PxDNA
Installation and Usage 2

Introduction

The PxDNA product is the "personal" offering of the DNA product line. It is aimed at the residential market where to total power in the dirty electricity is not a high value. The DNA products provide a "path of least resistance" to the dirty electricity. Once the DNA product has "captured" the dirty electricity, the DNA turns it into heat. Once it is converted into heat, it can never exist as "dirty electricity" again.

Dirty Electricity Sources

The PxDNA product is designed to reduce dirty electricity in the 5 kHz (5,000 cycles per sec) to 500 Khz (500,000 cycles per sec) range. In reality, the PxDNA will reduce dirty electricity, above and below that range, as well.

Dirty electricity in this frequency range can come from a wide variety of sources. They include the following.

-- Dirty electricity coming in from the power utility company connection. This dirty electricity can be from: 1] the non-linearities in the utility company's infrastructure, e.g. transformers. This type of dirty electricity is often referred-to as "harmonics", 2] broadband dirty electricity from insulator arcing, corona/multipaction in the utility company's infrastructure, 3] poor/corroded connections within the power utility company's infrastructure, 4] dirty electricity from neighboring residential, commercial and industrial properties.
-- Dirty electricity from switch mode power supplies that power various electronics that are connected to the A.C. line, including computers, off-the-grid power inverters, office machines, uninterruptible power supplies (UPS), entertainment electronics, etc.
-- Harmonics from traditional power supplies (not switch mode supplies) that power various electronics, noted above.
-- Harmonics from electrical motors.
-- Broadband dirty electricity from electric arc welders. This is severe, intense dirty electricity.
-- Broadband dirty electricity from induction heaters. This is severe, intense dirty electricity.
-- Broadband dirty electricity and harmonics from motor speed controls, light dimmers and solid state switches. The latter includes SCR's and Triacs.
-- Dirty electricity from certain Radio Frequency (RF) transmitters.

Applying The PxDNA

The DNA product line is not a "filter" product per se. Filter products typically have a Dirty-Power-In connection and a Clean-Power-Out connection.

The **DNA product line is much simpler** to apply, because you **simply plug it in**, in the area for which you want to reduce the dirty electricity. **You do not have to unplug existing appliances** and reconnect them to the DNA product. The DNA products – in this case the PxDNA - are simply plugged in where you want to reduce dirty electricity.

The PxDNA can be applied in many ways. There may not be a "best" way. In the following paragraphs, a number of different approaches to applying the PxDNA are given, each with its own assumptions.

Parameters For Applying The PxDNA

- Are you planning to reduce dirty electricity in a single room or for an entire house/building?
- Do you want to connect the PxDNA(s) and then forget about them, or are you willing to reconnect them at different locations as the day/night progress?
- What is the incoming utility power service?
    - Is it a traditional, 2 phase circuit (US) that supplies either 120 VAC or 240 VAC?
    - Is it a single phase, 120 VAC circuit?

    - Is it a feed from an inverter, where the original power source is a windmill or solar panels?
  - How many PxDNAs have you acquired?
  - Do you have in mind to reduce dirty electricity mostly for dirty electricity coming from your own appliances or dirty electricity coming in from the power utility lines or both?

These are some or the parameters to consider when applying the PxDNA. You will probably think of others as well. You can readily see that even with the above short list of parameters, you can have numerous ways to connect the PxDNA.

Some General Principles To Consider

Close To You. All of the DNA family will provide the greatest reduction in dirty electricity by installing them close to the area that you will be occupying. So for the situation of working in one room during the day, this means install installing the PxDNA there, in that room. At night, this would mean installing the PxDNA in your bedroom.

Close To You – But Not Too Close. Remember that the DNA line of equipment (including the PxDNA) work by providing a low impedance path (a path of least resistance) for the dirty electricity. The PxDNA (and all other DNA products) is "drawing the dirty electricity" into itself. Therefore there is **dirty-electricity-current** flowing into the PxDNA. This dirty electricity is flowing in the line cord of the PxDNA, or any of the DNA products.

The PxDNA will dissipate (turn into heat), a large fraction of the dirty electricity from the utility power line that it is connected-to. This means that the overall amount of dirty electricity power on the utility lines has been significantly reduced, and as a result of this, the overall radiated magnetic fields of the dirty electricity are reduced to the a similar degree. **However, because the dirty electricity is flowing through the line cord of the PxDNA, then there must a higher magnetic field (of the dirty electricity) in the immediate vicinity of the <u>PxDNA</u> <u>line</u> <u>cord</u>**.

So for example, when placing a PxDNA in a room, connect the PxDNA to the power utility circuit (wall outlet) that provides utility power for that room, but choose a wall outlet that is not immediately next-to where you are sitting or (in the case of a bedroom) where you are lying down.

Important Note: This approach (above) works to reduce dirty electricity on the power lines, regardless of where that dirty electricity came from, i.e. is the dirty electricity from your own appliances that are generating dirty electricity or is the dirty electricity coming in from the power utility lines?

Cover An Entire Building/House. If you would like a set-and-forget approach <u>and</u> wish to reduce dirty electricity for an entire building/house, <u>and</u> you feel that most of the dirty electricity on your power lines is coming in from the power utility lines, then installing

the PxDNA at the incoming service connection is a logical approach. This means installing at or near the circuit-breaker-box/fuse-box.

Incoming Service Connection Considerations. This section of the document is intended for the electrical engineers, electronic technicians, electricians, environmental specialists or any handyman/woman. If you are not one of the above, then this may sound like "greek", but since there definitely will be those folks reading this document, then we need to explain the following to them.

- The PxDNA is inherently a "single phase device". It has 2 connection wires.
- You can connect it to 50 Hz or 60 Hz AC power mains.
- You can connect it to any voltage that is nominally 240 VAC or less than 240 VAC.
- In the case of a traditional 2 phase feed in a US residence, you could connect it across the 2 hot leads (L1 and L2, 240 VAC) or you could connect 2-each PxDNAs with: one from L1 hot lead to Neutral and the other from L2 hot lead to Neutral.
- The **above 2 connection schemes are not the same for reduction of dirty electricity**. The approach of connecting one PxDNA across L1 and L2 will reduce dirty electricity that has been impressed across L1 and L2 from some infrastructure or appliance, but will <u>not</u> effectively reduce dirty electricity that is primarily on one phase only.
- The connection scheme of applying 2-each PxDNAs from L1 to Neutral and L2 to Neutral will reduce dirty electricity that is primarily impressed upon L1 to Neutral, <u>and</u> reduce dirty electricity that is primarily impressed upon L2 to Neutral, <u>and</u> will also effectively reduce dirty electricity that is primarily impressed across L1 and L2.

Multiple Phases In One Room/Area. In the aforementioned information regarding incoming service connections, it was pointed-out that there can be multiple phases with the incoming service for a building/house. If in one room/area for which you want to reduce the dirty electricity, it just happens that it contains both of these phases wired in or through that room/area, then it would be most effective to install 2-each PxDNAs, with one PxDNA from L1 to Neutral and the other PxDNA from L2 to Neutral.

Example Applications

[1] Example Application: One-each PxDNA. If you have just one PxDNA, <u>and</u> you want the maximum reduction of dirty electricity, <u>and</u> you want that PxDNA to work the most effectively for all internal (internal to your house/building) and external (from power company lines) sources of dirty electricity <u>and</u> don't mind moving it about during the day/night, **THEN, Take It With You**.

If you will be working in an office for a few hours or all day, then plug it in there.

If you will be relaxing in the living room for some time, then plug it in there.

When you retire for the night, move it to the bedroom.

[2] Example Application: 2 Phase Power and 2-each PxDNAs. If you want the PxDNAs to work for all internal (internal to your house/building) and external (from power company lines) sources of dirty electricity and don't want to be bothered moving it around during the day/night, then one logical approach is to install these 2 PxDNAs close to the incoming service connection. This means installing at or near the circuit-breaker-box/fuse-box. One PxDNA will be connected from L1 to Neutral and the other PxDNA will be connected from L2 to Neutral.

Note: This approach is not the optimum approach if you are most concerned about reducing dirty electricity that is generated internally, i.e. from some appliance within your building/house.

[3] Example Application: 3-each PxDNAs. You can combine examples #1 and #2 above. Connect 2 of the PxDNAs on each line near the service entrance and take the 3rd PxDNA and carry it with you.

[4] Example Application: 4-each PxDNAs. Install 2 PxDNAs as described in example #2 above. Install the 3rd PxDNA where you work/occupy most during the day and install the 4th PxDNA in your bedroom.

[5] Example Application: Combined Utility Feed for 240 VAC and 120 VAC, Using 2-each PxDNAs. This is an incoming service connection where the users have a single 240 VAC line for 240 VAC appliances and a single 120 VAC line for 120 VAC appliances. A possible and effective approach is to install one PxDNA across the 240 VAC line at some convenient place within the building/house. Move the other PxDNA around with you during the day/night to the location that you are most occupying. This second PxDNA will be connected to 120 VAC circuits.

As you can see, the options are many for applying the PxDNA to reduce dirty electricity. You can try one approach, and later change to another.

How Dirty Electricity Gets To You

Folks, this is important to understand. We are constantly surprised at the misunderstanding of the following principles, even by those who profess to know. First some rudiments of electricity.

Electricity Is The Flow Of Electrons. Well that's it. When electrons flow in some wire or object or device, we refer to that as an operating electrical circuit.

The Voltage In An Electrical Circuit Is the PUSH. Just as water pressure is the push that makes water flow in the pipes in your home, Voltage is the push that makes electrons flow.

- A D-cell battery has a voltage of 1.5 volts
- A typical US house power outlet has a voltage of 120 Volts AC

Current Is The Measure Of How Many Electrons Are Passing Some Point In A Circuit In A Period Of Time. A Current of Electrons only flows when there is some voltage pushing it. Just as water pressure causes a certain number of gallons per minute to flow, a voltage cause a certain number of electrons to flow and we call that measure: amperes (amps).

Electricity Can Be AC or DC. Direct Current (DC) means that the voltage is constant. A battery is a good example of this. Alternating Current (AC) means that the voltage is changing – usually constantly changing, and to be specific, it changes its amplitude and reverses it's direction-of-flow (polarity) periodically.

What Does This Have To Do With Dirty Electricity? Dirty electricity is in the wiring of your building/house. It is an AC voltage and therefore causes the flow of an AC current. Dirty electricity is a higher frequency than the power line AC frequency.

- The power line frequencies are typically 50Hz or 60 Hz
- Dirty electricity can be from a few thousand Hz to millions of Hz

Well How Does Dirty Electricity Get To You? You obviously are not touching the power lines with your body. The dirty electricity is getting to you because all voltages in an electrical circuit have an associated "field" called an Electric Field, and all currents (the flow of electrons) have an associated Magnetic Field.

Fields Radiate Into Space. Both Electric fields and Magnetic fields radiate into space. In this consideration of dirty electricity, they travel from the wiring to you.

What Is Induction? Simply put, it means that the presence of a changing (AC) field in the vicinity of object that is a conductor of electricity will cause a voltage to appear on or a current to flow in that object.

When you are in a space where there is dirty electricity in the wiring around you:

- The dirty electricity creates a changing field around you,
- The changing field around you causes a voltage to be present on your body and/or a current to flow within your body, because your body is a conductor of electricity.

How the PxDNA Works.

- The PxDNA will reduce the dirty electricity, **as it is present on the power lines as a voltage or a current**. These voltages and currents on the wiring are the source of the dirty electricity fields.
- By doing this, (reducing the dirty electricity voltages or currents) the dirty electricity field(s) that radiate(s) from the power lines to you, has been reduced in its (their) magnitude(s).
- Therefore the voltage that is impressed upon your body and/or the current that is induced into your body have been commensurately reduced.

Please read this over and over **until you get it**.

What The PxDNA Will Not Do

[A] The PxDNA reduces dirty electricity on the power lines. That is the only way that it works. To explain what it will not do, take the **example of a compact fluorescent light**. We are often asked if the PxDNA is effective for this application.

The answer is Yes and No.

These fluorescent lights typically have a switch-mode power supply in them that is operating somewhere in the 20 Khz – to – 1 Mhz region. It has been found that these switching frequencies (20 Khz – to - 1 Mhz) will leak dirty electricity back onto the power lines. Now the **PxDNA can reduce that dirty electricity because it is flowing on the power lines**.

The lamp will also, **from its body**, directly radiate 20 Khz – to - 1 Mhz into space, i.e. create a field of 20 Khz - to - 1 Mhz frequency. The PxDNA cannot help with this. The PxDNA is reducing the dirty electricity as it appears on the power lines only.

[B] We are often asked about the so-called **smart meters** for utility power consumption measurement and water metering. This is the same situation. The PxDNA can reduce the dirty electricity that these devices are putting back onto the power lines, but the PxDNA will not reduce the switch mode frequencies (20 Khz – to - 1 Mhz) that the smart meter power regulator is radiating directly into space and the PxDNA will not reduce the Radio Frequency (RF) energy that these smart meters are radiating from their antennas, typically the 2.4 Ghz band.

[C] The PxDNA will not reduce fields that are in your building/house that are literally coming through the exterior walls of your building/house from some source outside.

Examples of these sources are:

- Nearby utility power lines
- Nearby utility power substations
- Neighbors appliances
- Nearby radio, television, cell phone, radar, and other communications transmitters
- Nearby industrial sites with equipment/systems that generate dirty electricity

Assessing The Effectiveness Of The PxDNA

It has been addressed in this document that either a **dirty electricity voltage** present on the power lines (**creates a dirty electricity Electric field**) or a **dirty electricity current** flowing in the power lines (**creates a dirty electricity Magnetic field**) will have the ultimate result of producing a dirty electricity field around you and can and will induce a dirty electricity voltage upon your body or induce a dirty electricity current into your body, and it will probably be both.

If you are only concerned with the appearance of a dirty electricity voltage on the power lines and ignore the dirty electricity currents flowing in the power lines then you won't be getting any complete insight into the dirty electricity fields that are surrounding your body, and causing induction of dirty electricity on you and in you.

To the point, if you measure dirty electricity voltages on the power lines and see that they are "acceptable to you" you may still have dirty electricity fields that "would not be acceptable to you" that have been caused by dirty electricity currents flowing n the power lines.

Some More Field Theory For The Readers Who Are Experts

The Far Field is an electromagnetic field that has a fixed ratio of Electric field and Magnetic field together. This field could have been initially produced as a Magnetic field or it could have been initially produced as an Electric field, but once the wave has traveled out far enough from the antenna (power lines) it will indeed be a Far Field and have both Electric field and Magnetic field components.

An antenna theorist will define 3 regions from an antenna:

- Near Field region, aka Reactive Near Field, aka Reactive Field
- Fresnel Region, aka Radiating Near Field, Transition Region
- Fraunhofer Region, aka Far Field

The "Far Field" beginning location, which is given as a "range" (distance), R, is usually defined by antenna/field theorists such that **all three of the following must be true**:

1. R > 2 * (d^2) / Lambda
2. R > d
3. R > Lambda

(d is the largest dimension of the antenna. Lambda is the wavelength of the frequency of interest)

#1 (above) says that the place where we are measuring the field strength must be at a range that is more than: 2 times (d^2)/Lambda. This equation comes into play when the dimension of the antenna is reasonably close to the wavelength (Lambda) of the field we are measuring. An example is a ½ wavelength dipole antenna.

#2 (above) says that if the place where we are measuring the field strength, is too close to the antenna, such that your range (to the antenna) is of the same order as the antenna dimension, then you are not in the Far Field.

#3 (above) says that the place where we are measuring the field strength must be a larger distance away (range) than the wavelength (lambda). Some experts will say that this equation is to be interpreted that R must be at least 2 wavelengths away, but other will say R must be at least 10 wavelengths away.

This #3 consideration is important when considering dirty electricity. If we consider that dirty electricity (this is just one possible definition) is of a frequency from 60 Hz to 2 Mhz, then we have wavelengths as follows:

60 Hz: 5 million meter wavelength
2 Mhz: 150 meter wavelength

Therefore in considering which field (electric, magnetic or electromagnetic) will be present in a particular location, we find that **in most cases we are not in the far field**, because typically we are considering some property where the power wiring is radiating dirty electricity and we are a few meters away from the wiring or possibly 10 or 20 meters away from the wiring. Again, we call that distance of a few meters or 10 to 20 meters, the "Range". **According to the #3 (above) criteria we are not into the Far field** because:

- **For 60 Hz**, the wavelength is 5 million meters, so our range of a few meters to 10 to 20 meters is certainly not greater than 5 million meters.
- **For 2 MHz**, the wavelength is 150 meters, so our range of a few meters to 10 to 20 meters is certainly not greater than 150 meters.

Some of the techniques to reduce dirty electricity on power lines, such as application of the MxDNA/RxDNA/PxDNA will result in reducing both the Electric fields and the Magnetic fields that the dirty electricity is causing in the living/working space.

Nevertheless, in a particular environment, the engineer, technician or building-biologist may have an interest in which field (Electric field or Magnetic field) is predominant, so the discussion will continue with a few more details of fields.

The strength of the field (Electric field or Magnetic field) will vary as the range varies. This "variation of the range" simply refers-to your distance to the antenna (power wiring). Textbooks on field theory will often mention that regions that are close to the antenna (the power wiring), such as the Near Field, the strength of the field varies as:

1 / R^2 in certain sub regions
1/ R^3 in certain other sub regions

Textbooks on field theory will agree that once you are in the Far Field region, the strength of the field varies as:

1 / R^2

An Electric Field …..
A voltage present on a conductor (wire) will cause an Electric field to be present, around that conductor, and as mentioned above, the strength of that Electric field will reduce as you move away from the antenna (power wiring).

Let us take a simple example of a lamp that is plugged into a live electrical outlet. **Assume that the lamp is turned off**. There will be an Electric field radiating from the lamp cord and the lamp internal wiring (up to the on/off switch), even with lamp turned off. It is just the presence of the power line voltage (120 VAC 60 Hz in the U.S.) that is producing the Electric field. And yes, when the lamp is turned on, the Electric field will still be there.

A Magnetic Field …..
A current flowing in a conductor (wire) will cause a Magnetic field to be present, around that conductor, and as mentioned above, the strength of that Magnetic field will reduce as you move away from the antenna (power wiring).

Let us take a simple example of a lamp that is plugged into a live electrical outlet.

Assume first, that the lamp is turned off. There will not be any Magnetic field from the lamp cord or lamp wiring.

Assume now, that the lamp is turned on There will be a Magnetic field from the lamp cord the lamp wiring and even from the light bulb itself.

Again For The Technical Folks …

If you attempt to assess any device for its effectiveness to reduce dirty electricity, then you must make a field measurement. Simply measuring the dirty electricity voltage that is present on the power lines is not only, "not the full story" it could actually be misleading.

Measurement of these fields can be made with an antenna, such as a dipole or a loop, and some sort of "receiver". The receiver can be an oscilloscope that has a Fast Fourier Transform capability, a spectrum analyzer, a tunable RF voltmeter, etc.

One must be careful with this kind of testing including using instruments that read RF field strength over a wide range and magnetometers that read magnetic field strength over a wide range. The calibration factor of these "antennas" typically will vary significantly with frequency. Be careful with this and study the antenna characteristics before attempting to achieve a meaningful measurement. Also always keep in mind the need to have the antenna be a "balanced" arrangement. This can be accomplished with a transformer that is specified to work in the frequency regions you are interested in.

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