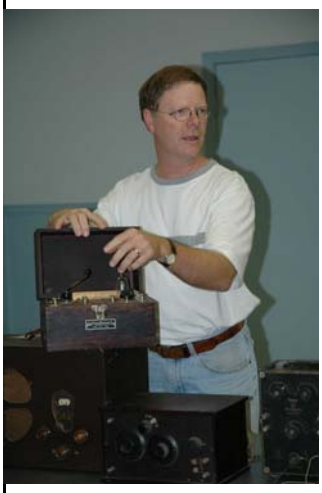
SoundWaves

VRPS FALL 2012

FROM THE PRESIDENT



This retirement thing is all it is made out to be….I love it!! Problem is, I find myself on the road more now than I did when I had an 8 to 5. No complaint, I just will have to re-learn to manage my time!!! But, to be sure, it has been a real change in my life.

Speaking of real changes, I will use this opportunity to welcome a new editor for the Soundwaves. As I have mentioned often times before, we have many talented members in our organization. For over ten years we have tapped into the talented duo of Randy and Jeannine James to produce our quarterly publication. Deservedly so, they asked to take a break. A quick look around for a qualified "volunteer" brought forth the name of one Mary Ann Caruth. This is her first issue, and what better way to get her started than combine the issue with our 2012 VRPS convention packet. I know Mary Ann will do a terrific job, and I look forward to working with her on the issues to come.

But, lest I forget my manners, I want to thank Randy and Jeannine (I think mainly Jeannine) for their outstanding contribution to the VRPS of the last decade. This organization's publication is mailed to more than 20 states and is given out to potential members at the many events we members attend. It has been the "link" that has brought us many new members over the years. Thanks Jeannine. Thanks Randy. And thanks Mary Ann, for your willingness to carry on the tradition.

Now, to more mundane things. Well, I jest, 'cause our 2012 VRPS convention is anything but mundane. Hopefully you have already made your reservations at the Hampton Inn and Suites in Mesquite for the third weekend in November. If not, then you will have ample opportunity to be reminded as you read this issue. I always look forward to this time of year and the annual convention. It is the one time each year I get to see many of you folks. In some cases, it will be the first time I will have the opportunity to meet new members who are from outside the metroplex and use the convention as an opportunity to come to the Dallas area. Either way, I will be looking forward to seeing you.

Our convention theme this year is "All Things Motorola". This all-American company had early beginnings and pioneered many innovative radio improvements - mobile, home, car, military, television…and more. Bring something to showcase in the contest.

One more thing before I put the typewriter to sleep. If you are into collecting Military and/or Ham Radio equipment, then you will not want to miss an auction in Little Rock, Arkansas, on October 13. There will be hundreds of these items…including some antique radios and speakers. It will be worth the drive. Check out the photos and list of items on my website, www.sargentauction.com

Until the convention, good hunting.

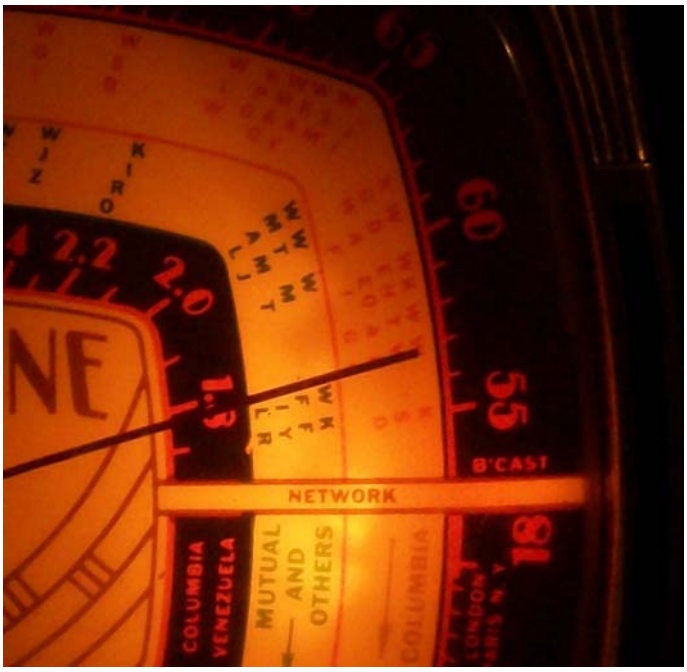
Jim

Mixers, Converters, and an Annoying Whistle at 570 KC
by Mike McCarty

After a meeting in the Dallas, Texas area some months ago, an astute member of the VRPS mentioned that he had noticed that there is a weak, but annoying, whistle on all superheterodyne receivers when receiving a local station at 570 KC. The tone of the whistle can be adjusted, and even virtually eliminated, through careful though touchy tuning. This annoying whistle is not present with TRF and regenerative receivers. He asked what could be the cause of this annoying whistle.

At the June meeting, Bret gave a partial answer, when he described mixer or converter action and the purpose of the IF transformers in superheterodyne receivers. You recall that, in the common AM receivers, the desired signal beats with a local oscillator signal, which is so arranged as always to be 455 KC higher in frequency than the received signal. The result is, that signals at the sum and difference frequencies are generated in the mixer or converter. Brett pointed out that the IF transformer in the converter circuitry selects for the desired 455 KC IF signal, and also discriminates against the undesired signal at the sum frequency. This is an accurate, if simplified, description of what happens in the mixer or converter and IF amplifier of a superheterodyne receiver. In order to understand the annoying whistle at 570 KC in Dallas, however, one needs a more complete description.

What actually happens in a mixer or converter, or any other non linear device, is that all harmonics of all signals present in the device beat against one another, and signals at all sum and difference frequencies are generated, and all sum and difference frequencies of all the harmonics of sums and differences,



ad infinitum. This results in quite a mish-mash in the output, so the discrimination against unwanted signals present is an important function of the IF transformers, indeed. However, sometimes the IF transformers just cannot, even in principle, reject all unwanted signals. This results in a phenomenon known as "image signal reception", which is an inherent defect present in all superheterodyne receivers.

There are two signals which differ in frequency from the local oscillator by 455 KC; one is below the local oscillator in frequency (the desired signal) and one is above (the image). One of the purposes of the antenna tuned circuit is to discriminate against the unwanted image frequency signal. With an IF of 455 KC, the image is 910 KC above the desired signal. In this case, a possible interfering signal would be at 570 KC + 910 KC or 1480 KC. There is no strong station in the Dallas area at 1480 KC, so this is not the problem. There is, however, a fairly strong station at 1310 KC in Dallas, and it IS a problem. Understanding why requires more subtle reasoning, though the cause is basically the

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same: image reception. When the receiver is tuned to 570 KC, the local oscillator is tuned to 570 KC + 455 KC, or 1025 KC. The third harmonic of this is at 3075 KC. Some of the 1310 KC signal sneaks through the antenna tuned circuit into the mixer or converter, and the second harmonic of this signal is at 2620 KC. These two harmonic signals beat, and produce sum and difference signals. The difference signal is at a frequency of 3075 KC - 2620 KC or 455 KC.

Of course, this is the same as the IF to which the IF transformers are tuned, and they are incapable, even in principle, of removing this signal. This is a sort of image reception on steroids, so to speak. Only the antenna circuitry's ability to reject the interfering 1310 KC signal stands between the production of a whistle and clear reception. A receiver with a tuned RF stage preceding the mixer or converter would have adequate ability to reject the interfering signal. Now, what is the cause of the whistle, and why can its frequency be altered by tuning the receiver?

No receiver is ever tuned EXACTLY to frequency. So, when one tunes in 570 KC, one actually tunes the receiver to 570 + e KC, where e is some small error in tuning. That means that the local oscillator is tuned to 1025 + e KC, and the third harmonic of that is 3075 + 3e KC. The FCC requires AM broadcast stations to transmit on a frequency no more than 20 cps from their assigned frequencies. If we accept that the 570 KC and 1310 KC signals from the stations are exact, then the second harmonic is exactly 2610 KC. The difference frequency then is (3075 + 3e) - 2610 KC which is 455 + 3e KC. At the same time, the 570 KC desired signal beats with the local oscillator to produce a difference signal at 455 + e KC. So, the IF amplifier sees, among others, signals at 455 + e KC and 455 + 3e KC, both of which it gleefully amplifies.

Now, the detector is a non linear device as well. That means that all signals which have made their way through the IF amplifier, and all their harmonics etc., beat against one another yet again. In this case, the main sum frequency is about 910 KC, and that signal is removed by filtering and is inaudible and irreproducible in any case, but the difference frequency is

$$(455 + 3e) - (455 + e) = 2e$$

So a tone at twice the tuning error is produced, that is, a 200 cps error in tuning results in a 400 cps tone, which the AF amplifier dutifully amplifies and passes along to the reproducer. That's why one can adjust the tone of the whistle and virtually eliminate it, through careful tuning. It also explains the difficulty in doing so. If we assume that a 60 cps tone is audible and reproducible, then one must tune within 30 cps. This means that the relative error in tuning of the local oscillator would have to be on the order of 30 cps/1025 KC, or 0.003 per cent., which is difficult to achieve by hand. Incidental frequency drift due to temperature changes, drafts of air, and even movement of nearby objects, like the listener's hands, may cause that much change in the local oscillator's frequency with the commonly used circuits.

A more exact analysis would take into account the errors in the transmitted signals' frequencies. It turns out that, in order to eliminate the annoying heterodyne, one must mistune the receiver by an amount which is equal to the error in transmission frequency at 1310 KC minus one half the error in transmission frequency at 570 KC.

Verification of this is left as an exercise for the reader.

Notes from the June Meeting

The meeting was conducted by President Jim Sargent with attendance at about 20 members. He reminded us about the July Repair Session and the August meeting topic about converting an AA5 to an AM broadcast transmitter. This device will let you broadcast your own private source of material from you CD player, or whatever you wish, and listen to it using your vintage receivers. Mike McCarty, to be the August program presenter, said that he will be handing out lists of materials needed, and to bring along your chosen candidate radio for hands-on conversion. He stressed that the candidate should not be a "hot chassis" type radio and suggested the use of a GFI protector salvaged from an old hair drier. Jim introduced our presenter for the day – Bret Menassa. He is creating another video DVD to add to his very useful series on vintage radio repair. The subject of his new DVD is radio alignment procedures. Bret gave us a run-through of the DVD, having invited members to inject suggestions for improvements and refinements to his material. To go along with the video presentation, he had set up test equipment and a radio for hands-on exercise. His DVD material starts with a discussion of tuned circuits and resonance, using the analogy of guitar strings and the transfer of power and energy in the process of making the strings vibrate at a given frequency. He did a live demonstration of a guitar string vibrating in response to an energy input from his voice.

The alignment process was described as the task of tuning multiple circuits ("strings") in the radio to their required resonant frequencies. The test setup requires a means to generate an audio tone that can be heard or its amplitude measured by a meter. (Most R.F. signal generators have an internal audio oscillator that can be selected to modulate the output and create the tone). The alignment tools that are needed vary with the type and vintage of the radio. In general, iron and steel tools should be avoided. For radios with iron slugs in the I.F. cans, special plastic tools are essential so as to not affect the tuning, and they reduce the risk of fracturing the brittle Ferrite slugs. A complete selection of alignment tools is still available from G.C. Electronics (gcelectronics.com). The alignment instructions found in Riders, SAMS or the manufacturer's data should be followed, if at all possible. To begin the alignment process, they usually call for a small (.001mfd) capacitor to be used for coupling the signal generator output to the antenna signal input grid of the (12SA7 G3 or equivalent). First, the I.F. transformers are aligned. You need to know what the radio was designed for, or the dial tracking will be bad. Most radios after the middle '30s use 455kc as the I.F. frequency, but several others have been used. Members suggested that an old loop antenna can be used – driven by the signal generator and placed near the loop of the radio to be aligned (if it has a loop). Also, members suggested that a voltmeter across the speaker voice coil can be used to observe where the peak response is located for a given adjustment. This

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can provide a more accurate alignment than just listening to the tone by ear. Another suggestion was to monitor the AVC voltage, but this requires access to wiring under the chassis. The latter method can be used even with the volume turned all the way down or with no speaker. The test signal should always be kept at the lowest level that provides a usable tone or voltage. Bret suggested aligning the R.F. section at the middle of the tuning dial range, if there is no "padder" capacitor. (For those that do, a published procedure should be used, or see Note.) Many radios have an index mark for the dial pointer to be set for the highest frequency to be tuned. This allows the pointer to be indexed so that the indicated frequency on the dial will be sufficiently accurate over the tuning range. This should be done before attempting the R.F. alignment.

There was a healthy interchange of ideas and tips for performing the alignment procedure. Bret's DVD is intended to provide the hobbyist with the basic knowledge needed to perform the alignment procedure, and to muster the incentive to try it. In closing, Jim Sargent mentioned Bret's other available DVDs.

Author's Note: If there is a padder, use two test signals, alternately – one near the low end of the dial and one near the high end. Alternately adjust the padder at the low end and re-adjust the oscillator trimmer and R.F. trimmer at the high end until a balance is achieved and the dial scale is sufficiently accurate.

Bill McKeown

Notes from the August Meeting

The meeting was conducted by President Jim Sargent. He reminded us of our September 15 swap meet, being held in place of our usual August event to avoid the summer heat. He also announced that he will soon be conducting a large auction that will feature many high-end items. (For information go to www.sargentauction.com). Program director Mike Grimes reminded the membership that the October 20 meeting will be a show-and-tell with emphasis on wireless transmitters, including remote controls. But, it's open to anything of interest that you might want to bring and discuss.

The meeting program was presented by Mike McCarty. The topic was the conversion of an ordinary AA5 radio to a low-power AM broadcast transmitter. This gives us an opportunity to use our favorite modern audio sources such as CD players, FM radios or MP3 players, broadcasting them for reception by our vintage radios. The transmitted power level is low, limiting the range to a few feet.

Mike had set up a demonstration of test equipment, illustrating the process of generating a transmitting signal and modulating the signal with the audio from the source. He illustrated and discussed the signal shapes and processes of signal radiation, selecting the frequency, modulation of the signal, and setting the percentage modulation. Attendees were given handouts that provided all the information needed to do the conversion. The circuit design for the conversion features the use of

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parts that are already in the radio, with the exception of a "wall-wart" saved from a small appliance. The handout included step-by-step instructions for the modifications to the radio. Mike stressed that the radio should be the type having a separate circuit ground that is isolated from the chassis, or in other words, not the hot-chassis type with the AC line cord power switched to the chassis. The wall-wart transformer provides for two functions – audio impedance-matching and electrical isolation between the transmitter and audio source.

Member Bret Menassa had brought his tools and a radio for a live demonstration of the conversion process. A camera was set up to view the chassis and project its image on a screen for the audience. During each step in the modification process, the work was watched on the screen, inspiring a lot of discussion around the activity. After the modifications were made to the radio it was tested and there was a round of applause for the successful final result. The speaker of the modified radio was still active, so there was discussion about disconnecting it. Mike suggested disconnecting the voice coil from the output transformer and connecting a 2 watt 8-to-10 ohm resistor in its place. This will prevent excessively high voltages from appearing across the transformer primary and threatening its insulation. (This modification frees the speaker to be used in repairing another radio.)

Author's Note: An old radio chassis is a good starting place for building up other circuit designs, which can be gleaned from the internet. There are some solid-state designs as well, and they operate with much less standby power, mostly because they have no filaments or heaters.

Bill McKeown

MONTHLY MEETING PROGRAMS

NOTE: Programs will be held at various locations in Irving, Texas. Refer to the WEB site. Programs start at 2pm. unless otherwise noted. Call us on the cell tellie if you get lost: 972-898-7251 or 972-742-8085.

OCTOBER 20, 2012 - Senter East Building Show and Tell. Bring your latest project of restoration and share with the club.

NOVEMBER 16-18, 2012 - Hampton Inn; Mesquite, TX. Annual Convention. Go to Convention Page of www.VRPS.org for detail.

DECEMBER 8, 2012 - Garden &Arts Building. Annual Christmas Party. 5pm to 11pm