Counterpoint:

Jamming: It's a sticky issue

Ed. Note: Following publication of an article entitled "Jamming: Will It Be Tactically Effective?" in the summer 1978 issue of TAC, several letters and articles from Signal personnel in the field were sent to our staff. One of those articles appeared in the fall issue ("The Electronic Piranha Can Jam" by LTC Don "Flash" Gordon and CPT Bill Anton). The following articles were submitted in response to both the jamming and piranha articles.

Watts the answer?

by CPT David M. Fiedler

In Mr. Follis' article, "Jamming: Will It Be Tactically Effective?," the importance of jamming-to-signal (J/S) and signal-to-noise (S/N) ratios is properly stressed. The calculations are typical of an AN/VRC 12 series radio being jammed by a 1,000-watt threat jammer.

These calculations assume, however, that the AN/VRC 12 is transmitting a signal at a 35-watt output level. Apparently overlooked are the various circumstances resulting in different power output levels which could create a much worse J/S ratio than talked about in Mr. Follis' article.

Even the use of the steerable null antenna processor (SNAP) is not sufficient to correct poor transmitter performance. Compounding the problem is the fact that unit radio operators have no way of telling whether their antennas are properly matched and their ratio of forward to reflected power is within limits.

The solution to the transmitter performance problem is the use of the AN/URM 182 in-line wattmeter. Unfortunately, this wattmeter will not be deployed to lower levels where operators can use it as often as necessary.

I have developed another solution which has been adopted by the National Guard Bureau and is under consideration for use in the active Army. While it was originally designed to check the AS-1729 antenna system by checking for proper signal propagation, this method also measures signal strength and, hence, transmitter power output. The method should increase the communicator's effectiveness and the anti-jamming capability of field units.

The procedure is rather simple and can be accomplished in just a few steps. First, a known good communications system must be installed. Next, a radio transmitter unit should be set to high power and keyed. The current reading in each frequency band of the MX-6707 on the voltmeter should be recorded.

At this point, the antenna should be replaced with the one to be tested. Again, current readings should be taken with this second antenna and compared with those from the good antenna. If the readings are not within 10 per cent of the known good readings, the antenna should be replaced.

This procedure can be used to test all antennas within the unit. Important to note, during the testing, nothing should be moved or changed except the antenna whips to be tested. Also, as part of the control of results, the antenna matching unit base should be functioning properly (i.e., retuning when the frequency is changed) and the coaxial cable between the radio and antenna base must be properly connected and in no way defective.

To explain how this "test" works, when the radio transmitter is keyed, radio frequency energy is sent to the antenna base through the coaxial cable. In turn, this energy is coupled to the antenna whip, which has been electrically tuned by the matching base for optimum signal radiation. A defective antenna will result in little or no signal radiation.

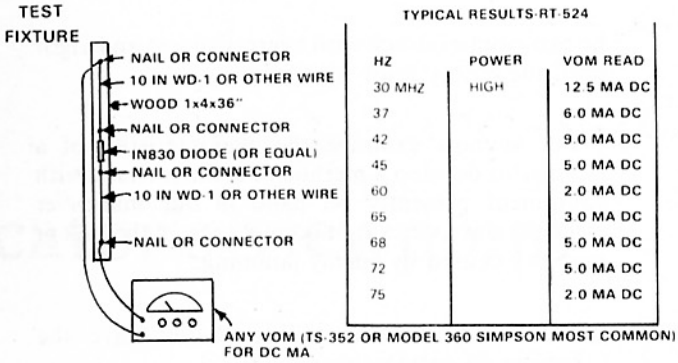
When the test fixture is mounted six feet from the transmitting antenna, the strength of the radiated signal can be measured on the voltmeter. The radio transmission induces a current proportionate to the radiated signal in the voltmeter leads and in the 10-inch lengths of WD-1 wire in the test fixture. The diode converts this induced radio frequency to a DC current, which is then measured using the DC matrix function of the voltmeter.

By starting with a known good transmitter antenna and coaxial cable, a "baseline" of signal strength readings for a specific antenna/radio combination can be established at various frequencies. If all components of the system except the antennas to be tested are then allowed to remain fixed, the respective signal strength readings (DC matrix) can be compared. Defective antennas will have a greatly reduced radiated signal and should be replaced. Antennas with close readings to the established baseline are not defective.

Although the AS-1729 whip is typically tested with the AN/URM-182 in-line wattmeter, the wattmeter is not usually available below battalion level. However, the testing can be accomplished by following the procedure outlined above. Company-sized units can construct the detector device (Figure 1) for about $2. This device, when used with any standard voltmeter (for example, the TS-352), will allow company level communications personnel to measure the radiated radio signal.

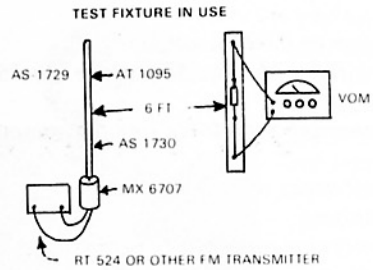
In addition, the proper functioning of other components can also be determined by using the detector device since the DC matrix level will be reduced when compared to a known good system.

The impact of this method of unit level testing on unit readiness is dramatic. Units using the method and device have reduced the rate of defective installed radio systems from 52 per cent to less than one per cent. And the "in-house" testing capability will ensure that a 35-watt output level for transmitting the AN/VRC 12 can also be reached.



TYPICAL RESULTS-RT-524

HZ	POWER	VOM READ
30 MHZ	HIGH	12.5 MA DC
37		6.0 MA DC
42		9.0 MA DC
45		5.0 MA DC
60		2.0 MA DC
65		3.0 MA DC
68		5.0 MA DC
72		5.0 MA DC
75		2.0 MA DC



(1) INSTALL KNOWN GOOD COMMO SYSTEM
(2) SET RT UNIT TO HIGH POWER
(3) KEY TRANSMITTER
(4) RECORD CURRENT READING IN EACH FREQUENCY BAND OF MX 6707 ON VOM
(5) REPLACE ANTENNA WITH ANTENNA TO BE TESTED
(6) MATCH READINGS AT EACH FREQUENCY WITH KNOWN GOOD READINGS
(7) IF READINGS ARE NOT WITHIN 10% OF KNOWN GOOD READING REPLACE ANTENNA
(8) REPEAT 2-7 FOR ALL ANTENNA IN UNIT

Piranha get FISTful

As project leader for the steerable null antenna processor (SNAP) at Fort Monmouth, NJ, I have a few comments for LTC Gordon and CPT Anton.

While it is true that SNAP can be defeated by use of the multiple jammers, just what effect this will have on overall division operations is the question.

The problem is purely military. Suppose that the 313th's jammers are operating in the aggressive manner LTC Gordon describes—2 to 5 kms from the forward edge of the battle area. By using the procedures shown in the 50th Armor Division electronic warfare counterattack plan, which follows, front line companies and battalions will have 81 mm and 4.2-inch mortar falling on jamming locations within minutes.

The more powerful the jammer and the closer it is to the forward edge of the battle area, the faster it can be located and eliminated by mortar, artillery and air attack. In the meantime, the SNAP critical nets are protected and will continue to operate with only minimal interference.

50th Armor Division - New Jersey Army Reserve, National Guard Electronic Warfare Counterattack Plan (draft)

Much has been written in the past several years concerning methods and results of electronic warfare attack. These articles focus mainly upon the Soviet/Warsaw pact capability of interfering with our VHF-FM command, control and coordination (C^3) communications nets.

The Soviets have produced and deployed a large variety of intercept, direction finding and jamming equipment in order to take advantage of our reliance on the VHF-FM spectrum for tactical communications.

We, on the other hand, have deployed a small number of ground and airborne systems for use at division and corps level to locate enemy emitters and develop intelligence information from them (electronic order of battle). We have also developed large numbers of "on line" voice encryption equipment in order to thwart the enemy voice intercept and analysis capability by making our C^3 radio nets secure.

Our success in developing "on line" encryption gear has, of course, caused a response from the Soviets. This response has been production of more and more powerful jammers on the theory that, if we can't gain intelligence information from the C^3 nets, we will just render them useless by jamming them.

Our response to the increased jamming threat has not been overwhelming and basically no equipment has been fielded to counter it. Some engineering work has been done in the fields of directional antennas and steerable null antenna processors (SNAPs) to reduce the effects of jamming signals; however, this equipment will not be fielded for many years.

What then can a company, battalion or brigade commander do in order to counter an array of enemy jammers which have rendered his command communication inoperative? He can, like soldiers always have, do two things: either assume a defensive posture and accept alternate means of communication, such as messenger and wire, and their corresponding lack of speed and mobility; or

he can counterattack with aggressiveness and vigor until the enemy must withdraw.

Let us now examine the characteristics of a jammer to develop a method of counterattack with equipment presently on hand in our maneuver elements since we cannot possibly accept the lack of mobility caused by enemy jamming.

The enemy jammer will probably have the following characteristics:

High power (up to 2,000 watts)
Cover entire VHF-FM frequency range (30-76 MHz)
Capable of jamming more than one frequency at a time
Directional antennas of several types
Vehicular mounted
Vehicle or generator powered
Several modes of jamming (gulls, tones, bagpipes, noise, voices, CW, etc.).

Knowing this, the problem then becomes how to locate and destroy these jamming stations since destruction is always the best countermeasure.

A jammer by definition is a strong radio transmitter tuned to the same frequency as a friendly net and interfering with it. By using its own transmission characteristics against it, we can at company, battalion and brigade levels, locate jammers interfering with our nets and destroy them.

If a jammer is in fact interfering with us, we automatically know several things about it: the transmit frequency; the fact that it is within some close proximity to our position (within 5-15 km in most cases); and that it is the most powerful signal arriving at our receive position. Knowing this, how can front line troops locate the jamming station with the limited assets on hand? The answer is through use of antenna loop AT-784/PRC.

Antenna loop AT-784/PRC is used in conjunction with AN/PRC-25, AN/PRC-77 and AN/VRC-12 radio sets or their equivalents. It is a "homing" device that enables the operator to find the direction of a transmitted signal within the 30-76 MHz range. The unshielded loop antenna is used to pick up a signal and the sense whip antenna is used to determine the direction of the signal. The antenna loop is not provided with an azimuth indicator since highly accurate bearings are not generally required for "homing" purposes. A compass is used to provide azimuth readings by siting in the direction of the indicated bearing. For more details on the operation of the AT-784/PRC, see TM 11-5985-284-15.

Antenna loop AT-784/PRC is issued at the company and battalion level in the combat arms. Bearings taken from two or more locations will indicate location of the jammer at the crossing points. If done correctly, jammer locations can be found within a few hundred meters.

Once these bearings are plotted on a map, the commander is then in a position to take offensive action. These actions are as follows:

Company commander - Have fault isolation teams observe areas of intersection to look for antennas and vehicles and listen for generator sounds. Once located, the company commander can fire his own 81mm mortars or request air, 4.2 inch mortar or direct support artillery on the jammer as required.

Battalion commander - Have company fault isolation teams located in the area of intersection look for jammers or have battalion scout platoon scout intersected areas. Once jammer is located, use air attack, 4.2-inch mortar or direct support artillery to attack jammer location.

Brigade commanders - Assist company and battalion commanders by providing air and direct and general support artillery attacks on targets located by company teams and battalion scout platoons.

With the aid of bearings taken with the antenna loop AT-784/PRC, both air and ground scouts have been able to locate jamming stations in very short times. Once located, jammers are not hard to destroy by fire since they are not often mounted in armored carriers.

Locating jammers at the company/battalion level using AT-784/PRCs is a particularly desirable method of engagement because it allows commanders to attack targets within range of organic weapons immediately before they can be moved. Otherwise, the commander must wait for target locations to be supplied from division or corps intelligence sources, which are often supplied after the jammer has changed location.

Introduction of the new fault isolation by semiautomated techniques (FIST) concept and TACFIRE will also enable long range fires to eliminate jammers much more effectively because of their shorter processing times.

By using this method, commanders now have an effective method for electronic warfare counterattack that does not involve sophisticated electronics that they do not understand. Rather, a solid target can be destroyed.

For installation and operations instructions, refer to Appendix 1 from TM 11-5985-284-15.