Antique Wireless Association of Southern Africa

222 January 2025

Hallicrafters HT-4 Transmitter 1938

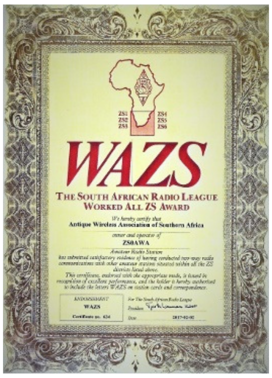
In the early 1940s, the U.S. military sought a high-powered radio transmitter capable of infallible voice communications over 100 miles (160 km), sturdy enough to work in all conditions, flexible enough to be able to cover a wide range of frequencies, self-powered and able to operate in motion or at fixed locations. The Hallicrafters HT-4 transmitter was chosen from units available from various U.S. radio manufacturers. The HT-4 was designed for amateur radio use and had been commercially available for several years at a price of approximately $700, rivaling the cost of a car. It was considered compact and stable for its era and could deliver in excess of 300 watts of power for voice or MCW communications and 400 watts during Morse code operation. As was typical in physically large vacuum tube equipment, the manual cautions power output is less at higher frequencies. It was quartz crystal controlled, but could be used over a wide range of frequencies through use of the master-oscillator power amplifier.[1]

Modifications requested by the Signal Corps were performed by Hallicrafters' engineers working with U.S. Army technicians at Fort Monmouth. They made a new version of the HT-4, which was known as the BC-610 transmitter, a part of the SCR-299 mobile communications unit, and production began in 1942. General Dwight Eisenhower credited the SCR-299 in the reorganization of U.S. forces, which led to their victory against the Nazis at Kasserine Pass. The SCR-299 was also used in the Invasion of Sicily and later, Italy.

A BC-610 transmitter was used by double agent Juan Pujol García during WWII as part of Operation Fortitude. Clear reception by the Germans of messages transmitted by García, code name GARBO, were so crucial to the Allied deception that use of the relatively high-powered transmitter was deemed necessary.

Over 25,000 units were produced by Hallicrafters and other allied companies. In 1944, a short subject film was produced by the Jam Handy Organization and sponsored by the Hallicrafters Company detailing how the HT-4 transmitter was adapted for military service and dramatizing its use by the U.S. military during World War II.

(Wikipedia)



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FROM THE PEN OF THE NEW "PRESIDENT"

Firstly, I am honoured that you have chosen me to lead the AWA for the next year. I Thank you for placing your trust in me.

Just before the New Year I spent some time musing on the year ahead and how it affects us all. I thought I would share some of these musing with you.

A new year is when many of us make *New Year* resolutions. It's commonly held that many resolutions don't last past the first 100 days or less. The reason is probably, that we set unreasonable expectations. How about setting some resolutions on what we '*will not do'* this year instead of what we will do. How about, 'I won't get dragged into doing things that others expect of me!', or, 'I won't do anything that does not contribute to my happiness and that of my family and close friends'. Or, how about making a conscious effort to avoid wasting time on negative conversations about the state of the economy, political corruption or crime. I'm not suggesting that we should be selfish or that we should stop caring for others, but so often we get manipulated in doing things that have no meaning or value in our lives. Life is short so make sure that everything you do this year has a positive effect on those around you. Face yourself every morning with the attitude of 'This is a New Day for New Starts!'

What is the AWA? This is a question asked by many of the newer Hams. There was a discussion on the Telegram group not long ago about the origins of the AWA and where does it fit in today's world of solid state, DSP and digital communications. In my view, not necessarily the view of everyone, is that the AWA provides a platform or forum for anyone interested in the art of Wireless Communication to discuss, learn and experiment. The AWA net is fairly unique and certainly has the greatest participation in Africa, with topics covering almost every aspect of Wireless.

One thinks of 'antique wireless' as being anything older than x number of years ago. Should it be confined to spark gap transmitters and coherers? Or, to equipment that uses glass envelopes that glow in the dark as their active devices. The earliest so called hybrid radios which use a mix of valves, what the Americans call tubes, and semiconductors were commercially sold in the mid 1960s. I stand to correction, but I believe the first hybrid was the Yaesu FT-100 designed for mobile operation. My FT-990 radio which is fully solid state and incorporates a number of DDS oscillators is now 34 years old. Do I classify this as antique?

So, back to what the AWA should provide its members and the Ham community in general. Given that Amateur Radio has always been a very innovative activity and has been at the forefront of development in all things Wireless. I feel strongly that, given that while radio science continues to progress, the foundations and precepts remain as valid as ever. In the same way that vinyl records have historic yet continuing space in the world of music reproduction, older radio techniques and equipment still have a very important place in Amateur Radio. I also think that in teaching of radio science much of the foundational knowledge gets left out or simply taken for granted. This is where the AWA has a very important role.

One area of interest can be antennas. There has recently been a resurgence of interest in wire antennas and how to best feed and match them. It is such a broad and interesting topic and does not require expensive test equipment or expert knowledge. Should we not re-visit and teach newcomers the techniques of open wire feeders, Marconi antennas, non-resonant wire antennas and similar techniques that don't require expensive coax cable or 'fancy' antenna tuners.

By encouraging discussion and experimentation about all facets of radio, old and new, the AWA can provide newcomers with a rich and rewarding hobby whilst keeping alive the inherited knowledge and experience.

So let us rope in the newcomers and share our collective experience of this wonderful hobby with them.

Please let me have your comments on topics of interest and more importantly let us share with our AWA community what's on your workbench or happening in your shack.

73 es 88

Chris Turner, ZS6GM

Reflections:

And so begins another year in the History of the AWA.

A new President, a new start, and I hope that non of you made any resolutions this year ?

I have set myself a few goals to achieve this year, and it doesn't matter how long I take to achieve them, as long as I can get them done, that will be the important issue to me.

I have found in this new lifestyle that I am living now, that speed is not the essence of getting things done, but I am looking now for some quality finishes.

I always seemed to be making a plan to get things done, and as long as it worked, that was the important thing.

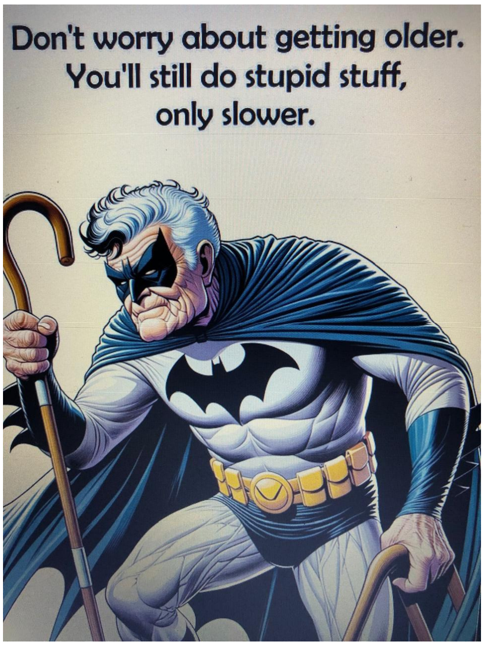
When I worked on the mines, we used to do "Risk" management and "Loss Control", where one had to identify all the things that could go wrong and work out ways to correct them before they did.

Well, when I look at the way some of my projects were put together, they were a great risk and were mostly temporary jobs that were just done to get things working. Those temporary jobs then became permanent fixtures, because why try and fix something that's working, right ?

Although none of them ever became costly repairs, I guess I was pretty fortunate in that.

So now with this "new" me….I have decided that things will be done properly, even if they take a bit longer to get done. At least that way I am hoping that they firstly will look a lot better, and secondly will work a lot better. Of course one of the reasons they take a bit longer is the age factor.

A friend sent me a birthday greeting that looks like this...



I didn't know if I should be offended or not, but then after a bit of reflection, I realised how true it was. I do still do stupid stuff.

Isn't it terrible when you realise how true some of these sayings are ?

The first of my goals is to get my tower back up with a new multiband inverted V and the TH3 sited on the tower. This I hope to complete before the end of January….this year.

I have refurbished the rotator and it now has a new steel ring after the second pewter one was found to have broken in two.

Last time I had to replace it, there were no steel rings available so I had to put a pewter one in.

The rotator was bought in 1990, second hand, so has had it's fair share of work. Not quite antique yet and no valves.

Looking forward from here, it seems that things have started off well and we are looking forward to a full year with new prospects, projects and lots of antique stuff to keep busy with. There is just so much out there that still needs to be collected, refurbished and put back into work again.

May the passion of "old" be reignited

in us to preserve and use for at least another year.

All the best for 2025.

DE Andy ZS6ADY

KENWOOD'S TS520S BAND PASS FILTER ALIGNMENT

On my bench by Renato Bordin ZS6REN

At the last IEE open day gathering, our dear friend Bruce brought his 520S hoping I was going to show some interest and when he saw I was not keen he quickly changed tactic and asked if I wouldn't mind having a look at it, I was told its working and free from any issues, it just needed a test. Haven't we all heard that story.

This example of the 520S was clean and in decent shape, only the resprayed enclosure panels had a poor paint job with lots of overspray. Internally the radio chassis was clean with evidence of a capacitor replacement job on the power supply section. On power up the radio responded as expected and injected a 7125KHz signal at -73dBm (S9) signal without modulation and radio in the LSB mode, the S meter barely lifted, and the beat tone was very low. I checked everything and made sure the drive control was set for a peak reading but still the S meter refused to lift and still a poor tone only just above the noise. Only by increasing the level of the injected signal improved things. A good example of a deaf radio, this one with lots of wax. It did not take long to find the TS520S service manual and after familiarizing myself with the layout moved on to the alignment procedure with step 1 ensuring correct voltage settings. Next the alignment of the bandpass filter calling for an RF sweep generator (Fig 1) and detector hooked up to the radios IF and RF boards via a simple diode detector with scope in XY mode.

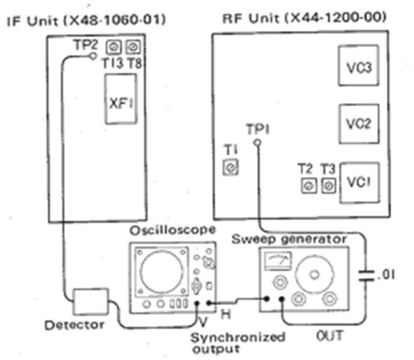


Fig. 18 B.P.F. for Reception

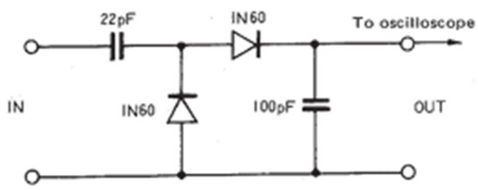


Fig 1 Sweep generator, scope and detector hookup to radio

I pressed into service a Philips PM5334 sweep generator intended for TV servicing but since the instrument covered the required sweep frequencies in the 8MHz range it was the perfect choice. Philips, as many of you know produced some of the best instrumentation available in its day and the few examples I have are in good working order and do not command high prices when made available. The important feature of the sweep generator used for this alignment is the DC sweep ramp output that will drive the X axis of an oscilloscope in XY mode. Any scope that has XY mode can be used for this application since we are not measuring high frequencies in the time domain, we are simply sweeping the trace from left to right with the generators ramp output and the output voltage of the detector on the Y axis. The PM5334 ramp is adjustable from 0 to 15Vdc perfect to get the trace moving, just make sure you set the scope Y input to DC coupling. The detector is also straight forward but I used 1N34A's and one could also just use an RF probe to sniff the output of the RF board or not use a detector at all if your scope has reasonable bandwidth. I used a period correct HP 100Mhz scope for the task.

Once all hooked up as shown in fig 2 and radio configured according to the service manual it was time to chase the filter response curve as shown in fig 3 by adjusting T2, T3 on the RF board and T8 on the IF board. I used a Systron Donner PLL locked signal generator to accurately set the marker frequencies of 8.295MHz, 8.595MHz and 8.895MHz by lightly coupling to the detector. With a marker of 8.595MHz on the center of the scope CRT it was now easy to adjust the sweep width and rate of the PM5334 to get the response curve centered. What I first saw was nothing like the skirt in Fig 3 and after a brief fiddle of the three cans I was able to adjust the skirt as shown in Fig 4. I could not believe how far off the response was, I am wondering if that golden screwdriver found its way in there at some point. Now with the same -73dBm signal the radio came alive and the S meter climbed to above S7 and at -120dBm, that's less than half a microvolt! the radio was able to produce a faint tone, we getting there. I only attempted to adjust the coil packs on 40M to see if I could gain another S point but did not gain anything. I was told by William, ZS4L that the 520 will not indicate S9 with 50uV and a simple mod by changing resistor values will solve the issue. RF, OSC and mixer coils were at optimum setting. It made sense to set the transmitters bandpass filter while I was at it. So to measure any differences, I keyed up into a dummy load via my Bird power meter before and after TX filter alignment. Before 12W after 14W in tune position.

Fig 2 – Sweep generator and TS520

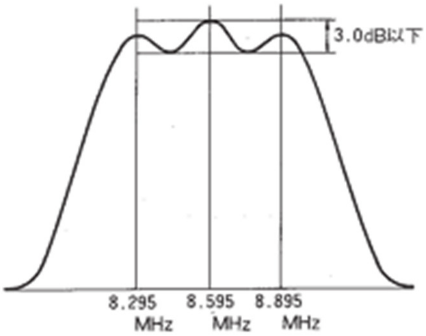


Fig 3 Expected BP filter response

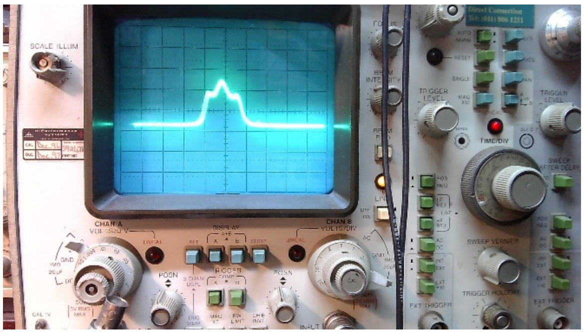


Fig 4 Response achieved with detector

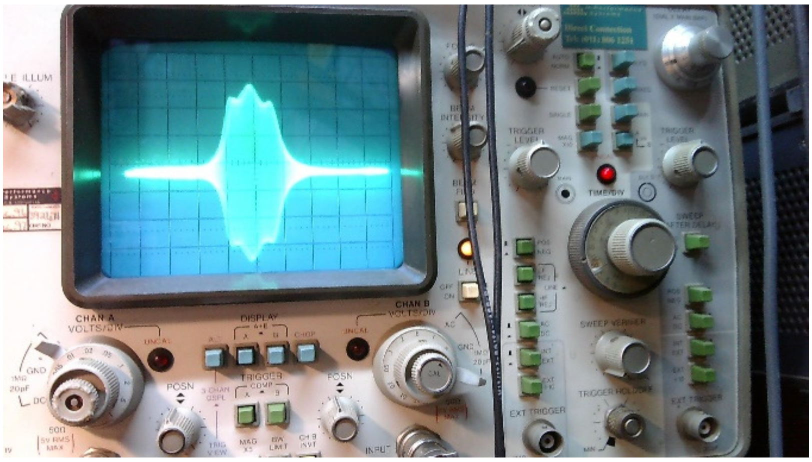


Fig 4 Response without detector

Another alternative to sweep the bandpass filter is with a spectrum analyzer and tracking generator which is a signal generator synchronized to the sweep of the analyzer. These results are not possible without a good PLL/DDS etc. locked signal generator as a marker or a spectrum analyzer with accurate markers, I suspect that this radio may have been aligned with a drifty signal placing the filter out of band or trying to peak the S meter by fiddling with the three cans, you might get lucky but I prefer verified results.

I will continue exploring the 520 with the objective of getting the most out of this legendary transceiver and will report on any new adventures but so far, the alignment of the band pass filters produced the most noticeable improvements.

I wonder if Bruce will now want more for the radio.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A Primer on Single Sideband
September 1974 Popular Electronics

Single-sideband (SSB) modulation was a big deal when it was first introduced at a time when the radio spectrum was getting pretty crowded - particularly in the commercial broadcast bands. It allowed more channels / stations to be packed into available space, which was obviously a good thing, but the other main benefit of SSB is the transmission efficiency - especially when a suppressed carrier format is used. At really high powers, electronic components, antennas, cabling, and facilities are very expensive, so being able to broadcast a signal over a given distance at a lower power represents a cost savings. As the old saying goes, though, "there is no free lunch." Modulators in transmitters require more circuitry and much be kept in alignment in order to properly operate in single sideband mode. Receivers, too, are more complex as the requirement for carrier recovery (for suppressed carrier SSB) and other accommodations are needed. This article from a 1974 issue of *Popular Electronics* magazine does a great job of introducing the uninitiated into the world of single sideband.

By James E. Trulove

Single-Sideband, or SSB, modulation has begun to supplant conventional amplitude modulation (AM) in electronics communication. Many military and commercial systems have made the switch. So, too, have a great many amateur radio operators. More recently, Citizens Banders have joined the ranks of the SSB communicators.

SSB modulation has distinct advantages in communications. One of the most important is its inherent conservation of the crowded frequency spectrum. When compared to conventional AM, SSB requires only half the spectrum space, in effect doubling the number of channels i n a given portion of the frequency band. A good example of this is the 27-MHz CB band where only 23 channels are available with AM, while 46 channels of SSB fit into the same band.

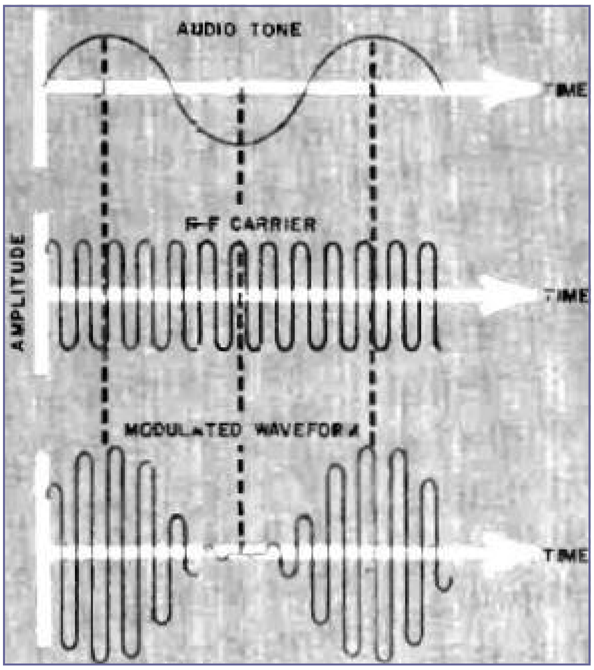

Fig. 1 - In amplitude modulation, audio tone (top) combines with r-f carrier (center) to produce waveform at bottom whose envelope varies in amplitude and frequency with the audio tone.

SSB is also much more efficient than AM. In AM, most of the power is concentrated in the r-f carrier. By contrast, SSB suppresses the carrier and concentrates most of the power in the information-bearing sideband signal. This, coupled with greater immunity to selective fading, gives SSB communication much greater "talk power" than is possible with conventional modulation techniques.

The Basis of SSB

To transmit a signal over a given distance, information is imposed on a r-f wave. The r-f wave serves as a "carrier" - hence its name - for the lower-frequency information. Successful communication results from proper utilization of the frequency-dependent properties of the carrier, as well as efficient use of the transmitted energy.

The information can be imposed on the r-f wave by modifying, or modulating, the carrier as the result of varying the carrier's frequency or amplitude (or both). Frequency modulation (FM) and amplitude modulation (AM) and simultaneous amplitude and frequency modulation (AM/FM) can take a wide variety of forms.

AM in its basic form is perhaps the easiest to produce. To impress an audio-frequency (a-f) modulation on a r-f carrier, the carrier is made to vary in amplitude according to the instantaneous amplitude of the a-f signal by a process known as "mixing." In Fig. 1, the audio and carrier waveforms are combined to produce the modulated r-f wave shown at the bottom. Notice that the relative peak-to-peak amplitude of the modulated wave varies in accordance with the relative amplitude of the modulating audio.

Mathematically, the amplitude-modulated signal contains several discrete frequencies for any given carrier and audio inputs. As shown in Fig. 2A, the output consists primarily of the original and carrier signals, plus two additional mixing products whose frequencies are the sum and difference of the a-f and r-f signals. Called "side tones," these two frequencies are equally spaced on either side of the r-f carrier's frequency. (There are many other mixing products, including harmonics of the inputs and outputs and their mixing products, but these are almost negligible and need not be considered in this discussion.)

When the audio input is of varying frequency and amplitude, as is the case with voice, the side tones vary in strict accordance, producing what may be termed "sidebands" on either side of the carrier. The sidebands form the characteristic "envelope" of the modulated waveform. These sidebands contain all the original audio information and are essentially mirror images of each other. With 100-percent modulation, the carrier contains twice as much power as the total in both sidebands, yet the carrier conveys no usable information. Also, since the sidebands are mirror images of each other, only one is needed for effective communication. This means that what remaining power there is must be divided between the two sidebands. Hence, under the very best of modulating conditions in AM, less than 25 percent of the available power goes into the information signal.

In SSB communications, one sideband and virtually all of the carrier are eliminated. After all, the audio signal already has both frequency and intensity. The frequency information is transmitted as the difference between the carrier reference and side tone frequencies. The intensity information is characterized by the amplitude of the side tone. So, one sideband of an amplitude-modulated wave can carry the audio signal if the reference frequency of the original carrier is available. The suppression of the carrier and elimination of one sideband permits all of the available power to be concentrated in the information-bearing signal (see Fig. 2B), effectively multiplying power efficiency while halving the bandwidth required.

An interesting aspect of the SSB signal is that it disappears when there is no modulation. (In conventional AM, the carrier is present regardless of whether or not it is modulated. In other words, the carrier has accompanying sidebands only when modulated.) In SSB, filtering out all but one sideband causes the sideband to disappear when modulation ceases.

The SSB Exciter

Unlike conventional AM, the SSB signal is usually generated at a low power level in separate transmitter stage known as an "exciter." SSB signal generation is easier to accomplish at a fixed frequency. The output of the exciter is translated in a mixer to the desired transmit frequency and is then amplified to the desired power level. (See Fig. 3.)

The balanced modulator, a type of mixer that suppresses the carrier at its output, is basic to the SSB exciter. The basic types of balanced modulators shown in Fig..4 include shunt, series, and ring (or double-balanced) types. The shunt and series types may contain two or four diodes, with the latter versions often referred to as "bridge" or "quad" modulators.

The operation of the balanced modulator can be visualized as an audio signal being switched on and off at the rate (frequency) of the r-f carrier. If the modulator is in balance, the carrier is cancelled at the output and only the two sidebands remain. Balancing of the modulator is achieved by close matching of the diodes and by trimming. In a properly designed and balanced circuit, carrier suppression can be as much as 50 dB. The ring modulator provides good carrier suppression with higher output voltages and lower unwanted mixing products than both the shunt and series modulators.

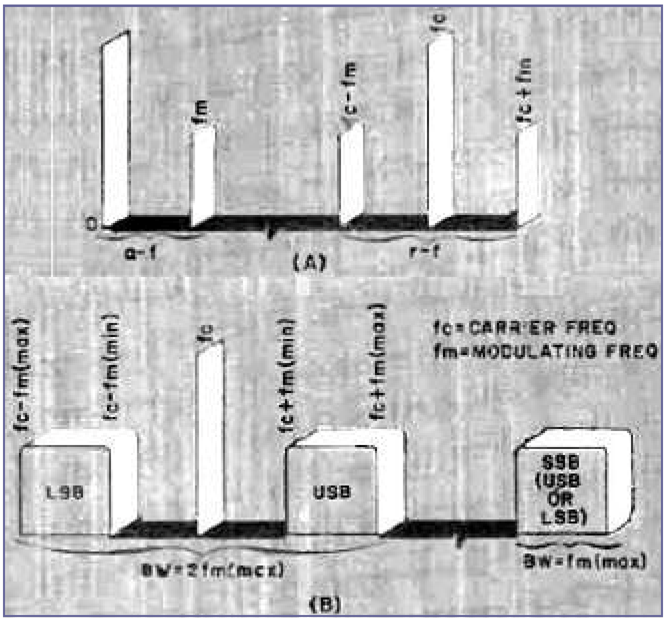

Fig. 2 - Frequency components of AM and SSB signals are shown in (A) and (B), respectively.

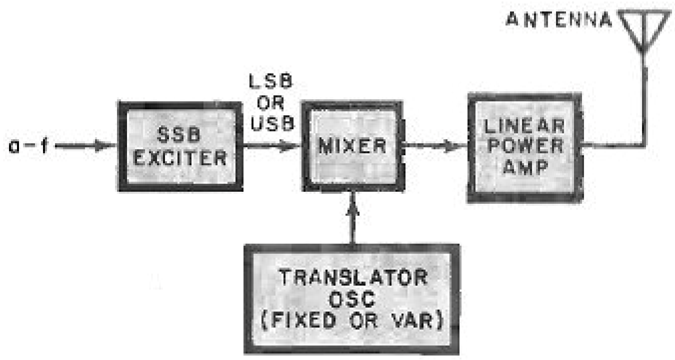

Fig. 3 - Basic block diagram of SSB transmitter.

After the double-sideband (DSB) suppressed-carrier signal is generated in the balanced modulator, one of the sidebands must be eliminated by filtering,. This is no easy task because the two sidebands are very close together in frequency. If the lowest modulating frequency is 300 Hz, the sidebands will be only 600 Hz apart. Hence, filtering must be accomplished by a very high-Q filter with a narrow passband and steep side skirts. A relative comparison between an ideal filter, a multiple-pole crystal or ceramic lattice filter, and an ordinary LC filter is shown in Fig. 5A. From the evidence of the curves, it is obvious why a crystal or ceramic filter is the usual choice in SSB.

Since the filter is designed for a fixed frequency, some method must be used to permit selection between the upper sideband (USB) and lower sideband (LSB). Two expensive filters can be used, but it is simpler and more economical to switch the carrier frequency input to the balanced modulator. For example, if the filter's output is the USB signal, the carrier oscillator can simply be raised by a fixed amount (usually 3 kHz) so that the LSB signal is at the filter's frequency. The carrier oscillator is usually crystal controlled. So, the change from USB to LSB and vice versa can be easily accomplished by switching crystals as shown in Fig. 5B.

The "phasing" exciter is another type sometimes encountered in SSB. It has two balanced modulators and two phase-shift networks, one for audio and the other for the carrier. The modulator outputs are combined in such a manner that one sideband is reinforced while the other is cancelled. This scheme requires critical phasing for each frequency if no frequency translator is provided. Another disadvantage is that circuit complexity is considerably greater than with the filter method.

Frequency Conversion

Since filter requirements force the exciter to operate at a fixed frequency, a converter must be used to translate the exciter's output to the operating frequency. The converter consists of a mixer with a tuned output and an


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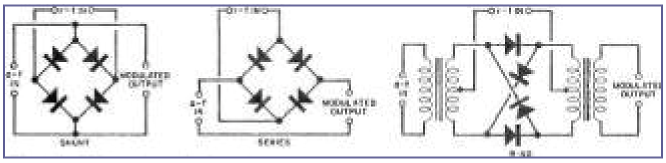

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Fig. 4 - In SSB, carrier and r-f signals are mixed in balanced modulators. Outputs have suppressed carriers.

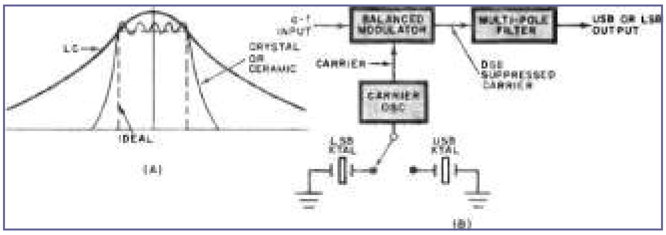

Fig. 5 - Relative comparison between ideal, crystal or ceramic and LC filters shown at (A). (B) shows elements of SSB exciter.

oscillator that can be either fixed or variable, depending on the requirements. The mixer produces the sum and difference products of the output of the exciter and the converter oscillator. The tuned mixer output passes the mixer product at the transmitter frequency.

To illustrate this process, refer to Fig. 6. Here, 9-MHz SSB signal, mixed with a 19-MHz crystal oscillator frequency, produces sum and difference products at 10 and 28 MHz. The tuned output allows only the 28-MHz signal to pass. The 28-MHz signal has acquired the SSB-modulation from the 9-MHz exciter output. The signal can now be amplified and transmitted.

The conversion from 9 to 28 MHz is referred to as "up-conversion." Similarly, "down-conversion" can be used to convert from 9 MHz to, say, 7 MHz. If a band of frequencies, such as from 28.0, to 28.5 MHz, must be covered, switching crystals from 19.0 to 19.5 MHZ could be used in the converter. However, this can become cumbersome if many frequencies are required. Frequently, a variable-frequency oscillator (vfo) is substituted in the converter to allow continuous coverage of a given frequency increment. A vfo with a 500-kHz range from 19.0 to 19.5 MHz would do the job, but it must be very stable to obviate any drift in frequency.

The converter provides two choices for the oscillator frequency that will produce the desired output. In the above example, a 37-MHz oscillator would produce primary mixing products of 28 and 46 MHz. The choice between the two oscillator frequencies is based on a number of factors, including oscillator stability, mixer efficiency, crystal stability, and cost. If the difference product is selected, as in the 37-MHz case, an inversion of the sideband occurs. This means that, if the 9-MHz exciter output was USB, the converter, output produced by subtracting 9. MHz from 37 MHz would be the 28-MHz LSB. This phenomenon does not occur when the sum product is selected.

Linear Amplifiers

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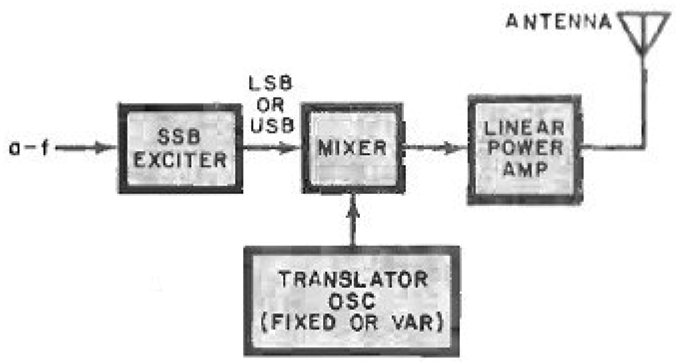

Fig. 6 - Typical converter stage translates exciter output to desired transmit frequency.

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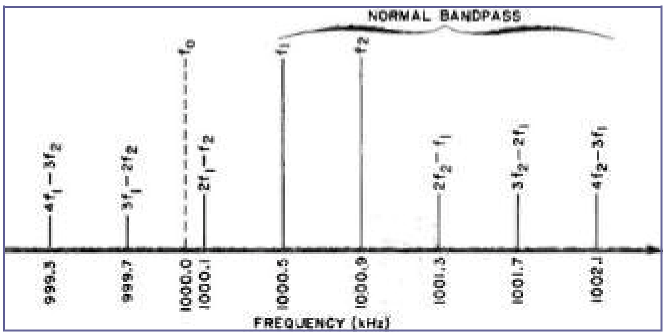

Fig. 7 - Distortion products created by r.f. amplifier nonlinearities create "splatter" on adjacent frequencies.

Once the SSB signal at the proper frequency is generated, it must be amplified to the desired output power level. Both AM and SSB signals can be severely distorted by any nonlinearities the driver or power amplifiers. In an AM transmitter, this problem is usually avoided by modulating the carrier in the final r-f stage. This "high-level" modulation cannot be used in an SSB transmitter where a low-level exciter signal must be greatly amplified. For this reason, it is important that amplifier stages be extremely linear to limit distortion to an absolute minimum.

The distortion products created by amplifier nonlinearities can appear in and around the SSB signal at appreciable power levels. Distortion products are produced by means similar those in the mixer. To illustrate, if a two-tone 500- and 900-Hz test signal were applied to the audio input using a 1000.0-kHz USB signal, the modulation would appear at 1000.5 and 1000.9 kHz. In Fig. 7,. the lower-order distortion products resulting from harmonic mixing are shown. Notice that some of these products are within the normal bandpass and others are adjacent to it. These spurious outputs can cause significant interference to adjacent channels and, if distortion is very bad, even frequencies far removed.

There is another common source of distortion that can be confused with power amplifier nonlinearity. This is distortion at the audio input due to either excessive clipping or compression in the audio stages or overmodulation.

The two-tone signal can also be used for determining the power contained in an SSB signal. The waveform of a two-tone SSB signal is shown in Fig. 9.The signal is rated in peak-envelope power (pep) developed by two tones of equal amplitude. Pep can be calculated by squaring the rms value of the peak, envelope voltage E_p and dividing the result, by load resistance R (pep = E_p^2/R). In the two-tone case, the pep is twice the average power dissipated in the load.

Receiving SSB

The SSB receiver is similar to any other superheterodyne receiver (see Fig. 9). Nonlinearities in the r-f or i-f amplifiers will cause distortion in the SSB receiver just as they will in the AM receiver. Distortion due to overloading the amplifier is reduced by the automatic gain control (agc).

The agc must be designed differently for SSB reception. Unlike AM where the carrier is present even when there is no modulation, the SSB signal disappears completely in the absence of modulation. For this reason, the agc must reduce amplifier gain quickly when it first senses a strong SSB signal and increase the gain very slowly when the signal disappears. This fast-attack, slow-release response compensates for short pauses in conversation. In some receivers, the sustaining time of the agc can be adjusted as desired.

The r-f amplifier, mixer, and local oscillator are similar to the circuits found in AM receivers. The i-f amplifier, however, can be much narrower in bandpass since the SSB signal is less than half the bandwidth of an AM signal. Reducing i-f bandwidth has the added advantage of reducing the total noise power presented to the detector. Frequently, the local oscillator frequency is selected so that the high-Q mechanical or crystal filter in the SSB exciter can also serve as the i-f filter.

SSB demodulation is radically different from AM detection. As mentioned earlier, the SSB signal varies in frequency from a reference, depending on the modulating signal frequency. The reference was originally supplied by the r-f carrier. That reference carrier must again be simulated to provide something with which to compare the SSB signal frequency. Thus, the receiver must inject a simulated carrier into the detector by means of a carrier-reinsertion oscillator or beat-frequency oscillator (bfo). The bfo is usually crystal controlled to maintain a high order of stability.

The proper bfo frequency depends on whether the signal to be received is USB or LSB. In the case of USB, the bfo frequency must be lower than the signal frequency, while for LSB it must be higher than the signal frequency. Crystal switching changes the bfo from the lower edge of the i-f passband to the upper edge to receive USB or LSB.

The actual process of detection can occur in an AM-type integrating detector after the bfo signal is injected. But much higher quality detection can be obtained with a "product detector." (Examples of product detectors are shown in Fig. 10.)

The quality of the received audio depends to a large extent on how dose the reinserted carrier is to the frequency of the original carrier. To allow for same drift or misalignment between the transmitted signal and the receiver's local oscillator and bfo, a means of adjusting one or both oscillators must be included. A trimmer for either oscillator might go under various names, the two most popular being "fine tuning control" and, in the case of CB radio, "clarifier." In some sophisticated receivers, this function is accomplished by an automatic-frequency control, similar in function to the afc circuit used in FM receivers. Without the aforementioned control, speech would be unintelligible.

In Conclusion

The use of SSB modulation offers distinct advantages for the modern communicator. Especially in the high-frequency bands, SSB conserves valuable spectrum space. Where the total output power (or input power to the transmitter's final amplifier) is limited by government regulation, SSB packs all the power into one no-nonsense information signal to provide greater communicating range and reliability. If maximum power is limited by tubes or transistors, SSB provides an increase in overall efficiency. In fact, it can be demonstrated that, compared to an AM transceiving system, an SSB system using similar components can provide an effective 9-dB increase in system performance.

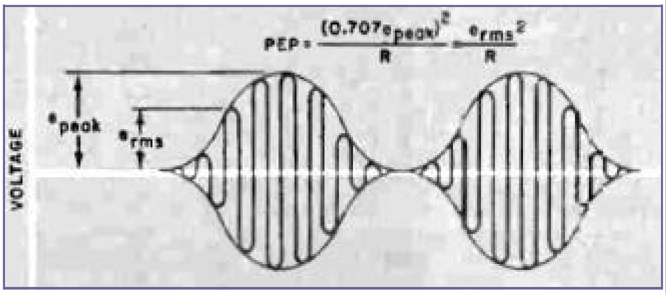

Fig. 8 - Diagram shows how two-tone SSB envelope can be used to calculate pep of SSB signal.

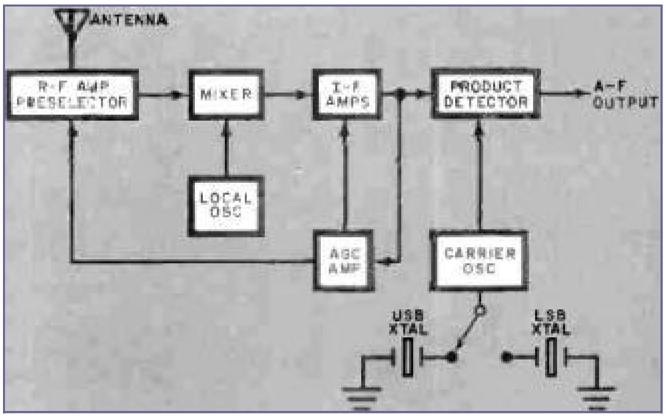

Fig. 9 - Basic SSB receiver is similar to other superhets. Note crystal switch to select sideband.

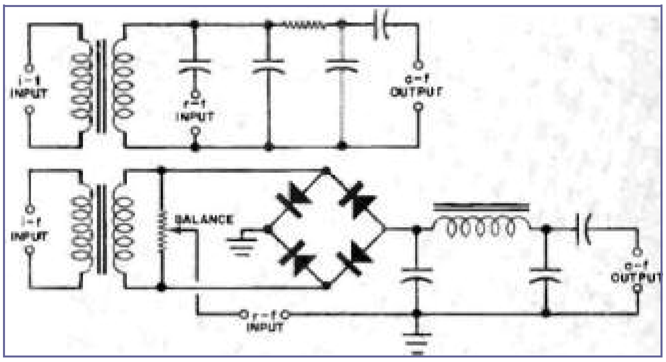

Fig. 10 - Two examples of types of product detectors that are used in SSB signal demodulation.

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ZS6ADY will be using the ZS100SARL special call sign for the week of 6 to 12 January to celebrate the 100th anniversary of the SARL. This call sign will be used on SSB, FT8, RTTY throughout the year. Operating times will be from 12:00UTC to 19:00 UTC starting on 40m and then changing bands every 1hour. 40m 20m 15m 10m. Dependent on band conditions and how busy it is, there may be longer periods on some frequencies.
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