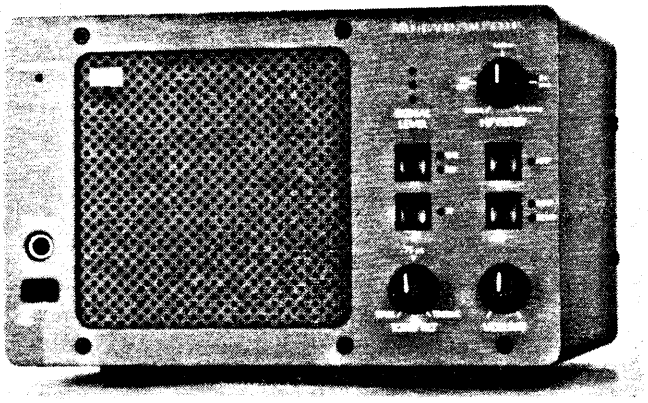
THE KIWA ELECTRONICS' MULTIBAND AM PICKUP

Guy Atkins



Any traveler knows that a map is a great help in reaching his destination. For the radio enthusiast, the recent introduction of the "MAP" by Kiwa Electronics promises to be a similar advantage for enjoyable listening.

The Multiband AM Pickup (MAP) is an unusual receiver accessory that provides synchronous detection, improved audio fidelity and selectivity, and other features for AM reception on many receivers. The MAP was designed by Craig Siegenthaler, the "one man band" behind Kiwa Electronics in Seattle, Washington.

●THE AUDIO QUALITY DILEMMA

A reading of *A DXer's Technical Guide, Second Edition* (IRCA), and last year's *Proceedings* reveals numerous references to the audio quality of all types and vintages of receivers. These two books were written by experienced mediumwave and shortwave enthusiasts, a cross-section of DXers. Their comments are often negative, and it's clear that the ranks of both tube and solid state radios have their share of clinkers in the audio department.

Signals struggling through an unpredictable ionosphere are already distorted before they reach the antenna. Most shortwave receivers available today do little or nothing to hold this distortion to reasonable levels. The 1985 WRTH reported that the ICOM R71A exhibits up to 30% audio distortion at 80 Hz! Listening over a long period can be very tiring. Not only does the program listener miss out on pleasant reception, the DXer is left wondering if his receiver is adding to his struggle to hear and identify stations.

The technology to accurately reproduce the audio in a received signal has existed for some time. However, manufacturers understandably make compromises; selectivity, stability, image rejection, etc. need to come first. Yet even the best receivers are normally optimized for single sideband reception, not AM.

What could the listener expect if factors such as signal detection, AGC, tone control, and IF/AF filtering were chosen specifically for the reproduction of AM signals.

●DEVELOPMENT HISTORY

Enter Kiwa Electronics. Craig Siegenthaler's background as a broadcast station engineer led him to look for a way to improve the quality of AM reception. Craig has worked at leading AM/FM stations in Seattle and with NBC in Washington DC seeking to maintain transmitted signal quality and in turn, help his stations win the all-important ratings war. He has also worked with PJZ-86 Radio Curom in the Netherland Antilles and with other stations in the Caribbean.

While living in Curacao, he began to look for ways to improve AM reception on his ICOM R71A. His experimentation began with a simple synchronous detector, and gradually expanded into other areas of reception enhancement. Many techniques were tried over a two year period. The result of his work is the Multi-band AM Pickup, a new twist in a receiver acccessory.

Craig believes there is a need in the marketplace for an "all in one" type of audio enhancing unit like the MAP. Synchronous detector add-on boards such as ESKAB's have their place, but they only address one aspect of the problem. Kiwa's MAP accessory bypasses many of the receiver's distortion-inducing stages and processes the signal in a manner specifically designed for the AM transmissions. The MAP's signal processing is completely analog, with no digital filtering. The signal exits the radio at the 455 KHz I.F. stage and does not return to the receiver.

The MAP is essentially the second half of a communications receiver optimized for AM listening. It will not work with SSB signals or CW.

All tuning while using the MAP is normally done with the receiver in AM. Because the I.F. signal is picked up ahead of the receiver's detector, changing to LSB or USB has no effect except to shift reception away from the carrier frequency by the LSB/USB offset amount (usually 1.5 kHz).

My participation in the MAP's development involved the front panel design, graphics layout, and field testing. I'll strive to review the unit objectively, detailing how it can improve both your SWLing and DXing.

●DESCRIPTION & FEATURES

A self contained unit (including speaker), the MAP works with any receiver employing the common I.F. frequency of 455 KHz. (The MAP will not work with any other I.F.) By use of either a direct or inductive pickup the 455 KHz signal is intercepted and reconditioned to provide lower noise & distortion, improved selectivity and a flatter frequency response. The MAP is composed of 21 integrated circuits and 19 transistors specifically chosen for low noise and distortion.

The MAP's chassis is sturdily constructed of 20 gauge steel with a .030" aluminum front panel. The entire chassis is produced on a computerized metal forming machine that allows professional touches like rounded corners and a precise fit of all parts. This is definitely *not* a homebrew piece of electronics.

The chassis and front panel are two shades of gray in a "powder coat" paint applied for durability. Knobs and pushbuttons are black. Labels for all controls are silkscreened white for good visibility. The Kiwa logo and MAP name are in blue. The overall effect is a professional, slightly "military" look that fits in well with modern communications receivers. Dimensions are 8.2 x 5.1 x 7.5 inches.

Circuit boards are made of durable glass epoxy, with high quality components well-spaced for serviceability. All switches except the power switch are electronic FET types for long life. The MAP is powered by an AC adapter (provided) or can be battery powered from 12.5 to 15.5 volts.

PICKUPS: A direct connection "pickup" or an optional inductive pickup couples the receiver's 455 KHz I.F. signal to the MAP. The MAP is normally supplied with a direct pickup which easily attaches to the proper point (before or after the radio's I.F. filters, depending on type of receiver and/or selectivity desired) by use of a spring-loaded microclip. *No receiver modification or internal rewiring is required,* and the pickup is removable so that the MAP may be used with other 455 KHz I.F. radios.

For tube and portable receivers the indirect (inductive) pickup is recommended. This device "sniffs" out the I.F. signal near I.F. transformers or coils. Both pickups are housed in a small plastic box and use a low noise preamplifier and a thin coax cable that transfers the signal and DC power. The MAP instruction manual contains detailed information for installing pickups in the receiver. Generally, the pickup housing is secured with Velcro (provided) to the inside of the receiver. A small alligator clip wired to the pickup attaches to a convenient receiver chassis ground point, and a micro-clip attaches to a location where the 455 I.F. signal is available (often the cathode of a switching diode before or after the receiver's filters). The thin coax exits under the edge of the receiver's cover, and delivers the signal to a 455 kHz input jack on MAP's rear panel.

SYNCHRONOUS DETECTOR: The heart of the MAP is its synchronous AM detection, a mode pioneered in consumer-grade receivers by the Sony ICF-2010. The synchronous detector in the MAP is a non-PLL type. Employing an enhanced-carrier technique, the MAP's detector is able to extract audio even from very weak AM signals while providing low audio distortion (<1.0% THD). The diode (envelope) detector found in most receivers is by its nature threshold sensitive, meaning detection cannot happen until the signal is higher than the forward voltage drop of the diode. The MAP's detector is not limited in this way, and a more complete and accurate rendition of audio information is the result.

Perhaps the main advantage of the MAP's detector is the ability to tune further off the carrier frequency to favor reception of either sideband *with less distortion* than diode detectors. It also has an edge over most other synchronous detectors in this respect; the majority of PLL-type synchronous detectors require that the receiver be tuned to the center of the carrier. For example, the Sherwood SE-3 and ESKAB's PLAM board for the R71A employ a PLL-type synchronous detector that loses signal "lock" if the receiver is tuned more than 35-40 Hz away from the carrier. The Kiwa MAP in wideband mode allows tuning as much as 3 Khz either side of carrier before significant distortion arises. As with other synchronous detectors, selective sideband distortion is reduced with the MAP if the receiver is tuned to fully capture a single sideband.

The diode detector normally found in receivers requires a proper carrier-to-sideband energy ratio for low distortion audio, a condition that is upset when tuning away from the carrier.

FILTER BANDWIDTHS: Using up to six cascaded ceramic filters which are followed by AF filtering, Craig has tailored the selectivity of the MAP for excellent adjacent channel rejection and a very flat passband. The narrowband position is 2.9 KHz at -6 dB and 4.6 KHz at -60 dB; the wideband position gives 6.9 KHz at -6 dB and 9.2 KHz at -60 dB.

Advertised shape factors for the narrow and wide bandwidths are conservatively rated at "better than 1 : 1.8" and "better than 1 : 1.45", respectively. Actual measured values are given in a custom *Certificate of Performance* supplied with each MAP. My particular unit has shape factors of 1 : 1.54 and 1 : 1.32, with total IF/AF ultimate rejection of -111 dB (narrowband) and -103 dB (wideband). Each MAP's actual parameters will vary, but will be within advertised limits.

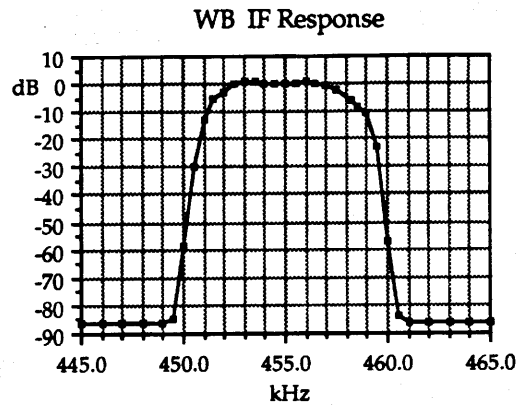
The specifications for Collins F455FD series mechanical filters suggest that the MAP's combined IF/AF bandwidths perform as well or better. I studied data sheets and found two interesting comparisions. According to Collins literature, the filters in the F455FD series typically have an ultimate rejection of 90 dB and 1 : 2.0 shape factors. The MAP's 2.9 KHz bandwidth is significantly narrower at -60 dB (4.6 kHz compared to 7.0 kHz for the Collins). A Collins F455FD 3.8 KHz filter is 9 KHz wide at -60 dB; the MAP's wideband position achieves nearly the same deep skirt selectivity (9.2 kHz at -60 dB) while providing 80% more useful audio at -6 dB (6.9 KHz for the MAP compared to 3.8 kHz).

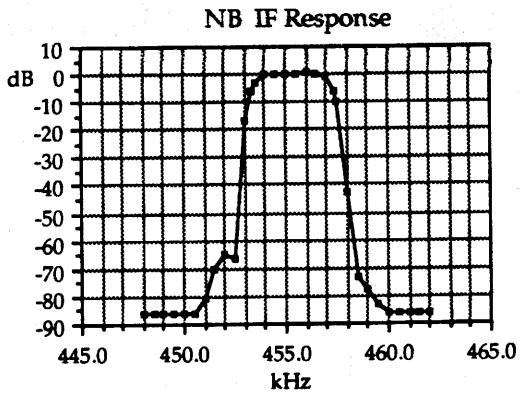
Depending on your radio, more selectivity combinations may be available by attaching the pickup after the receiver's filters. For example, a stock NRD-525 used with a MAP unit provides five bandwidths when

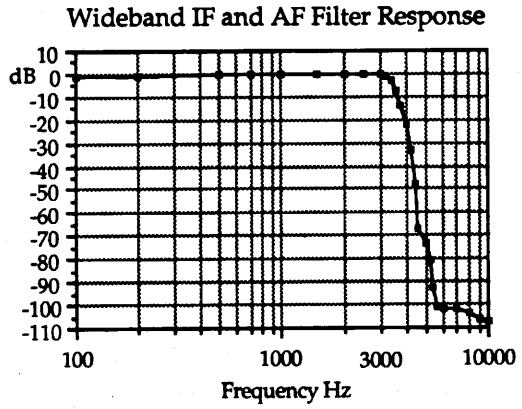
the pickup is placed post-filter; two bandwidths result when the pickup is located before the receiver's filters. The owner's manual gives details on this option for current receivers.

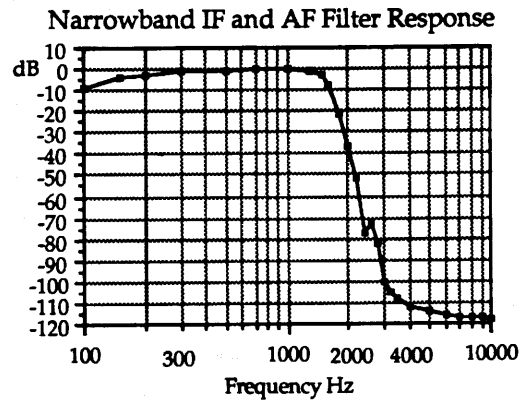
If 2.9 and 6.9 KHz seem rather wide compared to the usual 2 and 4 KHz widths found in good receivers, remember that the MAP's bandwidths have excellent shape factors and ultimate rejection. The non-PLL synchronous detector also allows more latitude in tuning before the point where distortion sets in. However, there are times when I wish the MAP included an intermediate width such as 4.5 KHz at -6 dB. Fortunately the "post filter" hookup with my NRD-525 gives other combinations, permitting signals to pass through filters in both receiver and MAP.

By the use of good quality, cascaded ceramic filters, certain distortion products that may occur with mechanical filters are avoided. Listening sessions confirm that Craig has found a combination of ceramic filters that function very well indeed. Considering that two Collins filters (plus installation) cost nearly as much as the entire MAP unit, this is quite an accomplishment. The following charts show selectivity curves of the bandwidths:









AGC: Automatic Gain Control circuitry in the MAP is designed for proper reception of AM signals. The MAP attaches to the receiver ahead of its AGC stage (in most cases), but some AGC action can occur before the MAP intercepts the signal. In the case of the NRD-525, it appears that significant AGC occurs before the pickup point. On signals with rapid flutter, reception can be improved by lowering the receiver's RF gain and turning the AGC off, which permits the MAP to control the signal.

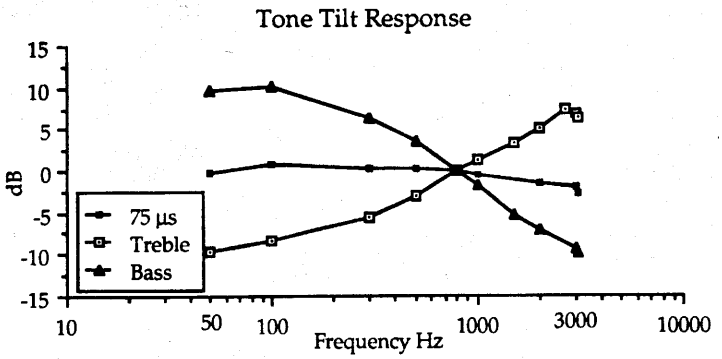
MONITOR AMPLIFIER & SPEAKER: A low distortion audio amplifier provides over six watts of drive to a polypropylene treated speaker which was chosen for its low "coloration". After extensive tests of many samples, this speaker was found to have the cleanest reproduction. It's a true hi-fi model and sounds excellent. The audio amplifier and speaker combination can fill a room with impressive volume.

A standard 1/4" phone jack disables the speaker, and works with either stereo or mono headphones. A nice touch in keeping with the MAP's approach to clean audio is a front panel "overload" LED that flashes if the amplifier is driven into distortion with excessive levels.

HIGH FREQUENCY FILTER (HFF): This control is basically an A.F. notch filter, calibrated and tunable from 1.1 KHz to 4.5 KHz. It operates to best advantage in the MAP's wideband position. The *Certificate of Performance* for my MAP indicates a -35 dB depth capability at 2.4 kHz. The HFF is not strictly for hetrodynes. It's main purpose is for audio tailoring and noise attenuation, and the HFF's notch width is wider than usual for this reason.

SIGNAL INPUT LEDs: Yellow, green, and red light-emitting diodes on the front panel give a visual

indication of the signal strength provided by the pickup. The LEDs do *not* function as an S-meter, but instead are a guide to signal level for optimum synchronous detection. Synchronous detection occurs even with low signal pickup (yellow LED), but the best signal-to-noise ratio and the lowest distortion occurs when the green LED is lit. This stage of the MAP incorporates an automatic level control which keeps the green LED glowing with most signals; a rear panel control allows adjustment of this range if necessary.

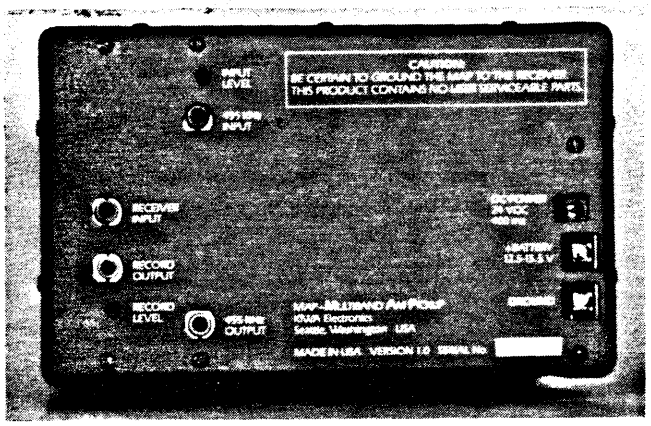


TONE TILT: I know of no other communications receiver or accessory that employs this type of tone control. This device is found in professional audio equipment and allows a wide range of tone adjustment by operating in a "teeter totter" fashion. As the bass is boosted, the treble is cut (or vice versa). The tone tilt provides over 16 dB of variation throughout its range. The center position of the tone tilt will be particularly interesting to mediumwave listeners, as it gives a flat frequency response for MW stations using a 75 microseconds pre-emphasis. This is becoming a standard for MW stations in the USA and the MAP compensates for the boost when the control is centered. Response curves are shown above.

MAP/RECEIVER CONTROL: A quick tap on this button gives an instant "A/B" comparision between the MAP audio and the original receiver audio. The receiver's headphone output is connected to the MAP with a supplied cable. The "receiver" position also allows any other audio source such as a tape recorder to take advantage of the good amplifier and speaker in the MAP.

Switching between MAP audio and original receiver audio with this control DOES NOT interrupt the processed MAP audio you may be sending to a tape recorder.

REAR PANEL CONNECTIONS: The following connectors and controls are found on the back of the Kiwa Multi-band AM Pickup: 455 KHz INPUT (I.F. signal from the direct or indirect pickup mounted in the receiver); INPUT LEVEL (adjusts with a small screwdriver for a green LED signal level on most signals); 455 KHz OUTPUT (a post-filtering I.F. signal useful for spectrum displays, panadapters, etc.); RECORD OUTPUT (synchronous detection audio output for tape recorders and measurement purposes); RECORD LEVEL (adjustable for both portable cassette recorders and tape decks); RECEIVER INPUT (audio from receiver's headphone jack, external speaker output, or other audio source); GROUND (a supplied ground wire & alligator clip connects this terminal to the receiver's ground terminal for proper operation of the MAP); DC POWER (supplied DC adapter plugs into this jack, which is wired in series with an internal fuse); + BATTERY (12.5 to 15.5 volts).



OWNERS MANUAL: Tired of vague, incomplete, poorly produced owners manuals? I suspect Craig Siegenthaler has struggled through sloppy manuals, too, because he has put many hours into an excellent guide. This manual contains descriptive text and graphics; performance charts (including a certification letter from the independent testing lab Hatfield & Dawson, and a detailed *Certificate of Performance* for each serialized MAP unit); clear hookup instructions with schematics and pictoral diagrams for the R1000, R2000, R70, R71A, NRD-515 and NRD-525 receivers; guidelines for hookup to other 455 KHz I.F. receivers; specifications; operating instructions; alignment information; MAP circuit schematics; and customer service information. The MAP's manual was produced on a Apple Macintosh SE computer and laserprinter, resulting in an attractive publication.

●OPERATION

The MAP is quite simple to use. With the MAP hooked up properly, the receiver's AF Gain is adjusted so the volume level with the MAP in *RCVR* position is equal to the volume heard through the *MAP* position. This permits a fair comparison of audio quality.

Stations are normally tuned with the receiver in AM mode. Adjustments to the audio quality are made

with a combination of receiver tuning (i.e. tuning off carrier or using Passband Tuning control), receiver bandwidth, MAP bandwidths, MAP Tone Tilt, and MAP High Frequency Filter.

Usually, I like to tune the receiver while listening to the MAP's synchronous detection audio with no other controls engaged. When I settle on a station I try various settings of other controls to see if any improvements can be made. I particularly like the combination of MAP wideband, +/- 1 kHz offset tuning from carrier, and Tone Tilt enabled in the 8 o'clock to 9 o'clock position. This seems to provide a bandpass effect that sometimes improves the signal-to-noise ratio. The MAP manual describes other useful tuning techniques.

● LISTENING IMPRESSIONS

As you would expect from a product offering so much flexibility, sufficient time at the controls is required to learn how to use the MAP to best advantage. It took me a few days to really master the controls and understand how to use them with various signal situations on the SW bands. Also, I wasn't accustomed to scrutinizing the audio quality of signals. As a typical DXer I had become accustomed to ignoring noise, fading, distortion, and other distractions. The Kiwa Multi-band AM Pickup made me expect more in audio quality.

The difference that the MAP can make in the fidelity and intelligibility of signals ranges from subtle to amazing. The effects are as varied as the signals found on the MW and SW bands. Clearer speech is the norm, due in part to improved reproduction of consonants such as Cs, Ks, and Ts which contribute to speech clarity. Voices seem to lift up out of the "mud", and station IDs are usually easier to catch. I have found that I begin to understand words and phrases in DX signals with the MAP in operation, when only the language was discernable through my NRD-525 alone. If you can imagine an announcer talking through a scarf or handkerchief, and then removing it, you will have an idea of how the MAP adds clarity to a signal. The MAP's low distortion also reduces listener fatigue during long DX sessions. Your ears will thank you for the relief.

John Bryant, an experienced Indo chaser from Stillwater, Oklahoma, was one of the first DXers to put Kiwa's Multiband AM Pickup to the test. He comments that *"the first morning I used my MAP, I heard a full ID on 'Radio Pemerintah Daerah Tingkat Dua Sumbawa' for the first time in my life. In fact, it was the first time I have clearly heard the 5 or 6 words of an RPD indentification all at the same time on any RPD reception from the Central USA. The additional clarity, especially on muffled languages, is startling!"*

Music is likewise improved. Local MW stations sound *excellent* in wideband (post-I.F. filter hookup on a NRD-525, "AUX" position). If you're a fan of the wide variety of music heard on shortwave, you will appreciate the MAP's fidelity. Stronger, interference-free signals are very impressive— the Afro-pops heard on *Africa Number One* (15475 KHz) seem to jump out of the speaker. Music from stations with marginal reception through the NRD-525 alone often becomes very listenable when processed by the Kiwa MAP.

I have heard the MAP in operation with an Icom R70 and R71A, Kenwood R1000, JRC NRD-515 and a NRD-525 (the NRD-525 sounds even better with the MAP when its AGC is modified; see article elsewhere in *Proceedings 1989).* Particularly impressive to me is the MAP's ability to greatly reduce receiver-generated "hiss". The NRD-525 has this problem which is not phase (synthesizer) noise, but reportedly is caused by interaction of stages or components on the I.F. board. When the MAP is switched in, the hiss totally disappears. This solves a major complaint I had about the NRD-525.

I have also heard the background noise level on the NRD-515 and R71A drop with the MAP attached.

In some ways the MAP accentuates the normal aural shortcomings of SW communication and studio environments. Previously inaudible chair squeaks, shuffling papers, and other background noises are occasionally audible to the careful listener. It's as if the sound of a broadcast is put under an "audio magnifying glass". A 1984 WRTH article describes the same peculiarities when using the Sherwood SE-3 synchronous detector. John Bryant mentions that his first reception with the MAP was an open-air interview on the BBC, and he could tell the announcers were in a train station. Without the MAP the background sounds were unnoticed.

The MAP provides sufficient controls for the radio enthusiast to tweak the sound to his liking. When interference and other problems cannot be reduced sufficiently, the overall fidelity and intelligibility is usually enhanced enough to warrant using the MAP.

Noise and static occasionally seem louder or stronger through the MAP because the MAP reproduces *all* signals better. There seems to be a greater high frequency (treble) component to noise that isn't audible in similar filter bandwidths with a diode detector.

There are two reasons for this. First, the MAP's IF/AF filter combination provides a flatter passband than many filters that experience a roll-off in treble response. Second, the MAP's synchronous detector reproduces high frequency information not normally heard through a threshold-sensitive envelope detector.

The NRD-525 is one of the more sensitive receivers around, but it improves significantly when hooked up to the MAP. (The NRD-525 does not use an envelope (diode) detector, but a "Synchro Phase" type of synchronous detector roughly similar to the MAP's.) I was pleasantly surprised to discover that the NRD-525/MAP combination occasionally pulls audio out of signals that only present a hetrodyne on the NRD-525. The improvement is sometimes dramatic.

In rare instances, problems in reception are masked by the receiver's own detector to a degree that listening to the receiver alone is preferred. As my skill in operating the MAP increased, these "receiver only"

situations became less frequent. I learned to quickly recognize which signals needed a certain combination of MAP settings for best reception.

It is possible to set up a signal processing "loop" using the MAP and another device like a active audio filter or graphic equalizer. The MAPs *Record Output* jack feeds synchronous detection audio to the input of another accessory. That unit's processed output goes to the MAP's *Receiver Input*. The *RCVR* setting of the *MAP/RCVR* control is then used to listen to the fully processed audio. If you enjoy knob twiddling, this is the set-up for you. Note however that the MAP cannot alter the audio that returns through the *Receiver Input* (audio) jack; it simply passes it on to the high-quality speaker. The same is true for audio from a tape recorder or other source.

There are a few things that I do not like about the MAP. When the unit is powered up, a brief, sharp "thump" is heard from the speaker, and pressing the *MAP/RCVR* or *WB/NB* buttons at any time creates a "pop" sound over the speaker. These are fairly minor complaints, however.

A little more bothersome is audio leakage around the volume control. Even with the volume control turned down completely, some audio gets through to the speaker and is faintly heard. I often tape record programs for later listening, and I don't want to hear audio from the MAP when I'm reading, etc. in a quiet room. Craig Siegenthaler has spent quite some time troubleshooting these problems, but so far no satisfactory solutions have been found.

●THE BOTTOM LINE

As a new accessory, it will take time to see whether this concept in audio enhancement catches on. As SWLs and DXers become more aware of the importance of clean audio, I hope we'll see manufacturers respond with better sounding receivers. Until these new rigs arrive, the Kiwa Multi-band AM Pickup can give a sizeable boost to fidelity and intelligibility.

That this unit is able to work with more than one receiver is a plus, too. Kiwa Electronics has plans to offer a junction box unit for those who own multiple receivers. This accessory will use FET electronic switching for quick and easy selection between four receiver inputs to the MAP.

In all, I've found the Multiband AM Pickup to be a worthwhile and flexible addition to my receivers.

●PRICE AND ORDERING INFORMATION

The MAP costs $340.00 (U.S), and it comes with a 30-day trial period during which the unit may be returned for a full refund. The MAP is also covered by a one year warranty. The MAP is shipped with an owner's manual, a direct pickup, AC power adapter, and various connectors and cables for hookup.

The optional indirect (inductive) pickup and additional direct pickups cost $40.00 each. Purchasing the indirect pickup is strongly recommended if you plan to use the MAP with a tube receiver.

The MAP and available accessories may be ordered direct from Kiwa Electronics. For complete ordering and shipping information, or for more details on the MAP, contact: Kiwa Electronics, 9815 61st South, Seattle, WA 98118. Phone: (206) 722-KIWA.

●SPECIFICATIONS

The following specifications are conservative, and they are the figures which Kiwa Electronics uses in their literature. Actual measured values (noted in the *Certificate of Performance)* typically are superior.

DC POWER REQUIREMENTS: 24 vdc at 400 ma DC adapter; current drain 220-250 ma at avg. listening levels; battery 12.5-15.5 vdc

NARROWBAND: (combined IF/AF filtering) +/- 1.5 dB bandwidth: 2.6 kHz +/- 200 Hz. -6 dB bandwidth: 2.9 kHz +/- 200 Hz. -60 dB bandwidth: 4.6 kHz +/- 200 Hz. Shape factor: better than 1 to 1.8. Ultimate rejection: 90 dB or better.

WIDEBAND: (combined IF/AF filtering) +/- 1.5 dB bandwidth: 6.2 kHz +/- 200 Hz. -6 dB bandwidth: 6.9 kHz +/- 200 Hz. -60 dB bandwidth: 9.2 kHz +/- 200 Hz. Shape factor: better than 1 to 1.45. Ultimate rejection: 90 dB or better.

AUDIO PERFORMANCE— WIDEBAND. Frequency response: +/- 1.5 dB 50 Hz to 3.1 kHz, +/- 100 Hz. Harmonic distortion: <1% THD (500 Hz, 60% mod.)

AUDIO PERFORMANCE— NARROWBAND. Frequency response: +/- 1.5 dB 50 Hz to 1.3 kHz, +/- 100 Hz. Harmonic distortion: <1% THD (500 Hz, 60% mod.)

HFF— HIGH FREQUENCY FILTER: tuneable from 1.1 kHz to 4.5 kHz, minimum 25 dB depth

TONE TILT: minimum 16 dB tilt 50 Hz to 2.7 kHz

DIRECT PICKUP: useable input range >70 dB (200 uV to 1.0 Vrms)

455 KHZ OUTPUT: 0.05 Vrms nominal output level

RECORD OUTPUT: -50 dB to +4 dBV adjustable, unbalanced

RECEIVER INPUT: balanced differential input

MONITOR AMPLIFIER: bridge amp. with 6 watts RMS output at 8 ohms

HEADPHONE AMPLIFIER: 3 watts RMS output at 8 ohms

OPTIONS: indirect I.F. pickup for tube and portable receivers

PHYSICAL: 8.2" x 5.1" x 7.5" (208mm x 130mm x 190mm)