

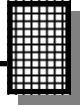
# PASSIVE AIR BAND MONITOR



## Ramsey Electronics Model No. **ABM1**

*Imagine monitoring the entire 118 to 136 MHz Aircraft band with no tuning! Then imagine being able to bring your receiver onboard aircraft to hear what's going on and not having to worry about interference! This monitor give you access to air traffic signals from aircraft and airports . . . just pop in the earbuds and listen to what's out there!*

- **Monitors the entire aircraft band 118 to 136 MHz without tuning!**
- **Passive design, can be used onboard aircraft, no local oscillator, creates no interference.**
- **Pick up local aircraft and tower communications**
- **Volume and Squelch controls allow for discriminating listening**
- **Fits in your pocket or clip to your belt**
- **Patented circuit and design.**
- **Runs on 9VDC and includes ear buds.**
- **Great for air shows!**



**PARTIAL LIST OF AVAILABLE KITS:**

**RAMSEY TRANSMITTER KITS**

- FM10A, FM25B, FM30, FM Stereo Transmitters
- FM100B, FM35 Professional FM Stereo Transmitters
- AM1, AM25 AM Broadcast Band Transmitters

**RAMSEY RECEIVER KITS**

- FR1 FM Broadcast Receiver
- AR2 Digital Aircraft Band Receiver
- AR1 Aircraft Band Receiver
- SR2 Shortwave Receiver
- SC1 Shortwave Converter

**RAMSEY HOBBY KITS**

- LBC6K Laser Beam Communicator
- SG7 Personal Speed Radar
- SS70C Speech Scrambler/Descrambler
- DC11 DTMF Controller
- LLS1 Laser Light Show
- MD3 Microwave Motion Detector
- LEDS1 LED Strobe Light
- BE66 Blinky Eyes Animated Display
- LTS1 Laser Trip Sensor
- ICI1C Infrared Switch Control Interface

**RAMSEY AMATEUR RADIO KITS**

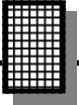
- HR Series HF All Mode Receivers
- DDF1 Doppler Direction Finder Kit
- QRP Series HF CW Transmitters and QAMP Power Amplifiers
- CW7 CW Keyer

**RAMSEY MINI-KITS**

Many other kits are available for hobby, school, scouts and just plain FUN. New kits are always under development. Write or call for our free Ramsey catalog.



Passive Air Band Monitor  
Ramsey Electronics publication No. ABM1  
December 2005



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## INSTRUCTION MANUAL FOR

# PASSIVE AIR BAND MONITOR

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## **INTRODUCTION**

Everyone from aviation enthusiasts to armchair listeners to schoolchildren can enjoy listening to aircraft and airport signals with the ABM1. It's an Aircraft receiver that does not radiate RF signals so you can take it to the airport and even onboard aircraft without worrying about causing interference. In order for the receiver to be non-interfering, no local oscillators or mixers are used. The unit directly converts the entire Aircraft Band meaning that the user can hear all local aircraft traffic at once. Stronger RF signals will produce a louder audio signal than weaker signals, making it easy for the user to pick out a specific conversation to listen to. This also has the advantage of allowing the user to hear both sides of a conversation without re-tuning the receiver. In fact, you never tune the ABM1, making it perfect for beginners and kids learning the fun of both electronics and aviation. We think you're going to find the Airband Monitor kit a useful and educational receiver that you'll be enjoying for years to come.

## **CIRCUIT DESCRIPTION**

We'll take the circuit in bite size chunks and explore each section to see how the kit works. Follow along on the schematic if you wish; we'll work from input to output.

### **Antenna Input/Audio Output**

Jack J1 allows the connection of a standard 3.5mm headphone jack to the ABM1. The headphones will provide two functions. Obviously they provide the audio for the user to listen to the aircraft band. The headphone wires are also used as an antenna for the ABM1. L2 is a high impedance to Radio Frequencies (RF) keeping the RF from traveling back to the Audio Amplifier.

### **1<sup>st</sup> Band-pass Filter**

C1 is a coupling capacitor that allows the RF signal picked up by the headphone wires to pass into the 1<sup>st</sup> Band-pass filter. This filter is made up of M1, C2, L3, C3, M2, and C4. M1 and M2 are micro-strip inductors that are actually formed from traces on the circuit board. This filter is designed to pass only frequencies between 118 MHz and 136 MHz, the aircraft band.

### **RF Amplifier**

The purpose of this stage is to increase the signal strength of the previously filtered signal. C5 is another coupling capacitor; it takes the 118 to 136 MHz RF signal from the 1<sup>st</sup> Band-pass filter and allows it to move to the RF Amplifier while isolating DC. U1 is a Monolithic Amplifier that provides about 18 dB of gain for our signal. Its frequency range is from DC to 1 GHz. Since component leads and foil runs can act as antennas at high frequencies C6 is used to prevent high frequency signals from entering U1 directly from the air. R1 sets the bias for the amplifier while C7 and C9 filter the power supply.

## **2<sup>nd</sup> Band-pass Filter**

The 2<sup>nd</sup> Band-pass filter is a copy of the first. Its job is to further filter the RF signal. It consists of coupling capacitor C8, and filter components M3, C10, L4, C11, C12, and M4.

## **AM Detector**

The AM detector consists of C13; you guessed it, it's another coupling capacitor that passes the signal to U2's non-inverting input while isolating DC. R6 provides the bias for the detector while C17 provides power supply filtering. C15 is used to prevent high frequency signals from entering U2 directly from the air. R2 sets the input impedance of the stage to 51 ohms. This is important for proper frequency response from the 2<sup>nd</sup> Band-pass filter, it needs to see a 50 ohm load. C14 essentially places the inverting input at AC ground. The Logarithmic Amplifier U2 provides a high amount of gain, detects or turns the RF signal in to audio, and provides a DC output voltage proportional to its input signal strength.

## **Squelch**

The squelch circuit allows the user to set the RF signal level that the Audio Amplifier will amplify and pass. C19 is a coupling capacitor that passes the detected audio from U2 to the audio amplifier section while preventing U2's DC output from being affected by the setting of R11. R9 prevents the AC output of U2 from being shorted to ground if the squelch is closed. R3, R4, and R5 make up a voltage divider that allows the user to set the voltage (squelch level) at U3 pin 3 through R7 (filtered by C16) between 0.1 VDC and 2.0 VDC. U3 is an operational amplifier being used as a comparator. This circuit compares the voltage from the voltage divider and DC level from the Detector's output through R8 (filtered by C18). When the Detector's DC level, which is proportional to U2's RF input, at U3 pin 2 falls below the level set by the operator (U3 pin 3). U3's output at pin 1 goes high (9 Volts) turning on Q1. Q1 is an N-channel Enhancement Mode Field Effect Transistor. The positive voltage from the comparator U3, pin 1, is felt on the gate of Q1, turning it on, which results in a very low Drain to Source resistance. This low Drain to Source resistance shorts the audio signal coming through R9 to ground. This prevents the audio from passing to the audio amplifier so nothing is heard in the headphones. When the input signal to U2 increases the DC output voltage at U2 pin 4 will increase. When this voltage being felt on U3 pin 2 increases above the voltage on U3 pin 3 (set by the user) U3 pin 1 will go low (0 Volts). With 0 Volts on the gate of Q1 it turns off which causes the Drain to Source Resistance to become very high. With Q1's Drain to Source resistance high the detected audio from U2 is allowed to pass through C19 and R9 into the Audio Amplifier. Now received audio is heard in the headphones.

## **Audio Amplifier**

The Audio amplifier section consists of R11, the On/Off/Volume control. This part turns the power on or off and adjusts the audio level sent to the headphones. C20 couples the audio signal to the Audio Amplifier, U4, while isolating DC. C21 keeps high frequencies out of the amplifier. C22 is a bypass capacitor. C23 sets the gain of the amplifier to approximately 200. C24 filters the power supply. C25 is the output coupling cap. C26 and R12 are used to prevent the amplifier from oscillating. L2 acts as a low impedance for audio allowing it to pass to J1 and on to the headphones.

## **118-136 MHz, WHAT YOU CAN EXPECT TO HEAR**

A basic fact about the VHF Aviation Band which even licensed pilots can overlook or forget is that communications are in the AM mode, not FM, as in the case of the FM broadcast band immediately below it, and the VHF public service and Ham bands immediately above it.

No matter where you live you will be able to receive at least the airborne side of many air traffic communications. You'll hear any aircraft you can see, PLUS planes up to ten miles away and more, since VHF signals travel "line of sight." An airliner at 35,000 feet altitude is still line of sight to your antenna. Similarly, whatever ground stations you may hear are also determined by this "line of sight" character of VHF communication. If there are no major obstacles between your antenna and an airport (tall buildings, hills, etc.), you'll be able to hear both sides of many kinds of aviation communication. Be prepared for them to be fast and to the point and for the same airplane to move to several different frequencies in the span of a few minutes! Here's a brief listing of the most common types of services in the NAS (National Airspace System) with which pilots communicate:

### **Clearance Delivery**

At most metropolitan airports, a pilot communicates with the FAA on a frequency called "Clearance Delivery" to obtain approval or clearance of the intended flight plan. This communication is done before contacting ground control for taxi instructions.

### **Ground Control**

From the control tower, ground movements on ramps and taxiways are handled on the "Ground Control" frequency.

### **Control Tower**

Runway and in-flight maneuvers near the airport usually within three miles (takeoffs, local traffic patterns, final approaches and landings) are on the "Control Tower" frequency.

ATIS – Automated Terminal Information System

ATIS, is a repeated broadcast about basic weather information, runways in use, and any special information such as closed taxiways or runways.

ASOS/AWOS – Automated Surface Observing System/Automated Weather Observing System

This system is similar to ATIS but usually located at un-towered airports.

Approach Control & Departure Control

These air traffic radar controllers coordinate all flight operations in the vicinity of busy metropolitan airport areas.

ARTCC – Air Route Traffic Control Center

When you hear a pilot talking with "Jacksonville Center" or "Indianapolis Center", you know the aircraft is really en route on a flight rather than just leaving or just approaching a destination. A pilot will be in touch with several different "Regional Centers" during a cross-country flight.

CTAF – Common Traffic Advisory Frequency

Airports without control towers are controlled by the pilots themselves and they rely on the local CTAF frequency dedicated only to advisory communications between pilots and ground personnel such as fuel service operators. The people on the ground can advise the pilot on the status of incoming or outgoing aircraft, but the pilot remains responsible for landing and takeoff decisions. Typical CTAF frequencies are 122.7, 122.8 and 123.0 MHz. Unicom frequencies used at manned, towered airports for day to day business are 122.75, 122.85, and 122.95 MHz.

FSS - FAA Flight Service Stations

The FAA's network of Flight Service Stations keeps track of flight plans and provides weather briefings and other services to pilots. Some advisory radio communication takes place between pilots and a regional "FSS". If there is an FSS in your local area but no airport control towers, the FSS radio frequency will stay interesting. Typical frequencies are 122.1, 122.6, and 123.6 MHz. Pilots always address the FSS by calling the FSS name followed by "Radio".

ELT – Emergency Locator Transmitters

Emergency and guard channels are used by airplanes in flight operations during an emergency or talking on official business. This can be heard on 121.5MHz.

ACARS - Aircraft Communication Addressing and Reporting System

ACARS is a digital VHF radio data link which allows airline flight operations departments to communicate with the various aircraft in their fleet. ACARS is used by many civilian and business aircraft and is similar to "email for airplanes,". Each aircraft has its own unique address in the system. Traffic is

routed via computers to the proper company, relieving some of the necessity for routine voice communication. With ACARS, routine items such as departure reports, arrival reports, passenger loads, fuel data, engine performance data and more can be retrieved from the aircraft at automatic intervals. This transmission will sound like a short data burst to the ABM1 user.

### **THOSE FAST-TALKING PILOTS AND CONTROLLERS!**

Aviation communication is brief but it is clear and full of meaning. Usually pilots repeat back exactly what they hear from a controller so that both know that the message or instructions were correctly interpreted. If you are listening in it's hard to track everything said from a cockpit, particularly in big city areas. Just to taxi, take off, and fly a few miles, a pilot may talk with 6 or 8 different air traffic control operations, all on different frequencies, all within a few minutes! Here are the meanings of a few typical communications:

#### **"Miami Center, Delta 545 Heavy out of three-zero for two-five."**

Delta Flight 545 acknowledges Miami Center's clearance to descend from 30,000 feet to 25,000 feet altitude. The word "heavy" means that the plane is a jumbo jet such as 747, DC-10, etc.

#### **"Seneca 432 Lima cleared to outer marker. Contact Tower 118.7."**

The local Approach Control is saying that the Piper Seneca with the N-number (tail number) ending in "432L" is cleared to continue flying an instrument approach to the outer marker (a precision radio beacon located near the airport) and should immediately call the airport radio control tower at 118.7 Mhz. This message also implies that the approach controller does not expect to talk again with that aircraft.

#### **"Cessna 723, squawk 6750, climb and maintain five thousand."**

A controller is telling the Cessna pilot to set the airplane's radar transponder to code 6750, climb to and fly level at an altitude of 5000 feet.

#### **"United 330, traffic at 9 o'clock, 4 miles, altitude unknown."**

The controller alerts United Airlines flight #330 of radar contact with some other aircraft off to the pilot's left at a 9 o'clock position. Since the unknown plane's altitude is also unknown, both controller and pilot realize that it is a smaller private plane not equipped with altitude-reporting equipment.

### **ELECTRONICS & FLYING: DOING IT "BY THE NUMBERS"**

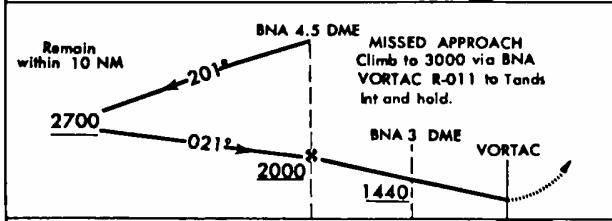
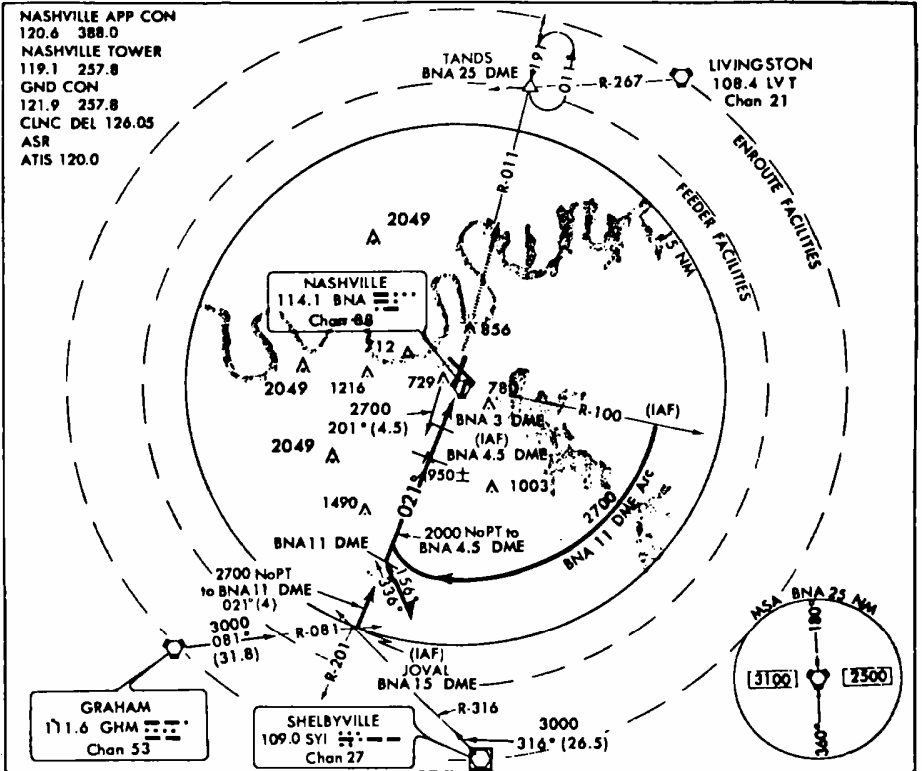
A peek at the sample FAA "instrument approach" chart for medium-large airports shows that pilots deal with many vitally important numbers and must do so quickly. Among the numbers on that chart, can you find the air-ground communications frequencies which can be heard on the ABM1 receiver? Can you find frequencies for uses other than communications?



# VOR/DME RWY 2L

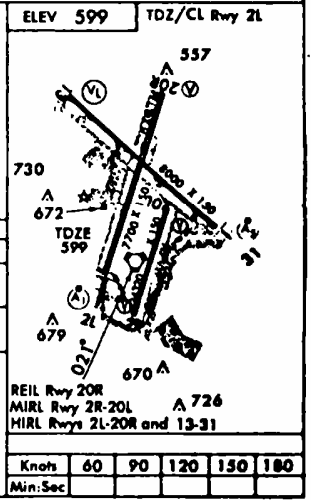
AL-282 (FAA)

NASHVILLE METROPOLITAN (BNA)  
NASHVILLE, TENNESSEE



CATEGORY	A	B	C	D
S-2L	980/24	381 (400-½)		980/50 381 (400-1)
CIRCLING	1060-1	461 (500-1)	1080-1½ 481 (500-1½)	1160-2 561 (600-2)

**CAUTION:** Brightly lighted building west of ALS Rwy 2L.  
With inoperative ALS, Cat. D visibility becomes 6000 RVR.



# VOR/DME RWY 2L

36°08'N - 86°41'W

NASHVILLE, TENNESSEE

## PARTS LIST

### **CAPACITORS**

- 2 2.2pF ceramic disk capacitor [marked 2.2] (C3, C11)
- 2 5pF ceramic disk capacitor [marked 5] (C6, C15)
- 4 68pF ceramic disk capacitor [marked 62] (C2, C4, C10, C12)
- 8 1nF or 0.001uF ceramic disk capacitor [marked 102] (C1, C5, C8, C9, C13, C14, C16, C21)
- 4 100nF or 0.1uF ceramic disk capacitor [marked 104] (C7, C17, C18, C26)
- 2 1 uF electrolytic capacitor [cylindrical body with a stripe marked 1uF] (C19, C20)
- 2 10 uF electrolytic capacitor [cylindrical body with a stripe marked 10uF] (C22, C23)
- 2 100 uF electrolytic capacitor [cylindrical body with a stripe marked 100uF] (C24, C25)

### **RESISTORS**

- 1 2 ohm resistor [red-black-gold] (R12)
- 1 51 ohm resistors [green-brown-black] (R2)
- 1 470 ohm resistor [yellow-violet-brown] (R1)
- 1 560 ohm resistor [green-blue-brown] (R6)
- 2 1k ohm resistors [brown-black-red] (R5, R7)
- 1 10k ohm resistors [brown-black-orange] (R9)
- 1 100k ohm resistors [brown-black-yellow] (R3)
- 1 330k ohm resistor [orange-orange-yellow] (R8)
- 1 1M ohm resistor [brown-black-green] (R10)
- 1 10k ohm thumbwheel linear potentiometer (R4)
- 1 10k ohm thumbwheel audio taper potentiometer w/switch (R11)

### **SEMICONDUCTORS**

- 1 BS170 [marked BS170] (Q1)
- 1 MAR-1 [marked 01] (U1)
- 1 AD8307AR [marked AD8307AR] (U2)
- 1 LMC6482AIN [marked LMC6482AIN] (U3)
- 1 LM386 [marked LM386] (U4)

### **INDUCTORS**

- 2 12uH inductor [looks like resistor but larger, brown-red-black-silver] (L1, L2)
- 2 0.41uH 11t air core inductor [11 turns of wire] (L3, L4)
- 4 0.14uH inductor [part of circuit board, no actual parts] (M5, M6, ML7, M8)

## **MISCELLANEOUS COMPONENTS AND HARDWARE**

- 1 3.5mm Stereo Jack NOSW [J1]
- 1 4 inches of 24 gauge Red/black twisted pair
- 1 Case Top
- 1 Case Bottom
- 1 Case Panel
- 4 Case screws
- 1 Belt Clip
- 1 Set of battery contacts
- 2 Thumbwheel for potentiometers
- 2 Thumbwheel screws
- 1 AR3 Rev 1.3 Circuit board
- 1 Ear Bud

## **REQUIRED, NOT SUPPLIED**

- 1 9 Volt Battery

## **ASSEMBLY STEPS**

In ALL PC board assembly steps, our word "INSTALL" always means to do this:

- Insert the part, oriented or "pointed" correctly, into its holes in the PC board.
- If helpful, gently BEND the part's wire leads or tabs to hold it into place, with the body of the part snugly against the top side ("component side") of the circuit board.
- Solder ALL wires or pins of the part.
- Trim or "nip" all excess wire lengths extending beyond each solder connection, taking care that wire trimmings do not become lodged in solder connections.

One of the goals of the ABM1 design was to keep the receiver as small as possible while trying to stay away from surface mount components. Staying away from surface mount components makes the kit a lot easier to assemble. You will notice that we had to use some SMT parts such as the MAR amplifier and log amplifier IC that only come in a surface mount package. We have preinstalled the log amplifier component to allow the assembler to keep their sanity. You will also notice that inductors M1, M2, M3, and M4 are actually made from foil runs on the circuit board. This means no actual physical parts exist for these components.

Since part of our goal was to keep the kit small the components are spaced very closely together. We highly recommend following the assembly procedure to insure proper installation and identification of all parts and their locations. Let's get building and have some fun!

## **IC INSTALLATION**

- Find the circuit board. U2 (one of those pesky surface mount parts) has been preinstalled for you. It has been mounted on the component side of the board.
- Find U1, the MAR-1 marked 01. This is the other surface mount part. This component will be mounted and soldered on the same side of the board as U2. Mount the MAR-1 so that its dot is on the same lead as the dot on the circuit board or facing C5. All other components will be mounted on this side of the board and soldered on the opposite side.
- Install U3, the LMC6482AIN Operational Amplifier IC. It's located near the center of the PC board. You'll see the PC board silkscreen shows a notch

on one end of the part; this corresponds to the notch on the IC and shows you which way to place the part. Line up the notches and make sure that all pins are through the board. With no other parts installed (other than surface mount) you can have the part sit flat on your bench and the board will hold U3 in place. That way the part will sit flat on the board. That's why we're putting the ICs in first! We typically solder the two corner pins, flip the board over to check placement, then solder the rest. Be sure to solder all 8 pins.

- Install U4, the LM386 audio amplifier IC. It's located next to U2. Again, line up the notch on the part with the notch marked on the board, make sure the part is seated flat, then solder all 8 pins.

## ANTENNA INPUT/AUDIO OUTPUT CIRCUIT

- Install J1, the 3.5mm phone jack. It is located on the narrow edge of the board closest to U3. Make sure the part is flush to the board and square to the edges. The part will tend to rotate counter-clockwise from square. Solder all three pins.
- Install L1, 12 uH inductor (brown-red-black-silver). L1 looks like a resistor but is a bit larger. This part can be installed in either direction. It is located next to J1. Make sure it does not cover any part of the mounting hole.
- Install L2, 12 uH inductor (brown-red-black-silver). Like L1 it can be installed in either direction.

## 1<sup>ST</sup> BAND-PASS FILTER

- Install C1, 1nF ceramic disk capacitor (marked 102). Disc capacitors have no polarity so they can be installed in either direction.
- M1 and M2 are inductors that are made with foil runs on the board. There are no actual components to install.
- Install C2, 68pF ceramic disk capacitor (marked 68).
- Install L3, 0.41uH 11t air core inductor (11 turns of wire). Again, this part can be installed in either direction. It will not sit flat on the board. Push it down gently until the leads are snug (do not crush the coil). It should be no higher than 1/8th of an inch.
- Install C3, 2.2 pF ceramic disk capacitor (marked 2.2). It is very important that this part is placed as close to the board as possible. You may need to use pliers to pre-bend the leads.





- Install C4, 68pF ceramic disk capacitor (marked 68).

## **RF AMPLIFIER**

- Install C5, 1nF ceramic disk capacitor (marked 102).
- Install C6, 5pF ceramic disk capacitor (marked 5 or 4.7). C6 is put in on a 45 degree angle. This is done to keep the foil run as short as possible as part of good, standard RF (Radio Frequency) practice. Excess lead length adds unwanted inductance in RF circuits.
- U1 is already installed.
- Install R1, 470 ohm resistor (yellow-violet-brown). This is another part put in at a 45 degree angle for RF reasons. Resistors have no polarity and can be installed in either direction. R1 is a one of three lay-down resistors in the ABM1. It is important that the body rests flat on the circuit board.
- Install C7, 100nF ceramic disk capacitor (marked 104).
- Install C9, 1nF ceramic disk capacitor (marked 102).

## **2<sup>ND</sup> BAND-PASS FILTER**

- Install C8, 1nF ceramic disk capacitor (marked 102).
- M3 and M4 are just like M1 and M2. They are made from foil runs on the board. No actual components to install.
- Install C10, 68pF ceramic disk capacitor (marked 68).
- Install L4, 0.41uH 11t air core inductor (11 turns of wire).
- Install C11, 2.2 pF ceramic disk capacitor (marked 2.2). It is very important that this part is placed as close to the board as possible.
- Install C12, 68pF ceramic disk capacitor (marked 68).

## **AM DETECTOR**

- Install C13, 1nF ceramic disk capacitor (marked 102).
- Install R2, 51 ohm resistor (green-brown-black). This is the second lay-down resistor. Install it just like R1.
- Install C14, 1nF ceramic disk capacitor (marked 102).
- Install C15, 5pF ceramic disk capacitor (marked 5 or 4.7).



- U2 is already installed.
- Install C17, 100nF ceramic disk capacitor (marked 104).
- Install R6, 560 ohm resistor (green-blue-brown). This is our 3<sup>rd</sup> and last lay-down resistor.

## SQUELCH CIRCUIT

- Install C19, 1uF electrolytic capacitor. Electrolytic caps have a polarity and must be installed correctly in order to work . . . and in some cases in order not to blow up when power is applied! You'll note that the legs of the part are different lengths and there is a stripe or band down one side of the capacitor that corresponds to the shorter of the two leads. This is the negative side of the cap. The silkscreen and Parts Layout Diagram will show where the positive lead is to be placed by a "+" sign on the board. Orient the part with the longer lead in the "+" hole and solder the part in. The legs of this part may need to be straightened so that the bottom of the capacitor body will sit flat on the PCB. If this part doesn't sit flat on the PCB the case will not fit together properly.
- Install R9, 10k ohm resistor (brown-black-orange). R9 and all the rest of the resistors are stand-up resistors. A stand-up resistor has one end of the resistor body resting on the circuit board with its lead through the pad. It is important that this end of the resistor actually rests on the board. The other end is up in the air with the lead bent over going through the other pad. It is important to make this bent lead as short as possible. Refer to the Parts Layout Diagram; it has a circle on the pad the resistor body is to rest on. Proper orientation of stand-up resistors may be important for RF or for physical spacing reasons.
- Install R8, 330k ohm resistor (orange-orange-yellow).
- U3 is already installed
- Install C18, 100nF ceramic disk capacitor (marked 104).
- Install C16, 1nF ceramic disk capacitor (marked 102).
- Install R10, 1M ohm resistor (brown-black-green).
- Install Q1, a BS170 (marked BS170) FET in a TO-92 package. The part has a flat side with the number on it and you'll see the outline showing where to place this flat side on the PC board silkscreen. Bend the center lead out to fit in the holes and push the part down close to the circuit board without forcing. Solder the transistor.
- Install R7, 1k ohm resistor (brown-black-red).

- Install R3, 100k ohm resistor (brown-black-yellow). This part is located at the notched end of U4.
- Install R5, 1k ohm resistor (brown -black-red). This part is located in the corner of the board that does not have anything mounted yet.
- Install R4, 10k ohm potentiometer (marked B10K). The three potentiometer contact leads (middle leads) may need to be bent slightly to fit in the holes. This was done intentionally to keep the part in the board while soldering. Ensure all five leads are sitting squarely on their shoulders before soldering.

## AUDIO AMPLIFIER

- Install R11, 10k ohm potentiometer with switch (marked A10K). Install this part exactly like R4. Ensure all five leads are sitting squarely on their shoulders before soldering.
- Install C20, 1uF electrolytic capacitor. Be careful to check the polarity; refer to [step X](#) to refresh your memory if necessary.
- Install C21, 1nF ceramic disk capacitor (marked 102).
- U4 is already installed.
- Install C24, 100uF electrolytic capacitor. Verify the polarity using the Parts Layout Diagram.
- Install C22, 10uF electrolytic capacitor. Watch polarity!
- Install C25, 100uF electrolytic capacitor. Verify the polarity using the Parts Layout Diagram.
- Install C23, 10uF electrolytic capacitor. Yes, check polarity before installing.
- Install C26, 100nF ceramic disk capacitor (marked 104).
- Install R12, 2 ohm resistor (red-black-gold).

## BATTERY WIRING

- Find the 4 inch Red and Black twisted pair (wire). Strip back the insulation on both ends of each wire 3/16 of an inch from the ends. Tin the four ends of the wire. Be careful not to use too much solder; use just enough to hold the strands of wire together. Insert one end of the Red wire into the BAT1 (+ ) pad and one end of the Black wire into the BAT1(-) pad. You will find these pads on each side of C21.

- Find the two battery clips. Look carefully at the two clips; the one with the narrower contact is the (+) clip and to be attached to the Red wire. The wider contact is the (-) clip and is to be attached to the Black wire. Feed the Red wire through the appropriate clip from the battery contact side (not the side that clips into the case). Solder the Red wire into place. Repeat the process for the black wire and appropriate clip.

## **CIRCUIT BOARD AND FRONT PANEL ASSEMBLY**

- Remove the Battery door from the case bottom (the bottom contains the battery box and belt clip).
- Adjust the case bottom so that the battery box is facing you with the battery door opening down.
- Place the circuit board in the case bottom so that J1 comes out the open end (away from you).
- Lift the end of the circuit board that contains J1 and place the front panel over J1. Line up the edge of the front panel to fit in the groove of the case bottom. Drop the circuit board and front panel into place.
- Bring the battery wires down toward the battery box alongside R11.
- Below R11, bring the wires down the left side of the case and R9 toward the battery box.
- Place the battery clips through the battery cavity.
- Bring one of the battery clips up through the clip slot on the left side of the battery box with the wire side of the clip up. The clip should snap into place.
- Repeat previous step for the other battery clip.

## **THUMBWHEEL ASSEMBLY**

- Line up the notch on a thumbwheel with the post on R11. Install the screw to hold the thumbwheel in place.
- Repeat for second thumbwheel and R4.

## **ABM1 ALIGNMENT AND ADJUSTMENT**

### **TUNING THE ABM1**

The ABM1 does not require any frequency tuning. It will receive the entire Aircraft Band at one time with the audio volume level being greatest for the strongest signals. The ABM1 is a total band monitor so you will hear any signal generated in that band. Since this is a total band receiver the band-pass filters have been specially designed to be wideband. The aircraft band is located between the FM broadcast band and one of the Pager bands. At times and in certain locations low level signals from these bands may be detected and heard in the ABM1. To reduce this align the band-pass filters. Weaker signals may also be eliminated by adjusting the squelch control.

### **BAND-PASS FILTER ALIGNMENT**

Your unit will probably work great without any alignment. Some users may find that the FM Broadcast band is easily picked up by the ABM1. To reduce FM band reception the band-pass filters can be tuned. Alignment of the ABM1 band-pass filters consists of stretching or compressing coils L3 and L4. Start off with the coils as they were when received (fully compressed). Start spreading the coils apart simultaneously a little at a time keeping both coils about the same. If you start to hear paging signals (152 to 159 MHz) then you have spread the coils too far. In a heavy RF environment you may have to balance the coils between a little FM and a little paging.

### **SQUELCH ADJUSTMENTS**

The ABM1 uses your headphones as an antenna. Since each brand and model of headphones is different the reception for each will be different. Some headphones will provide better reception than others. Different areas of the country have different RF environments. Some areas will have more RF or higher noise than others. The squelch circuit will react a bit differently depending on the antenna and RF noise in the area of use. Building the kit with the parts supplied, it should work well for all different conditions, however, the user may want to optimize their squelch circuit for the area they are in and the headphones they wish to use. To get the squelch to open closer to the low end of the potentiometer's (R4) range decrease R5. To get the squelch to close nearer to the upper end of the potentiometer's (R4) range decrease R3.

## **ABM1 TROUBLESHOOTING**

While we had hoped that it wouldn't come to this, if you are having trouble with your receiver, here are a few suggestions.

By far the most common sources of problems are misplaced parts or poor solder connections. It's always best to take a break before searching for bad connections. A good way of checking component placement is to double check the assembly steps going backwards from the last steps to the first. Bright lighting and a magnifying aid can be helpful in identifying soldering problems.

Use a methodical, logical troubleshooting technique. Most problems can be solved using common sense. A volt-ohm meter and a clear head are usually all that are needed to correct any problem.

### **No sound from ABM1.**

Check these items in the following order:

- Verify the Squelch control is fully counter-clockwise.
- Check that the Battery Clip is soldered in with the correct polarity (+) connected to the red wire and (-) connected to the black wire.
- Check that the Battery polarity is correct. The battery's (+) terminal connects to the smaller tab.
- Is your Battery Good? New does not necessarily mean good. Check for 9 Volts without the battery connected to the ABM1. If possible place a 1k ohm resistor across the battery contacts during the test. This places a load on the battery which gives a better indication of the battery's condition than open load testing:
  - Connect battery to the ABM1 and switch on the unit, verify the battery still has an output of approximately 9 Volts.
  - If not, turn off the unit and look for solder bridges and components improperly installed. Verify the polarity and orientation of all IC chips, transistors, and electrolytic capacitors.
  - If it has 9 volts, check the AM Detector, Audio Amp, and Squelch circuits carefully for solder bridges, and proper component placement.
- Verify pin 1 of U2 is less than 0.2 Volts DC, if not see: "Squelch Circuit Not Functioning".

## No Signals can be heard

- Check MAR-1SM (U1):
  - Check the input pin for 2.5 Volts DC +/- 10 %. This is the pin with the dot.
  - Check the output pin for 4.7 Volts DC +/- 10 %. This is the pin across from the dot.
  - Check the 1<sup>st</sup> Band-pass Filter, 2<sup>nd</sup> Band-pass Filter and the AM Detector circuits for solder bridges, misplaced components, polarity of components, and orientation of components.
- Check U2's supply Voltage at U1 pin 6 or 7; it should be 4.3 Volts DC +/- 20 %

## Erratic Operation:

- Check all solder connections for a complete, shiny solder joint.

## Squelch Circuit Not Functioning.

- Check U3 for the following Voltages (all voltages +/- 10 %):
  - Pin 2, varies between 0.2 Volts and 2 Volts DC with input signal strength.
  - Pin 3, voltage should be 0.08 VDC with R7 fully counter-clockwise, 1.0 VDC with R7 fully clockwise.
  - Pin 8, equals the Battery Voltage (approximately 9 Volts).
  - Pin 4, 0 Volts DC
  - Pin 1, 0 Volts DC with R7 fully counter-clockwise, 9 Volts with R7 fully clockwise.

If all else fails, check the inside back cover of this manual for instructions on how to send the kit in for repair. Hopefully you'll never get to that point but it's nice to know that there's someone out there to help you if you do.

## **CONCLUSION**

If you enjoyed this Ramsey product, there are plenty more to choose from in our catalog - write or call today!

We sincerely hope that you will enjoy the use of this Ramsey product. As always, we have tried to compose our manual in the easiest, most “user friendly” format possible. As our customers, we value your opinions, comments, and additions that you would like to see in future publications. Please submit comments or ideas to:

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Attn. Hobby Kit Department  
590 Fishers Station Drive  
Victor, NY 14564

or email us at: [techsupport@ramseymail.com](mailto:techsupport@ramseymail.com)

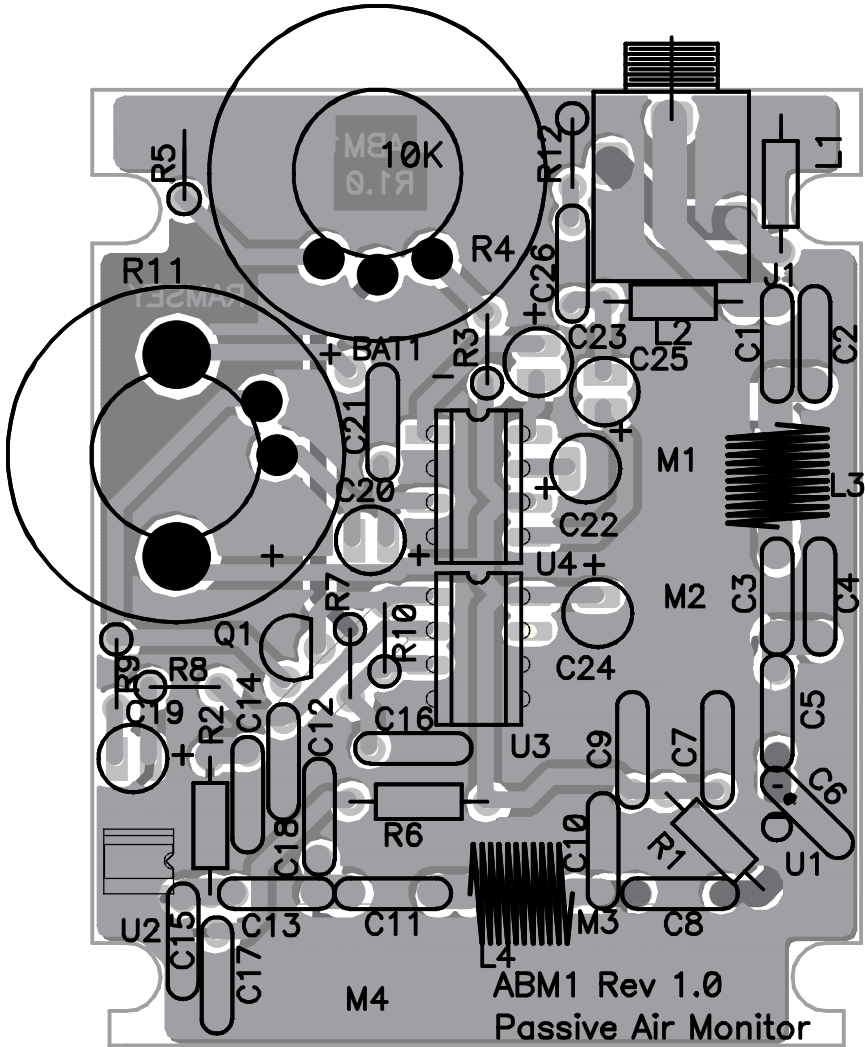
And once again, thanks from the folks at Ramsey!

## **ABM1 SPECIFICATIONS**

Frequency of Operation:	118 to 136 MHz
Receiver Type:	Patented Passive Detector
IF Frequencies:	None
Receiver Sensitivity:	Less than 2uV for detectable audio
Antenna Input Jack (Headphones):	3.5mm Stereo Jack
Audio Output Jack:	3.5mm Stereo Jack
Audio Output Power:	Approx. 700 mW into 8 - 24 ohms
Power Supply Requirements:	9 Volt Battery
Current Draw:	50 mA Maximum 20 mA typical
Circuit Board Dimensions:	2.25 inches X 2.80 in (57.23mm X 71.13mm)
Case Dimensions:	2.5 in X 4.60 in X 0.9 in (63.5mm X 116.8mm X 22.9mm)
Weight completed (with 9V battery)	Approx. 4 ounces (113.4 grams)



# ABM1 PARTS LAYOUT DIAGRAM



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## **The Ramsey Kit Warranty**

**Please read carefully BEFORE calling or writing in about your kit. Most problems can be solved without contacting the factory.**

Notice that this is not a "fine print" warranty. We want you to understand your rights and ours too! All Ramsey kits will work if assembled properly. The very fact that your kit includes this new manual is your assurance that a team of knowledgeable people have field-tested several "copies" of this kit straight from the Ramsey Inventory. If you need help, please read through your manual carefully, all information required to properly build and test your kit is contained within the pages! However, customer satisfaction is our goal, so in the event that you do have a problem, take note of the following.

**1. DEFECTIVE PARTS:** It's always easy to blame a part for a problem in your kit. Before you conclude that a part may be bad, thoroughly check your work. Today's semiconductors and passive components have reached incredibly high reliability levels, and it's sad to say that our human construction skills have not! But on rare occasions a sour component can slip through. All our kit parts carry the Ramsey Electronics Warranty that they are free from defects for a full ninety (90) days from the date of purchase. Defective parts will be replaced promptly at our expense. If you suspect any part to be defective, please mail it to our factory for testing and replacement. Please send only the defective part (s), not the entire kit. The part(s) MUST be returned to us in suitable condition for testing. Please be aware that testing can usually determine if the part was truly defective or damaged by assembly or usage. Don't be afraid of telling us that you 'blew-it', we're all human and in most cases, replacement parts are very reasonably priced.

**2. MISSING PARTS:** Before assuming a part value is incorrect, check the parts listing carefully to see if it is a critical value such as a specific coil or IC, or whether a RANGE of values is suitable (such as "100 to 500 uF"). Often times, common sense will solve a mysterious missing part problem. If you're missing five 10K ohm resistors and received five extra 1K resistors, you can pretty much be assured that the '1K ohm' resistors are actually the 'missing' 10 K parts ("Hum-m-m, I guess the 'red' band really does look orange!") Ramsey Electronics project kits are packed with pride in the USA. If you believe we packed an incorrect part or omitted a part clearly indicated in your assembly manual as supplied with the basic kit by Ramsey, please write or call us with information on the part you need and proof of kit purchase.

### **3. FACTORY REPAIR OF ASSEMBLED KITS:**

To qualify for Ramsey Electronics factory repair, kits MUST:

1. NOT be assembled with acid core solder or flux.
2. NOT be modified in any manner.
3. BE returned in fully-assembled form, not partially assembled.
4. BE accompanied by the proper repair fee. No repair will be undertaken until we have received the MINIMUM repair fee (1/2 hour labor) of \$25.00, or authorization to charge it to your credit card account.
5. INCLUDE a description of the problem and legible return address. DO NOT send a separate letter; include all correspondence with the unit. Please do not include your own hardware such as non-Ramsey cabinets, knobs, cables, external battery packs and the like. Ramsey Electronics, Inc., reserves the right to refuse repair on ANY item in which we find excessive problems or damage due to construction methods. To assist customers in such situations, Ramsey Electronics, Inc., reserves the right to solve their needs on a case-by-case basis. The repair is \$50.00 per hour, regardless of the cost of the kit. Please understand that our technicians are not volunteers and that set-up, testing, diagnosis, repair and repacking and paperwork can take nearly an hour of paid employee time on even a simple kit. Of course, if we find that a part was defective in manufacture, there will be no charge to repair your kit (But please realize that our technicians know the difference between a defective part and parts burned out or damaged through improper use or assembly).

**4. REFUNDS:** You are given ten (10) days to examine our products. If you are not satisfied, you may return your unassembled kit with all the parts and instructions and proof of purchase to the factory for a full refund. The return package should be packed securely. Insurance is recommended. Please do not cause needless delays, read all information carefully.

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Manual Price Only: \$5.00  
Ramsey Publication No. ABM1  
Assembly and Instruction manual for:  
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