История DCR по зарубежным источникам

Составитель: В.Т. Поляков RA3AAE

Январь 2015

https://groups.google.com/forum/#!topic/rec.radio.amateur.homebrew/S4wzbjk4xj8 —

Is this a bit garbled, or have I missed something? In the May 1961 issue of QST, there is an article entitled "Balanced Detector in a TRF Receiver". I have it, but I can't find it at the moment. It had a stage of amplification, a balanced mixer using something like a pentode (the 6SB7 sound about right), and it was in effect a "direct conversion" receiver. But it didn't use phasing, so there was an audio image.

(There were of course plenty of adaptors that used phasing to get rid of the audio image, and they could have been used this way, but I've never come across something in the tube age, ether directly or by reference.)

One could argue that this is the origin of modern "direct conversion", though the article does not use that term.

Realistically, it is just a variation on a regen receiver with regen set into oscillation. And as you, and others, have pointed out elsewhere in this thread, there were early attempts at using such a scheme for reception early on, and I've seen enough variation (and haven't seen original texts) to be unable to keep track of the various names for the same basic concept.

That 1961 article seemed an attempt at reviving the concept, and isn't really a surprise with all the talk of product detectors in the magazines and hobby in the previous 15 years or so.

The origin of the term "direct conversion" seems to be "Direct Conversion -- A Neglected Technique" by Hayward and Bingham, in QST for November 1968. It uses four hot carrier diodes in a double balanced ring mixer. I believe it references the 1961 article. This did set things afire, since after that most simple receivers for a number of years were direct conversion, until there was a turn back to simple superheterodyne receivers, fueled by the interest in crystal ladder filters. Obviously the technique did not originate with transistors, though they seemed the impetus for people to play with them in recent decades, but I do not think the term was applied until after this article.

The September 1969 issue of QST had "A Direct Conversion SSB Receiver" by Richard S. Taylor. It extended the Hayward article by adding a second mixer and a B&W phase shift network, so the unwanted sideband was knocked out considerably. (There was an article in Ham Radio magazine around the same time, for a simple CW transceiver with a phasing direct conversion receiver, but I don't know if it predates this QST article.)

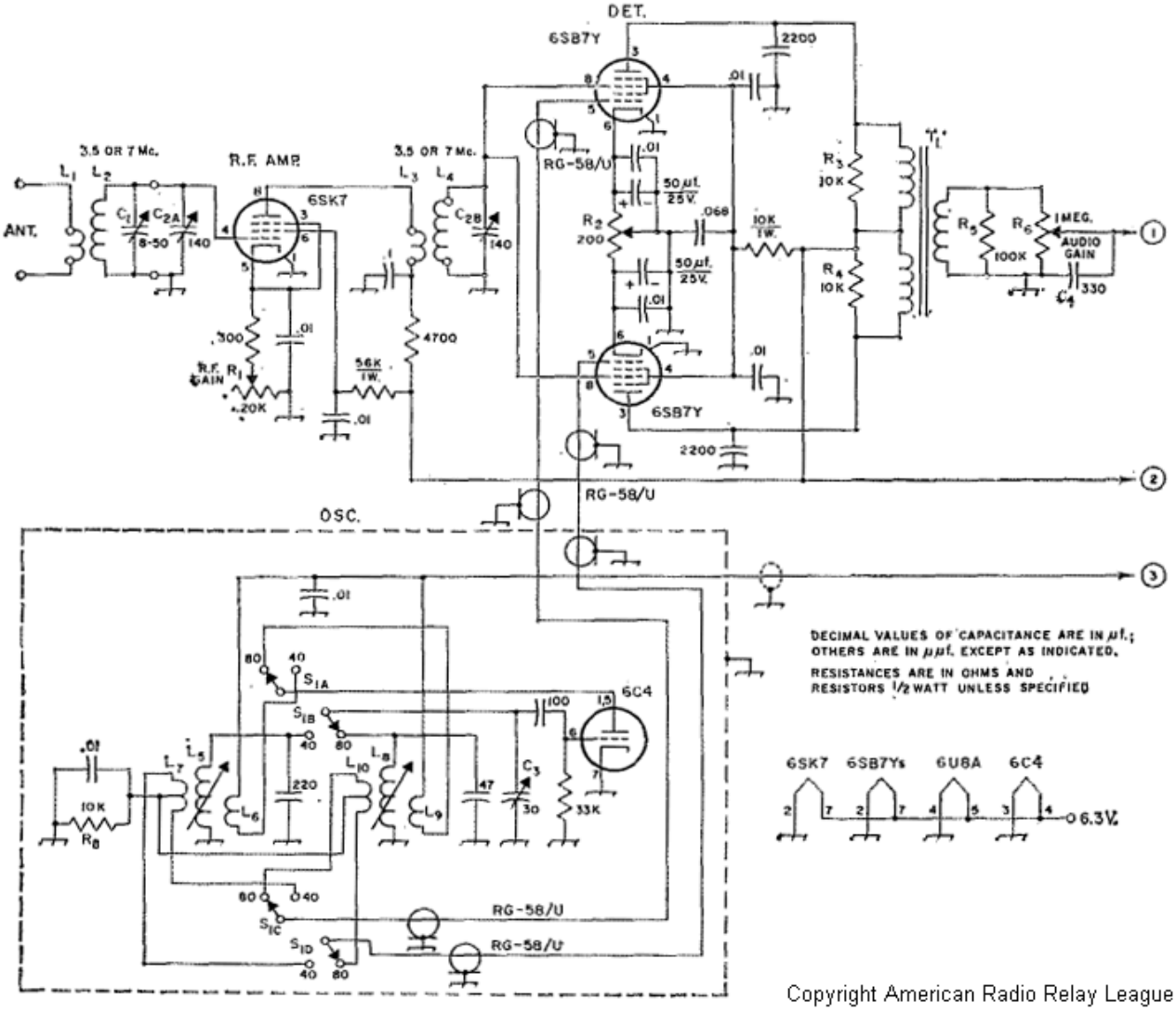
After the Hayward article, of course there were various attempts at making the scheme better, though all the effort went into different types of mixers. I don't think there was a major forward step until Roy Lewallen terminated the ring mixer (which admittedly had been done with mixers going to an IF) in his "Optimized QRP Transceiver" in QST for August 1980. That set the stage for Paul Breed's direct conversion phasing receiver in QST for January 1988, and Rick Campbell's various high performance direct conversion receivers in the 1990's.

Of course, the scheme is fairly common now in commercial circuits, where the scheme is used to get the signal down where an A/D converter can work for digital processing. I believe "Zero IF" is the term used in such circles.

Michael VE2BVW

http://theradioboard.com/rb/viewtopic.php?t=3877

James R. White, W2WBI, "Balanced Detector in a T.R.F. Receiver." *QST*, May 1961, pp 29-33.



Sorry for size of schematic, but did not scale down clearly. This article was mentioned in the article by Wes Hayward, W7ZOI and Dick Bingham, W7WKR, "Direct Conversion A Neglected Technique," *QST*, November 1968, pp 15-17, 156, that kick-started DC-receiver-mania.

73,

http://kr1s.kearman.com/
http://qrp.kearman.com/

http://forums.qrz.com/archive/index.php/t-234099.html — KL7AJ 01-23-2010, 10:28 PM

Most of us remember when the Direct Conversion (DC) receiver made its first appearance, it was considered a clever but crude way of doing things. Countless QST articles were published (and disparaged) by hams throughout the 1970s.

Things have changed. The DC receiver has become the standard of performance in nearly all scientific and military H.F. applications, where all unknown variables must be eliminated.

For example, at HIPAS Observatory, we had an ionosonde that had to operate simultaneously with our 67 MW ionospheric heater transmitter located barely 1000 feet away...without being totally crunched. We started out with some very expensive RACAL receivers in our ionosonde, at the time considered the best dynamic range receivers available at any cost. These only partially worked.

The perfect solution for us turned out to be the Direct Conversion receiver. Of course, we had to roll our own, because commercial grade DC receivers didn't exist. However, we discovered that many others were thinking along the same lines. The "Lock-in" amplifier, just becoming prevalent in ELF and ULF experiments at the time, was/is actually a DC receiver, but with two channels in quadrature.

By definition, a DC receiver has no images. There are no birdies. Anything you see on a DC receiver is the real thing.

However, a DC receiver can't just be slapped together. The local oscillator must be CLEAN and POWERFUL. Scientific grade DC receivers often use +27 dBm mixers....that's almost a WATT going into the front end! For amateur operation, the local oscillator should be about 100 dB stronger than the strongest anticipated R.F. signal you plan to encounter. This is a lot less than +27 dbm, but it's still "up there." And it must be CLEAN. Most hams who have contest-grade DC receivers use HP R.F.synthesizers for the local oscillator. You really need something about that good to have a DC receiver you'll be happy with. You can't do this with a free running Clapp oscillator!

I really became enamored with the DC receiver at HIPAS. I have one at home I use for all sorts of things....and yes, I'm using a surplus HP synthesizer. Fortunately, I didn't have to pay much for the thing...I repaired a "basket case".

You also want LOTS of stable audio gain, which, fortunately, is easy to come by with modern op-amps. Remember, also, that in a DC receiver, ALL your selectivity is determined by the audio stages! If you distribute all your filtering throughout the audio stages, you can get really sharp skirts, or stagger them a bit for really smooth audio quality. Or you can make one or more stages variable to achieve passband tuning.

Give the DC receiver a try, if you're looking for a great project. Eric.

— W1VT 01-24-2010, 12:49 AM

The first article I remember is this one by Wes Hayward W7ZOI.
Nov 1968 QST 15. Direct Conversion A Neglected Technique. Hayward, Wes, W7ZOI
As I was reading this thread I heard ZP6CW working Wes on 20 CW!

Примечания составителя

http://www.epanorama.net/sff/Radio/Communications/Synchronous%20Detection%20In%20Radio%20Recepption%20Part%201.pdf — Pat Hawker G3VA. Synchronous Detection in Radio Reception-1. Wireless World, September 1972. В статье приведены основополагающие схемы Д. Такера (1947) и В. Хейворда и Д. Бингхема (1968).

Кстати ламповые АМ синхродины, подобные Такеровскому, делал у нас Е. Г. Момот еще до войны, в конце 30-х. Он же описал фазовый метод подавления одной боковой, на 30 лет раньше Тейлора.

http://www.microwavejournal.com/articles/3226-on-the-direct-conversion-receiver-a-tutorial — выдержка из статьи, касающаяся истории:

Very much like its well established superheterodyne receiver counterpart, first introduced in 1918 by Armstrong,[1] the origins of the direct conversion receiver (DCR) date back to the first half of last century when a single down-conversion receiver was first described by F.M. Colebrook in 1924,[2] and the term homodyne was applied. Additional developments in 1947 led to the publication of an article by D.G. Tucker,[3] which first coined the term synchrodyne, for a receiver which was designed as a precision demodulator for measurement equipment rather than a radio. Another paper by Tucker in 1954[4] reports the various single down-conversion receivers published at the time and clarifies the difference between the homodyne (sometimes referred to as coherent detector) and the synchrodyne receivers -- the homodyne receiver obtains the LO directly (from the transmitter, for example), whereas the synchrodyne receiver synchronizes a free-running LO to the incoming carrier.

Over the last decade or so, the drive of the wireless market and enabling monolithic integration technology have triggered research activities on direct conversion receivers, which integrated with the remaining analog and digital sections of the transceiver, have the potential to reach the "one-chip radio" goal. Besides, it favors multi-mode, multi-standard applications and thereby constitutes another step towards software radio.

1. L. Lessing, "Man of High Fidelity: Edwin Howard Armstrong, a Biography," Bantam Books, New York, 1969.

2. F.M. Colebrook, "Homodyne," Wireless World and Radio Rev., 13, 1924, p. 774.

3. D.G. Tucker, "The Synchrodyne," Electronic Engng, 19, March 1947, pp. 7576.

4. D.G. Tucker, "The History of the Homodyne and the Synchrodyne," Journal of the British Institution of Radio Engineers, April 1954.

5. A.A. Abidi, "Direct-conversion Radio Transceivers for Digital Communications," IEEE Journal of Solid-state Circuits, Vol. 30, No. 12, December 1995.

Про Армстронга здесь правда, остальное – нет! На самом деле «the origins of the direct conversion receiver (DCR) date back» далёким 1899 (Н. Тесла) и 1902…4 (Р. Фессенден). См. мои статьи «Приёмники Н. Тесла» в CQ-QRP 2006 и «Bravo Ocean» на сайте cqham.ru.

http://news.cqham.ru/articles/detail.phtml?id=738

http://news.cqham.ru/articles/detail.phtml?id=773