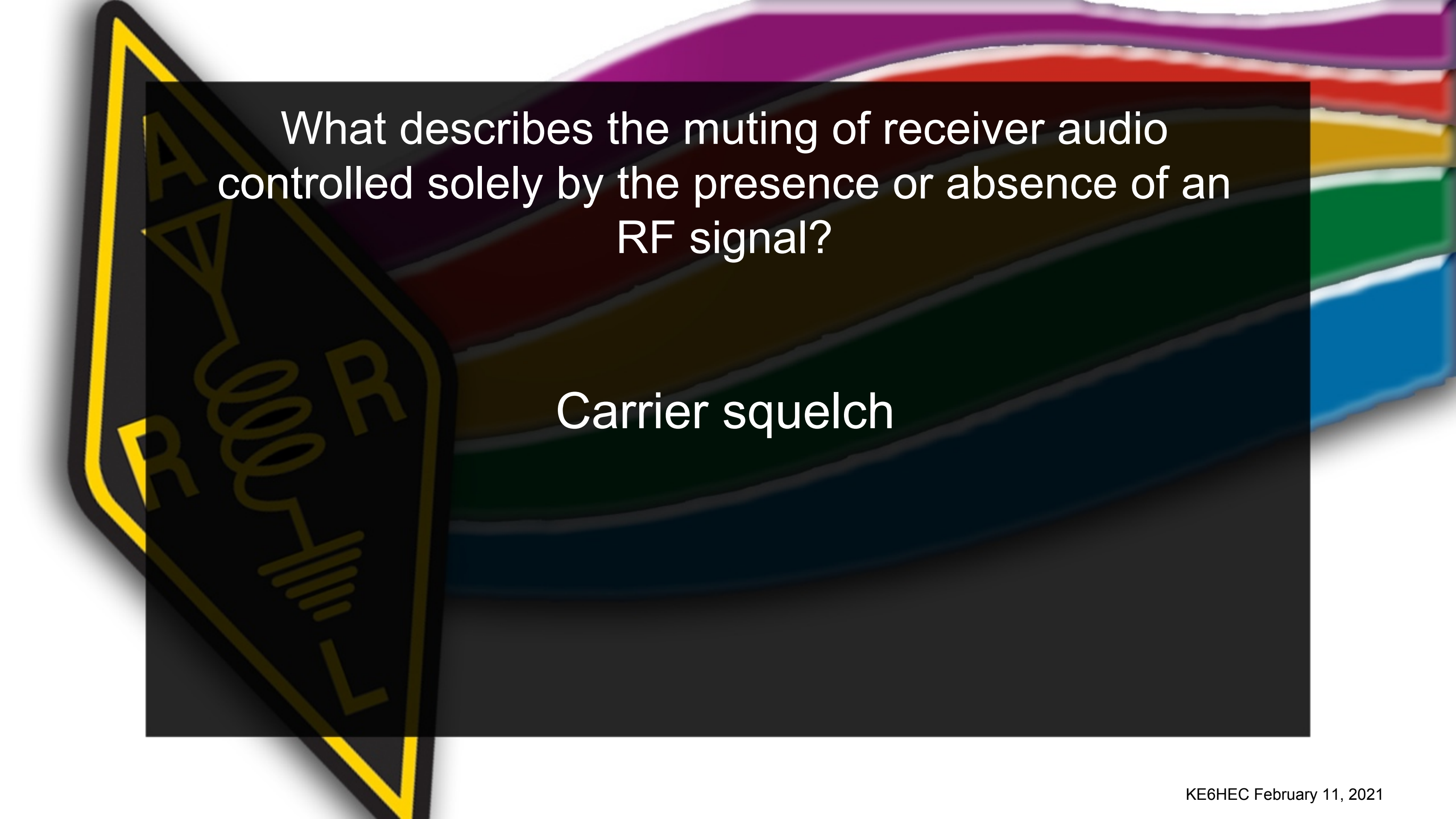
- Monitor battery temperature
- Make sure battery is well-ventilated



Practice Questions


The background features a vibrant, multi-colored wavy line resembling a rainbow or a spectrum, transitioning from purple at the top to blue at the bottom. On the left side, there is a stylized, dark-colored graphic of a radio circuit diagram, including a coil and a battery symbol, enclosed within a yellow-bordered shape that looks like a callout or a sign.

What describes the muting of receiver audio controlled solely by the presence or absence of an RF signal?



What describes the muting of receiver audio controlled solely by the presence or absence of an RF signal?

Carrier squelch

The background features a vibrant, multi-colored rainbow with wavy, horizontal bands of purple, red, orange, yellow, green, and blue. On the left side, there is a black triangular logo with a yellow border. Inside the logo, the letters 'A' and 'R' are positioned at the top corners, and a stylized call sign 'KE6HEC' is written in the center. The text 'What is true concerning the microphone connectors on amateur transceivers?' is overlaid in white on a dark rectangular area in the upper center.

What is true concerning the microphone connectors on amateur transceivers?

The background features a vibrant rainbow with wavy, layered bands of color (purple, red, orange, yellow, green, blue) on the right side. On the left, there is a dark, semi-transparent overlay containing a yellow-outlined logo. The logo is a triangle with the letters 'A' and 'R' at the top, a stylized antenna in the center, and the word 'HAM' at the bottom.

What is true concerning the microphone connectors on amateur transceivers?

Some connectors include push-to-talk and voltages for powering the microphone

The background features a vibrant, multi-colored rainbow on the right side, transitioning from purple at the top to red, orange, yellow, green, and blue. On the left, there is a dark, semi-transparent rectangular area containing a yellow-outlined triangle. Inside the triangle is a schematic diagram of an electronic circuit, including a coil (inductor) and a battery symbol. The letters 'A', 'R', and 'R' are also visible within the triangle's outline.

How might a computer be used as part of an
amateur radio station?

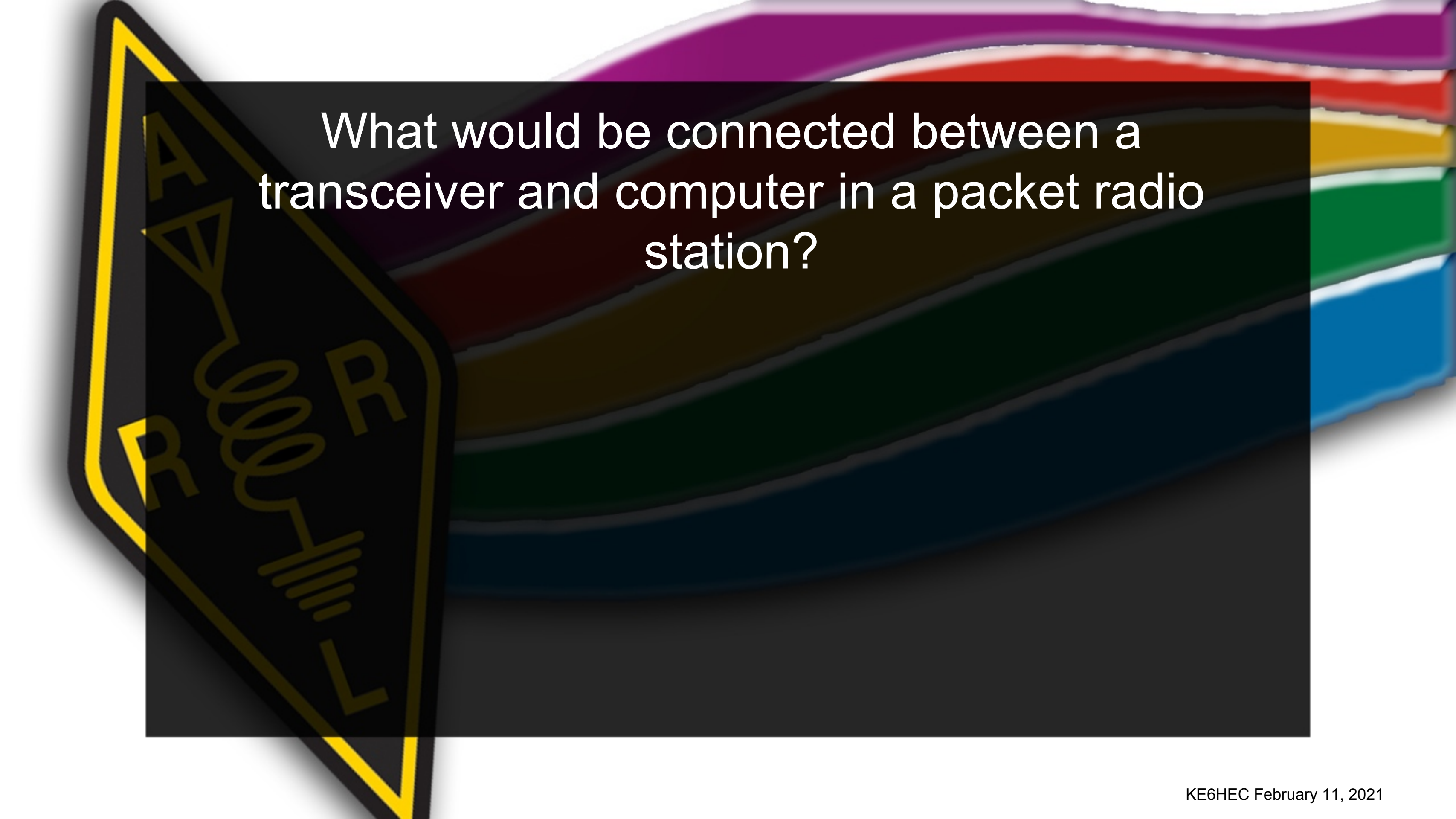


How might a computer be used as part of an amateur radio station?

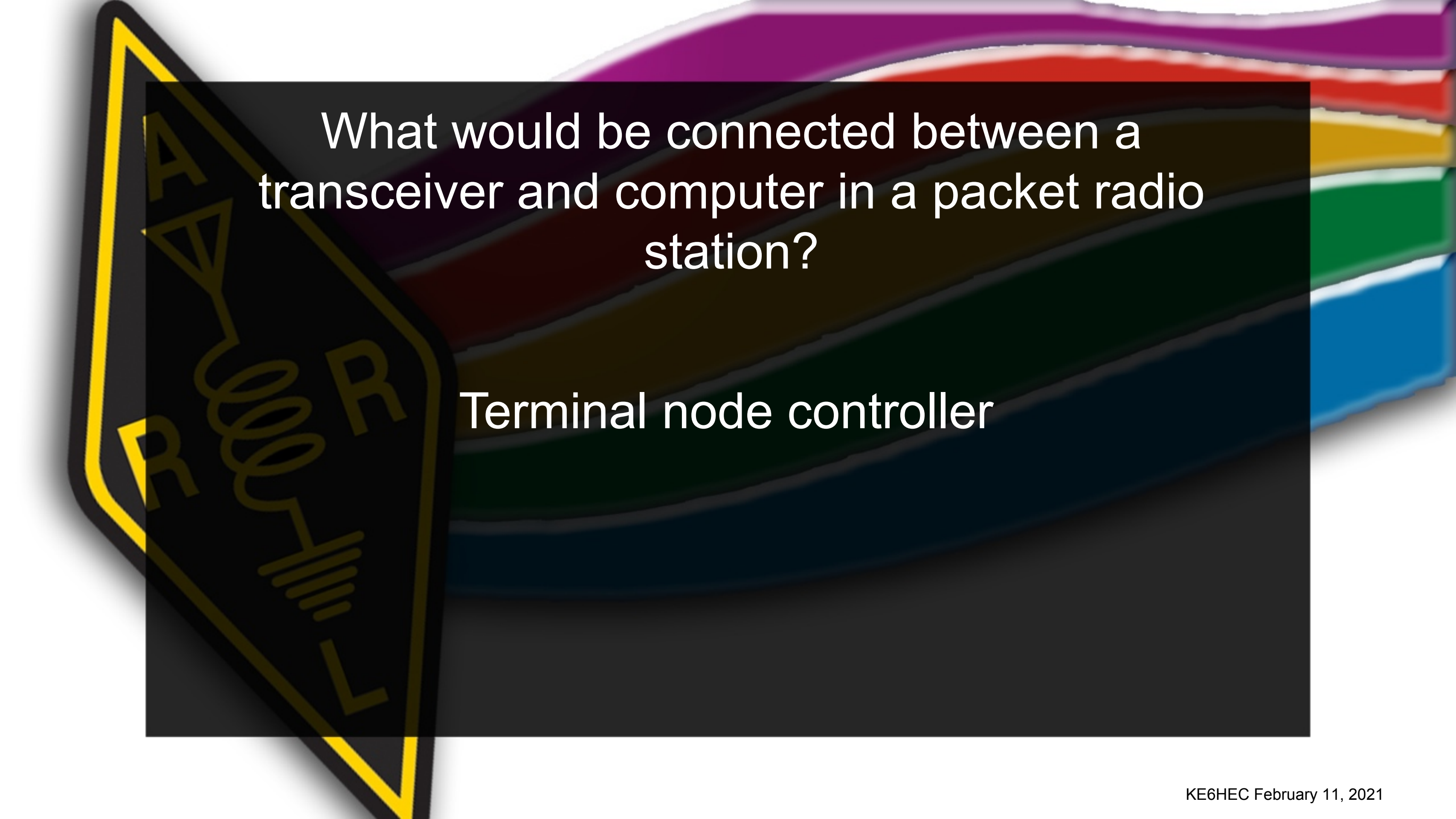
For logging contacts and contact information

For sending and/or receiving CW

For generating and decoding digital signals

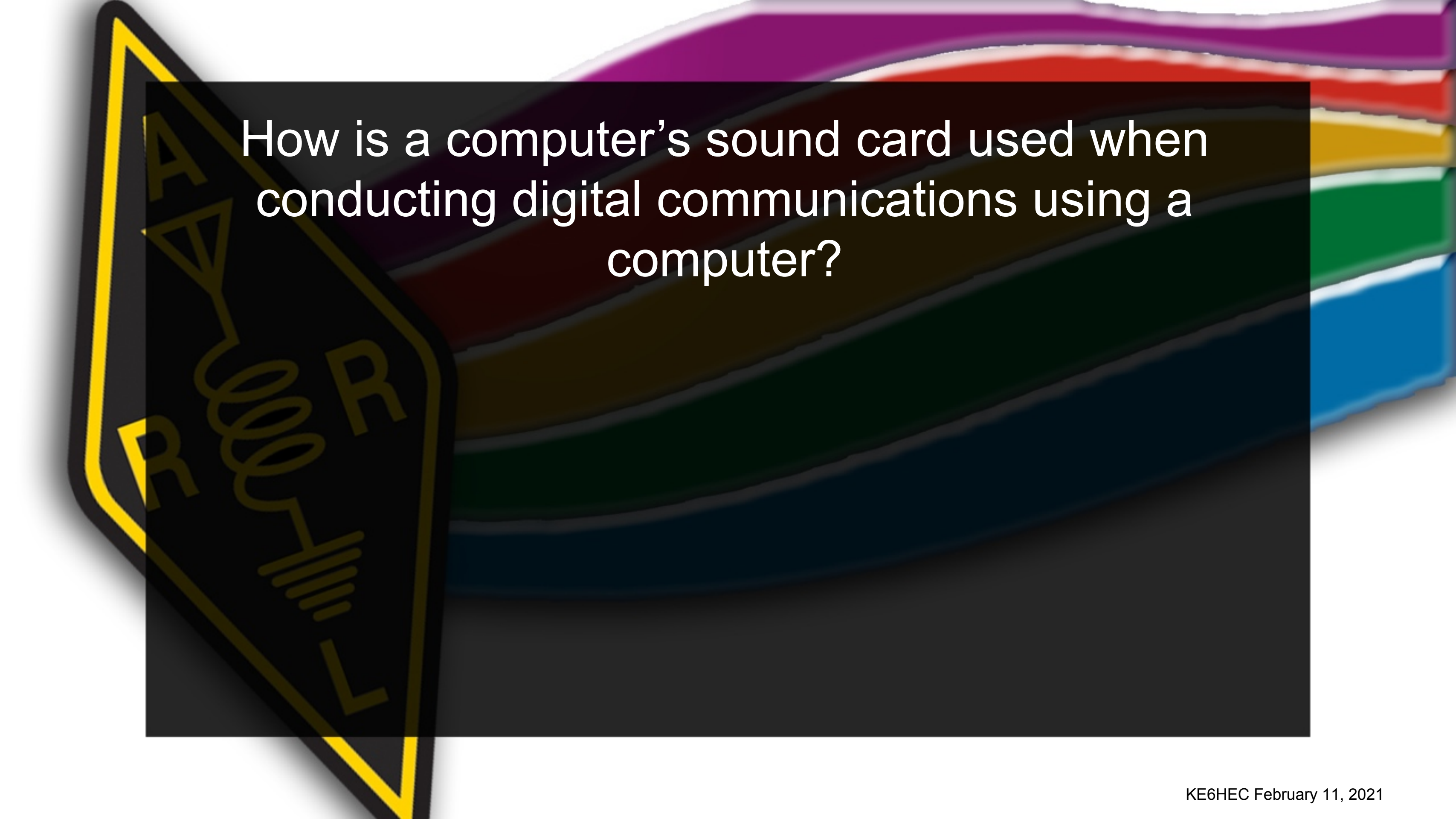
The background features a vibrant, multi-colored rainbow-like wave pattern in shades of purple, red, orange, yellow, green, and blue. On the left side, there is a large, stylized yellow-outlined triangle containing a black silhouette of a radio antenna and the letters 'A', 'R', and 'R' in a bold, sans-serif font.

What would be connected between a
transceiver and computer in a packet radio
station?

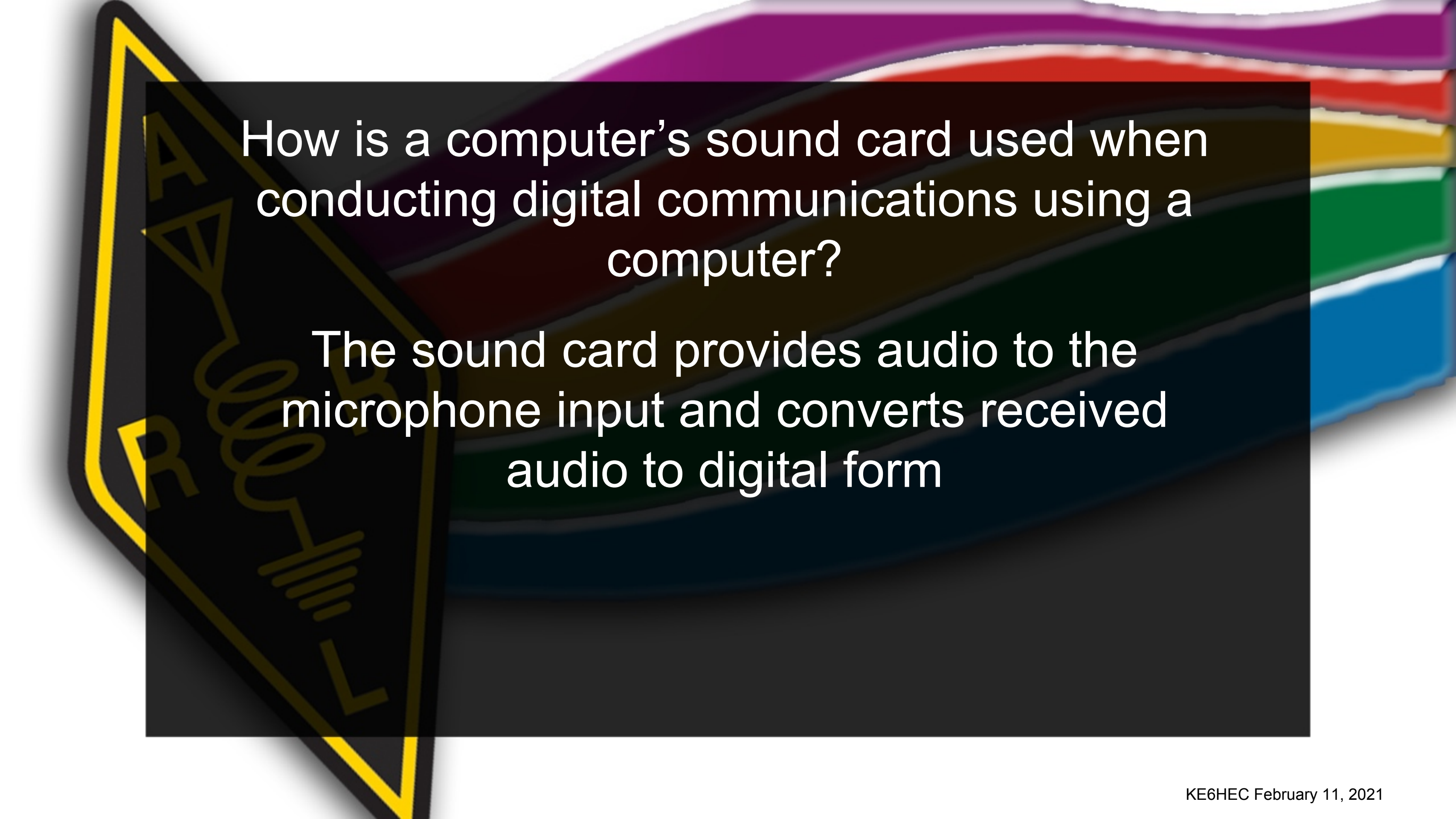


What would be connected between a
transceiver and computer in a packet radio
station?

Terminal node controller

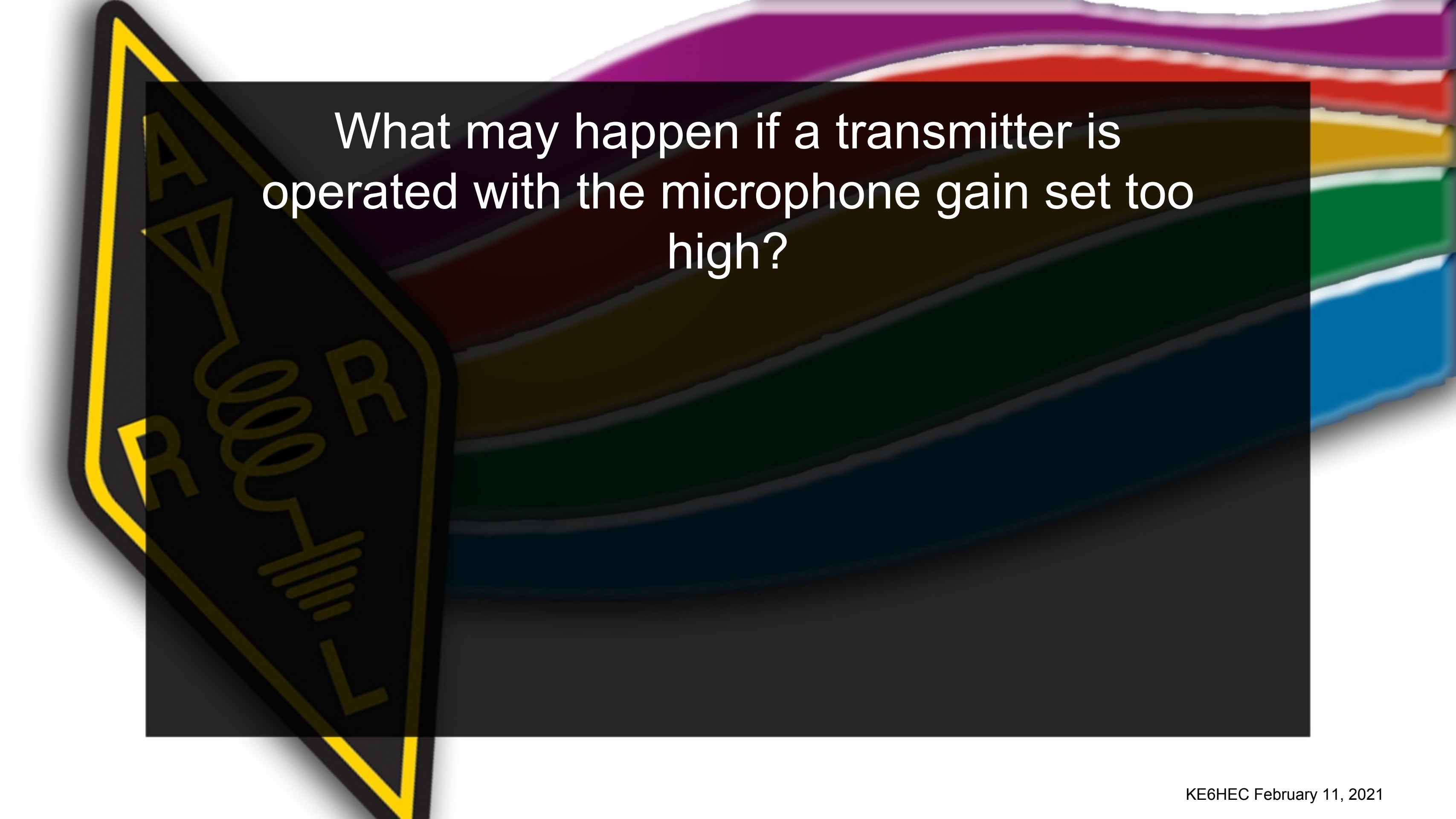
The background features a vibrant, multi-colored rainbow-like wave pattern on the right side, transitioning from purple at the top to blue at the bottom. On the left side, there is a dark, semi-transparent overlay containing a yellow-outlined schematic of a radio circuit. The schematic includes a coil labeled 'R', a battery symbol, and the letters 'A' and 'R' in a stylized font.

How is a computer's sound card used when conducting digital communications using a computer?

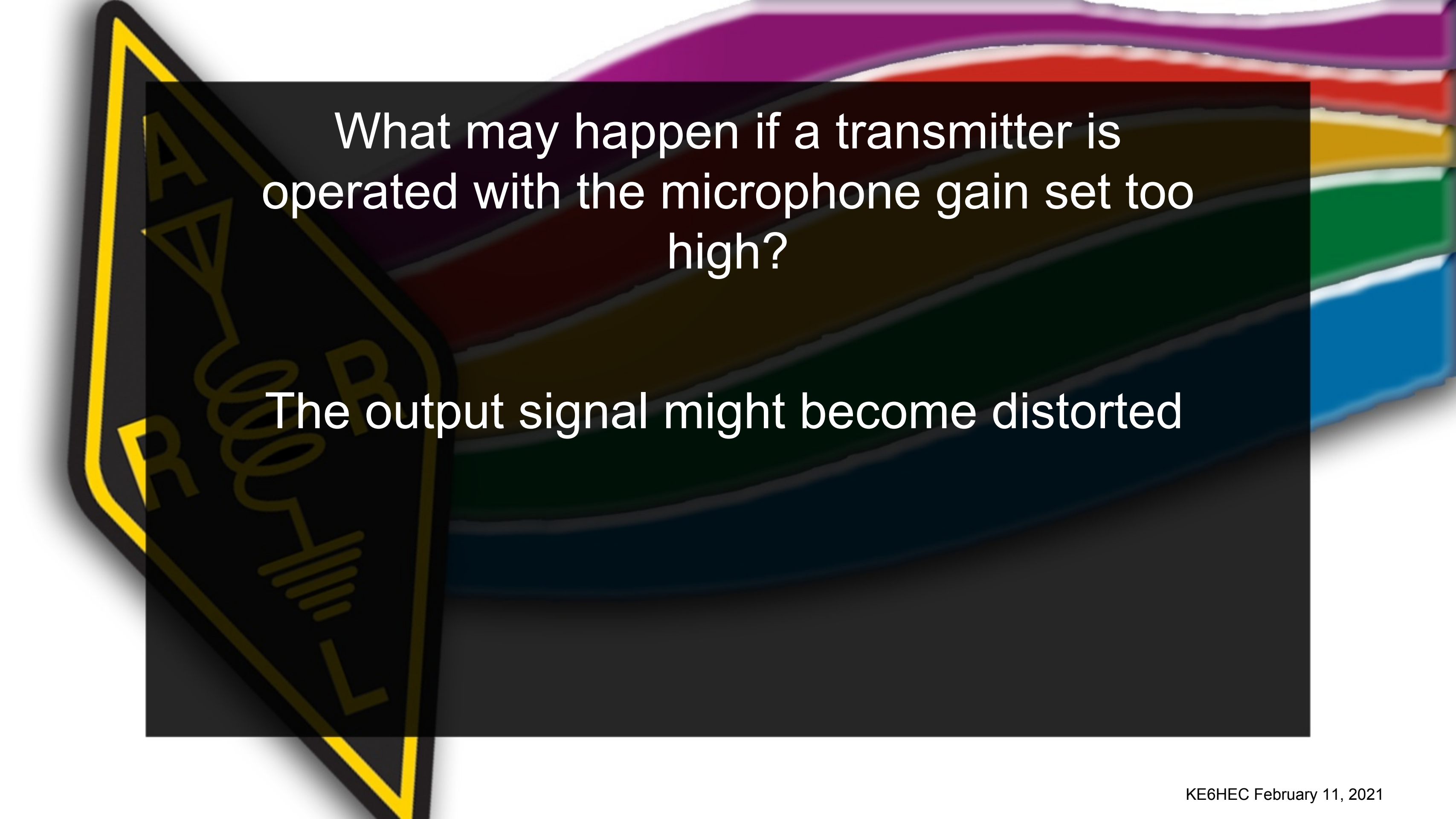


How is a computer's sound card used when conducting digital communications using a computer?

The sound card provides audio to the microphone input and converts received audio to digital form

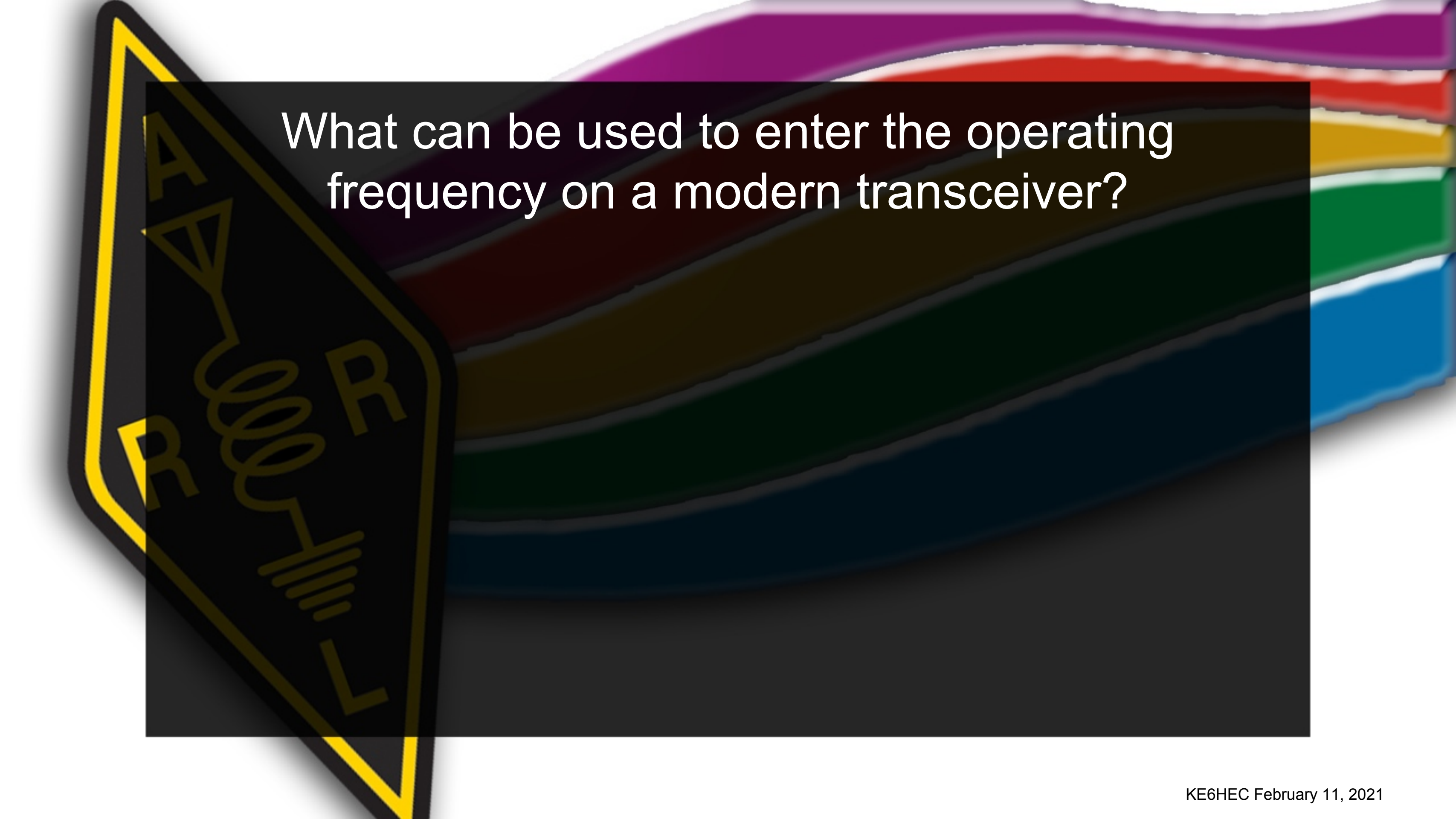
The background features a vibrant, multi-colored rainbow with horizontal bands of purple, red, orange, yellow, green, and blue. On the left side, there is a stylized logo for a ham radio. It consists of a yellow triangle with a black border, containing the letters 'A', 'V', and 'R' in a stylized font. Below the letters is a coiled line representing an antenna, and at the bottom is a battery symbol. The text 'What may happen if a transmitter is operated with the microphone gain set too high?' is centered in white on a dark, semi-transparent rectangular background.

What may happen if a transmitter is operated with the microphone gain set too high?

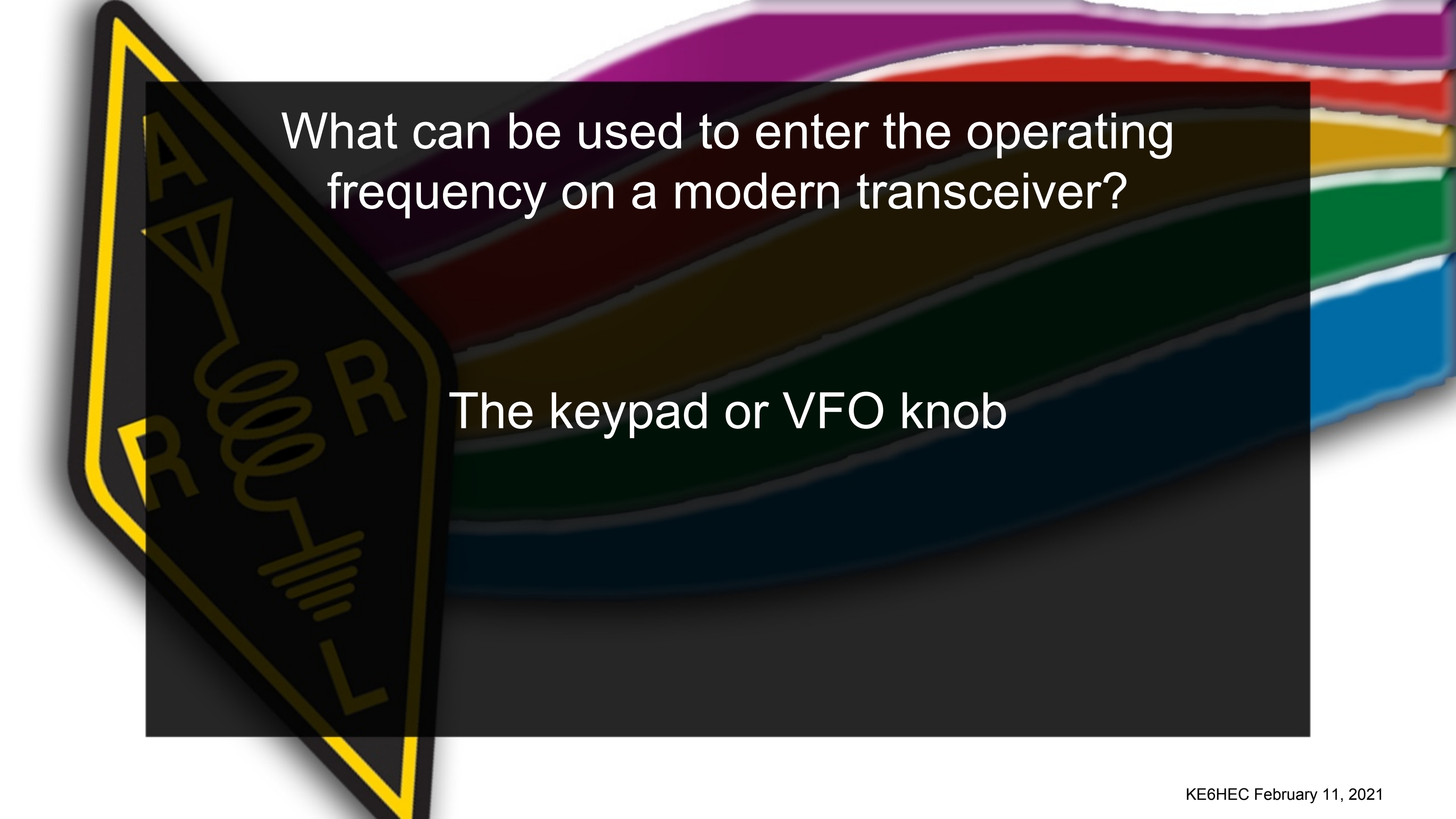
The background features a vibrant, multi-colored rainbow with distinct bands of purple, red, orange, yellow, green, and blue. On the left side, there is a large, dark-colored sign with a yellow border. The sign is tilted and contains the word 'RECEIVED' in a stylized, outlined font. The text of the slide is overlaid on a dark, semi-transparent rectangular area.

What may happen if a transmitter is
operated with the microphone gain set too
high?

The output signal might become distorted



What can be used to enter the operating frequency on a modern transceiver?



What can be used to enter the operating frequency on a modern transceiver?

The keypad or VFO knob

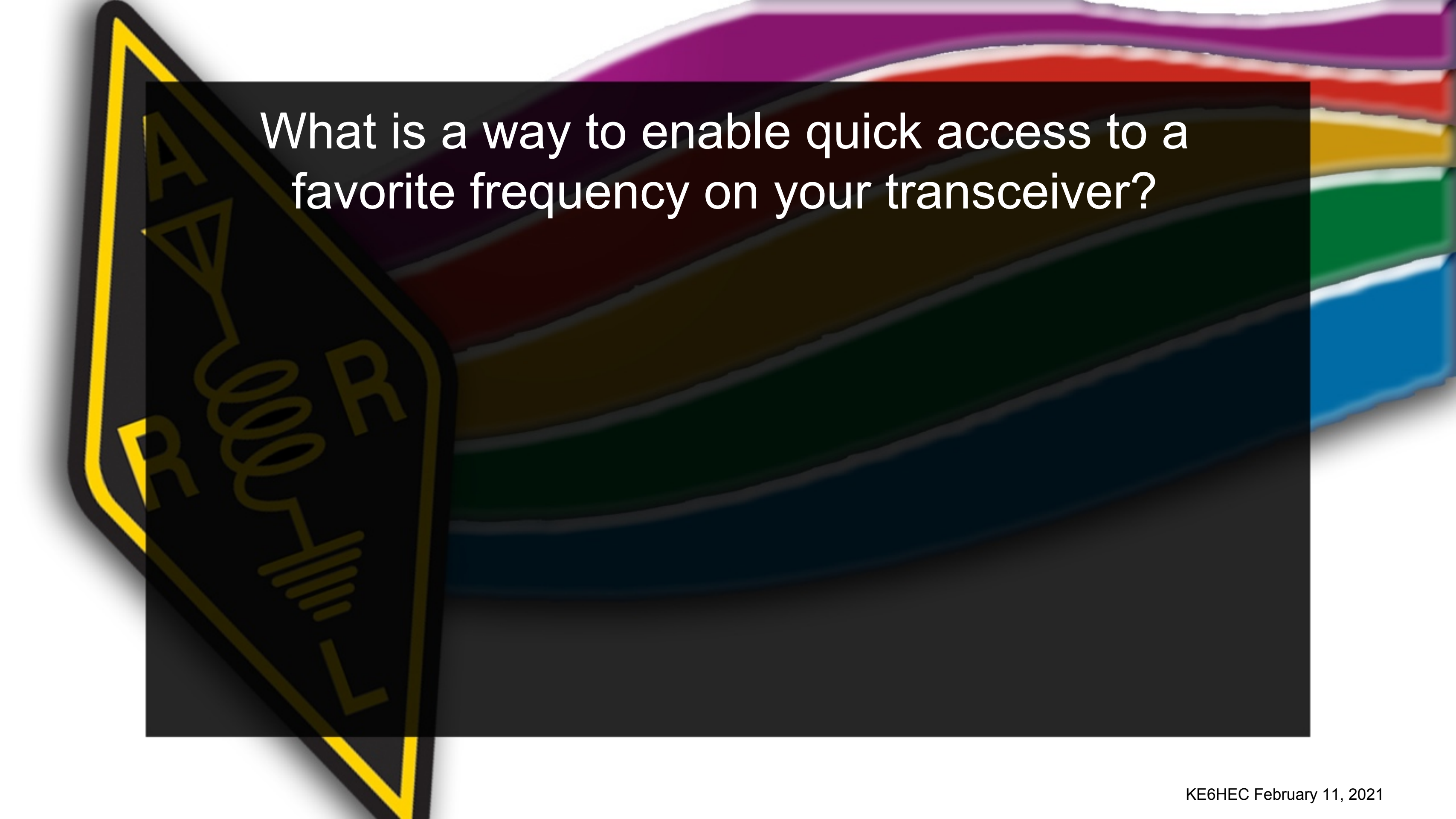
The background features a vibrant, multi-colored wavy pattern resembling a rainbow or liquid paint in shades of purple, red, orange, yellow, green, and blue. On the left side, there is a stylized logo for a ham radio. It consists of a yellow triangle with a black border, containing the letters 'A', 'V', and 'R' in a stylized font, with a coiled wire and a battery symbol below them. A dark grey rectangular box is overlaid on the center of the image, containing the text.

What is the purpose of the squelch control
on a transceiver?


The background of the slide features a vibrant, multi-colored rainbow on the right side, transitioning from purple at the top to red, orange, yellow, green, and blue. On the left side, there is a large, dark, triangular road sign with a yellow border. The sign contains the word 'ROAD' in large, stylized letters and the word 'CLOSED' in smaller letters below it, along with a symbol of a closed road.

What is the purpose of the squelch control
on a transceiver?

To mute receiver output noise when no signal
is being received

The background features a vibrant, multi-colored wavy spectrum on the right side, transitioning from purple at the top to blue at the bottom. On the left, there is a yellow-outlined triangle containing a circuit diagram with a resistor (R), an inductor (L), and a capacitor (C).

What is a way to enable quick access to a favorite frequency on your transceiver?

The background features a vibrant, multi-colored rainbow with wavy, horizontal bands of purple, red, orange, yellow, green, and blue. On the left side, there is a large, stylized logo for 'Radio Shack' in a yellow, outlined font. The logo is partially obscured by a dark grey rectangular area that contains the text.

What is a way to enable quick access to a favorite frequency on your transceiver?

Store the frequency in a memory channel

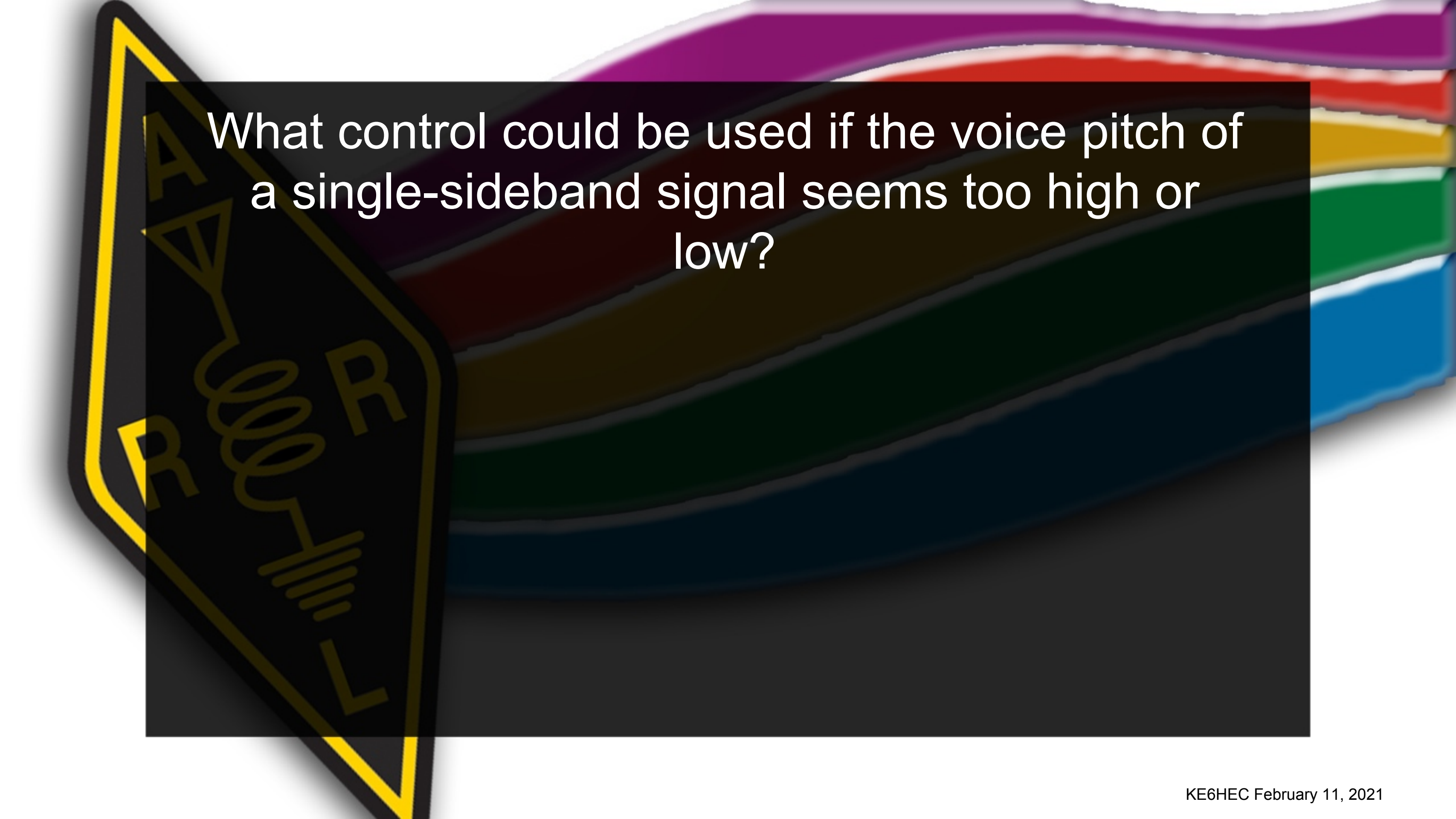
The background features a vibrant, multi-colored rainbow with wavy, horizontal bands of purple, red, orange, yellow, green, and blue. On the left side, there is a yellow-outlined triangular logo with a black background. Inside the logo, the letters 'A' and 'R' are at the top corners, and a stylized ham silhouette is in the center. The text 'KE6HEC' is written vertically along the left edge of the triangle.

What would reduce ignition interference to a receiver?

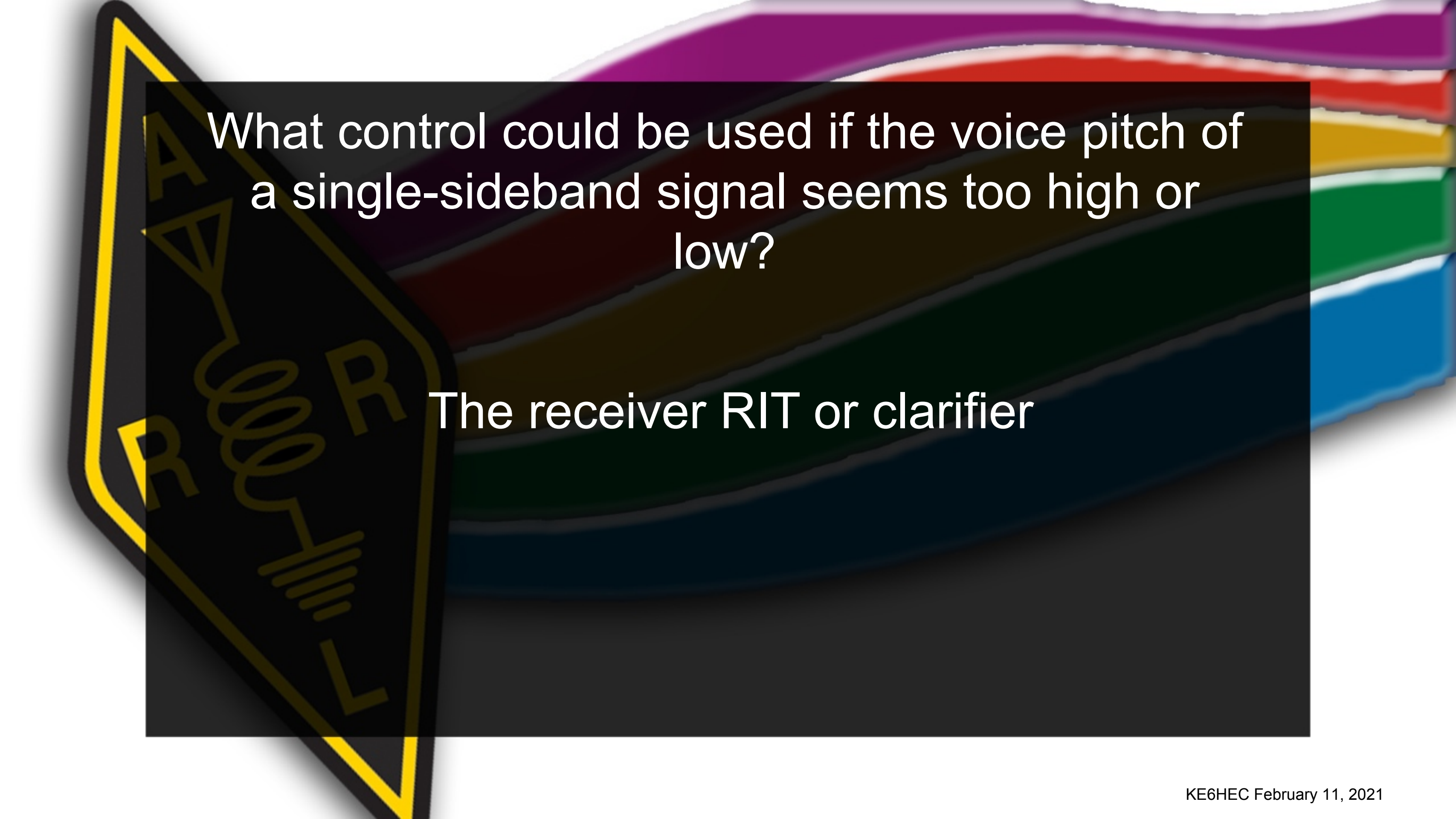
The background features a vibrant rainbow with wavy, horizontal bands of color (purple, red, orange, yellow, green, blue) on the right side. On the left side, there is a stylized logo for a ham radio, consisting of a yellow triangle with a black border. Inside the triangle, the letters 'A', 'V', and 'R' are arranged around a central graphic of a coiled antenna wire and a battery symbol.

What would reduce ignition interference to a receiver?

Turn on the noise blanker

The background features a vibrant, multi-colored rainbow on the right side, with colors transitioning from purple at the top to red, orange, yellow, green, and blue at the bottom. On the left side, there is a stylized, dark-colored graphic of a radio circuit schematic, including a coil and a capacitor, with the letters 'A', 'R', and 'L' visible. A semi-transparent dark rectangle is overlaid on the center of the image, containing the text.

What control could be used if the voice pitch of
a single-sideband signal seems too high or
low?

The background features a vibrant rainbow with wavy, layered edges. Overlaid on the left is a large, semi-transparent watermark of a radio circuit schematic, showing a coil, a capacitor, and a battery symbol, with the letters 'A', 'R', and 'R' visible.

What control could be used if the voice pitch of a single-sideband signal seems too high or low?

The receiver RIT or clarifier

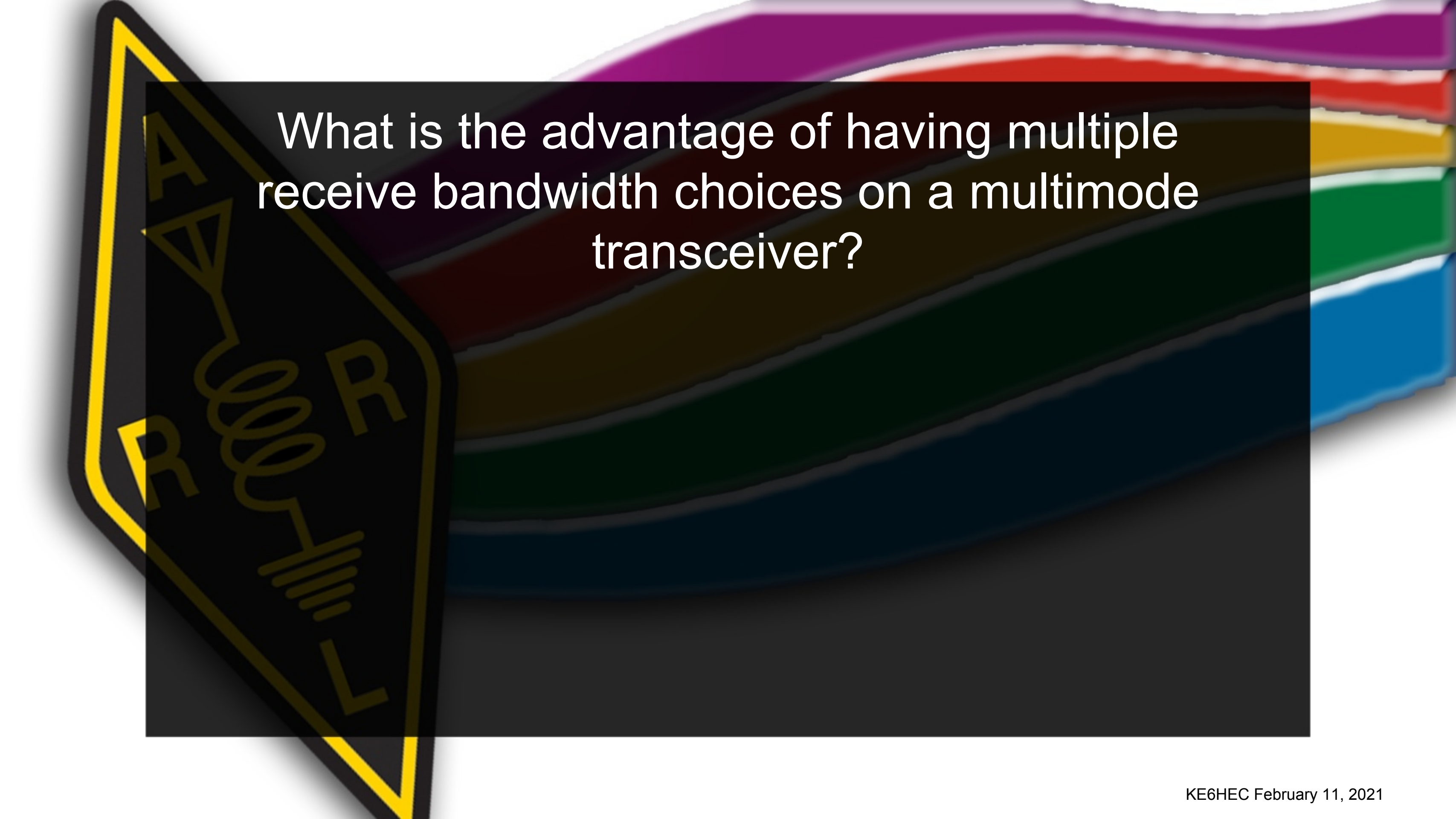


What does the term "RIT" mean?

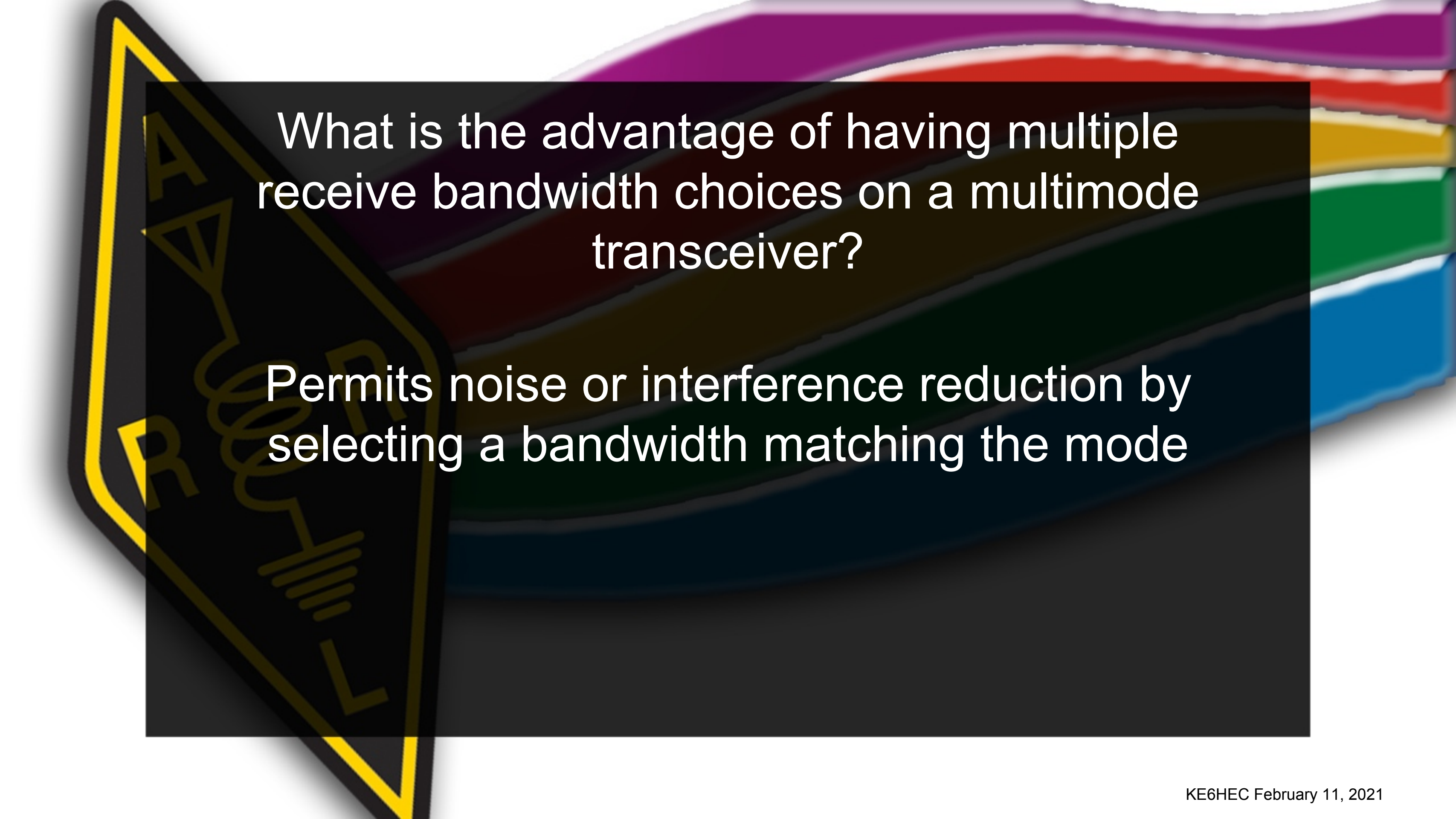
The background features a vibrant, multi-colored rainbow-like wave pattern in shades of purple, red, orange, yellow, green, and blue. Overlaid on the left side is a yellow-outlined triangle containing a black radio circuit schematic. The schematic includes a coil, a battery, and various electronic symbols. The letters 'A', 'R', and 'R' are visible within the triangle.

What does the term "RIT" mean?

Receiver Incremental Tuning

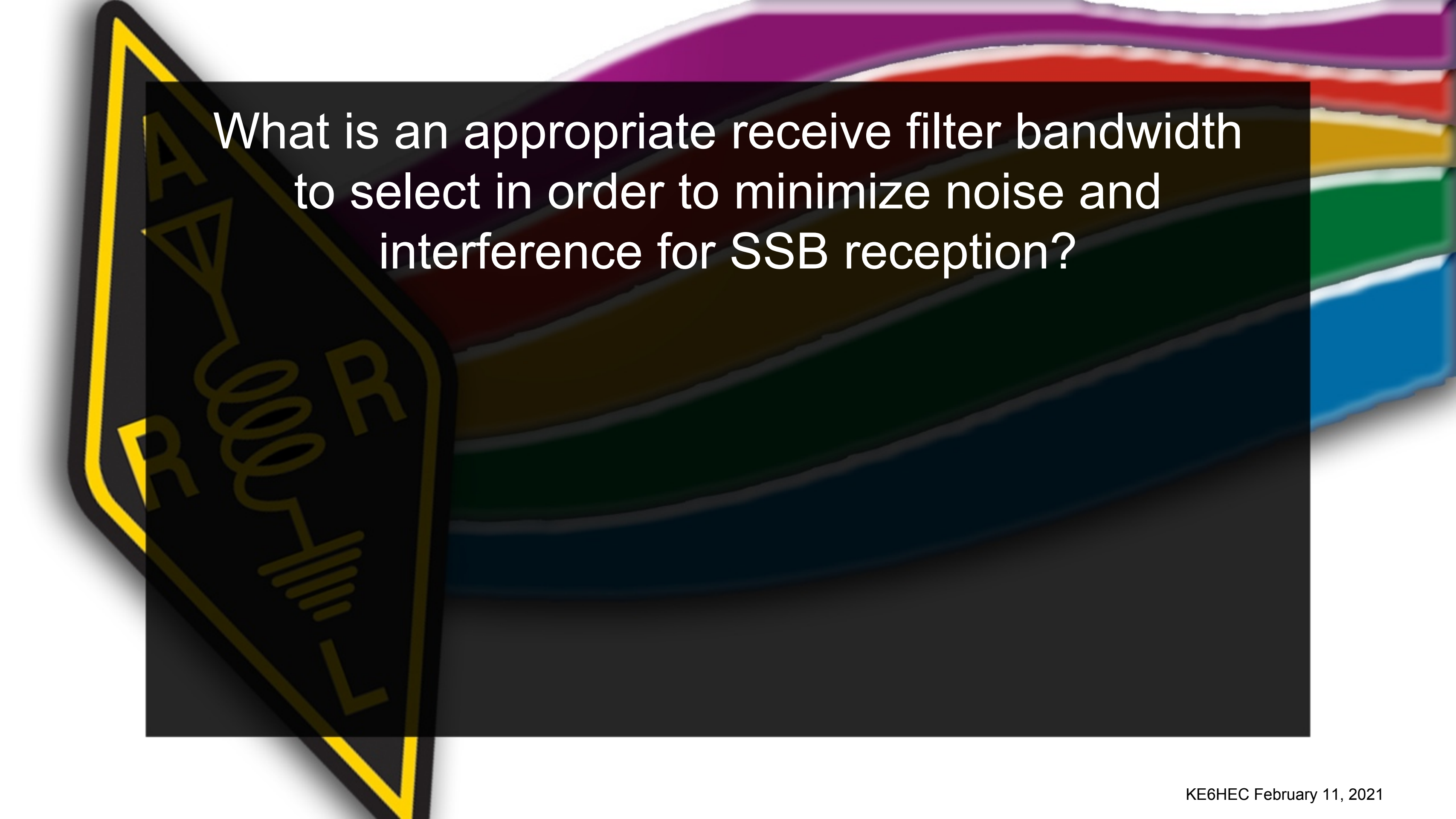
The background features a vibrant, multi-colored wavy pattern resembling a rainbow or liquid paint in shades of purple, red, orange, yellow, green, and blue. On the left side, there is a stylized logo for a ham radio. It consists of a yellow triangle with a black border, containing the letters 'A', 'V', and 'R' in a stylized font. Below the letters is a coiled spring representing an antenna, and at the bottom is a battery symbol. The text 'What is the advantage of having multiple receive bandwidth choices on a multimode transceiver?' is centered in white on a dark, semi-transparent rectangular background.

What is the advantage of having multiple receive bandwidth choices on a multimode transceiver?

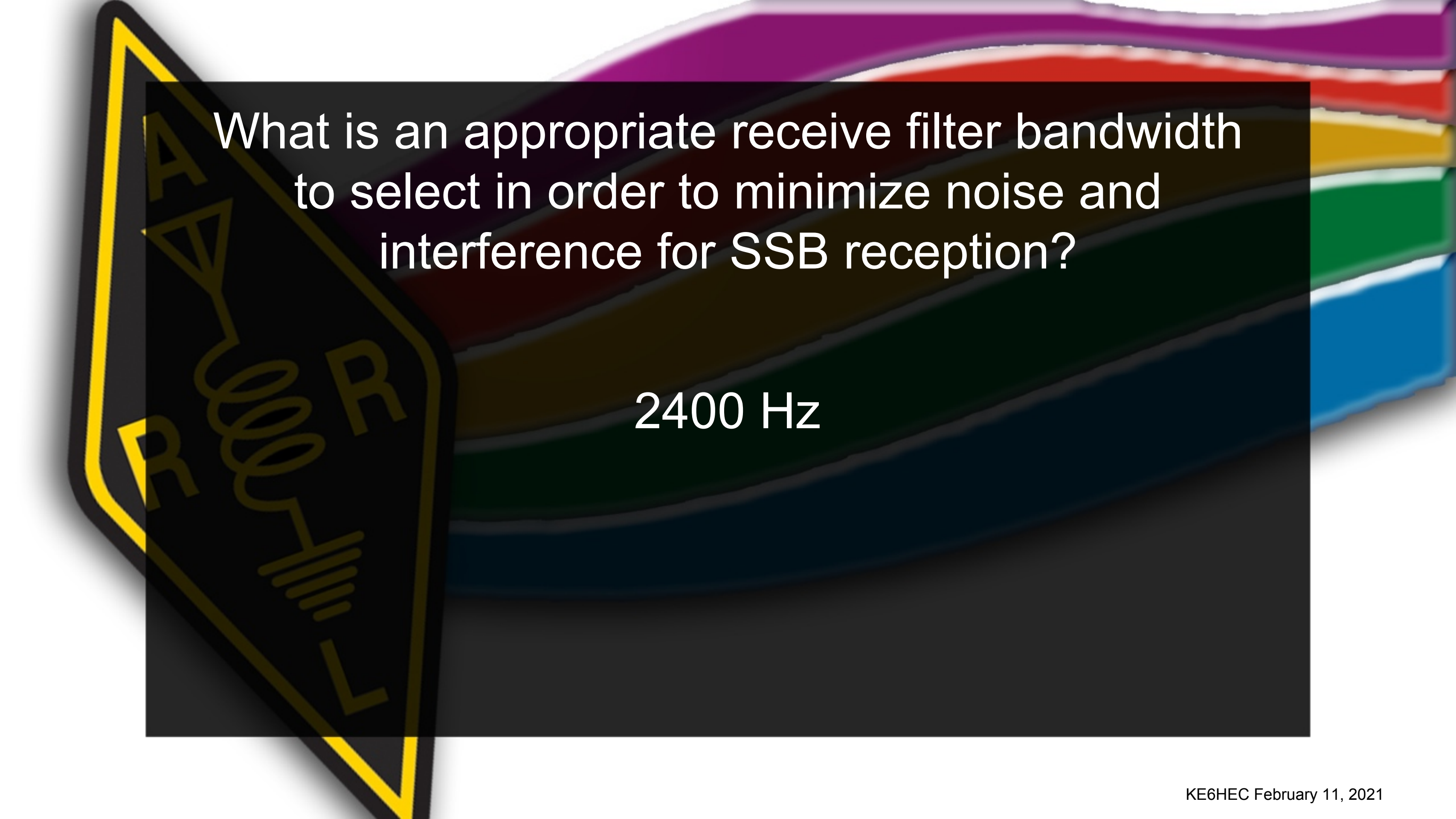


What is the advantage of having multiple receive bandwidth choices on a multimode transceiver?

Permits noise or interference reduction by selecting a bandwidth matching the mode

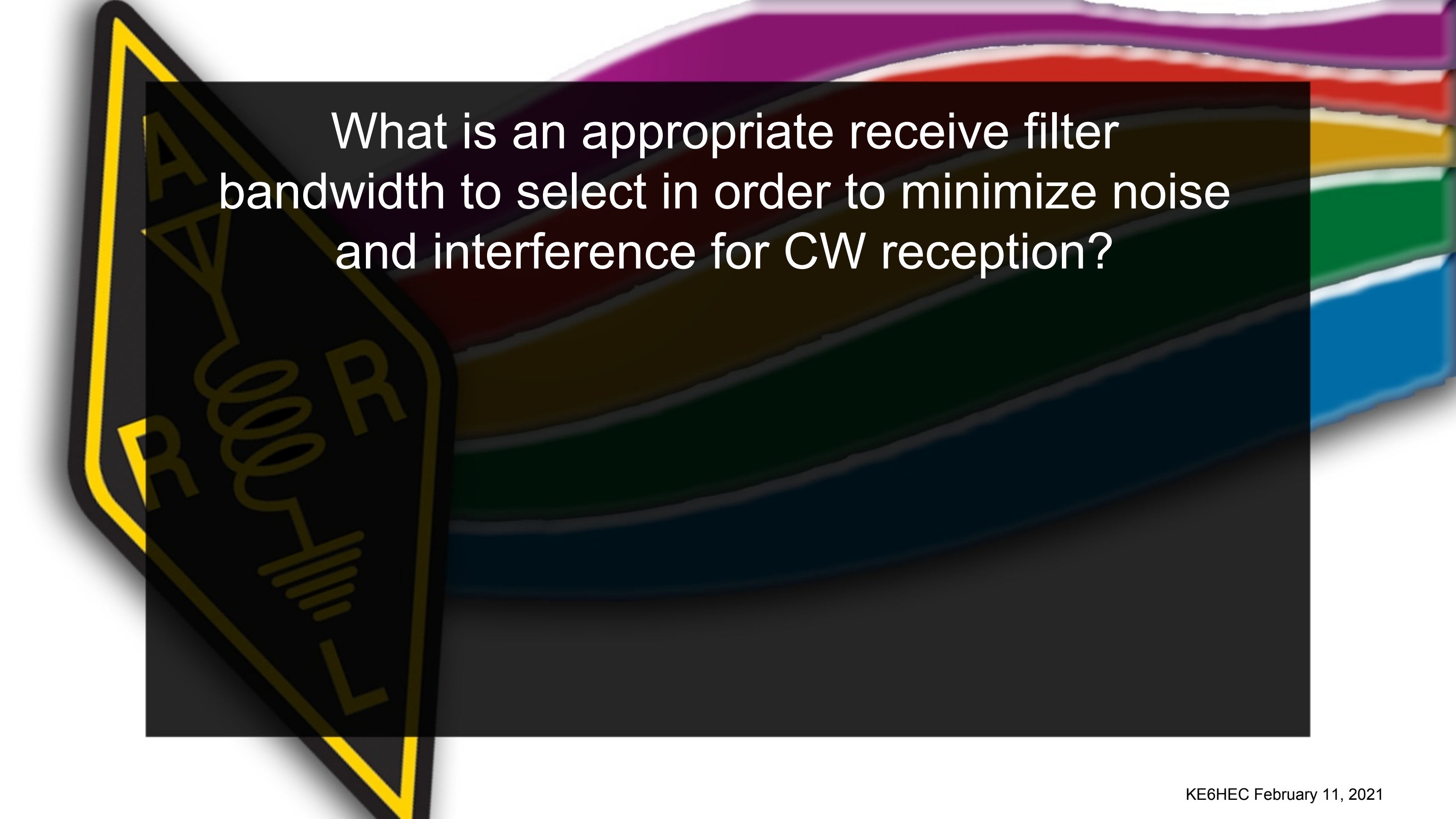
The background features a vibrant, multi-colored wavy pattern on the right side, transitioning through purple, red, orange, yellow, green, and blue. On the left side, there is a dark, semi-transparent overlay containing a yellow-outlined triangle. Inside the triangle, the letters 'A' and 'R' are visible, along with a schematic diagram of an electronic circuit including a coil and a battery.

What is an appropriate receive filter bandwidth
to select in order to minimize noise and
interference for SSB reception?

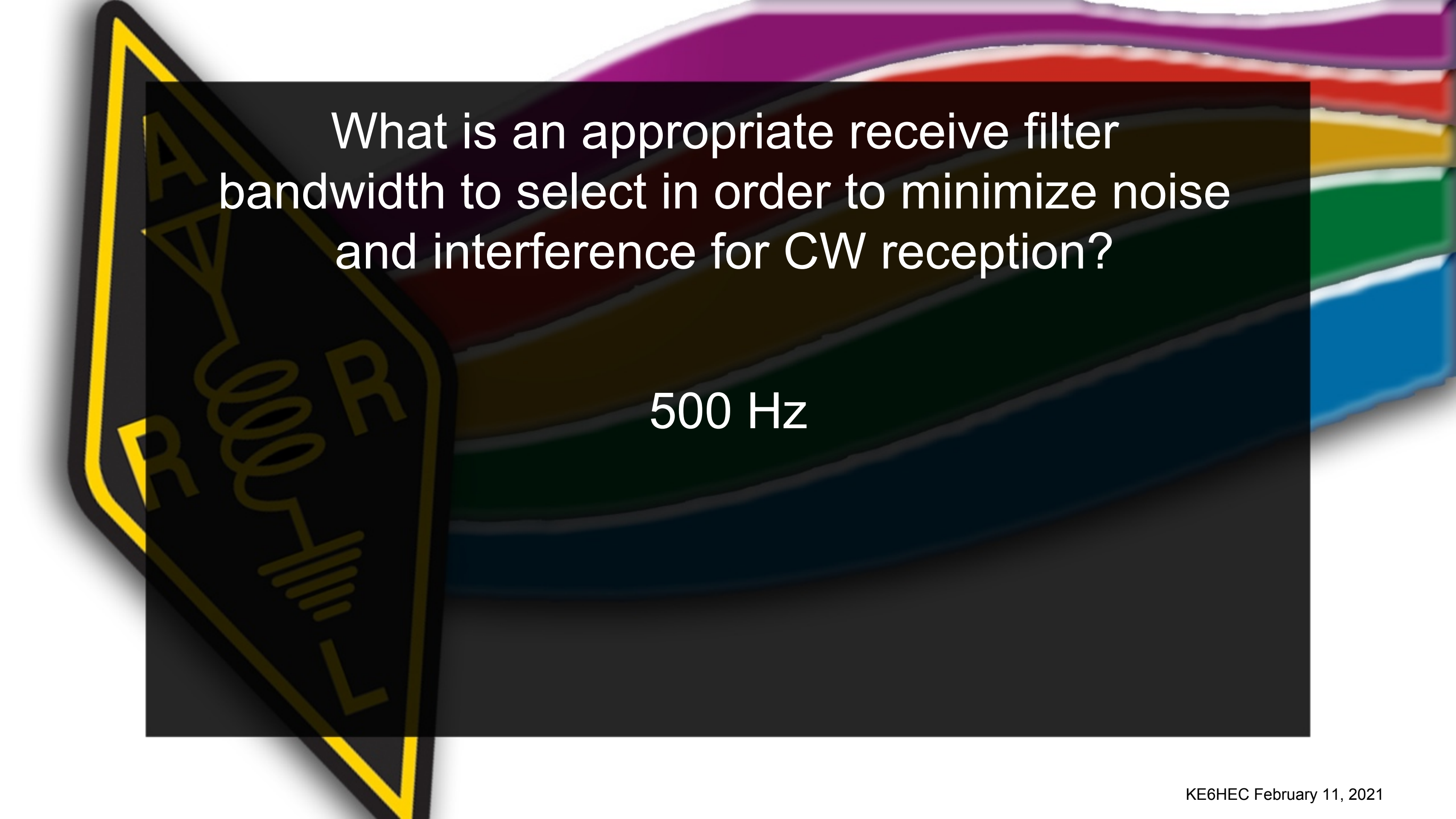


What is an appropriate receive filter bandwidth
to select in order to minimize noise and
interference for SSB reception?

2400 Hz

The background features a vibrant, multi-colored wavy pattern resembling a rainbow or liquid paint in shades of purple, red, orange, yellow, green, and blue. On the left side, there is a stylized logo for a ham radio. It consists of a yellow triangle with a black border, containing the letters 'A', 'V', and 'R' in a stylized font. Below the letters is a coiled wire symbol and a battery symbol. The text 'HAM RADIO' is partially visible within the logo.

What is an appropriate receive filter
bandwidth to select in order to minimize noise
and interference for CW reception?



What is an appropriate receive filter bandwidth to select in order to minimize noise and interference for CW reception?

500 Hz

The background features a vibrant, multi-colored rainbow-like gradient on the right side, transitioning from purple at the top to blue at the bottom. On the left side, there is a dark, semi-transparent rectangular area containing a yellow-outlined circuit diagram. The diagram includes a resistor symbol (zigzag line) and a capacitor symbol (two parallel lines), with the letters 'A', 'R', and 'C' placed near them. The text 'What is the function of automatic gain control or AGC?' is centered in white over the dark rectangle.

What is the function of automatic gain control
or AGC?



What is the function of automatic gain control
or AGC?

To keep received audio relatively constant

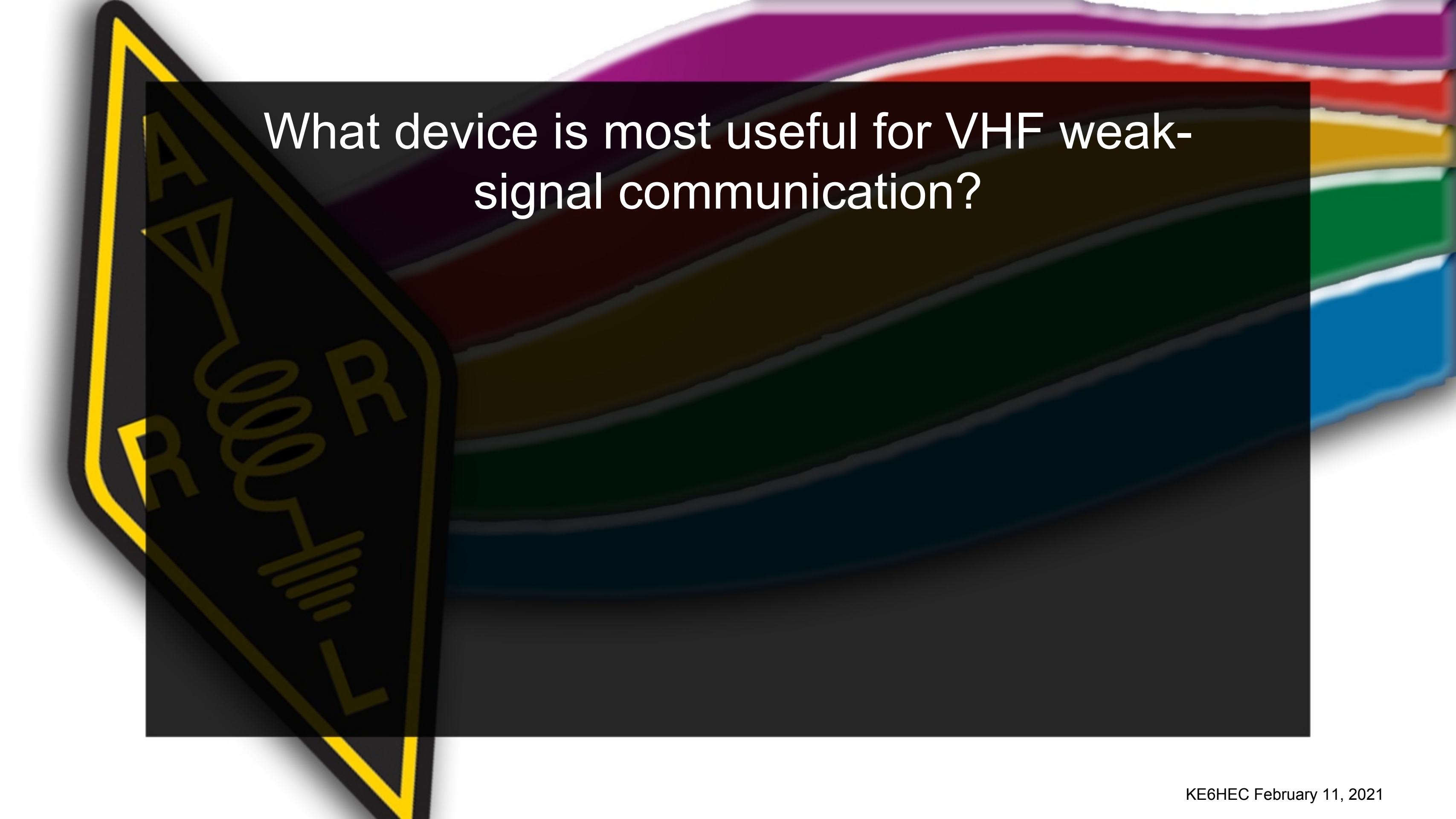
The background features a vibrant, multi-colored rainbow with wavy, horizontal bands of purple, red, orange, yellow, green, and blue. Overlaid on the left side is a yellow-outlined triangle containing a black schematic diagram of a radio circuit. The diagram includes a coil labeled 'R', a capacitor labeled 'C', and a battery symbol. The letters 'A' and 'R' are also visible within the triangle.

What is meant by the term "PTT"?


The background features a vibrant, multi-colored wavy line resembling a rainbow, transitioning from purple at the top to blue at the bottom. On the left side, there is a large, stylized logo for 'Radio Shack' in a dark, semi-transparent font. The logo includes the word 'Radio' in a script font and 'Shack' in a bold, sans-serif font, with a radio tower icon integrated into the letter 'S'.

What is meant by the term "PTT"?

The push to talk function which switches
between receive and transmit

The background features a vibrant, multi-colored rainbow with wavy, horizontal bands of purple, red, orange, yellow, green, and blue. On the left side, there is a stylized graphic of a yellow-bordered triangular sign with a black background. Inside the sign, the letters 'A' and 'R' are visible at the top, and a coiled wire and a battery symbol are at the bottom, representing a ham radio call sign.

What device is most useful for VHF weak-signal communication?

The background features a vibrant, multi-colored wavy pattern resembling a rainbow or liquid paint in shades of purple, red, orange, yellow, green, and blue. On the left side, there is a stylized logo for a ham radio, consisting of a yellow triangle with a black border. Inside the triangle, the letters 'A', 'V', and 'R' are arranged vertically, with a coiled antenna line and a battery symbol below them.

What device is most useful for VHF weak-signal communication?

A multi-mode VHF transceiver

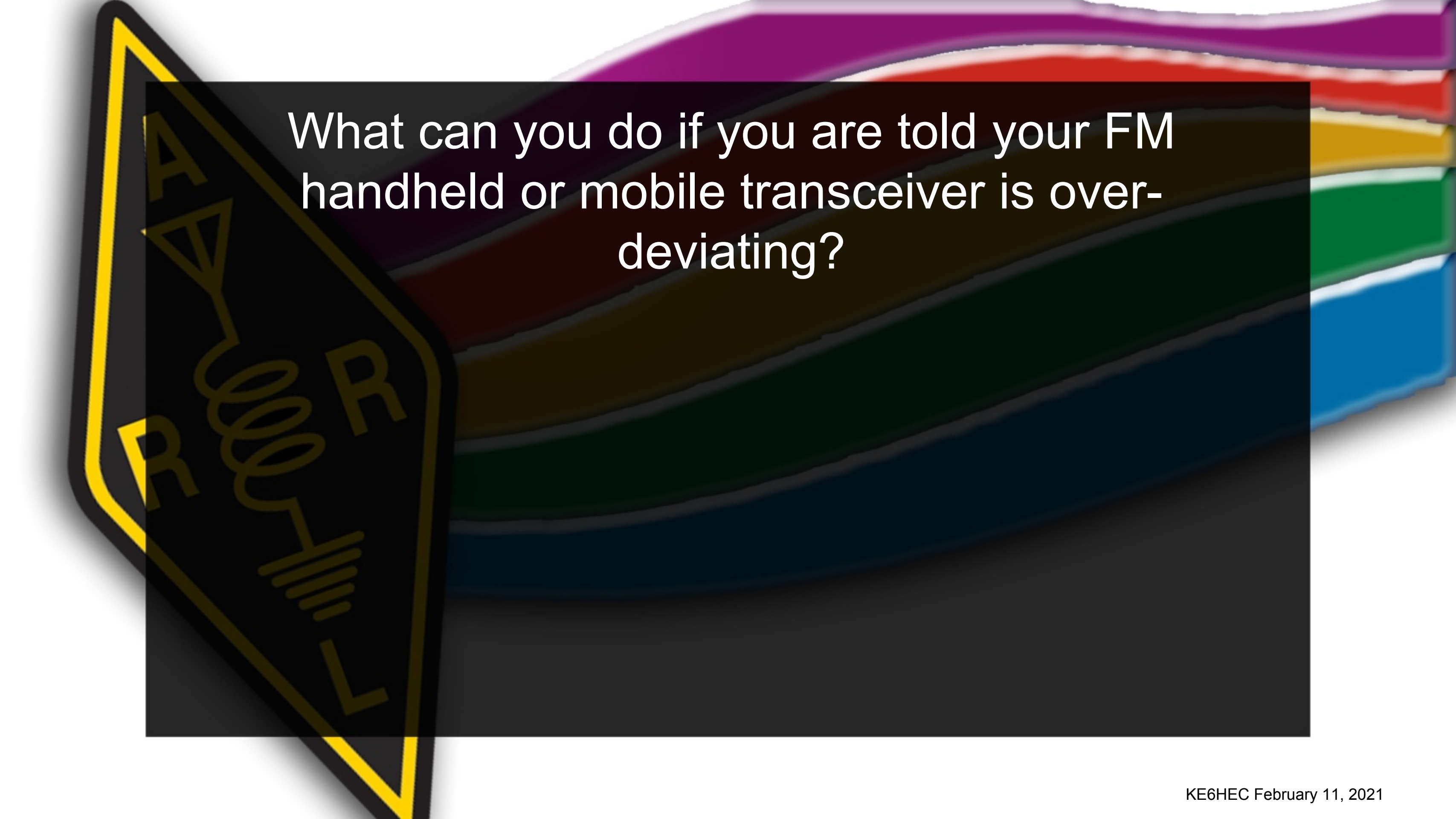
The background features a vibrant, multi-colored rainbow with wavy, horizontal bands of purple, red, orange, yellow, green, and blue. On the left side, there is a stylized logo for a ham radio. It consists of a yellow triangle with a black border, containing the letters 'A', 'V', and 'R' in a stylized font. Below the letters is a coiled line representing an antenna, and at the bottom is a battery symbol. The text 'What device increases the low-power output from a handheld transceiver?' is overlaid in white on a dark, semi-transparent rectangular area in the upper center of the image.

What device increases the low-power output
from a handheld transceiver?

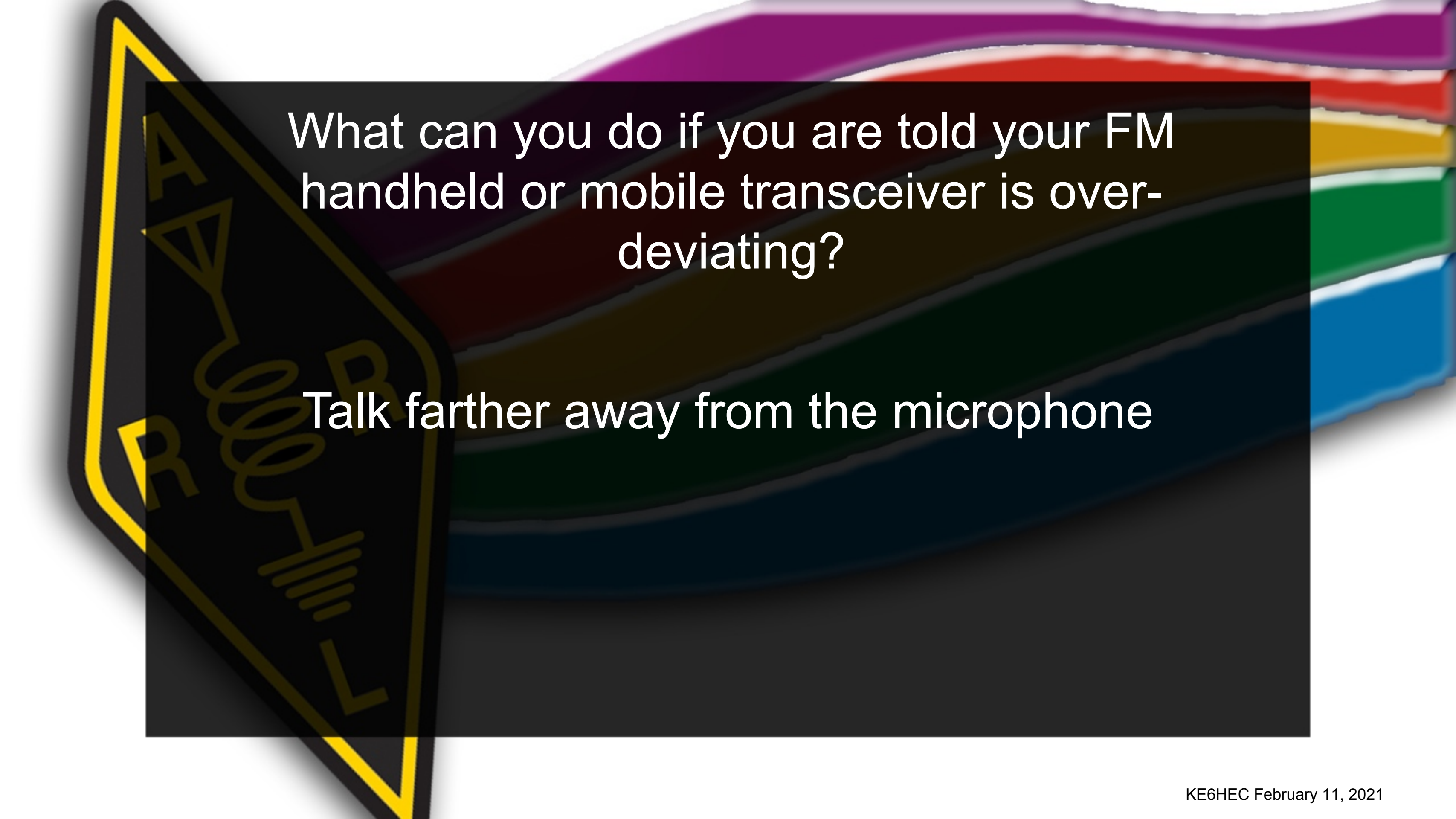
The background features a vibrant, multi-colored rainbow-like wave pattern. On the left side, there is a yellow-outlined triangle containing a schematic diagram of an RF circuit, including a coil (inductor) and a battery symbol. The text is overlaid on a dark, semi-transparent rectangular area.

What device increases the low-power output
from a handheld transceiver?

An RF power amplifier

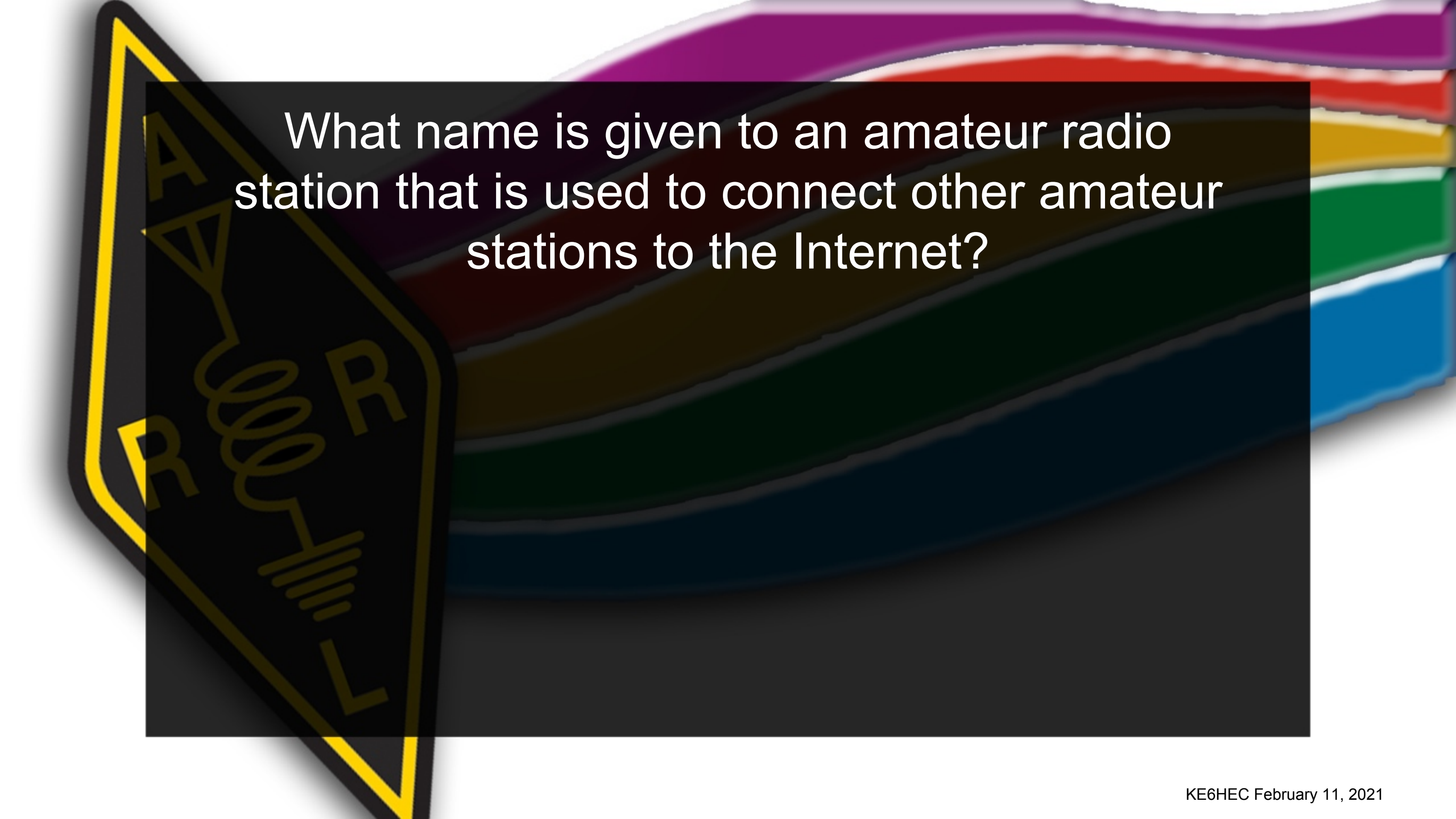
The background features a vibrant, multi-colored rainbow with wavy, layered bands of purple, red, orange, yellow, green, and blue. On the left side, there is a black triangular sign with a yellow border. The sign contains the text 'A' at the top, 'R' on the right, and 'R' on the left, with a stylized ham silhouette in the center. The text 'HAM' is also visible, partially obscured by the sign's shape.

What can you do if you are told your FM
handheld or mobile transceiver is over-
deviating?

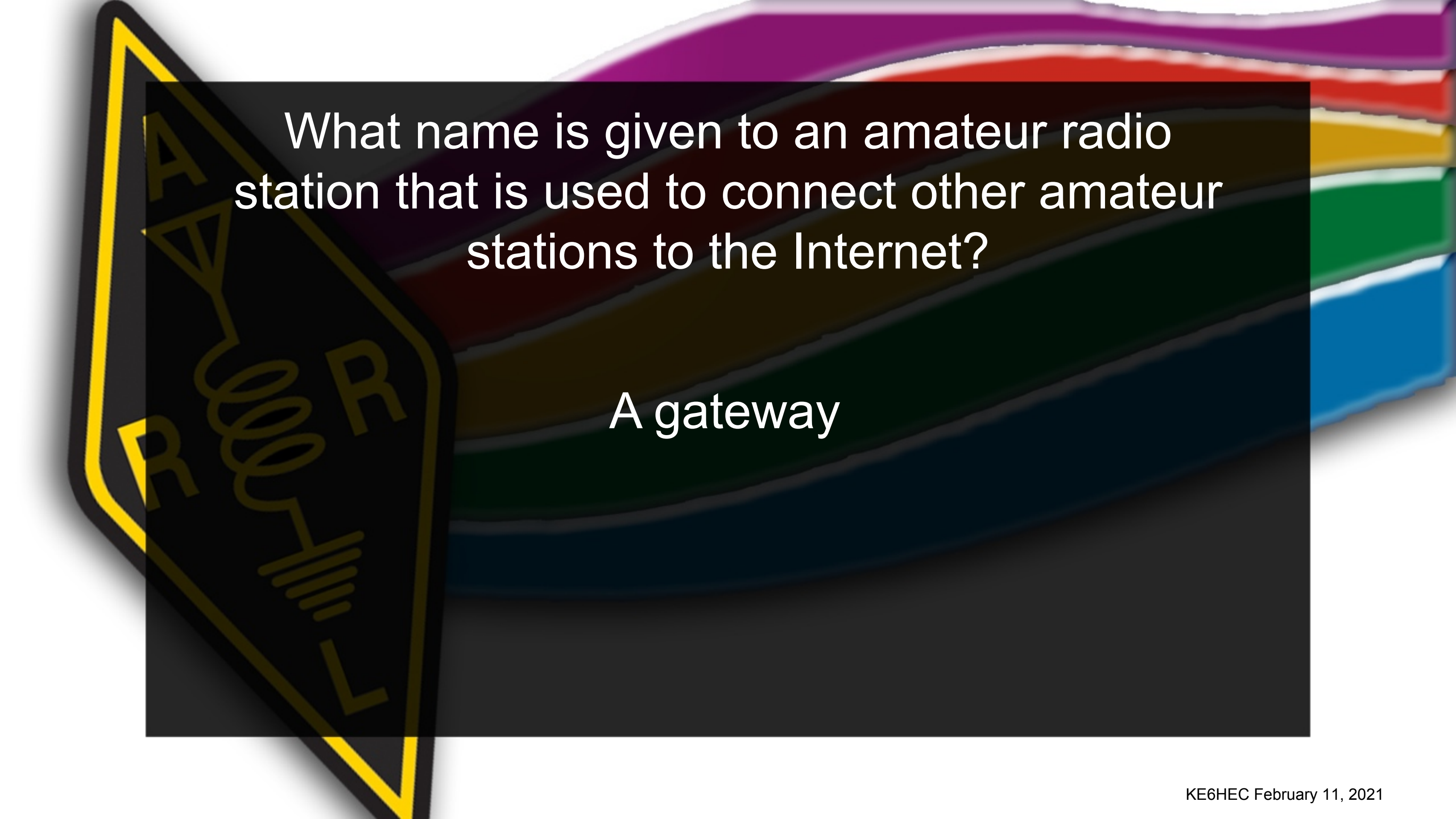
The background features a vibrant rainbow with wavy, layered bands of color (purple, red, orange, yellow, green, blue) on the right side. On the left, there is a large, dark, triangular sign with a yellow border. The sign contains the word 'ROAD' in large, bold, yellow letters, and the word 'CLOSED' in a smaller, yellow, cursive font below it. A yellow lightning bolt symbol is also visible on the sign.

What can you do if you are told your FM
handheld or mobile transceiver is over-
deviating?

Talk farther away from the microphone

The background features a vibrant, multi-colored rainbow on the right side, transitioning from purple at the top to red, orange, yellow, green, and blue. On the left, there is a dark, semi-transparent rectangular area containing a yellow-outlined triangle. Inside the triangle is a schematic diagram of an electronic circuit, including a coil (inductor) and a battery symbol. The letters 'A', 'R', and 'R' are also visible within the triangle's outline.

What name is given to an amateur radio station that is used to connect other amateur stations to the Internet?

The background features a vibrant, multi-colored wavy pattern resembling a rainbow or liquid paint in shades of purple, red, orange, yellow, green, and blue. On the left side, there is a large, stylized logo for 'ARRL' (American Radio Relay League) in a dark, textured font. The logo includes a yellow outline and a stylized antenna symbol.

What name is given to an amateur radio station that is used to connect other amateur stations to the Internet?

A gateway

The background features a vibrant, multi-colored rainbow with wavy, layered edges. On the left side, there is a yellow-outlined triangle containing a schematic diagram of a radio circuit. The diagram includes a coil labeled 'R', a battery symbol, and a speaker icon. The letters 'A' and 'R' are also visible within the triangle.

Which of the following is an example of a digital communications method?



Which of the following is an example of a digital communications method?

Packet
PSK31
MFSK

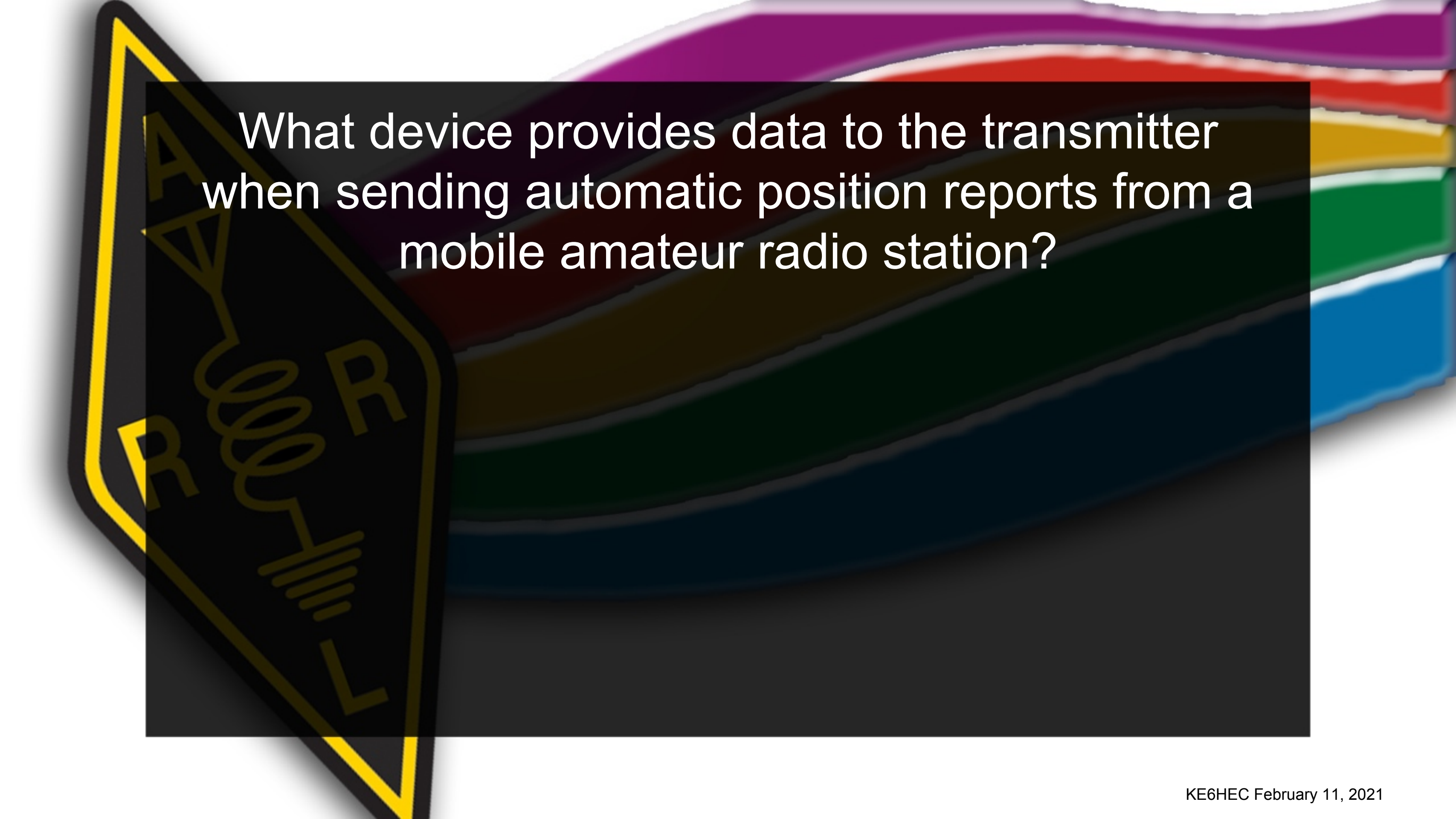
The background features a vibrant, multi-colored rainbow with distinct bands of purple, red, orange, yellow, green, and blue. Overlaid on the left side of the rainbow is a yellow-outlined triangle containing a black schematic diagram of a radio circuit. The diagram includes a coil labeled 'R', a battery symbol, and other electronic components. The text 'What does the term APRS mean?' is centered in white on a dark grey rectangular area.

What does the term APRS mean?


The background features a vibrant, multi-colored rainbow with wavy, layered edges. On the left side, there is a stylized logo for a radio station, possibly 'A 100.1', with the letters 'A' and 'R' visible. The logo is yellow and black, with a yellow border. A dark grey rectangular box is overlaid on the right side of the image, containing white text.

What does the term APRS mean?

Automatic Packet Reporting System

The background features a vibrant, multi-colored rainbow-like wave pattern in shades of purple, red, orange, yellow, green, and blue. On the left side, there is a large, stylized graphic of a radio symbol, consisting of a yellow triangle with a black border, containing a black coil and a battery symbol. Overlaid on this is a dark grey rectangular box with white text.

What device provides data to the transmitter
when sending automatic position reports from a
mobile amateur radio station?

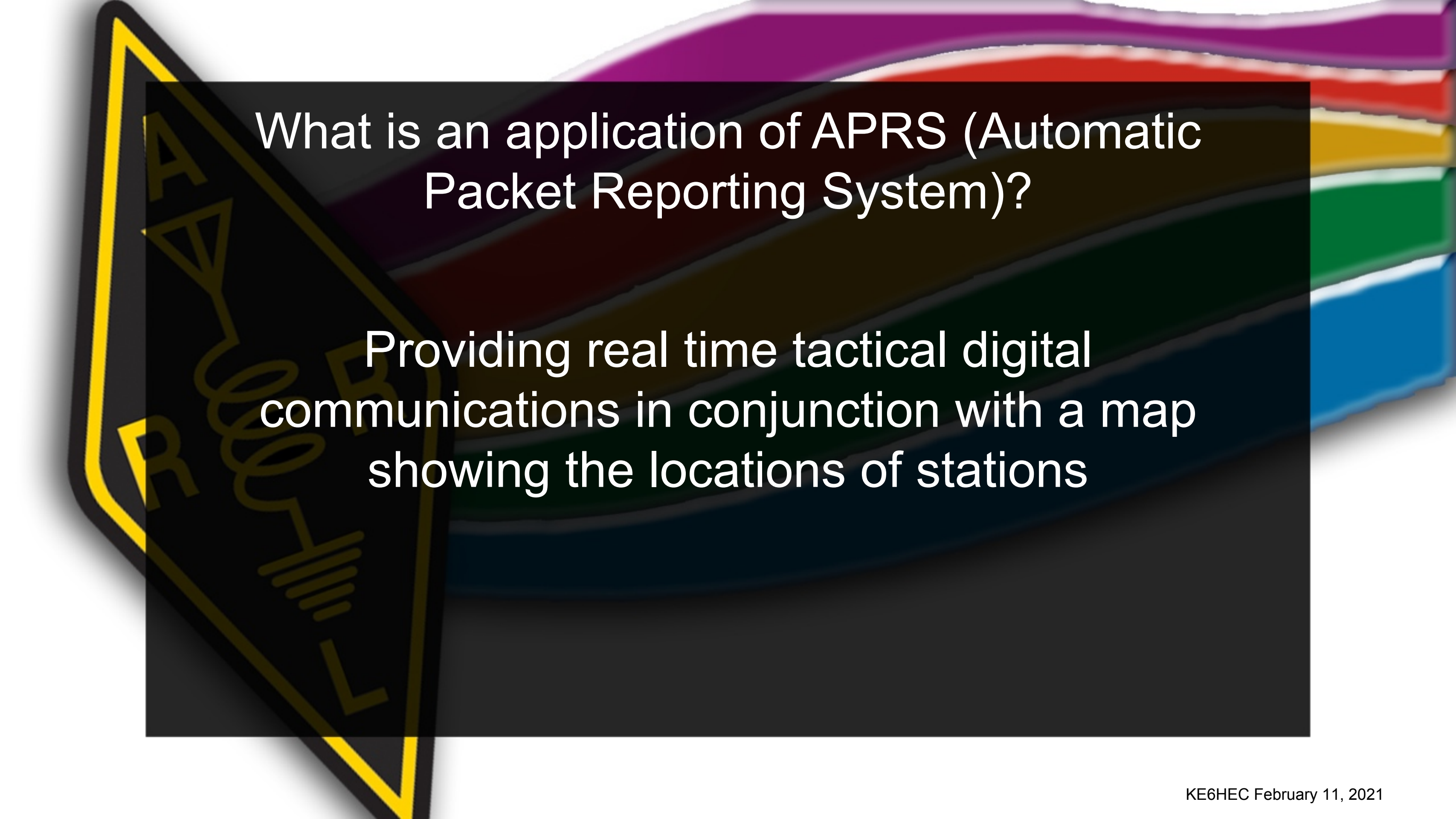
The background features a vibrant, multi-colored wavy pattern resembling a rainbow or aurora borealis in shades of purple, red, orange, yellow, green, and blue. On the left side, there is a stylized logo for a radio station, possibly 'Radio 100.1', with the call letters 'KE6HEC' visible. The logo is dark with yellow and white highlights.

What device provides data to the transmitter
when sending automatic position reports from a
mobile amateur radio station?

A Global Positioning System receiver

The background features a vibrant, multi-colored rainbow with wavy, layered bands of purple, red, orange, yellow, green, and blue. On the left side, there is a stylized logo for a radio station, possibly 'K6R', which includes a large 'A' and 'R' and a graphic of a radio antenna. The text 'What is an application of APRS (Automatic Packet Reporting System)?' is centered in the upper half of the image in a white, sans-serif font.

What is an application of APRS (Automatic Packet Reporting System)?



What is an application of APRS (Automatic Packet Reporting System)?

Providing real time tactical digital communications in conjunction with a map showing the locations of stations



What does the abbreviation PSK mean?

The background features a vibrant, multi-colored rainbow-like wave pattern in shades of purple, red, orange, yellow, green, and blue. Overlaid on the left side is a dark, semi-transparent graphic of a radio circuit schematic, including a coil and a battery symbol, with the letters 'A', 'R', and 'R' visible.

What does the abbreviation PSK mean?

Phase Shift Keying


What is PSK31?



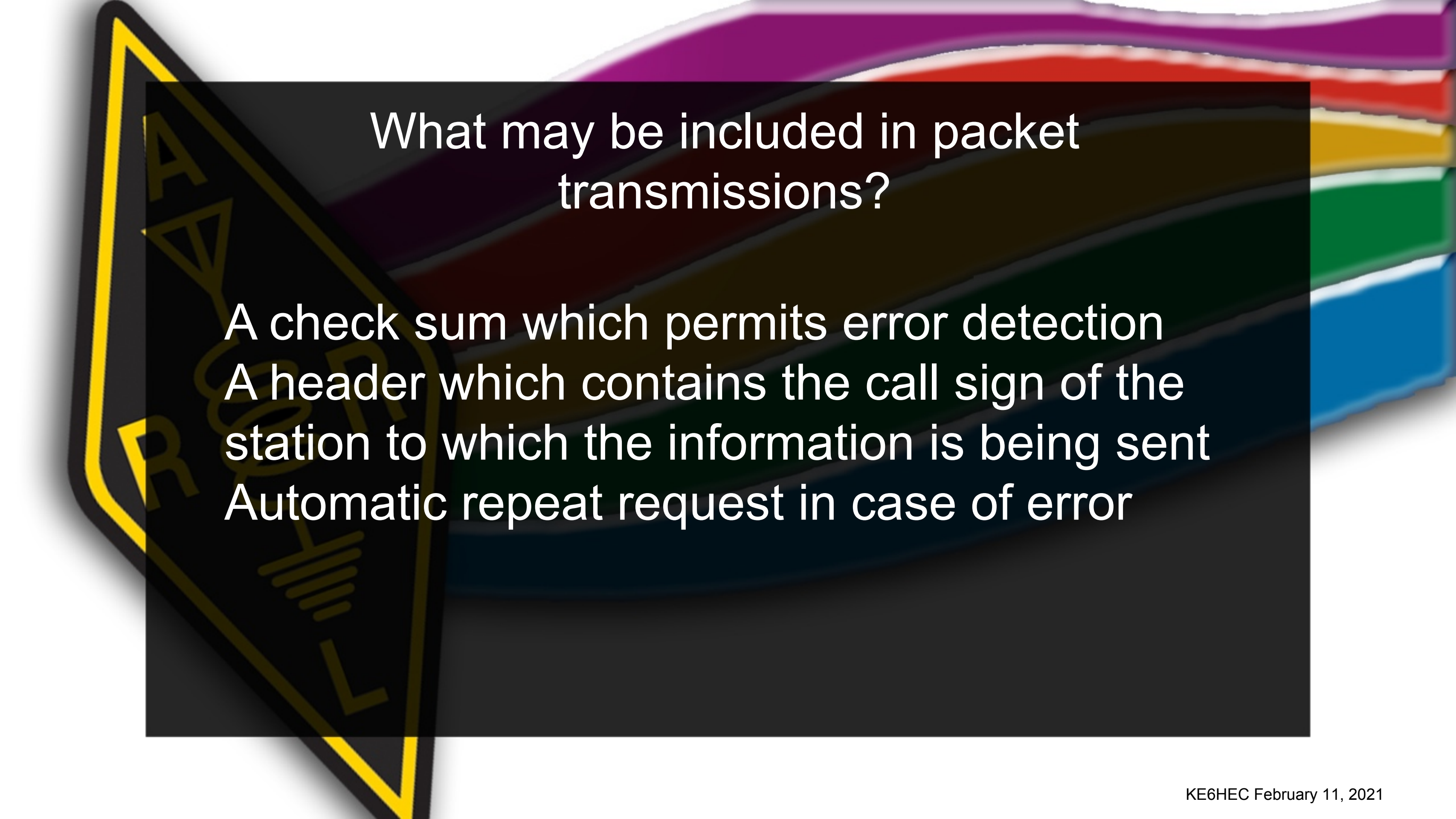


What is PSK31?

A low-rate data transmission mode

The background features a vibrant, multi-colored rainbow with wavy, horizontal bands of purple, red, orange, yellow, green, and blue. On the left side, there is a stylized logo for a radio station, possibly 'A 100 R', with the letters in a bold, sans-serif font. The logo is partially obscured by a dark, semi-transparent rectangular box that contains the main text.

What may be included in packet transmissions?

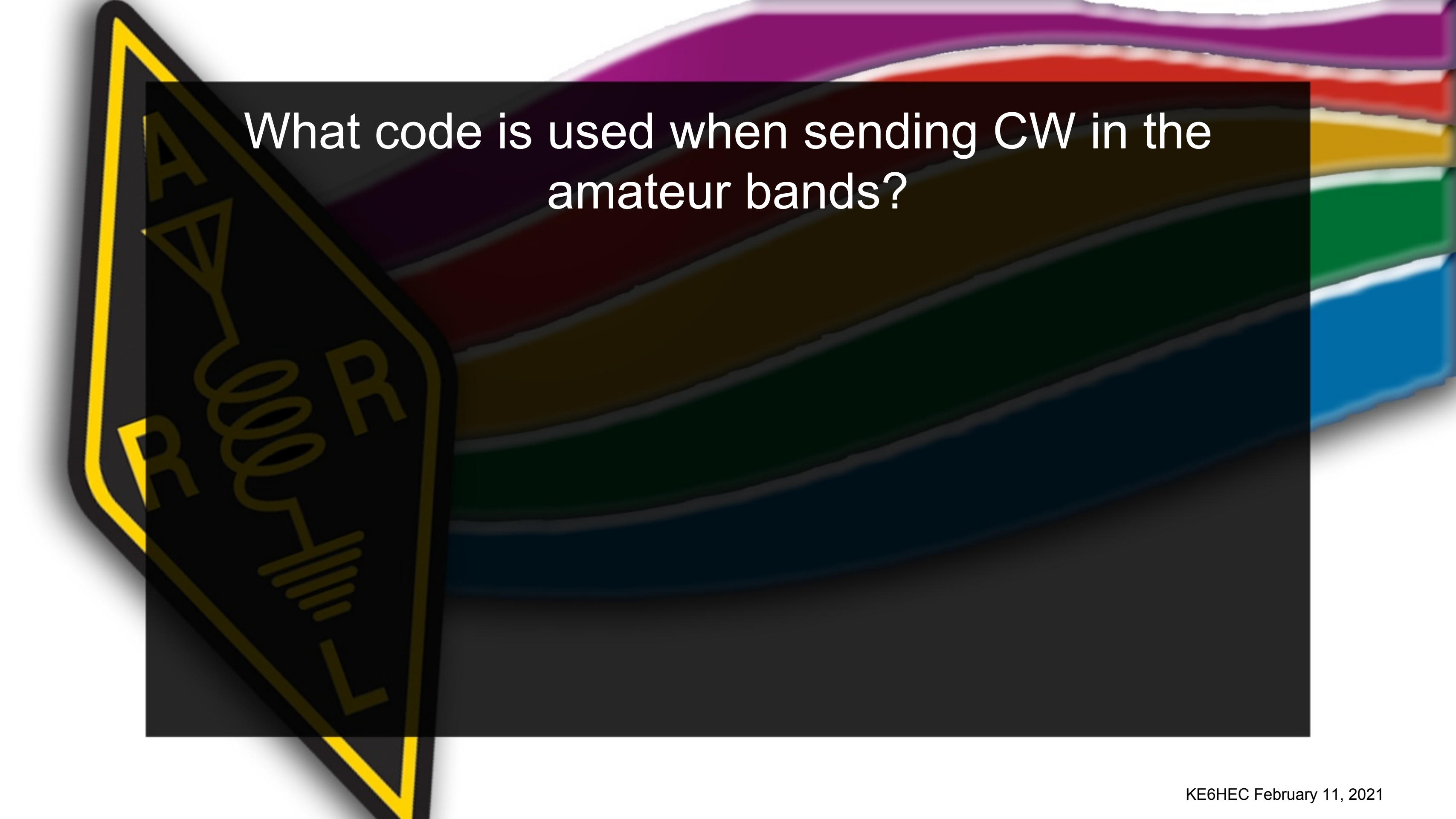


What may be included in packet transmissions?


A check sum which permits error detection

A header which contains the call sign of the station to which the information is being sent

Automatic repeat request in case of error

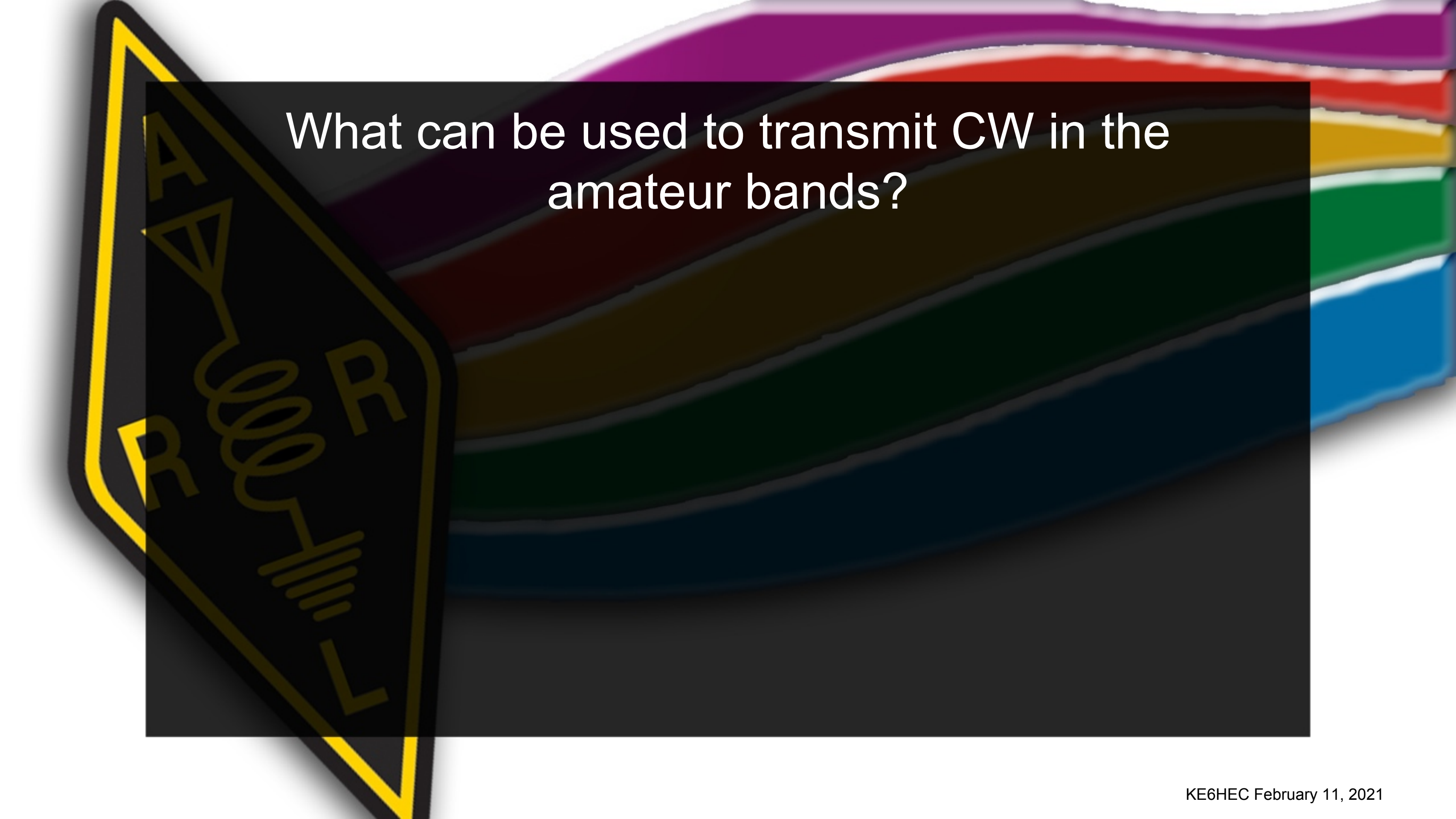
The background features a vibrant, multi-colored rainbow with wavy, horizontal bands of purple, red, orange, yellow, green, and blue. Overlaid on the left side is a stylized, dark-colored graphic of a radio circuit schematic, including a coil and a battery symbol, enclosed within a yellow-bordered triangular shape.

What code is used when sending CW in the
amateur bands?

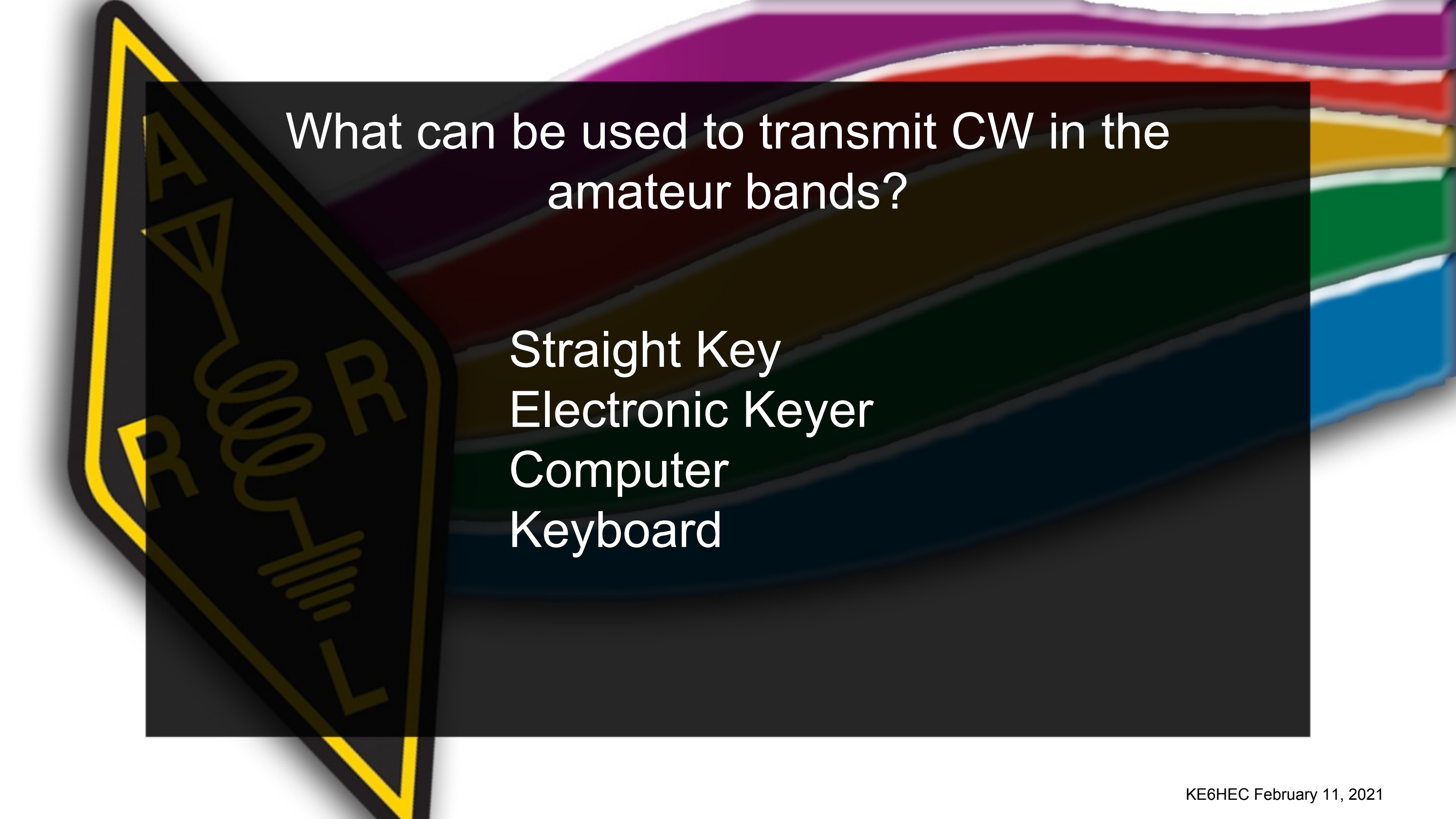


What code is used when sending CW in the
amateur bands?

International Morse



What can be used to transmit CW in the
amateur bands?



What can be used to transmit CW in the
amateur bands?

Straight Key
Electronic Keyer
Computer
Keyboard

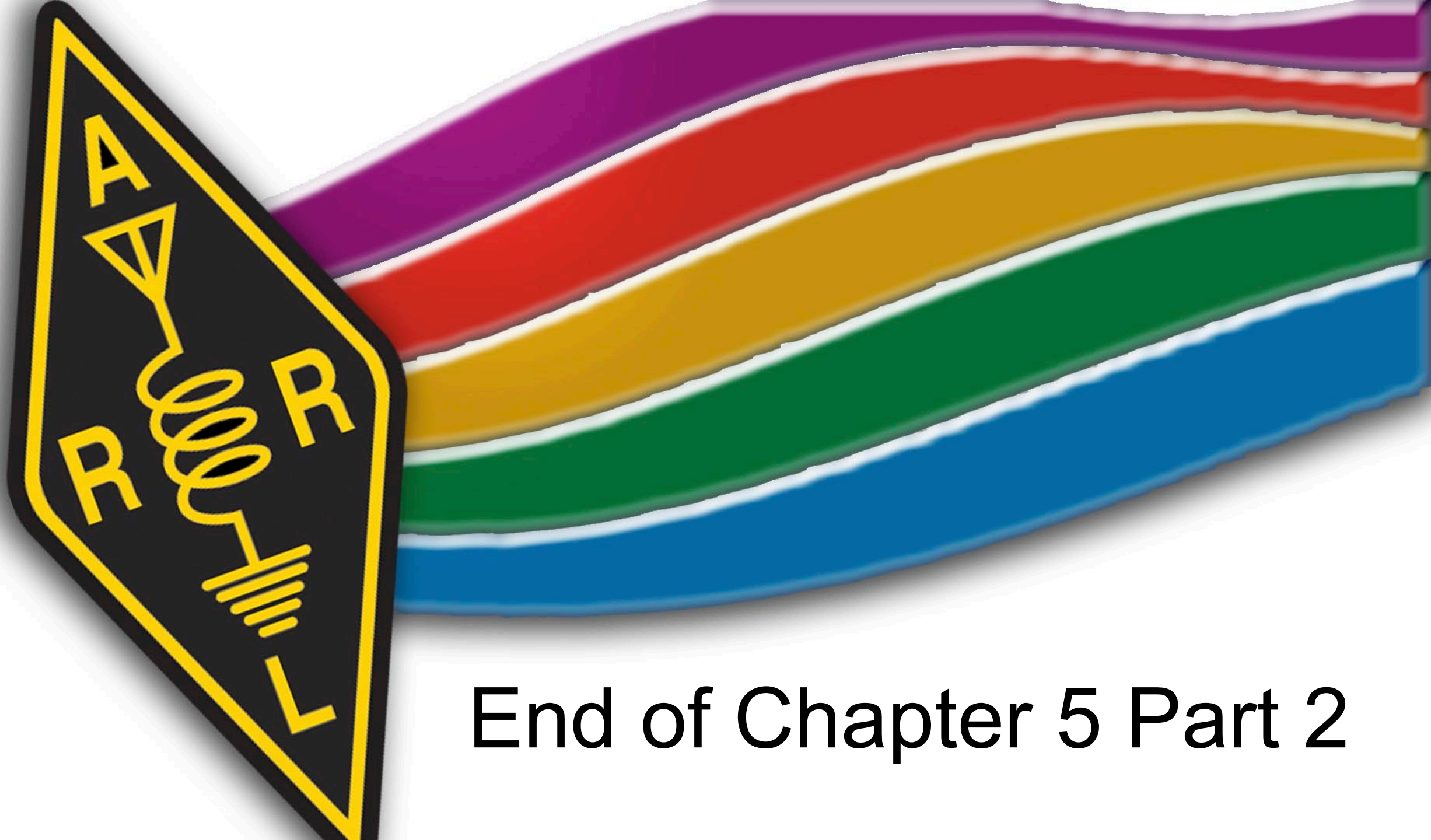


What is an ARQ transmission system?



What is an ARQ transmission system?

A digital scheme whereby the receiving station detects errors and sends a request to the sending station to retransmit the information



End of Chapter 5 Part 2



End of Module 11