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The SIGNAL/ONE CORPORATION was originally started in Florida as an N. C. R. subsidiary.

They believed that there was a need for a sophisticated solid state transceiver for professional and amateur radio operators, governmental and military services throughout the world. This belief has been confirmed by the broad-based reception of the original CX-7.

This uniquely conceived transceiver was made possible thru the application of new technology, a spin-off of the Aero-space industry. The result was a solid state radio capable of transmitting and receiving in a variety of communication modes worldwide, and having all the other usual external equipment built into one unit. Some basic advantages of this radio were to be as follows:

A. To contain everything needed for transmitting and receiving in a single unit. This not only is very compact but provides for a more efficient operation. External wiring, normally required when external equipment is used, is kept to an absolute minimum.

B. Digital frequency counter - this clearly shows one's transmitting and/or receiving channel as an illuminated 4-digit number rather than having to interpolate between two lines on a scale.

C. Two built-in frequency controls allowing for completely independent control of the received from the transmitted frequency. All other transceivers on the market lack this feature.

D. Built-in keyer - with this feature, one can automatically send dots and dashes to compose Morse code characters. This is the only piece of equipment of any type to have a built-in keyer.

E. Broadband output - this permits transmitting without having to adjust the transmitting section when changing from one frequency to another. This is a unique feature among the leading manufacturers of amateur radio equipment.

F. RF clipping - a complex form of processing speech to provide improved intelligibility, providing an increase in transmitted strength of substantial proportions. (See pp. 6 & 7 F. 1-5)

The ideas were good but the Florida firm found that the engineering proved to be more extensive than expected and the radio was marketed before the engineering was completed. The Florida venture was unsuccessful because of incomplete designing, unreliability in the field, and difficulty of service in the shop. The company was sold to a California corporation where a few minor modifications were made butthe basic problems remained. (See pp. 7 & 8 F. 6-17)

Again it was unsuccessful and the company went bankrupt. At a public auction Don Roehrs, Jr., representing a number of interested investors, bought all designs, inventories and assets of the SIGNAL/ONE CORPORATION; this inventory being adequate to build portions of 10 to 200 radios, depending on the part.

The number one priority was to improve the overall reliability of the radio, that being the major downfall in the past.

Servicing the old radios that were produced in Florida and California provided an invaluable source of information for determining and improving the reliability problems. During the servicing, far more problems were encountered than initially were expected. After substantial time delays, numerous problems were solved.

A typical problem was a slight but annoying frequency (tone) shift encountered during certain modes of operation. This was eventually traced to an inaccuracy in the power supply and necessitated a redesign of a substantial portion thereof.

A second problem, which caused spontaneous unwanted transmissions, was "spurious oscillations." This type of problem is in general very difficult to solve because no single part in and of itself in the radio is at fault; rather, its causes are spread throughout a major portion of the radio. Fortunately, our recently purchased Tektronix Spectrum Analyzer costing $8,500.00, proved to be of tremendous value in tracing these sources down.

Some areas of reliability were of such a serious nature that a redesign of whole portions of the radio became necessary. A good example of this is evidenced in the final amplifier section which formerly housed the only vacuum tube in the old radio. With the cooperation of Motorola in Phoenix, the tube has been replaced by reliable transistors. (See pp. 8
F. 18-28

In addition to the aforementioned areas of concern, some further refinements were deemed desirable in order to maintain a standard of present-day technology.

One such refinement is the replacement of the old 4-digit "NIXIE" readout frequency display by a 6-digit Hewlett-Packard "LED" display with greater accuracy and improved readability.

To further enhance ease of operation, a more versatile Morse code keyer was developed which allows for variation in style between operators. (see pp. 8, 9 & 10, F. 29-43)

Naturally, all the advantages of the old radio have been incorporated into the new model.

Cures have now been found for virtually all of the reliability problems and their implementation have been completed.

We now find that an improvement in the IF Circuit Board will be required before the CX-11 will be ready for full production.

Several CX-11's have been shipped to our distributors, Payne Radio in Springfield, Tennessee, and Mr. Carl Fjall, Side Band Communications, Stockholm, Sweden, for evaluation and sales. They found the problem of spurious signals to be minor but, nevertheless, a bit of annoying interference that they felt should be eliminated before production should be continued.

The basic problem stems from the use of MOSFETS as Mixers in deriving the second L. O. signal from the PTO outputs and the 34.2 MHz signal(s). Ideally, the mixing process should suppress the 34.2 MHz signal so that it cannot cause trouble later down the line -- that is, at the Front End Board. Unfortunately, the MOSFET Mixers as used on the IF Board do not provide a "dead-end" for the 34.2 MHz signal, they amplify it instead.

A Bankpass Filter had been incorporated to pass the desired 31 MHz signal while rejecting the 34.2 MHz signal; but is really not very effective due to the narrow separation between the two signals.

The end result is that a large amount of 34.2 MHz energy is getting to the Front End Board where it mixes with the harmonics of the 41 - 69 MHz Bandswitch Oscillator (and numerous other strong internally generated signals) to produce all those spurs. This problem will especially be noticeable during dual receive when yet another signal is added to the Front End.

Our plan of attack is to use double-balanced Mixers in place of the MOSFETS. These will be of the inexpensive diode type, and are specified to suppress the 34.2 MHz signal by at least 45 DB. Actual measurements made by us have substantiated the manufacturer's claims. In addition, we plan to update the previously mentioned Band-pass Filter for additional rejection. Another good modification that we have always wanted to put into the CX-11 concerns the Dual Receive Mode. Basically, it keeps the two "A" and "B" Local Oscillator Signals separate right up to the second IF Mixer; currently, these two signals are combined very early in the game making it quite impossible to prevent any undesired interactions which give rise to spurs.

The old IF Board cannot be altered for improved performance -- we have already pushed it to its limits. An entire redesign of this Board is the only answer, not only to incorporate the ideas that we have listed -- the Noise Blanker, Mode Switch IF Amplifier and Transmit Circuitry contained on this Board should all be updated. The required changes are for the most part accompanied by a reduction in complexity and an increase in reliability. Especially important to production is a certainty that the radio would be easier to align, and would be more repeatable.

It is our intention to continue manufacturing sub-assemblies, wiring harness and all other completed Circuit Boards while the engineering required on the IF Circuit Board is being completed. The delay caused by this redesign will be about six weeks with an additional six weeks to build and install this unit.

Due to our present cash flow, we feel it wise to work with a skeleton work force until our engineer is positive of a final completion date. At that point we would acquire the additional employees to meet our production requirement.

Based on the above, the success of this product depends solely on its reliability and performance to the consumer. Therefore, it is obvious that the redesign of the IF Circuit Board must be taken now to insure the success of the CX-11.

FOOTNOTES

Further proof of loyalty and acceptance of the CX-7 and CX-11 may be found in a review of present owners who have ordered or have sent radios to our company for service and upgrading. To name a few:

1. National Security Agency
   Fort Meade, Maryland

2. Air Force Academy
   Colorado Springs, Colorado

3. Senator Barry Goldwater
   Washington, D. C.

4. Canadian Research Center
   Shirley's Bay
   Ottawa, Ontario, Canada

5. King Hussein
   Jordanian Embassy
   Amman, Jordan

6. Swedish Tele-Communications Center
   c/o Carl Fjall
   Stockholm, Sweden

7. Law Offices - Frederick J. Lawson
   Union Bank Plaza
   Sherman Oaks, California

8. W. H. MacIvor
   Senior Executive Vice President & Cashier
   The First National Bank of Pennsylvania
   Erie, Pennsylvania

WA2JSW
Howard

The average charge that has been paid or authorized to upgrade the present CX-7 radios with the improvements designed for the new CX-11, is over $750.00.

Additional advantages of old radio:

1. Built-in FSK - this is used for sending teletype.

2. Transmitter offset - permits small excursions in transmitted frequency without affecting the basic frequency setting of the PTO. Extremely desirable for Morse code transmissions.

3. Noise blanker - very effective for reducing various types of noise (such as from gasoline engines or fluorescent lights) which would otherwise block reception of received signals.

4. I.F. Shift - effective in the reduction of interference caused by other signals being transmitted on adjacent channels.

5. Optional frequencies - through the use of plug-in devices, operation is possible on many frequency bands. This makes the radio capable of being used by a wide variety of services such as military, government, or international broadcast.

Problem areas of old radio:

6. Overall poor reliability:

   a) Power supply was unprotected. If any part in the radio drew excessive current, not only did that part become destroyed, but the source of power for the entire radio failed.

   b) The transistors used were IGFET's which are extremely prone to static charges which results in their destruction.

   c) In various parts of the radio, a device had to be hand-selected to fit that circuit. In other words, minor variations from transistor to transistor could cause the radio to operate improperly.

   d) Used "AMP" connectors for wiring in the circuit boards. Because of poor design, these connectors easily became loose and caused obvious problems.

   e) Wiring was done using wire so thin that a slight twisting would cause the wires to break.

7. Frequency shift is discerned as a change in pitch of the received signal when changing PTO's.

8. The Morse code keyer was unsuitable for use due to its non-flexability in allowing for operator variation in style of sending.

9. The "NIXIE" readout frequency counter display would have the last digit flicker between 2 numbers at such a high rate as to make frequency determination troublesome.

10. The broadband output could only be used under a small range of conditions, thus requiring tedious and time consuming adjustment of the final amplifier section each time a frequency change was made.

11. The FSK which permits teletype operation was unusable because it was positioned on the wrong sideband.

12. The noise blanker circuit was prone to oscillations.

13. IF shift control on transmit was too delicate and a correct setting was nearly impossible to make.

14. The radio was incompatible with a "phone patch." This is used to link the radio into the telephone lines.

15. False signals would be received on the 160 m. band.

16. The audio response on received signals was inadequate.

17. The ALC was incompatible with other equipment on the market.

Additional problems encountered on old radios:

18. Display flicker on TR or RT transitions.

19. Switching transients on S2 Board causing BFO and IF malfunctions.

20. Improper AGC action, hang time, etc., and "S" meter inacuracy.

21. Numerous spurious signals on various frequency Bands.

22. Poor noise figure in receiver front end.

23. Inadequate receiver dynamic range.

24. High intermodulation distortion.

25. Relay contact arcing when used with External Linear Amplifiers.

26. Out-of-tolerance crystals prevented calibration and affected transmit audio response.

27. Inaccurate clipping control characteristics traced to poor worst-case tolerance design.

28. Every Circuit Board could stand additional engineering improvements too numerous to mention.

New ideas and improvements:

29. Overall reliability is vastly improved:

   a) Power supplies are now fully protected so that if one part fails, the power supply will remain intact.

   b) Transistors are now fully protected dual gate MOSFET's or J-FETS.

   c) Circuitry has been redesigned so that minor variations from device to device will not affect the radio's operation.

29. d) DuPont Berg pins are used to wire in the Circuit Boards. These are spring loaded, gold-plated devices of the highest reliability.

e) If a component does fail, it can be changed in seconds due to the use of gold-plated plug-in sockets for each component.

f) Using larger #24 diameter wire has for the most part solved the problem of broken wires.

30. Completely Solid State Broadband Transmitter features a truly rugged linear amplifier taxed to only 50% of its 300 Watt output capability.

31. Fully protected power supply features unique "double knee" current fold back limiting high temperature shutdown, crow bar over-voltage fail safe circuitry and rugged power transformer with tape wound Hipersil core for highest efficiency.

32. Six computer optimized eliptic-function filters insure low harmonic radiation regardless of transmit frequency.

33. Transmit down converter utilizes double active balanced Mixer to provide high 3rd order intermod rejection prior to final amplification.

34. High speed dual reed relays enabling true break-in CW capabilities. Ideal for use with ETO Alpha Linears.

35. Hewlett Packard 'LED: 43" red, amber, green, digital counter - human factor engineered, direct, instantaneous frequency readout to 100 Hz.

36. Completely independent ± 2 KHz transmit and receive offset tuning controls; with push button command for instant switching to or from normal synchronous operation - among other things, this allows true CW transceive.

37. New-concept dual conversion Front End utilizes two active double-balanced J-FET Mixers preceded by a Broadband low-noise J-FET Amplifier -- this is the engineering masterpiece which enables the CX-11 Receiver to have the seemingly impossible combination of "none better" sensitivity and the ultimate in dynamic range.

38. 1500, 1000, 400 and 100 Hz active audio Bandpass Filters plus independent tuneable peak/notch filter combine with already outstanding selectivity characteristics provided by triple crystal filtering and the unique IF shift feature to supply the operator with the most powerful and versatile system available for overcoming QRM problems.

39. All popular modes of operation:

* Upper and Lower Sideband.

* True Break-in CW

* FSK Modulator allows use with 2125/2975 frequencies.

40. All transistors, IC's and Diodes --- employ the gold-plated Berg/DuPont® plug/socket system as used in all Tektronix® Instruments, assuring fast field serviceability.

41. Mil-grade Stainless Steel hardware throughout. No sheet metal screws, swaged Stainless Steel inserts in lieu of aluminum threads.

42. Instrument grade components. All components thoroughly screened and burned-in prior to installation.

43. Glass epoxy etched Circuit Boards --- same G-10 material used in military and space equipment.