RIFE'S MISSING LINK

<u>The Significance of Impedance in Rife Therapy</u>

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Rife's Missing Link

Since the 1930's many experimenters have tried to reproduce Rife's work on the killing or devitalisation of bacteria and viruses. For the most part such attempts have been hindered by lack of equipment and insufficient (and incorrect) information as to what is actually happening in the Rife effect. Experimental data that has been obtained has, more often than not, led to further confusion due to strange inconsistencies. Having extensively researched the subject I now believe that there is a single, simple explanation for the Rife effect in radiant devices and that all the data tends to be consistent with this explanation. In this paper I will address what that explanation is, and how it can account for most, if not all, the observed phenomena of the Rife effect. This explanation concerns an electrical property called impedance.

What is Impedance?

Electrical impedance is generally very poorly understood - even by electronics engineers in my experience! Impedance in reality is a very complex quantity, and to properly present it I will give some explanation below.

In electronics there is an electrical property which most people are familiar with, called resistance. The resistance of a system is a measure of how the circuit resists the flow of electric current. The more the circuit appears to "resist" the flow of electric current, then the higher the value of its resistance. To think of this in physical terms, imagine a hose pipe carrying flowing water. There is a current of water due to the flow. If someone was to now pinch the hosepipe, the current of water through the hosepipe would be reduced, because the available area for the water to flow through has been reduced.

In the above example the water is only flowing in one direction. This is analogous to DC (direct current) in an electric circuit. If the water was to flow in both directions (let's say we reversed the direction of flow several times every second) then it would be analogous to AC (alternating current) in an electrical circuit. If we did this in our hosepipe above, and again pinched the hosepipe, the flow of water would be reduced in both directions for the same reason as it reduced the flow in the one way current.

So pinching the hosepipe (increasing the resistance) would reduce the flow of current, regardless of whether the current was flowing only in one direction or whether it was alternating back and forth in opposite directions. The same is true of the electrical analogue. Increasing the resistance in a circuit will reduce the flow of current in a circuit by the same amount, regardless of whether the current is DC or AC.

So from the above it appears that all we need to know to assess the current flow in an electrical circuit is just how much electricity we have and at what pressure (which is basically equivalent to the voltage) and how much resistance we have in the circuit. Given these two quantities we then just apply Ohm's law to get the current, i.e.:

$$I = \frac{V}{R}$$

Where R is the resistance in Ohms (which is the SI unit of electrical resistance), V is the voltage in Volts, and I is the current in Amps.

And the above equation seems to be true for both DC and AC currents regardless.
But this is not the whole story!

There is a problem in dealing with AC currents, because AC currents are not only affected by resistance but they are also affected by two other electrical quantities, Capacitance and Inductance.

A full explanation of capacitance and inductance would take quite some time, so I'm going to simplify the explanation and leave out some of the "why's".

Basically, capacitances and inductances in a real circuit each contribute further apparent resistances to the flow of AC current - these special resistances have their own special name - they are called reactances.

All circuits, regardless of how they are constructed, have some degree of capacitance and inductance. In electronics we have special components called capacitors and inductors which are used to add measured amounts of capacitance and inductance to a circuit - but regardless of whether or not we actually use such components, the circuit will still have some natural capacitances and inductances already present. It is impossible to make any circuit in the real world that does not have some natural capacitance or inductance.

So it follows that if all circuits have some capacitance and inductance, then all circuits must also have some reactance. As we shall see later on, not only circuits have these capacitances and inductances - all real ***materials*** also have these capacitances and inductances and consequent reactances.

So what do these reactances do? Well, they are just like resistances except they have two fundamentally different properties from real resistances. Reactances change with frequency and they also cause phase shifts in AC signals or waves.

In a capacitor, the reactance decreases with frequency - so the higher the frequency, the lower the reactance and the greater the current flow. But at the same time in a capacitor, there is a shift in the phase of any AC signal or wave that passes through it - in particular any change in the voltage of the wave is retarded by one quarter wave cycle (90 degrees) relative to any change in the current of the same wave. In other words, if we apply an AC wave to a capacitor, it takes a while for the voltage through the capacitor to respond (or react, hence the word reactance) to the change in current.

The inductor is the exact opposite of the capacitor. Its reactance increases with frequency and it causes any change in the current of a wave to be retarded by one quarter wave cycle relative to any change in the voltage of the wave. So if we apply an AC wave to an inductor, it takes a while for the current of the wave to respond (react) to any change in voltage.

So you can think of a capacitor as being a device that resists changes in the voltage of a wave and the inductor as a device that resists changes in the current of a wave. These properties are not unique properties of the components themselves but rather of the wider electrical properties of capacitance and inductance.

If we go back to Ohm's Law mentioned above we can see that it's no longer strictly true for AC waves or currents. We can't assume that a change in voltage will cause an immediate and fixed change in current or vice versa (as the equation implies) - rather to find the true effect we now need to add a time component to the equation to allow for the delays that reactances cause in real AC signals.

But this time (phase) shifting effect causes a few problems of its own. In particular the power through a circuit is a measure of the total instantaneous voltage across the circuit multiplied by the total instantaneous current through it. If the voltage and the current are no longer in "sync" (phase) with each other, it follows that this will have implications for the amount of power that is produced in any given circuit.

I'll come back to this point later because it's very important.

When considering AC electrical theory we usually stick to an analysis of a simple sine wave. But in the real world signals are often complex - they are not simple sine waves. And because the reactances introduce phase shifts and frequency dependencies, the effect of different capacitances and inductances in a real circuit leads to all kinds of strange effects. The mathematical formulas for capacitive and inductive reactance are straightforward (see below) and the phase shifts simple for any one given sine wave. But when we consider a complex waveform which is built up of sinewaves of many different frequencies (Fourier's theorem) - the total effect becomes very complicated. We would have to use the reactance equations at every different frequency present in the wave to determine the reactance to that frequency, and we would have to add together all the different phase shifted voltages and currents to get an idea of the true shape of the wave.

$$Xc = \frac{1}{2\pi fC}$$

The capacitive reactance (Xc) in Ohms can be calculated from the frequency (f) in Hertz and the capacitance (C) in Farads

$$Xl = 2\pi fL$$

The inductive reactance (Xl) in Ohms can be calculated from the frequency (f) in Hertz and the inductance (L) in Henrys.

Most of the time we won't want to do such a complex analysis. What we want is just an overall (but accurate) idea of how the current changes for any given change in voltage. So to simplify matters, we define a new property which is the mathematical combination of all the resistances and reactances in the circuit. This property is called ***impedance*** and is given the symbol Z - it is measured in Ohms, just like resistance and reactance.

$$Z = \sqrt{(X_L - X_C)^2 + R^2}$$

The real magnitude of the Impedance (Z) in Ohms can be calculated from the combination of the resistance (R) and the capacitive and inductive reactances respectively (X_C and X_L)

Using impedance instead of pure resistance and reactance we can go back to using the simple Ohm's law equation for the voltage and current relationship, only instead of using resistance, we substitute impedance. So the equation becomes:

$$I = \frac{V}{Z}$$

And the equation is now true for any type of signal, both AC and DC.

This seems straightforward, but we must never forget that "behind" the deceptively simple Z symbol there is a very complex set of equations and properties. Unfortunately, all too often people ***do*** forget this - even engineers - and as a result they misunderstand the true nature of impedance.

Even the "standard" impedance equation above is misleading - it doesn't mention the time component at all - so this is only half the true story - the phase equation for impedance is separate - and in real impedances the phase can never be separated from the magnitude. Also it doesn't mention frequency - the frequency is implicit in the reactances.

So there are two things we must never forget about real world impedances.

1. Impedance is ***frequency dependent***. Impedance changes with frequency.

2. Impedance has ***two components***, a real overall magnitude in Ohms and a "virtual" component that is time related that describes the phase of the signal.

If we want to work with real values of impedance to do calculations etc., we cannot ignore these factors. Because the impedance has two components, a magnitude and a phase it's actually a mathematical ***vector***. And so impedance is not a scalar quantity, it's a vector quantity. Therefore in the real world, we need to find some way of handling the two different properties, the magnitude and the phase simultaneously.

In mathematics there is an "easy" solution. We define the impedance to be a complex number. In mathematics a complex number is defined as a special class of number vector that has two components. It has a "real" part which describes it's magnitude, and it has what is called an "imaginary" part which describes it's direction or phase.

Don't be confused by the word "imaginary" - the quantity is question is a real quantity. The reason we call it the "imaginary part" is because it's defined mathematically in terms of a special operator (the square root of minus one) which although it appears to be a number, isn't a number and never can be - so the square root of minus one is an imaginary ***number*** but is nonetheless a real ***operator***.

In mathematics an operator is defined as a mathematical manipulation that converts one mathematical function into another mathematical function. A function is defined as a mathematical manipulation that converts one number into another number. So numbers and operators are not directly equatable.

The square root of minus one operator is usually given the symbol ***i*** in mathematics and ***j*** in electronics - because in electronics we use ***I*** as the symbol for current, so engineers use a different symbol to avoid confusion.

Complex numbers are usually written as a simple sum. The real part is written directly and the imaginary part is written as an addition or subtraction multiplied by ***j***.

Using the special mathematical properties of complex numbers like this we get the correct answer when we add together impedances (or subtract or multiply them etc). Because impedance is a vector we can't just add impedances in the normal fashion - we need to use vector addition etc., it just so happens that complex numbers behave exactly like vectors, which is why they're so useful in this application.

So a real impedance would be written something like this: 204+j23, or 135-j2 etc.

In some cases, either the real part or the imaginary part can cancel out in which case we have the choice of writing the complex number with a coefficient of 0 in either the real or imaginary part, or just omitting the 0 part entirely.

i.e. 0+j5 = j5 or 235+0j = 235

We don't want to go deeply into the mathematics of vectors and complex numbers here, so suffice it to say that we should remember that the real part of the impedance is the overall magnitude of the impedance, and the imaginary part tells us about the phase.

Although this looks confusing, all you need to remember is that if you see that "j" part in an impedance it means that there is a phase shift involved.

So now we have some idea of what impedance is I will go on to explain just how impedance is important in real systems, and ultimately what its significance is to the Rife effect.

The Importance of Impedance

So why is impedance important? There are several answers but the most important is how impedance relates to power transfer in real systems.

There is a fundamental theorem in electronics which is also true in other areas of physics which is called the maximum power transfer theorem. This theorem states that in any two systems which are connected and in which there is a transfer of energy, then the maximum amount of energy will be transferred from one system to the other ***only*** if their impedances are equal.

Now this seems simple enough, but as usual it's only half the story! The above statement refers ***only*** to the real part (the magnitude) of the impedance - it doesn't take the imaginary part into account. This leads to a "hidden" implication in the maximum power transfer theorem which will be explained below.

Most engineers are familiar with this theorem, however in my experience many are not fully aware that they also need to deal with the imaginary part or phase of the signal. Sadly this is usually due to inferior explanations in many modern electronics books and courses.

Above, I mentioned that power is calculated by considering the current multiplied by the voltage. As an equation this is:

$$P = IV$$

Where P is the power in Watts, V is the voltage in Volts and I is the current in Amps.

This seems straightforward, but we already know that if a system contains capacitances and inductances then the phase of the voltage may be shifted relative to the phase of the current and vice versa. So what happens if the phase of the current just happens to be 90 degrees out of phase with respect to the voltage? If this were to happen, then when the voltage would be at maximum, the current would be zero and when the current would be at maximum, the voltage would be zero. And anything multiplied by zero is zero.....

So the simple answer is that no power will be produced when either the voltage or current is at maximum - somewhere in between these extremes, the product of voltage and current would be non-zero but much reduced from what they would be if they were in phase - so if the signals are at all out of phase, then only a proportion of the possible power will be actually produced in the target.

Since the equation above doesn't take into account the phase shifts it must be wrong for AC power. We need to correct it for real impedances.

The easy way to do this is to substitute one of our new possible definitions for voltage or current in terms of complex impedances into the above equation. Let's try it. Firstly from Ohm's Law, corrected for impedance we know that:

$$I = \frac{V}{Z}$$

And by rearranging the above we also know that:

$$V = IZ$$

So from that we can substitute either the V or the I above for either the V or the I in the power equation to get two new power equations:

$$P = \frac{V^2}{Z}$$

or

$$P = I^2 Z$$

But since we already know that Z is a complex number (i.e. “Z” is really a number that looks like x+jy) , then in introducing it into the power equation, we’ve just made the power into a complex number as well!

So what does this mean? In particular, since we’ve now defined power as a vector, what is the significance of the imaginary part of power?!

As I explained above, the real part of complex number vector is the actual magnitude of the quantity in question, the imaginary part is the phase shift. So the actual power transferred in a real world system depends on the real part of the complex vector. In other words, the imaginary part of the complex power vector represents lost power that isn’t transferred - the imaginary part is the power that is “out of phase”. In reality this “out of phase” power tends to be reflected from the target impedance.

So here is the significance of the “hidden” part of the maximum power transfer theorem. The maximum amount of power is transferred from one system to another, if and ***only if*** the real part of the impedances match, ***and*** the imaginary parts of the impedances cancel each other out as well. Because if there is any imaginary component left to the impedances when the systems are connected then this will represent a power loss between the systems and a non-optimal power transfer.

This may seem all very theoretical but it’s actually vitally important - power that is reflected is wasted power - if we have a high reflection coefficient (i.e. the proportion of radiation that is reflected) is say 99% then this means that 99% of all the power we put into a system has no direct effect on it at all. So for a 100W plasma amplifier we could be talking about a real power transfer of only 1W!

How do we cancel imaginary impedances in practice? The way to do this to change one of the impedances (traditionally the receiving system) so that its impedance forms what is called the complex conjugate of the impedance of the transmitting system. When a complex number is added to its complex conjugate, the imaginary parts cancel out to zero.

To form a complex conjugate mathematically, just change the sign of the imaginary part of the complex number. For example if we have a system with impedance 235+j5, then it will form a perfect match to a system which has an impedance of 235-j5. The impedance 235-j5 is the complex conjugate of impedance 235+j5.

This is all very well mathematically, but how do we do this in the real world? The answer is quite simple. Remember that capacitances and inductances are opposites. Each imaginary part of a real world impedance is mainly due to either capacitance or inductance. So if the impedance of the transmitter is primarily capacitive all we need to do is add a cancelling amount of inductance to the receiver. And vice versa.

Anyone who has used a Rife-Bare machine will already be familiar with this process - although they might not have realised it! In the RB machine you have a transmitter which has to be matched to a plasma tube to ensure an optimum transfer of power from one to the other. The purpose of the antenna tuner in an RB system is to adjust the complex impedance of the plasma as seen by the transmitter so that the imaginary reactive components are cancelled out and only the real part of the impedances match.

Inside the antenna tuner there are banks of tunable capacitors and inductors that are used to do this as described above. If the plasma appears to be capacitive the antenna tuner adds some inductance to cancel out this capacitance. If the plasma appears to be inductive the antenna tuner is adjusted to add some capacitance to cancel it out. Of course this process isn't perfect - in the case of something as complex electrically as a plasma it's impossible to get a perfect match.

In an RB system we need to know just good how our impedance matching is. So we use a convenient measurement that radio engineers use, called the VSWR, or voltage standing wave ratio. There's no need to go into complex definitions of this because just about everybody who has used a system like this knows that the idea is to get the VSWR as low as possible. Since VSWR is a ratio - a perfect match is defined as 1:1. A VSWR of 1:1 is absolutely perfect - and impossible to achieve in practice!

Every RB user also knows that if we have a very bad VSWR then the tube won't light. This is simply because a bad VSWR represents a large amount of imaginary as opposed to real power - i.e. it represents more power being reflected back into the transmitter as opposed to being transferred into the plasma.

This concept will help enormously in understanding what I believe the real Rife effect to be. But before getting into that I want to say one more thing about impedance matching.

Impedance and Resonance

As I've explained above, a real VSWR of 1:1 (or a perfect impedance match) is impossible to obtain in practice. But let's imagine that it was possible. In that event we would actually be able to cancel out all the reactances in the system - we would perfectly balance out the capacitances on one side with the inductances on the other and vice versa. At that moment, the current and the voltage would be perfectly in phase. In electronics this only happens at one specific frequency for any given value of capacitance and inductance - and this frequency is called the ***resonance*** of the system. Because of the frequency dependence it follows that the signal which causes this resonance must be a perfect sine wave. If it's not it must contain additional frequency components or ***harmonics*** that will not have a correct impedance match - unless of course the transmitting system had identical linearity to the receiving system - which is again impossible in practice.

So what is the significance of this? Quite simply, it is impossible in the real world in practice to achieve a perfect resonance between any two systems. The systems may get close to resonance, but they will never be able to hit the precise resonance. And if the frequency of either system is changed, the chances of hitting a resonance are even lower because the impedance match will shift with frequency (i.e. the impedances will go out of match). If the wave is anything other than a perfect sine wave - then power will also be lost and resonance will not be achieved.

It is absolutely impossible to get a pure sine wave out of a plasma tube. The tube has non-linear characteristics that add harmonic distortion to any signal - for this reason a perfect resonance between plasma radiation and anything else is also impossible.

The best we can ever hope for in practise is a high degree of resonance (i.e. good as opposed to perfect impedance matching) between any two systems. But absolute resonance is impossible in real world systems. And also the chances of actually hitting a resonance will require us to re-tune our systems for each precise frequency involved.

The Rife Effect

I will now finally move on to the Rife effect itself. I spent a lot of time above explaining the concepts of impedance and resonance because unless this is clearly understood, there won't be much chance of fully understanding and appreciating what I propose for the Rife effect.

In the classical Rife effect we are told by Rife that the machine works by resonance. Most people interpret this to mean that we are shaking a bacterium etc., with a kind of mechanical resonance just like the breaking of a wine glass when a singer hits a high note. This explanation is far too simplistic. Such effects are possible but are subject to a wide range of influencing factors such as damping of the pathogen membrane, the rate of power transfer versus the rate of power dissipation, the mechanical properties of cells etc. In the past I've used the analogy that a cell is rather like a water filled balloon. If you take some mechanically rigid system like a bell, or a wine glass it's quite easy to hit it and cause it to ring or resonate. But if you hit a water filled balloon you won't get a nice ringing resonance - the best you can hope for is a dull thud! The cell is similar. Under certain conditions it may be possible to mechanically vibrate cells - but most people don't realise that mechanical vibration per se is not resonance. Mechanical vibration due to stresses in things like cell membranes can "break" cells, as I've explained in a previous paper. But there is quite a distinction between this and true mechanical resonance. In true resonance a mechanical system must be rigid - to the extent that the mechanical deformation of the system is constant when repeated stresses are applied. Cell membranes and other cell components are not rigid in this way and so when you apply a mechanical deformation their coefficients of elasticity also change (they are defined as "plastic" bodies in physics) and so does their "resonant frequency". Because their mechanical resonance is never constant, the idea of shattering a cell membrane with a constant resonant frequency stimulus just doesn't hold up in practise. Physicists may want to look further into Hooke's law and the physics of stress and strain and elastic deformation to understand this further. But remember this does not exclude the possibility that just shaking it enough may cause damage and that certain frequencies of shaking will tend to cause more damage than others.

So what is happening in the Rife effect? Well let's go back to resonance and look at it from a different angle.

We saw above that the maximum power transfer theorem says that we need to "match" impedances to transfer maximum power from one system to another. And we then saw that "matching" impedances didn't involve making them mathematically identical but rather it involved cancelling out phase shifts between the transmitter and the receiver. And finally we developed the idea of resonance as being the point where the phase shifts ***did*** cancel out.

So what we're saying in effect then is that the point of maximum power transfer is also the resonance! And of course that's exactly true in practice.

So if we stop for a moment and discard the idea that "resonance" has to involve something mechanical ringing like a bell, and look at the electrical definition of resonance, then we see that true resonance doesn't depend ***only*** on frequency. It basically depends on ***impedance*** - which in turn depends on frequency (amongst other things).

This has important implications for the Rife effect. In particular the Rife effect is not solely dependent on frequency - frequency is only one of several equally important factors that must be satisfied in order for "resonance" (or as near as we can get to it in practice) to occur.

<u>Clarification of Frequency Based Resonance</u>

This may still not be clear, so let's look at some real world examples of resonance to get a better idea.

Imagine a metal bell. You hit the bell and it rings at exactly 440Hz (A in the musical scale). This is a clear example of resonance. Now if you take a bigger bell, hit it and it rings at 220Hz this is also resonance. Now if we create a loud sound at 440Hz or 220Hz then either or both bells will start vibrating in sympathy - this is also resonance.

So from this we might conclude that resonance depends only on frequency - but in reality it doesn't!

Why not? Well in the above we've taken no account of the material the bell is made of - nor have we considered the effects of the medium that the bell is suspended in - the same bell may resonate at a different frequency underwater for example.

If we make a soft rubber bell of identical size and shape to one of our bells above, will it still resonate at 440 or 220Hz? Of course not - rubber has totally different characteristics to metal. Rubber won't "ring" like metal because it's a plastic material (using the physics definition of "plastic"). In fact, with a soft rubber bell it probably won't ring at all, no matter what frequency we use.

So resonance clearly does not depend only on frequency - we won't be able to get a rubber bell to ring at any frequency, so it's not just a question of finding the "frequency" of the bell. And a metal bell embedded in mud for example also won't ring at any frequency - because the mud will damp out the bell. So the ringing of a resonant object like the bell doesn't always depend just on frequency - it depends on the material the bell is made of and the medium it's suspended in - in effect it depends on the mechanical analog of ***impedance***.

Although I've referred to the material of the bell and the medium it's in determining the mechanical impedance, these are still not the only factors. There are many other factors such as temperature involved. A frozen soft rubber bell will be stiffer and so more likely to ring for example.

Now what about a cell like a pathogen in the body? Will it be like a metal bell and cleanly "ring" at one frequency? I doubt it! Is a pathogen hard like metal or soft like rubber? It's like rubber. And where is the pathogen? Well, if it's inside the body it's rather like the metal bell which is embedded in mud! So for a real pathogen inside a real body is a clean "resonance" likely? The simple answer is no.

Now although I've been referring to mechanical resonance above, the same is equally true of electrical resonance. If the material of a pathogen changes so does its resonance - both electrically and mechanically. If a pathogen is embedded in fat tissue then it won't resonate cleanly because the fat will damp it out, and so on.

So if resonance is impossible does that mean the Rife effect doesn't exist? Luckily the answer to that is no. The Rife effect is still possible if we let go of the literal idea of exact ***frequency*** resonance and instead ask ourselves, is a net power transfer possible? The answer to that, fortunately, is yes!

If we stop equating the idea of resonance with a mechanical vibration and accept that we can never hit a true resonance in practice, we can instead aim at something as close as we can get to the true physics definition of resonance in practice - and that is bulk power transfer.

Power Transfer and Pathogens

All cells have electrical (and mechanical) impedances. All real materials have impedances, so it follows that this applies equally to cells as to anything else.   We also know from common sense that if any object is different from any other object, then the two objects must have different impedances. So from this we can safely assume that any two different bacteria, viruses, mycoplasmas or fungi must also have different impedances.   Each different individual of any one species (i.e. two different E. Coli of the same strain) must also have different impedances.

However, what we also know is that any two individuals of any one species are also likely to have ***similar*** overall impedances.

Taking this as a general principle we can then ask ourselves the question - is it reasonable to assume that we could isolate or identify any one given species of pathogen just by considering its overall impedance?

The answer to that question is yes. In recent years there has been considerable development of new commercial devices which are designed to identify strains of bacteria and viruses etc., solely by determining their electrical impedances. Such techniques are widely used in the food industry. Systems such as the RABIT system are well known for this application.

I must also clarify at this point that it's impossible to identify a real bacterium in a human body by impedance measurements alone because just like the bell in the mud, the impedances of real bacteria change in body tissues and also it's impossible to tell which part of the response is due to the bell and which is due to the mud! So we can't absolutely determine whether any response in the body is due to a pathogen or to something else in the body.

So far, the industry as a whole has largely concentrated on using such techniques to determine the presence of bacteria - very little work has been done on the opposite end of the equation - i.e. what happens if we match the impedance of a power source to the impedance of a specific bacterium or virus etc?

We know from the power transfer theorem above that such matching will result in an overall transfer of power from the power source to the target - in this case our pathogen. So what happens if we simply transfer bulk electrical power into specific pathogens? In general we don't know the specific immediate effects (one such effect that I've proposed before and still believe is relevant, is transmembrane hyperpolarisation) - but we don't need to know the specific effect to predict the outcome. If we transfer enough power into a pathogen at some point we ***must*** inevitably damage or destroy it - just as if we transfer too much power into a circuit we can blow it up, or if we pump too much air into a balloon we can burst it, if we hit a bell too hard we can shatter it.

This I believe is the ultimate key to the Rife effect.

Quite simply, if we can find some way of "matching" (remember what that means in practice above) the impedance of the output of a source of power to the impedance of any given pathogen, we ***must*** be able to destroy it.

In other words we are ideally aiming at resonance. But for the reasons I've already mentioned we'll never hit real resonance in practice. But it doesn't matter in practice whether we actually hit resonance or not - all we need to do is to get as close as we can to the resonant point (i.e. an impedance match) and eventually we will transfer enough power to do the trick anyway.

The questions we need to address now are: how could we do this in practice, and what are the implications of such a process in the real world? Considering these two questions leads inevitably to a new theory and also to an explanation of just about all the known phenomena of the Rife effect.

Radiation Impedance

A classical Rife device consists of some sort of power driver which causes ionisation of a plasma in a low pressure tube. Some form of radiation is emitted by the tube which penetrates the body of the subject and causes in some way an adverse effect on pathogens. We know the effect appears to be frequency specific and species selective.

Everybody knows that when we fire up the plasma tube we create radiations of various kinds. The most obvious radiation is light, and there is also usually some radio frequency component. Even in plasma systems which are driven solely at audio frequencies there is a degree of RF electromagnetic emission, due to harmonics in the applied signal as well as non-linearities in the plasma itself.

The question has arisen many times as to whether there is some sort of "subtle energy" being emitted from the plasma tube. Unfortunately most people seem to equate the word "subtle" with "mystical"! But the word means exactly what it says - subtle - i.e. is there some radiation component which is maybe less obvious than the normal RF and light etc? The answer to that question is yes - there is just such an emission - and no, there's nothing "mystical" about it!

Electromagnetic radiation (which includes radio waves, light, x-rays etc) is defined as being a special incidence of a plane wave which has two orthogonal components. One is an electric field and the other is a corresponding magnetic field. In physics books it's usually taught that these two components must be in phase and that the ratio of the electric vector to the magnetic vector must be equal to the impedance of free space - which is approximately 377 ohms.

What is not obvious from this explanation is that the wave itself has an inherent impedance. What we're actually saying above is that conventional electromagnetic radiation in pure free space always has its components in phase and that it has an inherent impedance equal to that of free space - i.e. 377 ohms. So a stream of "normal" EM radiation always has an electric field component exactly 377 times stronger than its magnetic component. And because the electric and magnetic field vectors are always in phase, the imaginary component of the impedance is 0j. So the impedance of "conventional" radiation is 377+j0 Ohms.

This is all very well - but this explanation only considers an "ideal" universe in which there is such a thing as perfect free space. What happens to that same EM wave when it passes into a real material?

The answer is not immediately obvious until we remember the maximum power transfer theorem above.

If the medium does not have an impedance of 377+j0 Ohms and the wave does - then there is an impedance mismatch. To think of it another way, the VSWR of the wave itself relative to the medium is not 1:1. So what happens? Some of the energy of the wave is reflected. This makes perfect sense - because if the radiation was light for example, and the object had a perfect impedance match the wave would be completely absorbed - and the object would be perfectly black. No normal material object is perfectly black. By perfectly black I mean the object would never reflect any light at all - if you shone a light on to it, it would still be just as black and you would never see any detail of it at all under any circumstances, you would never see the light on the object. A black hole is a perfectly black object.

Now what happens to the energy that is absorbed by a material is also important. If the material absorbs the energy but doesn't change it into any other form, then it will simply transmit the energy unchanged - and the object will be perfectly invisible.

But no real normal material ever is perfectly black or perfectly invisible, there is always some reflection. This is another reason why real resonance is impossible - only a perfectly black or perfectly invisible object would reach actual resonance.

The impedance of air in the atmosphere is pretty close to 377+j0 ohms - the result is that air is pretty much invisible - although not completely because as always there is a slight mismatch.

But if we take another object, say a lump of metal - this has a very different impedance from 377+j0 ohms and so it reflects a good proportion of the light that hits it.

It's interesting to note that this theory explains the phenomenon of colour. When waves of different frequencies of light (different colours) hit an object, there is a different degree of impedance mismatch between the object and light of any specific colour frequency. In practice this means that certain frequencies of light are reflected easier than others whilst some are absorbed. The strongly reflected light frequencies are what we perceive as the colour of the object in question.

Depending on the degree of impedance mismatch, some of the wave may be absorbed. What is important to remember however is that real systems have complex impedances which have that imaginary component I discussed earlier. If there is an imaginary component to the material's impedance then it ***must*** reflect a conventional EM wave to some extent.

So from the above, we can see that if a conventional EM wave hits a real material then any radiation which is absorbed by the material must have an impedance that matches the impedance of the material. Since this doesn't match the impedance of our perfect conventional wave it leads to an immediate and obvious conclusion that ***it must be possible to create EM waves of non-standard impedance***.

If we now take the two conclusions above, firstly that EM waves have an inherent impedance of their own - a radiation impedance, and that it's possible to create a wave of non-standard impedance relative to free space - then it follows that it must be possible to create a non-standard impedance EM wave that will perfectly match to any material we want it to! And if we can do that, we can create a kind of specific EM radiation that will cause maximum power transfer precisely into one specific target material.

Taking that another step further, we know that cells, bacteria, viruses, mycoplasmas, fungi and anything else we want, have specific impedances - and similar impedances within particular species. So it must be possible to create a specific kind of non-standard EM radiation which will result in optimum power transfer into exactly any one species of pathogen.

Finally, if we can basically pour as much power as we want uniquely into any one pathogen - then it follows that we must be able to devitalise or destroy it in this way.

I believe that this is the true explanation of the Rife effect.

Generating Non-Standard Impedance Radiation

At first sight, elegant though this theory is, it seems unlikely that we'll ever be able to generate this kind of non-standard radiation in practice except inside some real material - i.e. not in free space. If we create an oscillating electric field vector in free space (or air which we'll treat as equivalent for this explanation) then the magnetic component that will be generated by electromagnetic induction must be exactly 377 times smaller - because it's the impedance of free space which determines the magnitude of a corresponding induction vector.

But what happens if we simultaneously generate both an electric field vector and a separate magnetic field vector? Provided these vectors have the correct spacial relationship (i.e. orthogonality) then they must combine to create a field which is at least at one small instant self-reinforcing. This is the condition required for electromagnetic radiation. And so we may assume that any system which does not generate pure electric only or pure magnetic only vectors ***must*** at least instantaneously, create some radiation of non-standard impedance.

In practice, all radiating systems create simultaneous electric and magnetic vectors - and so it follows that any and all radiant systems must create some radiation of odd impedance. And in fact this is true. It is well known amongst radio experts that even a normal antenna creates a field in which there is non-standard impedance radiation.

The impedance of the radiation produced depends on the relative magnitude and phase of the electric and magnetic field vectors. To decrease the real part of the impedance you can either reduce the electric field strength relative to the magnetic field strength or increase the magnetic field strength relative to the electric field strength. To do the opposite just vary the vectors in the opposite manner. To change the imaginary part, just shift the phase of electric field vector relative to the phase of the magnetic field vector.

Because this non-standard radiation does not match the impedance of free space we can also predict that it won't travel very well (due to impedance mismatch). Some of the energy must reflect and dissipate until eventually the ratio of the vector fields matches that of free space. So we can predict a limited zone inside which the radiation of the antenna will be non-standard and a much bigger zone outside this in which the radiation will eventually convert into normal impedance radiation.

In radio/antenna theory the inner zone of non-standard radiation is known as the near-field of the antenna. The outer zone is known as the far field. There is also a second division of the near-field region into what is called the ***reactive near-field*** and the ***radiative near-field***.

There are general formulas that predict the boundaries of the near field and far field and these show that the boundary of the zones depends on the wavelength (and hence the frequency) of the radiation.

$$r_1 \approx 0.62\sqrt{\frac{d^2}{\lambda}}$$

$$r_2 \approx \frac{2d^2}{\lambda}$$

The equations above give approximate values for the reactive near-field radius (r_1) and the width of the radiative near field (r_2) for a linear antenna of length d and for radiation of wavelength lambda. Note that r_2 is a ring shaped region outside region r_1.

The near-field is also sometimes called the Fresnell region and the far-field is called the Fraunhofer region.

If the antenna is primarily capacitive i.e. a standard dipole then it willl tend to create electric field vectors much larger than magnetic field vectors - and we can predict that the predominant near-field radiation of the dipole will be of greater (magnitude) than free space impedance i.e. greater than 377+j0 Ohms.

If the antenna is primarily inductive (i.e. a magnetic loop antenna) then it will tend to create magnetic field vectors that are much larger in proportion to electric field vectors and so the radiation will tend to be of less (magnitude) than free space impedance i.e. less than 377+j0 Ohms.

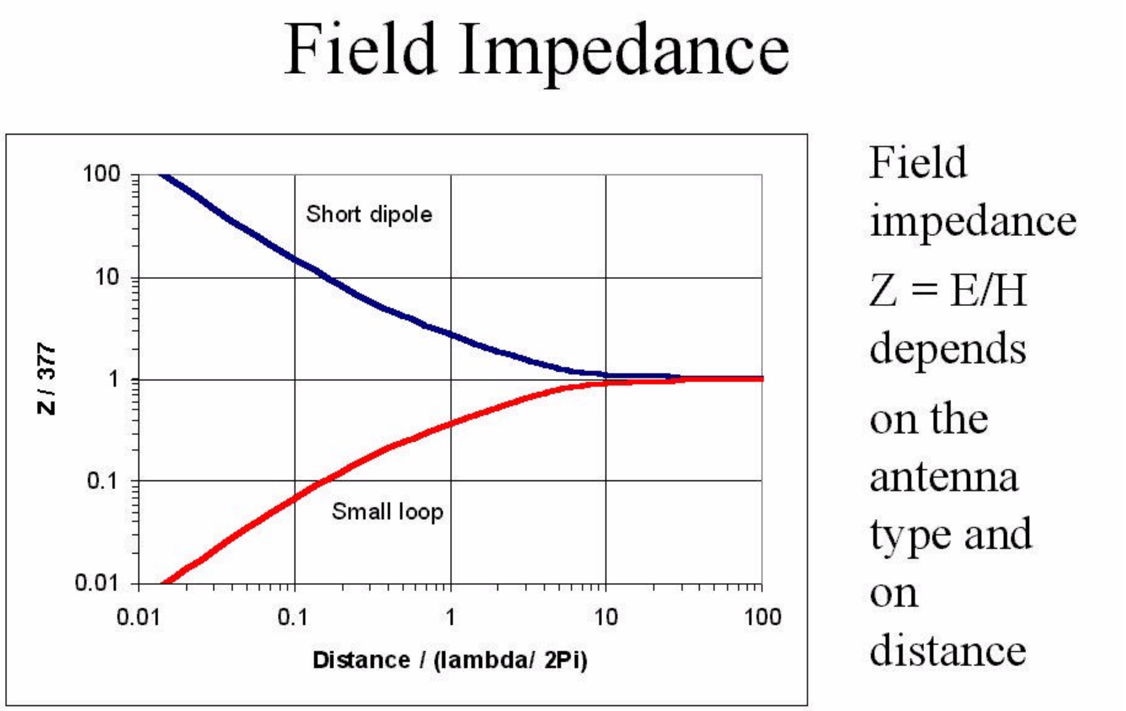

Fig 1. Radiation Field Impedances for Dipole and Loop Antennas

We can also predict that radiation of a primarily capacitive or inductive source may also have a significant imaginary component due to phase shifting of the relative field vectors.

Fig 1 shows typical radiation impedances for dipole and loop antennas as a function of distance from the emitting antenna.

The Plasma Tube

So what kind of radiation does a plasma tube create?

This is a difficult question to answer! The answer depends on several inter-related factors.

Let's start with a simplistic analysis.

We apply a high voltage across the electrodes of a plasma tube. This oscillating voltage will create a strong electric field. The plasma tube is capacitive in that the plasma is not extremely conductive (compared with a metal, like in a dipole antenna) - but the degree of conductivity depends in turn on the degree of ionisation. And the degree of ionisation also depends in turn upon the gas type and the gas pressure! The oscillating electric field will create a magnetic field by way of the displacement current in accordance with Maxwell's equations.

But, as the plasma ionises it will also carry a current. The moving ions will cause a magnetic field to be set up - the magnetic field due to ionic conduction will reinforce the existing magnetic field that was set up due to displacement current. This magnetic field will be circular and will run in corkscrew fashion around the radius of the electrode axis.

What we can predict overall is that the plasma tube will generate a much stronger magnetic field (due to the combined current+displacement reinforcement) than a conventional dipole type or purely capacitive antenna. From this I believe that it's true in general that plasma tubes tend to create low impedance radiation.

However, we must not forget all the above factors. The plasma is not ionised at the point where we first apply a voltage to it - it then goes through a process of current build up - and so we can also say that the plasma tube must also create a very wide spread of radiations of widely different impedances, both low and high. Initially it will create a burst of high impedance radiation up to the point of plasma firing and then it will create a more steady train of low impedance radiation after that.

And of course we mustn't forget the phase shifts either.

What we can say about a plasma tube is that as antennas go it creates a very wide range of changing radiation impedances. If we are looking for a special kind of radiation impedance in order to match to biological tissue then it's fair bet that we're more likely to get some match at some point, from a plasma tube than from any conventional antenna - at least in current systems.

Let's take a closer look at the factors involved.

1. Gas type. The type of gas in a plasma tube will effectively set the voltage/current response pattern. In particular if it is driven to the upper edge of the glow discharge region, the voltage

across the gas will drop to the ionisation potential of the gas. Each different gas has different ionisation potentials and hence different electric field strengths.

2. Gas pressure/density. This will affect the number of available ions or charge carriers when the gas is ionised. It will also affect the striking voltage. It will require a higher potential with higher pressure to ionise the gas - leading to increased E field generation prior to strike. When it is ionised the greater number of charge carriers will result in an increased contribution to the radial magnetic field. Therefore the total range of radiation impedances produced (or impedance bandwidth of the tube) will tend to be proportional to gas pressure.

3. Electrode spacing and geometry. The closer together the electrodes, the stronger the E field will be and the further apart they are, the stronger the final magnetic field will be - due to increased number of ions between them. From this we can conclude that as electrode spacing increases, this will tend to lower the impedance of the radiation from the tube. The geometry will tend to distort the fields, particularly the E field and may lead to intensity “hot-spots” in particular places or directions. The angled electrode geometry of a phanotron tube is conducive to a distorted E field which has a vector that runs approximately 15 degrees off, but otherwise parallel to, the face of the angled electrode. This will create an enhanced E field contribution in that direction as many phanotron users have observed (including myself).

4. Electrode material and tube material. The electrode material probably won’t make a very significant contribution to the fields or fluxes unless it is prone to secondary thermionic emission. In the case of hard or refractory metal electrodes this is unlikely except at extreme power levels or temperatures. The glass of the tube may have some contribution to blocking or distorting waves of an impedance similar to that of glass. But since the fields extend well beyond the tube walls this is likely to be minimal. So neither of these factors is likely to be very important.

5. Overall voltage - this will be extremely critical as it’s the main factor that determines the E field strength - and depending on the voltage/current characteristic of the tube, the current as well. Of course it’s interdependent with the tube characteristics.

6. Output impedance of the driver. This will make a significant difference to the current flow and indirectly the voltage across the tube. A high impedance output will not be able to source sufficient current to allow high magnetic field strengths. And of course, if there is a bad mismatch between the driver and the plasma there will reflection and loss of power as well.

7. Frequency. The impedance of the system will change with frequency! This is the most important effect of all. Each different frequency (and that includes both carrier and modulation frequencies as well as waveform types) will have a different voltage/current characteristic in the plasma and ultimately will affect the overall impedance of the radiation produced. Not only that, but because we already know that the boundary of the near field and far field regions depends on wavelength, it therefore indirectly depends also on frequency as well.

The last point is extremely significant. Basically, taking all the above factors into account, we can conclude that each machine will be significantly different in its ability to create ranges of certain impedances of radiation - and not only that, but the distance of the subject from the tube will be important as well. In any given machine there is usually little scope to vary the gas type, gas pressure or electrode geometry since these are factors of a fixed tube in most cases. So any variation in the impedance of the radiation output by the machine will be primarily affected by the last 3 factors. If the voltage output of the machine is fixed - and ignoring the output impedance of the driver - the factor that will have the greatest single effect on the impedance of the radiation produced by the machine will be the frequency.

If that is the case - then in general, if we assume that the Rife effect really is nothing more than matching a certain impedance of radiation to the natural impedance of a pathogenic body - then our experience should be that each pathogen will be primarily affected by different frequencies. In effect, changing the frequency of a Rife machine will not so much tend to cause a frequency specific resonance with any pathogen - but it will cause an impedance specific "resonance" (or something close to such a resonance, which is actually impossible to achieve in practice) between the radiation and the pathogen itself. When this happens power will be strongly absorbed by the pathogen - ultimately destroying it.

So from this I conclude that there is no such thing as an "MOR" Mortal Oscillatory Rate for pathogens - but rather there is a specific "MI" or "Mortal Impedance" for each pathogen - that simply ***looks*** to us like an MOR because as yet, we have not been able to separate the overall radiation impedance from the frequency that simply contributes most to it in any given machine or configuration.

The Rife Machines

The latter point needs to be expanded upon. If this is correct then in general we would expect different machines to require different frequencies to affect the same pathogens. In practice therefore I predict that what we call "MOR's" are highly specific to the actual machine they were determined on, and will not necessarily have the same effect in a different machine - unless all the other factors above happen to coincide in some way for the two different machines.

This has serious implications for Rife research and for Rife therapy in general. I realise that many practitioners have achieved good results using the fixed accepted "MOR's" for different pathogens - but I also believe that this can be easily explained in another way, and that there is considerable evidence that suggests that what I have proposed, is in fact true.

The first and foremost piece of evidence is in the form of the early Rife machines. We now have details of several of the original Rife machines.

The well known Rife lab notes which have a carrier frequency and a wavelength of super-regeneration give us the first clear indication. In the lab notes Rife has noted that each of the effective frequencies was determined at significantly different power levels. On the notes you will observe that Rife didn't just record the frequencies - he also recorded the voltage and current levels as well. And for each pathogen there is a significant difference in each of those settings. So Rife obviously didn't just switch his machine on with one fixed power setting - he tried the machine with many different frequency settings to get the general response range of the pathogen, and having done that, he tuned the power to effectively adjust the impedance of the radiation for optimal effect. I'll use the BX "MOR" for various machines as an example - in this early machine it was 17.6 meters (17.034 MHz).

Note: I assume that the true MOR is the wavelength of super-regeneration because in the original lab notes several different pathogens have identical "cycles per second" values - it's the wavelength of super-regeneration that is unique to each pathogen.

The second machine we can consider is the Rife Ray No. 4 machine. We are told (Johnson) that the machine is a much higher power version of the earlier devices and more stable. Presumably it has more constant overall power regulation than the earlier models, so the dependence on overall power is now lessened. But the frequencies are still critical. But because the power level is different to the first machine the frequencies are also different - taking the BX frequency again as an example it has now reduced to 1.604 MHz.

The third example is the case of the 1939 Beam Rays machine acquired by the UK Rife Research Group. This machine, which I reverse engineered and measured myself, uses a frequency of approx 21270 Hz for BX - this setting being confirmed by notes from a 1939 diary in which one of the researchers had noted the key settings for various conditions and pathogens.

The final example is the Crane frequencies which are used by most Rife researchers and therapists today in which the BX frequency finally reduces to 2128 Hz.

Each of the Rife machines uses a different frequency for the same thing. Whilst it could be that these are just (intermodulation) harmonics that affect a pathogen, there is no clear evidence that pathogens can be made to "resonate" even with a fundamental frequency alone let alone a harmonic. The much more likely explanation is simply that because each machine had different electrical characteristics, each created a specific impedance match to the BX pathogen in a different range of frequencies. The impedance match on each of the machines was the same - the actual frequency at which the match occurred was different on each machine.

The difference between the last two machines was quite a puzzle initially. Upon measuring the frequencies produced by the 1939 machine I confirmed that all of them were pretty much exactly 10x the known Crane frequencies for the same conditions. My initial reaction to this was to assume that Crane had made some mistake in transcribing the frequencies - we know from the original Crane report, that later machines produced by Verne Thompson and John Crane were based on the Hoyland designed Beam Rays machines. The way in which this becomes apparent is to examine the frequency list of the 1947 Verne Thompson unit which was photographed by Jim Bare. The photos are available on Stan Truman's web site http:/www.rife.org.

The Verne Thompson machine has similar controls to the Beam Rays machine. There is a left hand band switch with 4 positions, a frequency vernier dial in the centre and a right hand amplitude modulation depth control. The Thompson machine also has a further power control (tube current control) switch near the top centre. Now there are two significant differences between the Thompson machine and the Beam Rays machine (ignoring the power control). The band switch on the Beam Rays machine is labelled bands 1 through 4. On the Thompson machine the bands are labelled A through D.   The list of settings for various conditions on the Thompson machine (i.e. the number dial setting) is different from the equivalent settings on the Beam Rays machine. So for example on the Thompson machine the setting for BX is

168-C (i.e dial setting 168 band C). The equivalent setting on the Beam Rays machine for BX is 10-4 i.e. dial setting 10, band 4. So how do we know that Thompson/Crane had examined the Beam Rays machine? At the bottom of the list of Thompson machine settings there is a handwritten addendum which says “BX Vir 10-4”. This setting is meaningless in the context of the Thompson machine and can only refer to the 1939 Beam Rays machine.

So if Thompson had examined the 1939 Beam Rays Machine, how likely is it that he would have made a major mistake in transcribing the frequencies? It’s possible that he did - but a more likely explanation would be simply that his machine had slightly different electrical characteristics to the 1939 machine - probably the carrier frequency and power level, and so it actually required a different modulation frequency setting to create the same impedance as the earlier machine that was necessary to devitalise BX.

Taking this further is there any evidence that the effective frequencies are machine dependent other than this? The answer is yes. From experiments I have conducted with the 1939 machine I have found that the machine consistently creates responses at exactly 10x the known “MOR’s” for various conditions. For example when someone with known Candida infection was exposed to the 1939 machine at 464 Hz there was no response. When the same patient was exposed to 4640 Hz from the same machine there was a major reaction. I’ve noticed similar reactions myself which always seem to equate to exactly 10x the CAFL MOR’s for any given condition.

I tried another subjective experiment using my own machine design. I tuned through a range frequencies on the machine for a fixed 500 Khz carrier until I got a distinct “hit” at 4220 Hz. I verified this by tuning back and forth on the frequency dial and noted that I got the same quite distinct reaction every time I went through the same frequency (about 10 times in all).

I then retuned the power level of the machine - I decreased the input voltage by 0.5 volts - which equates to an approximate change in tube voltage of 80V. I then tuned back to the same frequency where I had noticed the hit - there was no response at all. I tried this again some 10 times with the same negative result.

I then restored the machine to its original voltage and the hit was back again at more or less the same frequency as before. So I once again tuned to 0.5 volts down and hunted for the hit. I found it at around 4420 Hz - so it had shifted in frequency when the voltage had changed. I checked at 4420 with the original voltage setting and there was no response.

Finally I reduced the input voltage by 1 volt from its original setting and the hit now moved to 4775 Hz.

Each overall change in tube voltage caused the hit to move in frequency.

More objective experimentation needs to be done on this, but the circumstantial evidence is pretty convincing.

This result is completely consistent with the idea that the “MOR” is in fact an impedance match not a direct frequency response. A change in machine parameters consistently causes the “MOR” to shift in frequency. Also as I have shown above, power transfer and “resonance” is critically dependent on several factors - of which frequency is only one.

There is further evidence still in the scientific literature on the use of impedance matching for bacterial identification. Reports tend to indicate that changes in temperature or pH of the medium cause a significant change in the response frequency of any given bacterium to any given machine. Which is also entirely consistent with the theory.

In the notes from the Gables Lab experiments conducted by Gonin and Siner in England in the early 1940's they observed that pH was critical to establishing a stable MOR for any given sample. Siner also mentioned having to hunt (with the machine and microscope) for the MOR for Staphyloccocus Albus - which is rather strange since Rife already knew the frequency for this pathogen - unless of course they knew that the MOR's were different on different machines. In another letter whilst joking to Rife, Siner mentions that his MOR should be changing since he has been in England because the MOR depends on the environment of the subject.

There is a further piece of evidence from John Crane. If the impedance is a factor then changing the power output level of the machine will cause the MOR to shift. In which case, if a fixed MOR is determined at one power level, then changing the power of the machine either up or down will cause a shift in the MOR. And if the frequency is left unchanged whilst the power is varied one would expect the effect on the pathogen to vary accordingly. In particular the mortal effect would only manifest inside quite a narrow power window, and that either too much or too little power at any given frequency would destroy the effect. This is confirmed by Crane on the Rife Tapes in a conversation with Dr Robert Stafford:

CD 2 Track 5 Time Index: 3:40

"Now this point Bob, has been very critical in the past and that Rife has found that the volume, in other words the power output of the frequency instrument has a great effect on the destruction of the microorganisms. This in fact has been observed in that the greater powered instruments, the increase in power, has been actually a detriment to the control and destruction of these microorganisms. There is, as Rife has found, a certain power range in which the instrument is effective and above which and below which, very low results are obtained."

So although the evidence is still circumstantial it all tends to point in the same direction.

Implications for Existing Rife Therapy

As I mentioned above this has major implications for existing Rife therapy. The most obvious question is, are we all using the wrong frequencies?

Unfortunately this can't be answered directly at this time. I am convinced that each different machine will cause some shift in the effective frequencies. However, machines which conform closely in design (for example RB's built exactly to Jim Bare's specifications) may well work sufficiently in the same range as to normalise the effect. But different power levels and tuner settings must cause some effect on the overall impedance match and therefore the overall amount of power delivered to the target organism. It is possible that changes in antenna tuner settings in particular could compensate for this effect.

This is worth expanding upon. The RB machine in particular uses an antenna tuner to adjust the power transfer (i.e. impedance match) between the linear amplifier and plasma. Adjusting the antenna tuner will therefore determine the overall power efficiency of the machine - but at the same time it will also change the field impedance - and by implication the effective MOR as well. This implies that mismatches between machine impedance and the "standard" used to assess MOR's may be compensated for to some extent by antenna tuner settings. If this was the case then in some machines we would expect better effects to be obtained at any given frequency if the antenna tuner was ***not*** tuned to optimum plasma match - i.e. we would expect some machines to work better if the SWR was ***not*** optimised to 1:1 (or as near as possible) and that these machines would actually work better at higher SWR readings. This effect has been observed in practice.

Similar arguments apply to other machines like EMEM plasma variants, although these lack the antenna tuner. In the ignition coil type machines a compensating effect would be to increase the duty cycle of the waveform - this would cause a wider impedance bandwidth to be created and will to some extent offset the effect of a bad match. This ties in closely with the observation that 90% duty cycles on these kind of machines tend to be more effective therapeutically.

If the match is "off" then what happens to the target organism? Although I am still working on a means to accurately identify the actual impedance of specific organisms I am reasonably confident that many common organisms have impedance responses in the same overall range. If that is the case then even a bad impedance match will cause some power to be transferred to the target organism. In effect, the organism will probably be adversely affected by radiation with impedance in the correct general range even if the frequency is wrong. The difference will be mainly that it will take a longer exposure to achieve the same effect. This same thing can explain the effectiveness of various unproven frequency calculations, including my own 66.5 Hz harmonic series. It's probable that there is nothing inherently special in my selection of harmonics of 66.5 Hz - but by using a wide range of closely spaced frequencies I am ensuring that in general somewhere in the range there will be a reasonable match to most things at some point - enough to transfer enough power to adversely affect many pathogens.

There is some supporting evidence for this idea. Firstly Dr Couche who worked with Rife at the Scripps Clinic and continued to use the Rife technology for many years with outstanding success, worked with his daughter in his clinic. His daughter who was located by Dave Jeffers reported that he only ever used 5 different frequency settings of the machine for ***all*** disorders. Since his success rate is a matter of record, it follows that he was clearly able to affect many different disorders with only a small subset of the frequencies currently in use.

It has been reported, but unverified, that Rife himself later settled on a similar subset of 4 of 5 "universal frequencies" in his research. Which if true, further confirms the idea that precise matching to specific "MOR" frequencies is not absolutely necessary in all cases.

Whilst I mentioned the above main factors of voltage, current level etc., it is also worth noting that the fields of odd impedance radiation produced by antennas and plasma tubes vary considerably over a relatively short distance. What this means is that a good match may only be obtained at a specific distance from the tube. This will vary considerably with carrier frequency amongst other things. Rife typically used exposures at distances of some 10 inches from the plasma tube and recommended moving the tube around the patient during treatment. This is again consistent with the above theory. The radiation fields as measured around typical plasma tubes seem to vary quite considerably between approx 8 to 12 inches away from the plasma tube at carrier frequencies in the low Megahertz range.

Now whilst a plasma tube may create a wide spectrum of impedances it should be possible to create a much more specific and controllable spectrum of variable impedance radiation with a special emitter design. If this could be accomplished it would radically improve the power transfer into specific organisms and thereby increase the effectiveness of the device as well as lower treatment exposure times. It is highly probable that Rife's early success with cancer patients was due to an extremely efficient narrow band tuning of the output impedance of the device. This was almost certainly coincidental.

Other Effects Explained

There are numerous further "famous" effects attributed to Rife machines which are superficially difficult to explain. Most of them are easily explained in terms of my impedance theory and in most cases can be easily predicted as well.

1. Reproducibility of microscope experiments. The majority of the researchers who have tried to kill pathogens on a microscope slide with a plasma device have failed to achieve any results - or in some cases have managed to get a result which they were unable to reproduce later. I have experienced one such incident myself. This is easily explained in that the impedance of the radiation from a plasma machine depends on all the above factors. A slight change in the power setting or the antenna tuner from one experimental run to another may cause the effect to disappear - or to shift in frequency. Since most researchers have traditionally accepted the fixed frequency MOR idea, it follows that most will be highly confused if they find an MOR at one frequency, go away, come back the next day and are unable to reproduce it at the same frequency. Because the idea of fixed MOR's is so entrenched in the Rife community many will not try other frequency ranges having once determined a single frequency that apparently "works".

A second factor is that when a sample is placed on a slide - particularly with a cover slip, the glass of the cover slip may actually shield the sample from the radiation - because the impedance of the cover slip may actually be similar (or wildly dissimilar) to that of the sample. In this case, most of the power will be absorbed or reflected by the cover slip before it ever gets to the sample. The same applies to closed Petri dishes. Several researchers have told me that they were unable to affect samples in closed Petri dishes with a plasma device - but the same sample exposed in a open dish responded. It is worth noting that Rife himself used fused quartz slides and cover slips, not normal glass.

Regardless of whether or not the slide absorbs or reflects some of the radiation, the proximity of the sample to the slide will alter the impedance environment. So a sample sandwiched firmly between a slide and cover slip will effectively have a different overall impedance to one which is simply placed on an open slide without a cover slip.

Also it's worth noting that in the Gables Lab experiments, they did not hunt for MOR's on traditionally prepared slides with a sandwiched cover slip, rather they used the hanging drop technique - maybe (probably) Rife himself did this - which would present a quite different impedance to a more traditional preparation.

In a related fashion, on a traditional slide, moving a cover slip relative to a sample (spacing it from the sample) will also affect the overall impedance of the sample and therefore its responsiveness to the radiation - Jim Bare has reported exactly this effect in his experiments.

2. "Seeing through walls". It has been often reported that the Rife effect works through many but not all types of conventional shielding such as lead, concrete, steel etc. It has been reported to be blocked by aluminium. This is perfectly consistent with the impedance theory. It is well known from EMC studies on near-field radiation that certain impedances of radiation are able to easily penetrate conventional EM shielding materials. Many metals are at least partially transparent to low impedance radiation and particularly so at low frequencies.

This further explains the inability of many detectors to accurately register the "subtle" radiation from the plasma tubes - the fault lies in the detector, the pickups of which are transparent to radiations of low impedance. In my own experiments I have a developed an experimental sensor which consists of a gelatin filled tube with contacts and which contains a balance of sodium and potassium ions similar to real body tissue - this has a range of impedances which is also similar to other biomaterials. This detector consistently registers radiation from the plasma tube which does not appear on a broadband trifield meter or on any other conventional detector or antenna. See appendix 1.

In the course of experimenting with this sensor I have confirmed that lowering the power output from a plasma tube can actually increase the response in the gel - this is another confirmation of the impedance theory. Also, I have found the effect of changing frequencies (both carrier and modulation) to be, to a large extent, indistinguishable from the effect of changing the voltage across the plasma tube - which is a further confirmation and ties in with my other experiment above.

3. Stimulation of Pathogens. Several researchers have noted that very short exposures to key plasma frequencies that normally kill a pathogen seems to actually stimulate the pathogen instead of killing it. This is once again easily explained by the above theory. We are transferring power directly into pathogen bodies. A large amount of power will obviously kill the pathogen - a small amount of power will be absorbed and will be equivalent to a slight rise in temperature - which is well known in general to stimulate pathogen growth.

It may be that ultimately the Rife effect is nothing more than a highly targetted and specific form of RF diathermy. But further research needs to be done on that.

4. Machine inconsistencies. From the 1930's right through to the 1960's experimenters reported inconsistent behaviour in the machines. Johnson in one letter remarked that one of the Hoyland machines varied enormously in effectiveness. On some days it worked perfectly and on others seemed not to work at all. Johnson even noted that the humidity of the air appeared to affect it. It has often been assumed that this inconsistency was solely due to frequency instability in the machine circuitry. However from the analysis of the 1939 Beam Rays Machine it was found that the frequency generator was an early Wein Bridge Oscillator. This oscillator, whilst not perfect, is just as stable as any modern analog frequency generator and should have been more than adequate for the task. So the inconstant effect was probably

not due to frequency stability alone. It's much more likely that changes in the electric field vector (due to things like atmospheric humidity) caused an overall change in the impedance of the radiation field from the tube. The net effect would have been the same as if the frequency had been unstable. Which explains why Rife and Crane spent years trying to attack the frequency stability problem without much overall success in improving the machine consistency. From the Crane era reports of machine inconsistencies it is clear that neither Rife nor Crane ever fully appreciated the effect of the overall machine impedance. Although they must have been aware that changing some machine parameters caused frequency shifts in the MOR's.

5. Patient inconsistencies. It's been widely reported that Rife cured 16 out of 16 cancer patients at the Scripps Clinic in 1934. However, 14 of the 16 responded much more quickly to the treatment than the other two. A few changes in parameters such as body pH would account for why some patients respond better to one frequency than another - the effective MOR of the target may have shifted slightly - not completely cancelling the effect, but enough to ensure that longer exposure was necessary to deliver sufficient power to affect the target.

The Question of Harmonics and Wave Shape

The last thing I want to address in this paper is the significance of harmonics and wave shape.

When I examined the 1939 Beam Rays machine I found that the modulation was a pure sine wave. The carrier is generated regeneratively (but is not super-regenerative) and is a crude approximation to a sawtooth wave which as I predicted before would be essential for a high harmonic content. But the modulation of the carrier is basically a pure sine modulation, the depth of which can be varied from 0 to significant overmodulation (>100%). In the highly overmodulated state it starts to approximate a square wave but I've found that the effect is most strongly felt at 100% modulation. There is considerable harmonic intermodulation which confirms my earlier predictions for this kind of machine. But despite all this, the main effect is firmly centred on the applied audio modulation which because it's a sine wave, is purely one frequency only.

There was also a surprise, in that the machine had quite a large current limiter in series with the tube - which would of course make a significant difference to the magnetic field strength in particular, but which also significantly reduces the overall power output of the machine to a very low level - I estimate approx 20 Watts. This is however consistent with the idea that getting a good field match is probably more important than raw power. A very high power machine with the wrong field impedance will probably waste most of its output as the radiation will not match to the target organisms.

Considering the impedance question, if a target organism has one specific impedance, then in general for any given machine setup, it will not respond to harmonics, but only to the fundamental. If this is the case then it explains why a sine wave modulation is superior - there is no point in wasting energy in creating harmonics at different impedances which will only be reflected away from the target. But at the same time there remains the question of why are harmonics present?

There are two simple answers. The regenerative circuit that Hoyland used in the 1939 machine was very simple and easy to build, it's also quite efficient. It would have been more difficult and costly to have designed in a pure sinewave carrier circuit. The second reason is that whilst modulation harmonics may not be desirable, carrier harmonics may be - because it may be that the wideband intermodulation of the carrier with the modulating signal would create a wider bandwidth of impedance in the output radiation. If they didn't know at the time the exact required impedance, or even that impedance was important, they may only have been able to get the machine to function by introducing harmonics as a way of producing a series of impedance shifts to obtain a better overall match for a wide range of targets.

This ties in well with Abrahms observation that damped sine waves were much more bioactive than straight sine waves. A damped sine wave will necessarily cause impedance changes in the output radiation spectrum - so it will achieve a necessary "impedance wobble" effect.

It's probable that Rife's very first machine prototype used damped waves. The later generations of Rife's own machines used dual signals, mixed, which given the right harmonic ratio would approximate the impedance spectrum of damped waves - and finally in Hoyland's machines he used increased harmonic content. All of these methods amount to a similar spreading of the impedance spectrum. Of all of them, adjusting the harmonic content is probably the cheapest and easiest way of doing it - which would explain why the Beam Rays machines ended up using this method. It may also explain the "harmonics" argument between Rife and Hoyland.

A pure damped wave or a limited harmonic intermodulation due to mixing of two sine signals would have been more "energy efficient" than simply adding general harmonic content. However it would have also been very much more difficult and complicated to set up in practice. It probably worked better in a laboratory under very rigidly controlled conditions - but in a normal doctor's office (and in the hands of a non-electronics-expert doctor!) it would have been all but impossible to control.

The harmonic technique has a further advantage as well. If the frequency generator is not absolutely stable - as it wouldn't have been in those days, then a slight natural drift in the frequency generator would actually increase the harmonic content and spread the output impedance somewhat as well. So if impedance spreading was desirable then the frequency drift of the machine would actually kill two birds with one stone. But of course there would have been a trade off between excessive harmonic content (and consequent power wastage in unmatched harmonics) and the degree of harmonic "wobble".

There is a final direct piece of evidence in the old Rife documentation. In a letter to Mildred Schram on September 25, 1935, Milbank Johnson says:

"Also, about that time, the new Rife Ray Machine had arrived at its point of construction when elaborate tests had to be made in order to synchronise the MOR produced by it with the MOR produced by the old machine. Now, we are in the throes of accurately charting the 14,000 possible settings on the new machine".

Note that Johnson does ***not*** say they had to calibrate the frequency setting of one machine with the other, he specifically says that they had to synchronise the MOR produced by one machine with the MOR produced by the other.

In other words, the two machines produced different MOR's for the same pathogen - it was necessary to bring them in line by adjusting 14,000 possible settings. A straight set of frequency dials would not have required 14,000 calibration points - but an accurate adjustment of all the main electrical factors, (i.e - the impedance of the machine) when combined with frequency dial settings, would in all probability have required at least that number of possible settings.

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26 February 2002
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Appendix 1

The Gel Tube Sensor

This is a description of the gel tube sensor I made, which I use to examine the output from various tubes and machines. The response of this sensor has been compared with various other sources such as dipole antennas and even an identical tube without the gel - with little correspondence in response. The response from the gel is always different to any “normal” antenna. The response of human tissue was also tested by inserting acupuncture needles quite deeply into muscle and measuring the electrical response on an oscilloscope. The response was similar to that of the gel tube.

If the gel tube is set up alongside another conventional pickup or antenna - they will show the same response to normal radio emissions or RFI. But as soon as the plasma tube is switched on (the actual plasma not just the machine) the gel tube shows a totally different response to the conventional pickup.

The response in the gel to the Beam Rays machine (approx 20W) at approx 6 feet is between 5 and 10 times stronger than the response to my own machine design at a similar distance and more than 10 times the power level (300W). This is not solely due to carrier frequency differences as I have measured the response of the gel up to 10Mhz and there is no major change in the voltage response of the gel as the frequency changes between 500Khz and 10Mhz (within the level of measurements taken). Changing the field impedance of the machine by inserting a different plasma tube or changing the voltage of the machine seems to have a much more significant response than the frequency alone - but the response is not proportional to power output.

The gel sensor consists of a pyrex glass tube 30 cm long and 1.8cm wide, open at both ends. Rubber stoppers are inserted into both ends. The lower stopper has a single hole through which an electrode is inserted (I used a 4 inch nail in the prototype). The upper stopper has two holes. One contains another identical electrode to the bottom stopper and the second hole is just left open - this is to prevent pressure changes when filling the tube.

The tube is filled with a hot liquid gel mixture, made by dissolving approx 7 grams of pure natural gelatin in 125 ml of hot water. Approx 5 grams of a mixture of 66% Potassium Chloride to Sodium Chloride is also dissolved in the mixture. The mixture is poured hot into the tube, completely filling it, and the top stopper is inserted so that there is no air left inside. The mixture will set as soon as it cools to room temperature (no refrigeration required) at which time (provided there is no air) the second hole in the top stopper can be plugged.

Once the mixture has set, the tube can be used for measurements. An oscilloscope probe (10 MOhms impedance) can be connected between the electrodes and the response viewed on the scope.

Fig 2. shows a schematic of the gel tube.

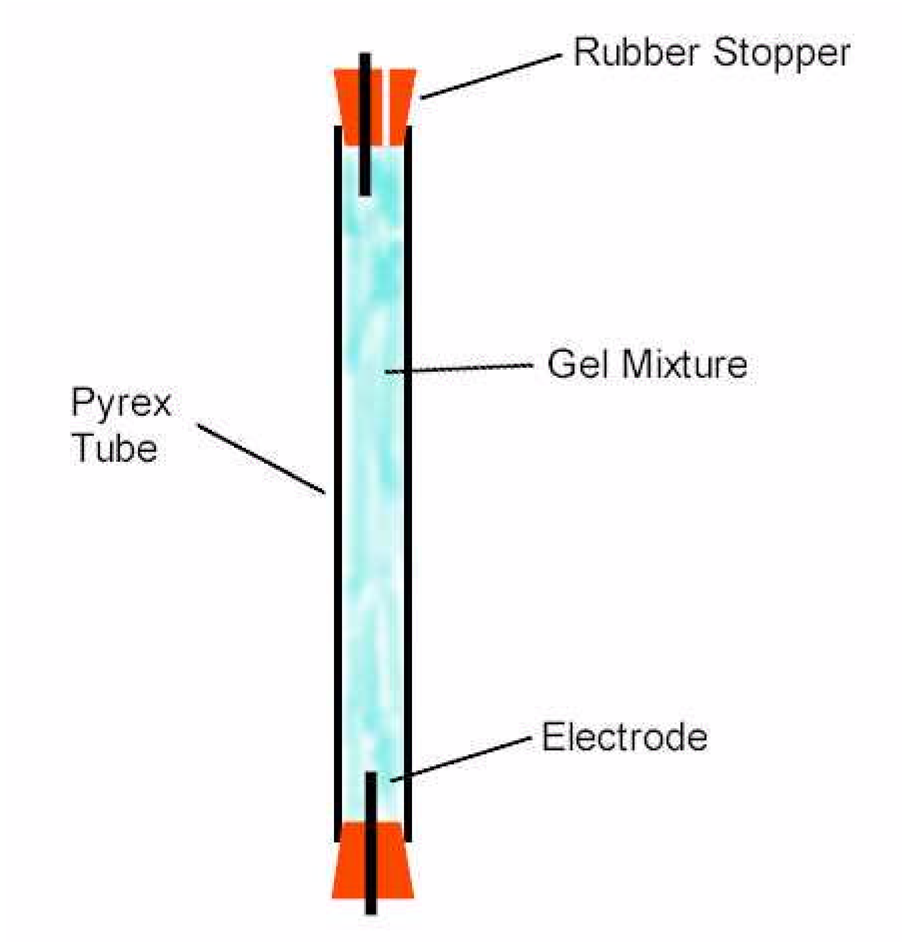

Fig 2. The Gel Tube Sensor

The response of the gel tube corresponds very well to the actual current waveform in the plasma tube at any time.

Appendix 2

Field Impedance Measurements of a Nazarov Phanotron

I have conducted various experiments on measuring the field impedance from a Nazarov phanotron tube connected to my own machine design. I have used my own machine because it allows me to vary more parameters than most and assess the effect.

Fig 3 below shows the field impedance from the plasma tube as a function of distance using a 500Khz square wave carrier and at 500 Hz and 1000 Hz square wave modulation. I have only plotted these two series because I found that more series rapidly become confusing, particularly in black and white.

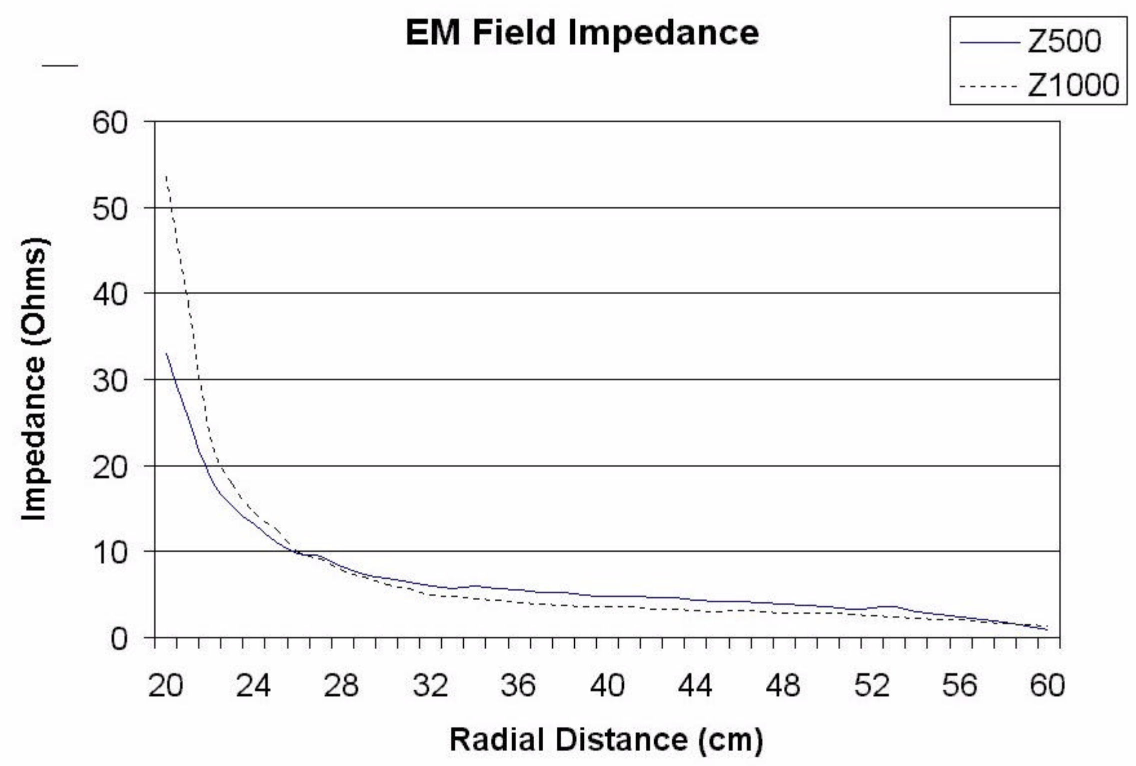

Fig 3. Plot of Plasma Tube Field Impedances with Distance for 2 Modulating Frequencies and Fixed Carrier.

It can be clearly seen from the graph that changing the modulation frequency (which would be the "MOR" frequency) - causes changes in the field impedance of the radiation from the tube. I was unable to measure accurate phase components with the equipment I have, but the magnitudes of the impedance are fairly accurate. What is interesting is that there is no obvious single shift in the response curve with frequency. The higher frequency response starts at a much higher initial impedance but crosses the curve of the other and ends up at a lower point.

It was also impossible to get a clear reading beyond 60 cm with the equipment I was using.

The parametric change in impedance was not continuous. For example, at 5 KHz the impedance was much higher, but between 5 KHz and 10 KHz it dropped again - and the response was not symmetrical with the response below 5 KHz.

Increasing the carrier frequency between 100Khz and 1MHz caused an overall upward trend in the field impedance.

Increasing the voltage however appeared to cause an overall decrease in the field impedance. This seems paradoxical at first sight (since increased voltage leads to increased E field which would imply higher impedance), but can be easily explained in that my machine design tends to operate right on the boundary of the arc-discharge region of the plasma characteristic. So an increase in applied voltage does not actually increase the E-field across the tube significantly but instead causes a major increase of current flow. This would tend to reinforce the magnetic H field component and thereby decrease the overall field impedance. This may not be true of other machines which tend to operate well below the arc-discharge region.

I need to make many more measurements and I am waiting to see if improved measuring equipment can be obtained before running many more tests, as the experimental setup and data verification is time consuming and tedious and I'd rather wait to get better equipment to make better measurements instead of repeating what will probably require close to 100 experiments to gauge properly. But the data I have managed to derive so far shows that there is a very complex and not immediately predictable relationship between the field impedance at any given distance from the plasma tube and the carrier frequency, the modulation frequency, the voltage and the current through the tube. This is exactly what I expected in terms of my theory above.

Some cursory measurements were also made on different tubes belonging to Bob Haining and Stuart Andrew. These tubes also showed significant variation in their field impedances when attached to the same machine running at the same frequency. This is also predicted by the theory.