The News of the

SWAMP FOX CONTEST GROUP

Tales From the Swamp

Editor: Scott Brown, N2OG

AUGUST 2022

Presidents Corner

On July 31st our President, **Ed K3DNE w. XYL (Kathrin) and 2nd harmonic (Derek) and puppy (Yogi)** hosted the First Annual Eyeball BBQ. The location was at their beautiful, peaceful residence on Lake Greenwood. Everyone arrived around 2PM. We enjoyed BBQ pork and good fellowship. Guests included, Bill, N4IQ, Dave, NJ4F, Ted K7OM, Bob, AC4MC, Scott, KG9V, Scott, N2OG and John, K4FT. We had great weather, a nice breeze kept the temperature comfortable with sunny skies and no rain during the BBQ. We traded stories and enjoyed getting to know one another. During our time together we kicked around the idea of making the BBQ an annual event which could be held at different locations around the state. If you think you could host this event next year, contact Ed and show your interest. Ed gave us a look at his awesome station set up. Ed has two towers and a variety of wire antennas connected with heavy RG213 or LMR 400 to his Yaesu FT-101D and a Yeasu Quadra Amp. I don't think one could ask for much more.

Here is Ed, Kathrin and Derek in their backyard on the shore of Lake Greenwood.

Nothing blocking radio waves here! And no RFI interference!
Thanks Ed for hosting a great day!

Ed's house is at the end of the road so it is very peaceful and quite.

Your Antennas Health Checkup

Lets ask ourselves some questions about our antennas

by, antenna-theory.com

An antenna is a type of tuned circuit consisting of both capacitance and inductance. At resonance, capacitive and inductive impedance are equally balanced - in a sense canceling each other out. At this point the antenna appears to be entirely resistive. The apparent resistance is a combination of loss resistance (for example in the feedlines and antenna elements) and radiation resistance.

The inductance and capacitance of an antenna are determined by a number of factors, including construction materials, height above earth, and its dimensions. Of these, dimensions are usually the major feature affecting resonant frequency. For example, operating on HF requires an antenna with much larger elements that when operating on VHF.

Ideally, antennas are operated close to their resonant frequency. However, this would effectively result in a limited bandwidth being available for use.

Possible solutions to this problem are to use a "thicker" element, or to use a different antenna type. Does you antenna only work well over the entire band or not? Are you able to adjust your antennas resonance effectively between the CW portion and the Phone portion? All the little things add up to better scores.

Bandwidth is another fundamental antenna parameter. Bandwidth describes the range of frequencies over which the antenna can properly radiate or receive energy. Often, the desired bandwidth is one of the determining parameters used to decide upon an antenna. For instance, many antenna types have very narrow bandwidths and cannot be used for wideband operation.

Bandwidth is typically quoted in terms of VSWR. For instance, an antenna may be described as operating at 100-400 MHz with a VSWR<1.5. This statement implies that the reflection coefficient is less than 0.2 across the quoted frequency range. Hence, of the power delivered to the antenna, only 4% of the power is reflected back to the transmitter. Alternatively, the return loss S11=20*log10(0.2)=-13.98 dB.

Note that the above does not imply that 96% of the power delivered to the antenna is transmitted in the form of EM radiation; losses must still be taken into account.

Also, the radition pattern will vary with frequency. In general, the shape of the radiation pattern does not change radically.

There are also other criteria which may be used to characterize bandwidth. This may be the polarization over a certain range, for instance, an antenna may be described as having circular polarization with an axial ratio< 3dB (less than 3 dB) from 1.4-1.6 GHz. This polarization bandwidth sets the range over which the antenna's operation is approximately circularly polarized.

The bandwidth is often specified in terms of its fractional bandwidth FBW. The FBW is the ratio of the frequecny range (highest frequency minus lowest frequency) divided by the center frequency. The antenna Q also relates to bandwidth (higher Q is lower bandwidth, and vice versa).

To give some concrete examples of bandwidth, here is a table of the bandwidths for common antenna types. This will answer such questions as "what is the bandwidth of a dipole antenna?" and "which antenna has a higher bandwidth - a patch or a spiral antenna?". For a fare comparison, we set the center frequency for each antenna to 1 GHz (1000 MHz).

Linear Polarization

Let's start by understanding the polarization of a plane electromagnetic wave.

A plane electromagnetic (EM) wave is characterized by electric and magnetic fields traveling in a single direction (with no field variation in the two orthogonal directions). In this case, the electric field and the magnetic field are perpendicular to each other and to the direction the plane wave is propagating. As an example, consider the single frequency E-field given by equation (1), where the field is traveling in the +z-direction, the E-field is oriented in the +x-direction, and the magnetic field is in the +y-direction.

$$\mathbf{E} = \cos\left(2\pi f\,(t - \frac{z}{c})\right)\hat{\mathbf{x}} \qquad (1)$$

In equation (1), the symbol $\hat{\mathbf{x}}$ is a unit vector (a vector with a length of one), which says that the E-field "points" in the x-direction.

A plane wave is illustrated graphically in Figure 1.

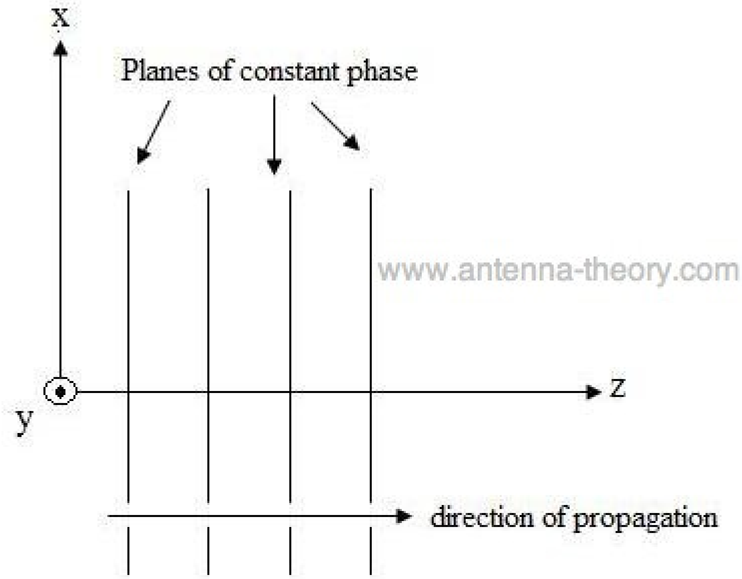

Figure 1. Graphical representation of E-field travelling in +z-direction.

Polarization is the figure that the E-field traces out while propagating. As an example, consider the E-field observed at (x,y,z)=(0,0,0) as a function of time for the plane wave described by equation (1) above. The amplitude of this field is plotted in Figure 2 at several instances of time. The field is oscillating at frequency *f*.

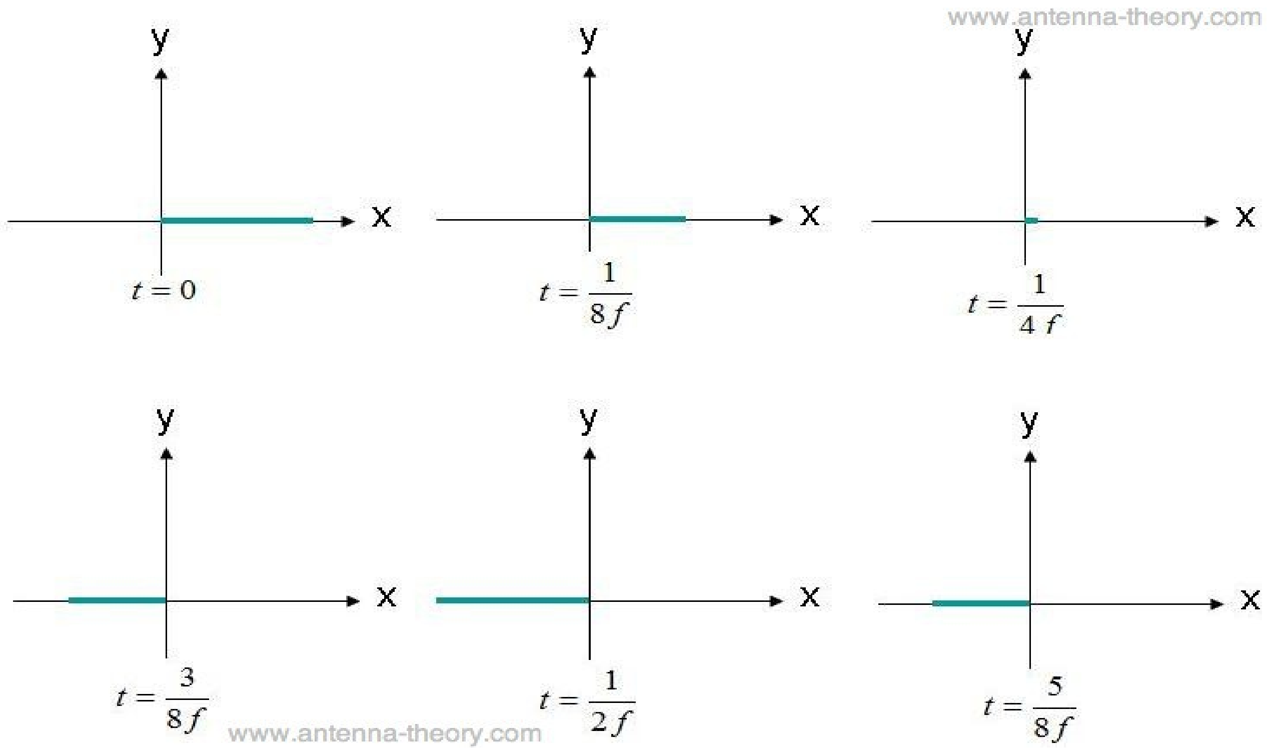

Figure 2. Observation of E-field at (x,y,z)=(0,0,0) at different times.

Observed at the origin, the E-field oscillates back and forth in magnitude, always directed along the x-axis. Because the E-field stays along a single line, this field would be said to be **linearly polarized**. In addition, if the x-axis was parallel to the ground, this field could also be described as "horizontally polarized" (or sometimes h-pole in the industry). If the field was oriented along the y-axis, this wave would be said to be "vertically polarized" (or v-pole).

A linearly polarized wave does not need to be along the horizontal or vertical axis. For instance, a wave with an E-field constrained to lie along the line shown in Figure 3 would also be linearly polarized.

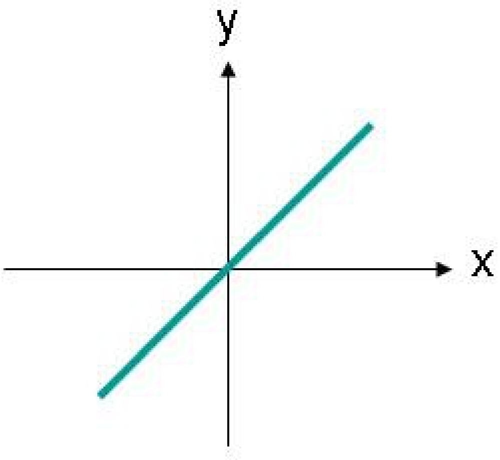

Figure 3. Locus of E-field amplitudes for a linearly polarized wave at an angle.

The E-field in Figure 3 could be described by equation (2). The E-field now has an x- and y- component, equal in magnitude.

$$\mathbf{E} = \cos\left(2\pi f\,(t - \frac{z}{c})\right)(\hat{\mathbf{x}} + \hat{\mathbf{y}}) \qquad (2)$$

One thing to notice about equation (2) is that the x- and y-components of the E-field are in phase - they both have the same magnitude and vary at the same rate.

Circular Polarization

Suppose now that the E-field of a plane wave was given by equation (3):

$$\mathbf{E} = \cos\left(2\pi f\,(t - \frac{z}{c})\right)\hat{\mathbf{x}} + \sin\left(2\pi f\,(t - \frac{z}{c})\right)\hat{\mathbf{y}} \qquad (3)$$

In this case, the x- and y- components are 90 degrees out of phase. If the field is observed at (x,y,z)=(0,0,0) again as before, the plot of the E-field versus time would appear as shown in Figure 4.

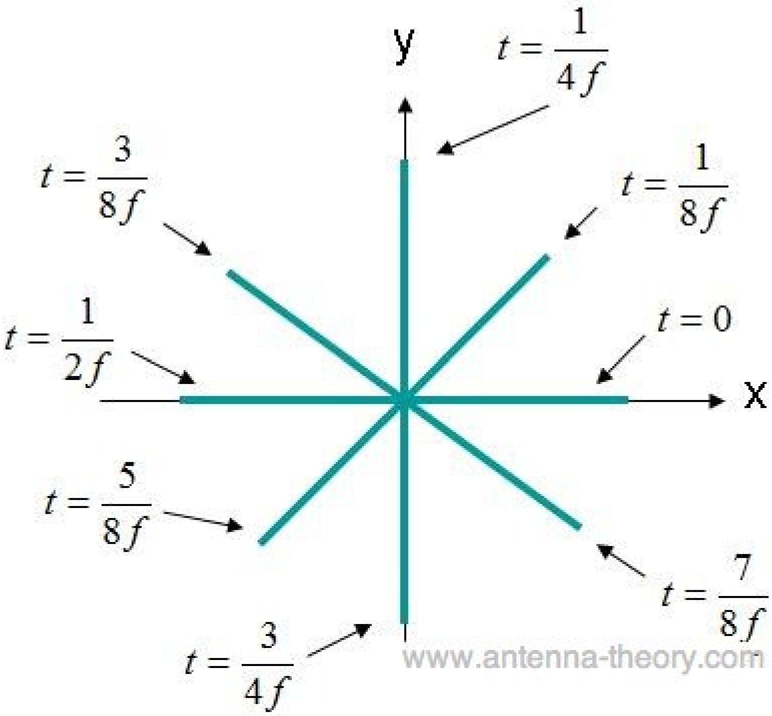

Figure 4. E-field strength at (x,y,z)=(0,0,0) for field of Eq. (3).

The E-field in Figure 4 rotates in a circle. This type of field is described as a **circularly polarized** wave. To have circular polarization, the following criteria must be met:

Criteria for Circular Polarization
• The E-field must have two orthogonal (perpendicular) components.
• The E-field's orthogonal components must have equal magnitude.
• The orthogonal components must be 90 degrees out of phase.

If the wave in Figure 4 is travelling out of the screen, the field is rotating in the counter-clockwise direction and is said to be **Right Hand Circularly Polarized (RHCP)**. If the fields were rotating in the clockwise direction, the field would be **Left Hand Circularly Polarized (LHCP)**.

Elliptical Polarization

If the E-field has two perpendicular components that are out of phase by 90 degrees but are not equal in magnitude, the field will end up **Elliptically Polarized**. Consider the plane wave travelling in the +z-direction, with E-field described by equation (4):

$$\mathbf{E} = \cos\left(2\pi f(t - \frac{z}{c})\right)\hat{\mathbf{x}} + 0.3\sin\left(2\pi f(t - \frac{z}{c})\right)\hat{\mathbf{y}} \qquad (4)$$

The locus of points that the tip of the E-field vector would assume is given in Figure 5.

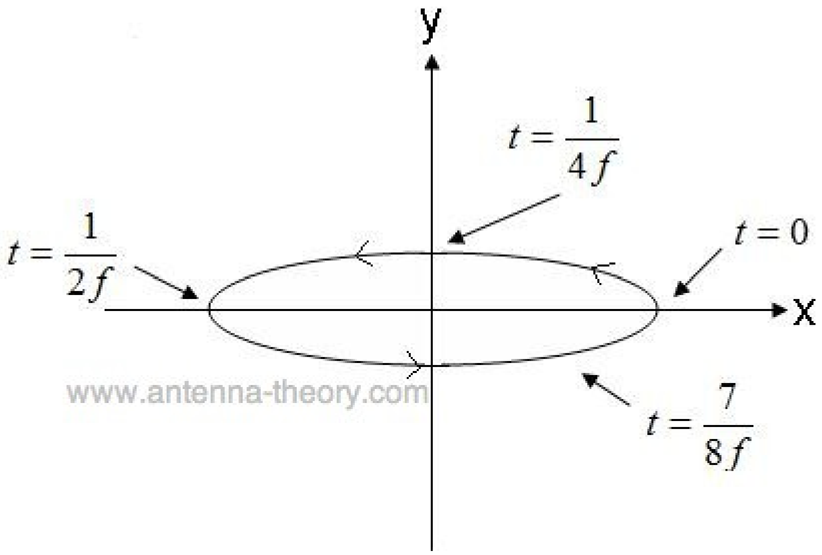

Figure 5. Tip of E-field for elliptical polarized wave of Eq. (4).

The field in Figure 5, travels in the counter-clockwise direction, and if travelling out of the screen would be **Right Hand Elliptically Polarized**. If the E-field vector was rotating in the opposite direction, the field would be **Left Hand Elliptically Polarized**.

In addition, elliptical polarization can be defined by its *axial ratio*, which is the ratio of the major and minor axis amplitudes. For instance, the axial ratio of the wave given by equation (4) is 1/0.3 = 3.33. Elliptically polarized waves are further described by the direction of the major axis. The wave of equation (4) has a major axis given by the x-axis. Note that the major axis can be at any angle in the plane, it does not need to coincide with the x-, y-, or z-axis. Finally, note that circular polarization and linear polarization are both special cases of elliptical polarization. An elliptically polarized wave with an axial ratio of 1.0 is a circularly polarized wave; an elliptically polarized wave with an infinite axial ratio is a linearly polarized wave.

In the next section, we will use the knowledge of plane-wave polarization to characterize and understand antennas.

Polarization of Antennas

Now that we are aware of the polarization of plane-wave EM fields, **antenna polarization** is straightforward to define.

The polarization of an antenna is the polarization of the radiated fields produced by an antenna, evaluated in the far field. Hence, antennas are often classified as "Linearly Polarized" or a "Right Hand Circularly Polarized Antenna".

This simple concept is important for antenna to antenna communication. First, a horizontally polarized antenna will not communicate with a vertically polarized antenna. Due to the reciprocity theorem, antennas transmit and receive in exactly the same manner. Hence, a vertically polarized antenna transmits and receives vertically polarized fields. Consequently, if a horizontally polarized antenna is trying to communicate with a vertically polarized antenna, there will be no reception.

In general, for two linearly polarized antennas that are rotated from each other by an angle ϕ, the power loss due to this polarization mismatch will be described by the *Polarization Loss Factor* (PLF):

$$PLF = \cos^2 \phi$$

Hence, if both antennas have the same polarization, the angle between their radiated E-fields is zero and there is no power loss due to polarization mismatch. If one antenna is vertically polarized and the other is horizontally polarized, the angle is 90 degrees and no power will be transferred.

As a side note, this explains why moving the cell phone on your head to a different angle can sometimes increase reception. Cell phone antennas are often linearly polarized, so rotating the phone can often match the polarization of the phone and thus increase reception.

Circular polarization is a desirable characteristic for many antennas. Two antennas that are both circularly polarized do not suffer signal loss due to polarization mismatch. Another advantage of circular polarization is that a RHCP wave will reflect off a surface and be LHCP. This is advantageous because an antenna designed to receive RHCP waves will have some immunity to the signal-fading effects of reflected waves interfering with the desired wave. These are some of the reasons GPS signals from satellites are RHCP.

Suppose now that a linearly polarized antenna is trying to receive a circularly polarized wave. Equivalently, suppose a circularly polarized antenna is trying to receive a linearly polarized wave. What is the resulting *Polarization Loss Factor*?

Recall that circular polarization is really two orthongal linear polarized waves 90 degrees out of phase. Hence, a linearly polarized (LP) antenna will simply pick up the in-phase component of the circularly polarized (CP) wave. As a result, the LP antenna will have a polarization mismatch loss of 0.5 (-3dB), no matter what the angle the LP antenna is rotated to. Therefore:

$$PLF\,(\text{linear to circular}) = 0.5 = -3\text{dB}$$

The Polarization Loss Factor is sometimes referred to as polarization efficiency, antenna mismatch factor, or antenna receiving factor. All of these names refer to the same concept.

With all of this fresh in our minds lets tweak those antennas in our backyards and be prepared to talk about what you accomplished at Thursday nights SFCG Net.

Remember to test your theories beforehand using the Reverse Beacon Network and or listen here

International Beacon Project Transmission Schedule (ncdxf.org)

From the Reflector

Winding binocular cores with magnet wire

By Kevan Nason, N4XL

In a thread on the Amateur-Repairs reflector started by Doug, WA1TUT, it was mentioned wire used to wrap binocular cores sometimes shorted when the enamel was worn off the wire by the hard edges of the core. Here is a solution Charlie, N0TT, uses for the smaller cores like those found in beverage antennas. It is post in post #85832. I had never heard this idea. YMMV and keep in mind the material described isn’t designed to withstand much heat so probably good for receive only. Charlie wrote: “On the binocular cores...the "small" ones...I use ordinary plastic soda straws. I first cut them to the same length as the core, then slit them lengthwise, curling them to fit the holes. Trim excess if needed, but allowing some overlap. Works great for me when winding with enameled wire. No scratches ever!"

From Dave IARU effort

Thanks Kevan,

One of my many goals for this contest was to actually work a contest beyond FT (my definition of FTin contesting is working it at least 75% of the contest duration) and work it 100%… all 24 hours.

I've learned a few things from my 100% effort…

1. A Marathon.. not a Sprint…When you have all the ducks in a row for a 100% effort in the contest, you can more effectively plan your activity and there are less ADD temptations to change bands/modes or operating function (RUN or Catch and Capture).

2. Q Rate and Q goals
The Q rate IMO one of the most important factors in contesting. Look at the category winners an set your rate goal accordingly. Then you can plan your rate goals per hour than overall.

3. 100% BIC separates the contenders from the normal players. I looked at the hour totals of all the ops in my cat during the previous year and only to top players were putting in the top hours. Since i was SO1R competing against SO2R ops, i had to go the distance to have a chance.

4. Low Q Rate Hours
As inmost contests, those early morning hours from 0900z to 1200z are important. You have to keep on going during these hours when the rate is low. Therse are the nourds when many ops take the their breaks, which makes sense if you are going to break. I struggled during these hours by trying to defermine whether to RUN or C&C. I

should have been in RUN mode for the last 3 hours. When fewer stations most ops would typically go C&C mode. RUN RUN RUN is the way to increase your rate.

5. You can do it…. Just do it and you will get to that point where you can’t not finish the 100% effort.

I look forward to my next 100% effort.

73 Dave WN4AFP

Symptoms of damaged PA or blown finals on HF Transceivers

Contributed by Kevan, N4XL

From a thread on the Amateur-Repairs groups.io reflector.
Jose, EB5AGV
I fix rigs for a living and am reaching the 5000 units worked on. On some of these, of course I have replaced quite a lot of power transistors. The symptoms of bad power transistors are varied. I will list some I recall (for sure I am forgetting a lot):
-Power varies from band to band, in some almost the nominal one but, as you go higher in frequency, it diminishes. That usually means one bad transistor (you need to replace both anyway)
-Power is very low on all bands. That could be caused by other things besides PA transistors but, when they are KO, somtimes what you see is just some power from the drivers which gets through the finals.
-Power is zero in all bands. That could mean driver transistors are gone and have fused the protection fuse for them. Usual in Kenwood TS-2000, as a sample.
-Power supply detects a short or has a very high current output, even on RX. Shorted finals and/or drivers. Beware of smoking other parts. One typical case is the FT-1000MPMkV. The external PS detects the short and powers down
Please, note that there are different kinds of power transistor faults, and "shorted" is not always the case. On bipolars (both drivers and

finals), being C, E and B, Collector, Emitter and Base, they would be:
-Short from C to E: that would cause a power supply overload and no power would be produced. Those are easy to spot. Measure voltage on Collectors just in case there is an open circuit on the supply to them due to the overload. With power supply removed, just testing C-E resistance should show the short.
-Short from B to E: that would mean no proper BIAS. Hint: always check BIAS voltage in SSB with MIC set to 0, in both transistors. If one is suspiciously low, it has this fault.
-Open (one or both junctions): if you have an oscilloscope, check RF signal in any continuous carrier mode (CW/FSK/FM), setting the unit to low power, in the Bases of both transistors. If one is higher than the other, that points to an open junction. You can also just check if, when PTT is activated for a while, one gets warmer than the other.
For MOSFETs, replace Collector with Drain, Emitter with Source, and Base with Gate, and cases are similar (except perhaps when Open, as impedance is already high on a properly working transistor). Note that biasing on MOSFETs is usually independent for each transistor. But BIAS voltages on a proper paired set are very close
From Jim, N6OTQ
And to add ... in a push-pull final circuit, if one transistor fails open but the other one doesn't fail, the first indication will be an abrupt drop by half in output power.
From Dean, N2AWJ
On a few occasions over many years repairing old transceivers, I have removed apparently open transistors only to find the transistors tested good on the bench even at full voltage. Examining the solder patterns on the tabs and PCB, I noticed that there was minimal coverage. My conclusion is that the tab had separated from the PCB after many heating cycles. I solved the problem by cleaning both the tab and PCB and pre-soldering the PCB landing before soldering the transistor in place with a large tip soldering iron.

OK guys talk to you Thursday evening!

73 N2OG Scott