

# Evaluation of the Aclara I-210+C AMI Meter City of Talent, Oregon Town Hall Meeting

By William Bathgate, EE, ME

May 30, 2018

*Note: This report has been written in terms that a common person with limited knowledge of electricity and engineering can understand.*

# About the Author

## **BACKGROUND: William S. Bathgate**

I hold an electrical engineering and mechanical engineering degree and previously was employed through late 2015 for 8 years at the Emerson Electric Company. While at Emerson Electric I was the Senior Program Manager for Power Distribution Systems and in charge of RF and IP based digitally controlled high power AC power switching system product lines in use in over 100 countries. I was also directly responsible for product certifications such as UL, CE, PSE and many other countries electrical certification bodies. I am very familiar with the electrical and electronic design of the AMI meters in use because I was responsible for very similar products with over 1 Million units installed across the world.

I hold a DOD Top Secret Clearance, serving in Cyber Security at the USMDA and Homeland Security

I have done this analysis due to my own curiosity without conflict of interest of this new technology.

I have 40 Years work experience in design and deployment of:

- High tech power management systems, UPS and power distribution
- Switched Mode Power Supplies
- Electrical and Electronic hardware engineering
- Computer systems engineering
- Radio Systems design and testing
- High Current and High Voltage switches
- Internet communications using both wired and wireless technologies
- UL, CE (Europe), Africa, Japan, Australia and China product safety certifications
- Cyber encryption and protection of Radio Communications using digital signals
- RFI/EMI mitigation

# Agenda

## **Part 1 - Basic Engineering of the AMI meter**

- **The Analog meter versus the AMI “Smart Meter”**
- **Surge suppression Analog versus the AMI “Smart Meter”, What is missing?**
- **The Switched Mode Power Supply (SMPS) which converts 240 Volts AC to the various low voltage DC power sources for the electronics**
- **The life of a Smart Meter 5-7 years, not 20 years**
- **How bad is “Dirty Electricity” in the Aclara I-210+C meter?**

## **Part 2 – Aclara I-210+C Meter construction and design**

## **Part 3 – Power Measurement and accuracy, design summary**

# Advanced Meter Infrastructure (AMI) Meters and their Switched Mode Power Supply (SMPS)

Aclara  
AMI  
Meter

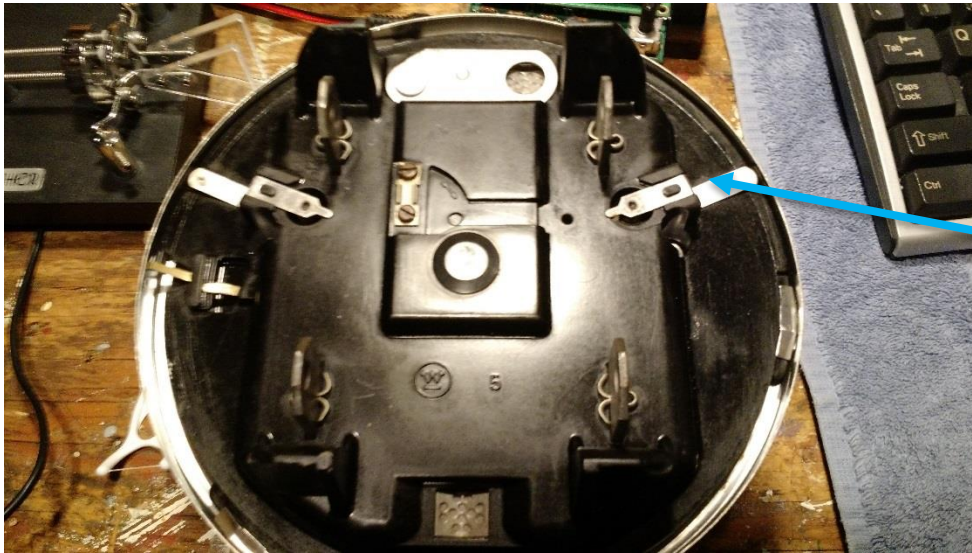


Analog  
Meter



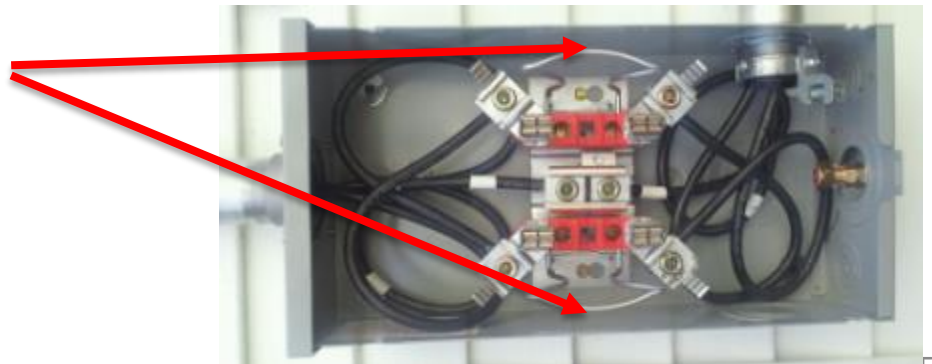
- What is the AMI Meter?
  - The AMI meter is commonly called a “Smart” meter and is the end point of a Smart Grid infrastructure attached to your house. The AMI end point is not required for a Smart Grid to exist. In fact the Smart Grid will take over two decades to fully deploy, but first the utilities decided to deploy the AMI Meters based on incentives and payments from the Federal Government included in the Community Re-Investment Act of 2009. The useful life of the AMI meter is 5-7, not 20 years and needs to be replaced due to the aging of the electronic components. At that point all the costs will be born by the utilities and will be recompensed by the consumer in the form of higher rates. The older Analog meters which the AMI replaced are still available and have a useful life of 30-50 years and had no electronic circuits. Nowhere in the country have rates ever decreased due to the use of Smart Meters

# What is missing on the AMI Meter?



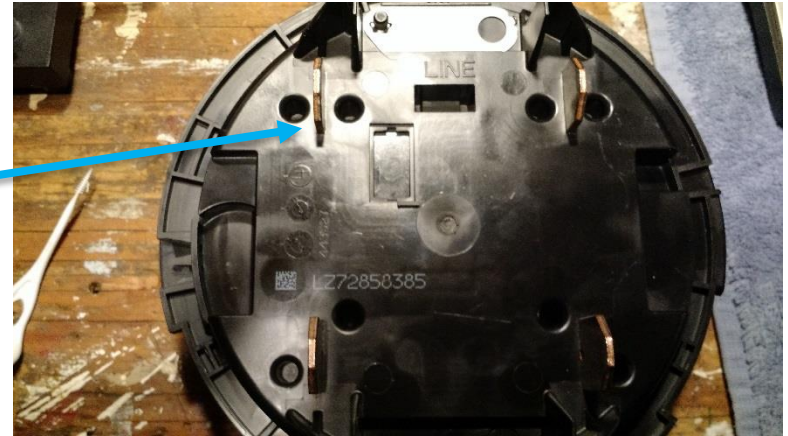
Analog Meter - Surge Suppression tabs which allows any power surge or lightning strike to safely route to earth ground, they touch the semicircular rings of the meter box.

Inside of your meter box are two semicircular rings that connect to the metal chassis of the box which is connected to the neutral wire and ground rod.

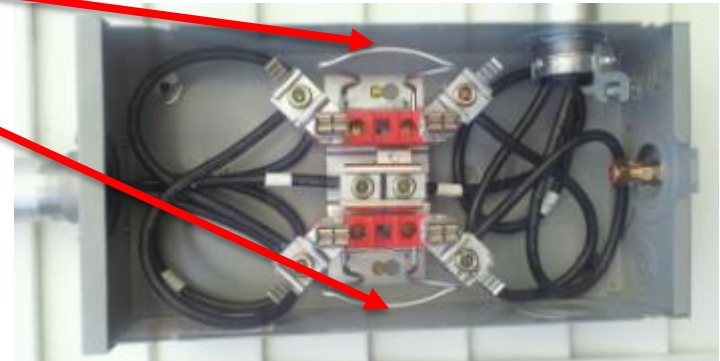


# What is missing on the AMI Meter?

AMI Meter - Surge Suppression is not present, therefore any power surge or lightning strike will route to the electronics boards and cause an explosion and likely a fire.



Inside of your meter box are two semicircular rings that now connect to nothing in the meter, therefore surge suppression no longer exists



# Advanced Meter Infrastructure (AMI) Meters and their Switched Mode Power Supply (SMPS)

AMI  
Meter



Analog  
Meter



- Each AMI meter has several electronic circuit boards and up to two radio transceivers. In order to power the electronics and radios it requires a conversion of the 240 Volts AC power feed to lower voltage DC current via a Switched Mode Power Supply (SMPS). A SMPS is very efficient, is lower in cost and weight and have replaced the older linear power supplies that had been in use in the past. However the new SMPS injects high frequency voltage transients onto the feeding AC wires
  - You likely have several SMPS in your home in your TV's, Stereos, Phone Chargers and many other electronic devices you own. Many of these devices have been tested to very stringent UL Home Use standards, some have not. The devices that do not meet the home appliance UL standards (cheaply made grow lights as an example) inject high frequency oscillations back onto the power line, which radiate through all the power wires in the home like a thousand foot long antenna, these cause human health issues and equipment failures to downstream appliances and circuits. The AMI's SMPS is the type of design that injects high frequency oscillations on the power line entering your home. There is a UL standard for AMI metering but it is very different from the Home Appliance UL standard and does not address the AMI SMPS characteristics. The New Aclara AMI meter does currently meet the UL 2735 standard. However there are still issues as pointed out by UL that need to be addressed related to melting from high voltage surges



# How good is the UL 2735 rating? Maybe not so much !

## UL 2735 Conformity Assessment Findings



*Enclosure flammability – sustained burning/molten and flaming dripping*  
*Single component failures – ejections/flames/accessibility to live parts*  
*Endurance of service switches – welded contacts*  
*Deficient electrical spacings*  
*Supply chain control of safety critical components – compliance of production*



Source : UL Report 20140328 EPRI Presentation-UL2735



# If the AMI meters are UL Approved

## How does this happen?

The root cause is the lack of surge protection and the failure of the Varistor component of every AMI Meter allowing high voltage AC power to the circuit boards. This fire will continue until the feed wires melt and ultimately break the circuit.

Oh by the way the utility does not compensate the homeowner for the damage. They blame it on “customer wiring” How do they know, there is no way to assess this because all the evidence is burned up. Also take note that no heat sensor would ever catch this condition in time to prevent a catastrophe

<https://www.youtube.com/watch?v=Ah3nNo89-NU>

# Life of a Smart Meter

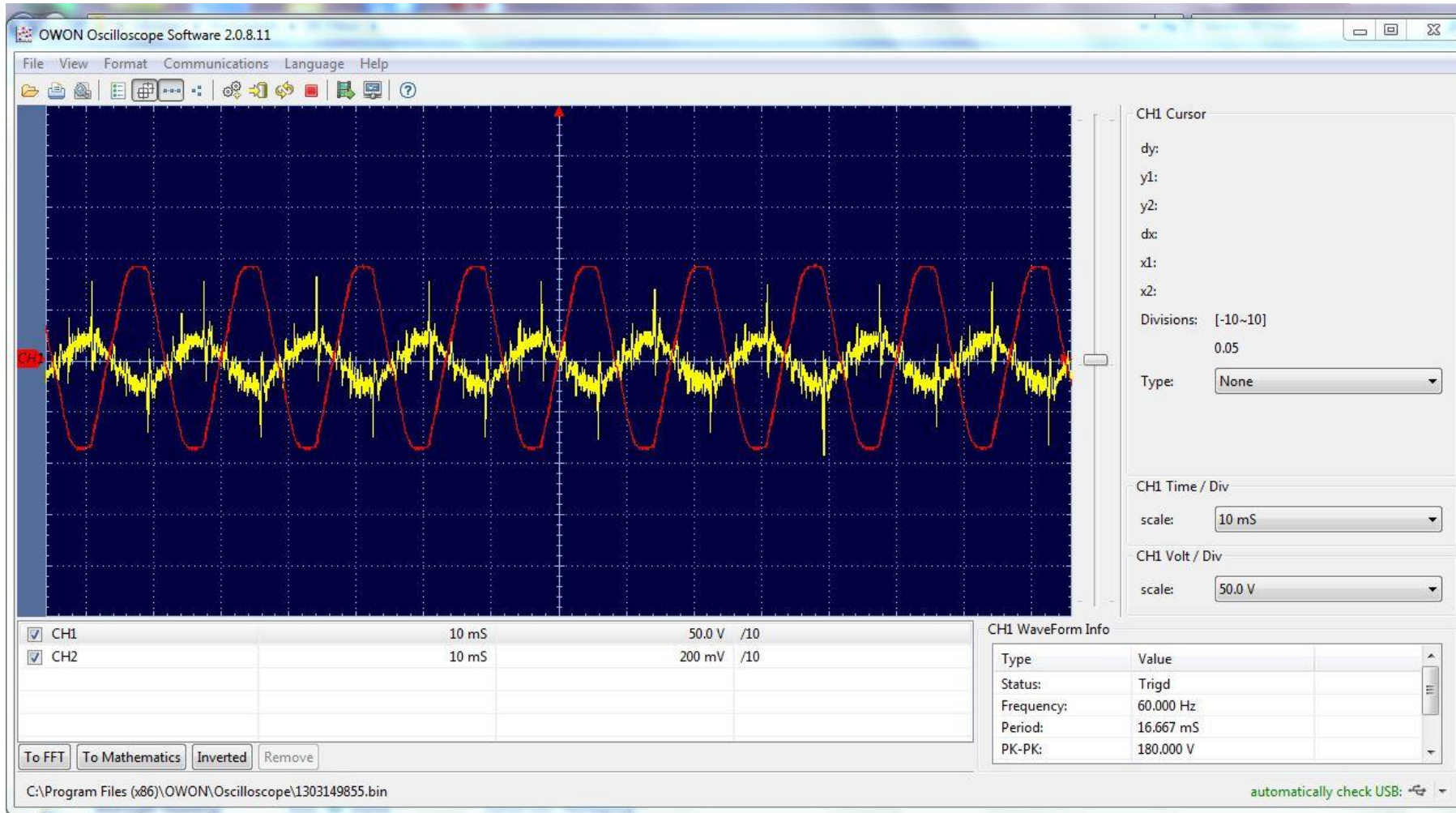
- The typical life of an analog meter is between 40 to 47 years with no loss of accuracy
- The most failing component of the AMI meter is the radio module, APS replaces 20,000 meters per year for this failure alone
- The AMI meter last between 5-7 years due to obsolesce of parts, does anyone have a Smart Phone for more than 5 years?

<https://smartgridawareness.org/2015/10/29/smart-meters-have-life-of-5-to-7-years/>

# How Bad is the “Dirty Electricity” of Aclara I-210+ C

- The following pictures tell the story
  - The first picture is of the Aclara I-210+C reading from an Oscilloscope trace. The red signal is the normal 60 Hertz power provided by the utility. This red trace is normal. The second trace in yellow is of the additional voltages injected by the SMPS onto the power wires of the home. This yellow trace is abnormal. It shows over 300 Millivolts peak to peak. The limitation in FCC class B specifications is 250 Microvolts above 60 Hertz . The measured reading is 1,200 times in excess of the FCC Conducted Emissions Limit.
  - The second picture is of the same home with an Analog meter installed. You will notice a dramatic difference. There is no voltage above 60 Hertz that is even perceptible.
  - All measures were done in a home feed by an Analog meter, this home is vacant with no heat, no lights or any appliances The only device in circuit was the Aclara I-210+C

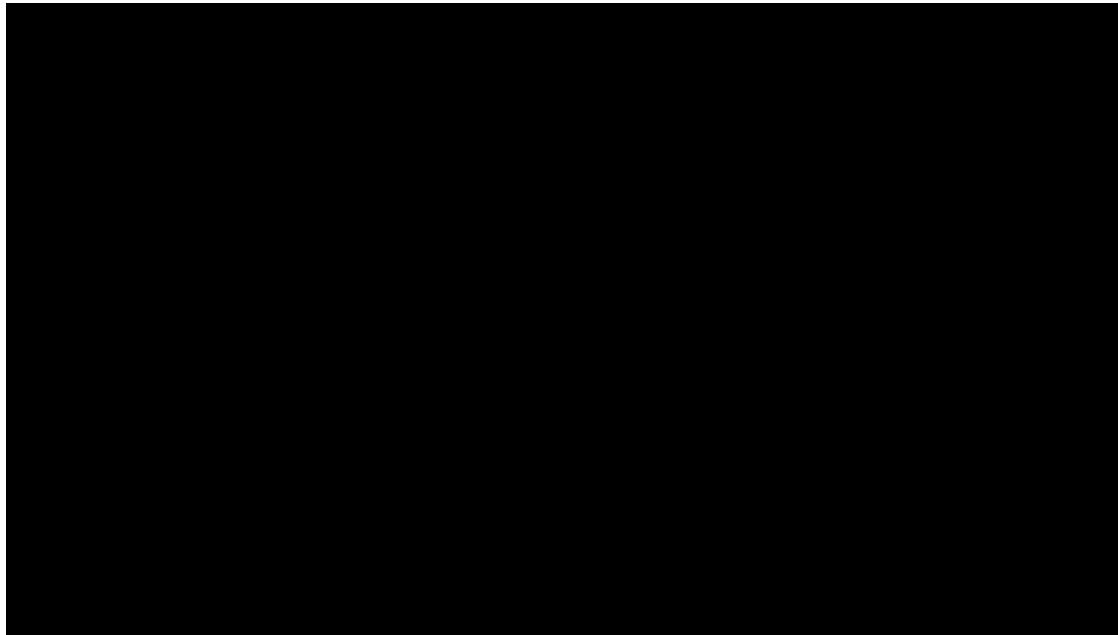
# The “Dirty Electricity” from the ACLARA I-210+C



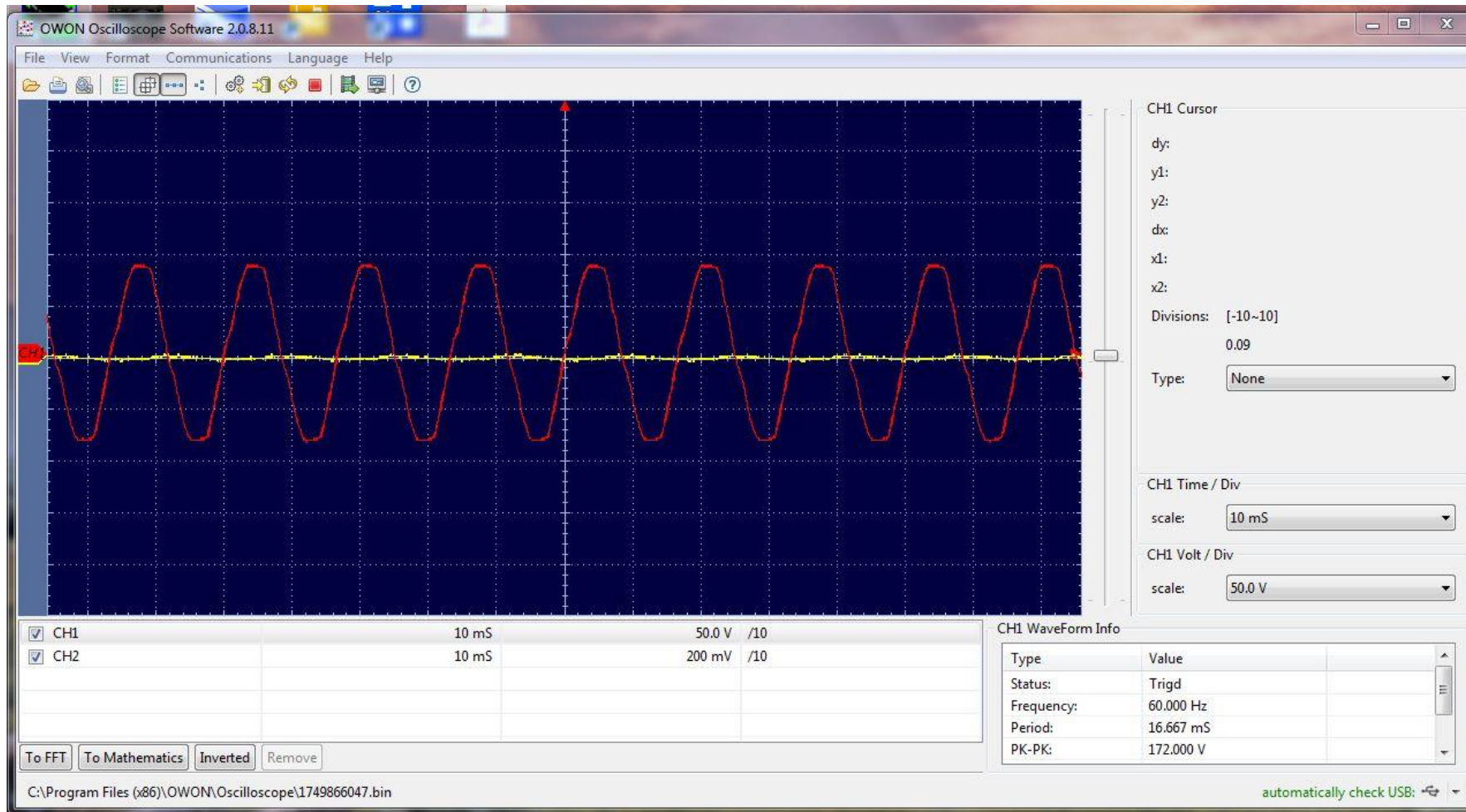
# The “Dirty Electricity” from the ACLARA I-210+C

Click play to watch a live video of the oscilloscope trace

Or go to this site and look down the page - <https://www.defiltersllc.com/dirty-electricity-emc-research-papers/>  
<https://www.defiltersllc.com/dirty-electricity-emc-research-papers/>



# The Analog Meter. Notice no apparent voltages on the yellow trace. There is no detectable Dirty Electricity





# Can the SMPS be Fixed?

1. Yes, but it requires a complete redesign of the AC to DC power supply circuit, a cost of about \$2-\$3 per meter. This is very unlikely to happen however unless there is a class action lawsuit to force this redesign. There are capacitive power designs available on only two meters on the market, the Stratus Sensus and the Aclara C1S meter, and have much lower dirty electricity, but not as low as an Analog.
2. It can be fixed external to the AMI meter, but now the SMPS has put this dirty electricity onto your power lines with anywhere from 100 to 200 amps of current and it is impossible to remove 100% of it. There are filters that can remove between 75 to 90 % of it, but these will cost about \$1,000 to obtain and must be installed at your power panel by an electrician at your expense.
3. There are Stezer or Greenwave filters that plug in your outlets, but these are not a great solution, because they neutralize the dirty electricity from the hot side to the neutral wire causing these voltages to still be present, but now the neutral wire has what the hot wire had. Many people have complained about getting even sicker from these filters because they increase the magnetic effect on the wires, that was not present before.

# Agenda – Part 2

## **Part 2 – AMI Meter design**

- **The Aclara I-210+C Basic Block diagram**
  - **The SMPS board and characteristics and Power Sensing “Current Transformer” sensors**
  - **The Metrology System board, LCD placement, back up battery, Power Disconnect point**
  - **The “Brains” of the meter and the two radio transceivers**

## Theory of Operation

## The Display



## To the house power panel

# Agenda – Part 3

## **Part 3 – Power Measurement and accuracy, design summary**

- **The radio transmission, frequency and signal encryption**
- **The cost in kWh to run the meter, you pay to run the meter**
- **Meter accuracy and your bill**
- **Expected life of the Meter**
- **Overall observations and weak design areas of the Meter**
- **Has the investment in new AMI meters benefited the consumer?**

# AMI Radios Characteristics

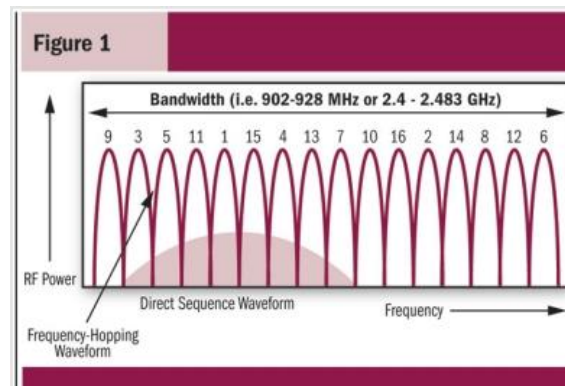
- 1st Radio Signal using RF Mesh – different for a Hub and Spoke system, but the number of pulses are the same
  - Power rating at the meter in an **isolated** environment is within FCC specifications of less than < 1 Watt at “Unity” gain in the spec FCC Part 47.15
    - Radio transmissions are allocated by the FCC in what is called the radio spectrum. This is typically stated as the wavelength of resonance, similar to piano tuning forks which resonate as a particular sound frequency based on its length of the forks. Antennas are usually stated in the frequency of resonance and gain.
    - This meter’s 1<sup>st</sup> radio operates in the 33 CM radio spectrum which is between 902-928 MHz 33cm is called the full wavelength which about 12.99 inches long. Wavelength is important in that to fully “hear” the signal you need an antenna that is 12.99 inches in length or typically some even fraction of the full wavelength. Such as ½ or ¼ of the full wavelength. The antenna in the Aclara meter is ¼ wavelength or about 3.25 inches long.
    - It uses a “Spread Spectrum” technique and sends “packets” of information.

FCC Frequency Allocation

902-928 MHz	Spread Spectrum Transmitters	1 Watt Output Power		15.247
	Field Disturbance Sensors	500,000 $\mu$ V/m @ 3 m	A	15.245
	Any	50,000 $\mu$ V/m	Q	15.249
	Signals Used to Measure the Characteristics of a Material	500 $\mu$ V/m @ 30 m	A	15.243
	Intermittent Control Signals	12,500 $\mu$ V/m @ 3 m	A or Q	15.231
	Periodic Transmissions	5,000 $\mu$ V/m @ 3 m	A or Q	15.231

# AMI Radios Characteristics

- Frequency Hopping Radio Signals
  - “Spread Spectrum” is a frequency hopping technique invented by the famous 1940’s actress “Hedy Lamar” and sends “packets” of information. It was developed to foil the enemy radio signals from blocking our proximity sensing anti-aircraft shells in WWII.
  - Frequency Hopping is a technique to avoid collisions of transmitted signals, so the first packet of data will be sent to a random channel in the frequency range. If it senses that there was a collision it shifts the frequency until it is successful in sending the data packet, then the process starts all over again for the next packet. Packet size can vary from 576 bytes to 1500 bytes, Aclara does not disclose the packet size it uses. As the number of meters increase the signal experiences a lot of collisions causing retransmissions
  - The number of transmissions increases as the number of nodes in the network increases, the result is a type of radio immersion of the entire neighborhood, sometimes called a “Radio Soup” environment leaving no safe harbor from the microwave radiation.
  - Packets are sent approximately every 4-5 seconds all day based on observations of readings. The daily upload of the meter data usually occurs each night taking from one to two hours long.





# The Radio Characteristics



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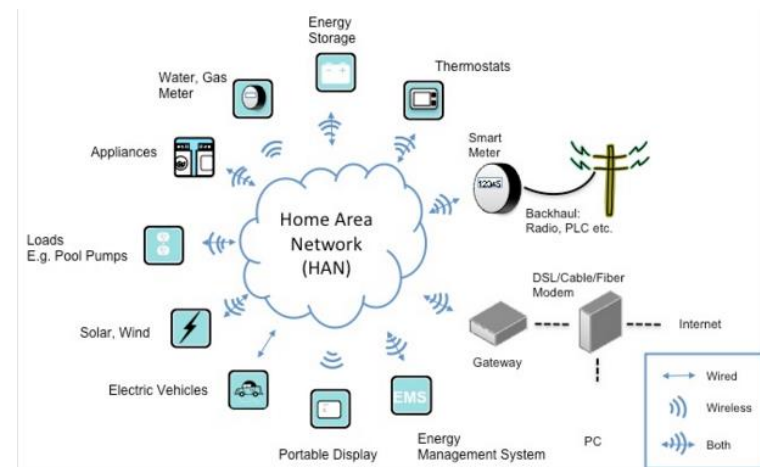
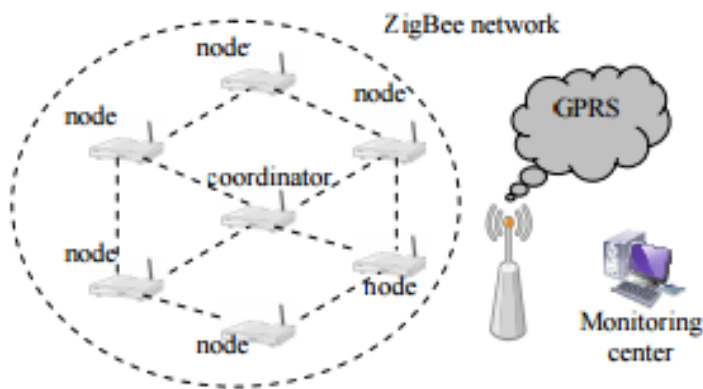
# AMI Radios Characteristics - Lies

- The number of transmissions **LIE**.
  - Because of the Frequency Hopping Radio Signals dynamic there is no practical calculation the utility does on paper that is anywhere in reality in the field. The radios are always in collision with other meters and the re-transmission of packets causes much more traffic. Therefore the meters are very busy all day long trying to get it message out. The utility statement that they only transmit once a day for a small number of seconds is completely false. You should challenge this directly and if the utility is so confident that they only transmit once a day to be challenged by a \$1,000 bet and jointly test a meter.
  - The transmission profiles for the ZigBee radio if it has one are about every 6 – 30 seconds, so in my field testing the radios transmit a signal about every 4 -10 seconds, the 900 MHz transmissions are much stronger than the ZigBee radio but the two combined cause the meter to send out an enormous amount of transmissions.
  - How do I know this is all true, see this court documents from the trial in California in 2011 where PG&E had to confess to the lies they were telling the consumer. In addition to the power emitted lie  
[docs.cpuc.ca.gov/efile/RESP/149398.pdf](https://docs.cpuc.ca.gov/efile/RESP/149398.pdf)

There are whole host of added lies told, such as the AMI meter is less than a cell phone, which is also a lie. The typical cell phone power is between .4 to .5 watts an AMI meter is rated at 1 watt or more. See [https://skyvisionsolutions.files.wordpress.com/2013/06/powell-report-bioinitiative-report-2012-applied-to-smart-meters-and-smart-appliances\\_june\\_11\\_2013.pdf](https://skyvisionsolutions.files.wordpress.com/2013/06/powell-report-bioinitiative-report-2012-applied-to-smart-meters-and-smart-appliances_june_11_2013.pdf)

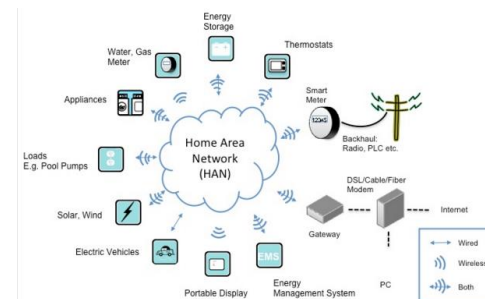
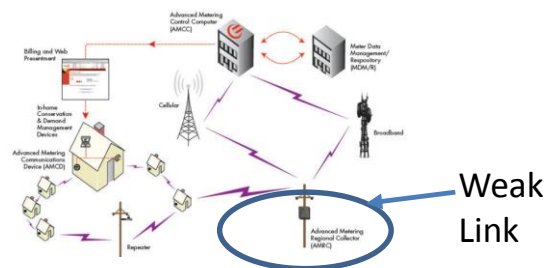
# AMI Radios Characteristics

- ZIGBEE Home Area Network (HAN) Radio Signal
  - Encrypted Packet Radio Network (GPRS), @2.4GHz radio frequency
  - Uses a Mesh Network topology similar to the AMI meter's 902-927 MHz radio
  - Also uses a gateway to your home network router
  - The Aclara Meter acts as the coordinator, therefore you need to contact the utility to register each device you add to include them in the HAN network
  - The packet size is 127 bytes
  - Coordinator power levels are up to 1 Watt, though mostly 0.4 Watts



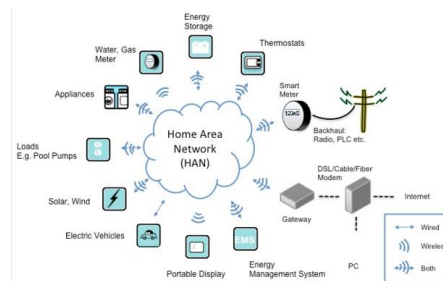
# AMI Meter Vulnerability

- Can the radio signals be hacked?
  - The 902-927 MHz and the HAN ZIGBEE 2.4 GHz radio packets are AES 128 encrypted . Therefore it is unlikely that a hacker would take the steps needed to attack your home. It would not gain them anything financially.
  - The Collector which is the most vulnerable component (Weak Link) is the regional repeater/collector. While this device cannot be easily hacked, it can be attacked. I do not condone in any way any actions but any terrorist group can obtain a shotgun and disable it by shooting it. It is unclear what individual homes would experience regarding their power, it may cause a massive power shutdown due to a “false Positive” to a tampering alarm of the meters.
  - Another method would be to design a broadband RF interference transmitter operating at >30 Watts and flood the repeater with signals so it cannot collect data.



# AMI Meter Vulnerability

- Privacy - Can your personal information be hacked?
  - The 902-927 MHz radio sends personal usage on a 15 minute interval to the utility. The signal can determine if you are at home, when you use your power the most, and whether the load is resistive (Light Bulbs) or inductive (electric motors).
  - With the Energy Bridge device they can determine the model number and serial number of the appliances you have, turn off your appliances remotely without your permission and share your personal information with third parties you will not be able to control. They also can connect to your Smart TV and scan what TV shows you watch and report that to third parties. With a Smart TV they can actually listen to your conversations. Spam and fishing attacks will likely expand
  - With the Energy Bridge device they can connect to your home network router and listen to your internet traffic such as VOIP phone conversations, emails, streamed downloads etc. Since they will be directly connected to the router via a wired connection and do not need encryption to detect the traffic.
  - Each Meter also has a infrared LED at the top which flashes more frequently as you use more power. If you have a night vision goggle you can readily see this. Police can use this as an indicator of a possible illegal drug growing indicator. Thieves can use this to determine if a house is not occupied at the time.



# Meter accuracy and your bill

- There is the common perspective that a digital readout is more accurate. This is not true, a digital readout is not as reflective of the measurement as a needle on a dial. A needle will react immediately to a change, a digital readout will change based on the sample rate of the circuit.
- The AMI meter is “accurate” based on the Navigant Consulting Report in 2010 and referenced on the Aclara web site. However within this report the extremely high rate of billing complaints after the installation of the new meters is evident and explanations were difficult to verify as to their cause. The number of complaints was dramatic This test was done in Texas with temperature ranges from ~30 to ~88 degrees.
- Control testing conditions were not well explained in this report, in particular the type of load the meter accuracy was compared to.
  - Restive loads such as light bulbs
  - Inductive loads such as electric motors
  - No discussion on how the meters did the kWh calculation, with averaging of samples, averaging of peaks over a fixed period of time, or totalization of the all readings?
  - The tests were all done in a controlled room

Can harmonics affect a meter? Yes→



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# Meter accuracy and your bill

- The meter electronic sensor used to calculate power is called the “Voltage / Current Sensor” in the AMI meter versus the “Eddy Current” sensor in the Analog meter. Both methods are accurate and within ANSI standards of 2%. What is very different in the AMI meter is the algorithm used to calculate the readings from the sensor into the indicated display. The analog meter is a type of “totalizing” meter just like a gas pump. The AMI meter uses sensor data, which has to be averaged by a mathematical calculation and then registered into memory and on the LCD display. The gas pump has a weight and measures standards sticker to assure the Consumer they are getting what they paid for, there is no such concept on an AMI meter.

# But Wait, I thought the new meters we more accurate?

	<b>Accuracy</b>	<b>Precision</b>
<b>Definition</b>	The degree of conformity and correctness of something when compared to a true or absolute value.	A state of strict exactness — how often something is strictly exact.
<b>Measurements</b>	Single factor or measurement	Multiple measurements or factors are needed
<b>Relationship</b>	Something can be accurate on occasion as a fluke. For something to be consistently and reliably accurate, it must also be precise.	Results can be precise without being accurate. Alternatively, results can be precise AND accurate.

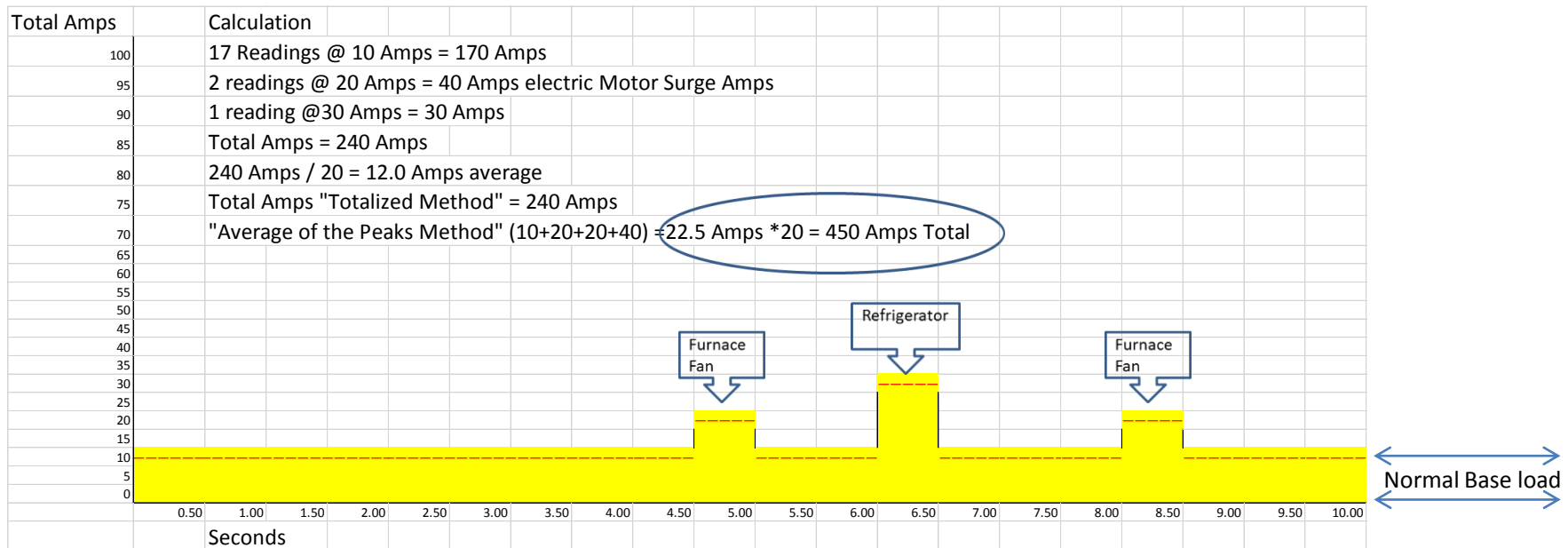
So to be accurate I must hit the bullseye 1 time, to be precise, I must hit the same target spot repeatedly. The AMI meters meet the ANSI standard for accuracy, but they only have to hit the reference measurement

once to be declared accurate according to the ANSI Test. They do not have to be precise and repeat the same measurement, over and over. ANSI is an industry funded standards body, it is not independent government body as the NIST actually is.

# Why is the Bill Higher?

## It depends on how it is calculated

### Totalized versus Average of the Peaks



The utilities will not likely reveal how they are doing this calculation, unless forced under court order, this method can be electronically changed at will by the utility with no transparency to the consumer

6/1/2018

# The example of a totalizing meter – a gas pump

A gasoline pump is a totalizing type of device, regardless of how fast you press the handle the meter on the pump registers only the amount total fluid dispensed. It is as if you put the gas in a bucket and then poured it in your tank. The meter reads the total volume of gas dispensed, there is no averaging of the rate at which you pumped the gas.

Since I have managed a power measurement product using current sensors and hall effect sensors I can tell you that averaging electronic readings is prone to results that are wrong. In the ANSI testing there is no fluctuating load characteristics. It does vary in load but the load is very stable. The test is similar to using a very, very large Edison Light Bulb with no variation such as a refrigerator motor starting and stopping frequently, and other “reactive” type of loads such as your furnace fan.

Now lets think of calculating the amount of gas dispensed based on how fast the gas is pumped over a window of time, irrespective of the total volume dispensed.

On the next page the math is calculated, it is a very simplified example but illustrates how easy it is to calculate the wrong amount by using averages over time.

The analog meters we had were true totalizing meters, the wheel and dials worked exactly like a gas pump does.

# Totalizing versus Average of the Peaks

Run the pump at the slowest setting at 1 Gallon a minute for 1 minute

Stop pumping for 4 minutes

Run the pump at a faster setting at 50 gallons a minutes for 5 minutes

Stop pumping for 4 minutes

Run the pump at the slowest setting at 1 Gallon a minute for 1 minute

<u>Gas Pump Example</u>											
Averaging of the peaks											
1	Rate of flow in Gallons per minute										
50	Rate of flow in Gallons per minute										
1	Rate of flow in Gallons per minute										
17.33333	Average rate in Gallons per minute - $1+50+1 = 53$ -- Rate of $53/3$ samples = 17.33 Average per minute										
15	Sample window for computing the average in minutes										
260	Total Amount of gas pumped via averaging the peaks = 17.33 gallons per minute x 15 Minutes = 260 total										
Total Volume - Totalizing Technique											
1	Total volume for 1 minute										
250	Total volume for 5 minutes										
1	Total volume for 1 minute										
252	Total Volume in Gallons - there is no sample window, you could pump 252 gallons over a full hour and it would still total the same amount										
In this example you paid for an extra 8 gallons of gas based in averaging the peaks versus total amount pumped											

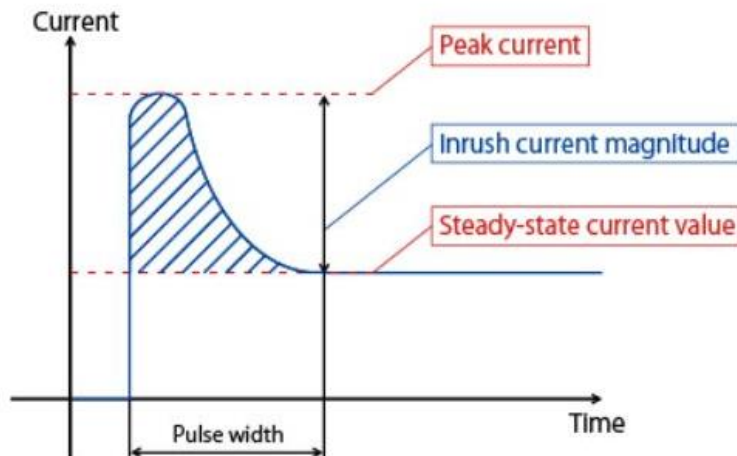
# **Summary - The consumer is at the mercy of a computer calculation not in their control**

- The consumer is at the total mercy of the utilities, the consumer has no tangible means to challenge an inaccurate reading, even the utility cannot confirm whether a meter is accurate, they do not have the equipment or personnel.
- The utilities and meter manufacturers have created and deployed a product that by design creates inaccuracies in measurements from harmonic distortion called voltage transients/harmonics.
- Transients/Harmonic distortions are well documented to create measurement inaccuracies in multiple studies, one of these is Applied Electrometric Technology AEMT conference of April 2014 G201 “Analysis of Harmonic Distortion Effect on Deviation Measurement of Electric Energy in a kWh Meter. I learned this basic concept in my electrical engineering classes over 40 years ago.



# Meter accuracy and your bill

- Navigant Consulting's Report in 2010 is referenced on the Aclara web site. But there were two different meter manufacturers Aclara and Landis+Gyr. The report did not differentiate performance characteristics between manufacturers
- The Navigant Report tried to explain the billing inaccuracies using complex mathematic explanations and reference to "degree" days but the degree variance was typically within 10% year over year, yet this did not explain power bills increasing as much as 25%-40% higher year over year.
- Their test lab control set setups were done at room temperatures as shown in pictures in the report
- There was no field test at various temperatures for accuracy, nor was there a test using electric motors, they only lab tested with light bulbs, two completely different variables.

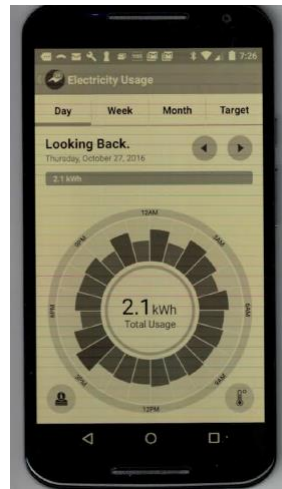
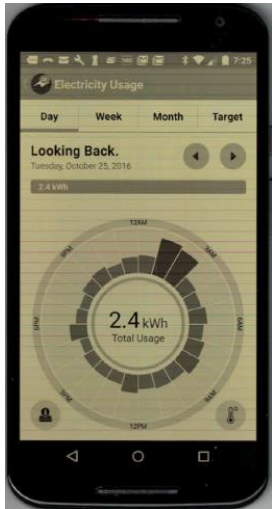


Electric Motor Current Draws are different than a light bulb

- There is a short .5 to .6 sec burst of current needed to start an electric motor, so a 5 amp rated motor may need 8-9 amps to get rotating up to rated speed
- If the utility is measuring peak current and averaging this over a window of time you can skew the average when you combine the two types of loads.
- Only the utility knows the math in the software
- If you have "Energy Star" refrigerator/freezer it starts and stops frequently, and so the skew of the average is worse, imagine the impact on the average reading after 3-5 motors start and stop in the sample window.

# My Energy Insight Readings

**Average Daily AMI kWh Use 2.37 kWh @ 0.13 per kWh = \$0.31 (865 kWh/Yr.)**



As you can see this is not just simply reading power consumption. This is full blown surveillance

Note – No breakers were on and the time and reading of the meter is not a simple “Text” message

# Meter accuracy and your bill – Power Required to Run the AMI Meter

Data Source – DTE Energy Insight Phone Application

Test Conditions: Main breaker ON, All branch circuits OFF

Home Unoccupied – Skipped dates are from periods when we were moving into the home and we excluded any dates when we needed to turn on a light bulb

Date	kWh Consumed by the AMI Meter
October 17, 2016	1.8 kWh
October 18, 2016	3.0 kWh
October 19, 2016	2.2 kWh
October 20, 2016	3.2 kWh
October 21, 2016	2.1 kWh
October 25, 2106	2.4 kWh
October 26, 2016	2.2 kWh
October 27, 2016	2.1 kWh
October 28, 2016	2.3 kWh
Average Daily AMI kWh Use	2.37 kWh @ 0.13 per kWh = \$0.31

# Meter accuracy and your bill – Power Required to Run the AMI Meter

**Based on real collected data, not extrapolated calculations**

- At ~ \$.31 per day cost just to run the AMI meter this equals an added \$113.15 per year per customer for 865 kWhs annually
- If you consider the total annual AMI kWh use for the 2.1 M DTE customers @ \$113.15 this is an added \$238,350,000 in added revenue to DTE to run the AMI meters, fully paid by the customer base
- If you also consider the Annual kWh consumed by just running the AMI meters in the 2.1 Million Customers in the DTE territory this equals an added 1,816,605,000 kWh in required added generation capacity just to run the AMI meters.

**Conclusion: There is absolutely no evidence the AMI Meter program saves energy in kWh or money, in fact it only drains the bank accounts of the consumer and pads the revenue of the utility.**

**The only way the AMI program will save kWh's is to use it to ration power to consumers via Demand Response/Time of Use rate structures at 4-8 X normal rates where the elderly, disabled and young families with a parent and small children at home can least afford it or do without power during the Demand Response/Time of Use period. Under this scenario the AMI program is the largest fleecing of the consumer to ever exist.**

# AMI Meter Life Expectancy

- New to the home consumer is the deployment of an electronic power meter on the exterior of the home. There is no realistic expectation that these new meters will last 20 years of more.
  - The miniaturization of electronics constantly leaps forward in reducing the size of an electronic design. This causes the industry to obsolete certain logic chips sets within one or two years from the date of the original start of manufacturing.
  - With obsolescence comes the risk that direct replacement of a meter after 2 years with the same components is unlikely or the required software compatibility will be restrained.
  - Electronic circuits do fail under the extremes of temperature and humidity. The meters are not hermetically sealed to keep out dust and moisture. There are conformal coatings on the circuit boards which indicates they had issues with moisture on the chip sets in the past, the whole board is not covered with a conformal coating but only on special areas.
  - The number of incoming power surges hitting the Varistor on the power supply board will degrade this component over time to where it no longer protects the circuit and increasingly permits power line quality issues to enter the circuit boards. This can cause an exacerbation of the “Dirty Electricity” issues already present or circuit board failures .
  - The LCD will be hard to read after exposure to temperature extremes and humidity in less than 5 years. LCD’s are very sensitive to low temperatures, and they dim considerably below 0 ° F

# Overall Observations of the Meter

- After a hard look at the design and construction of this Aclara meter there are the following observations
  - The biggest weakness is in the power disconnect, it suffers from a small surface area for the disconnect contact and would be prone to excessive heating and likely result in contact pitting and carbon deposits that are not readily visible by the customer and there is not a sensory circuit that could detect it and report it to the consumer or the utility. This design would be prone to creating unpredicted fires.
  - The second weakness which is causing thousands to become ill is the lack of a common mode and differential filtering of the SMPS oscillations being injected from the meter onto the house wiring circuit, thus making the whole house into an antenna with dangerous RFI/EMI. Overall costs for the needed components would be around \$1.50 per meter/circuit board. There are ways to design a SMPS without these filters but this design would need to have a solid ground reference to earth, but this meter design and construction does not permit an earth ground so this scenario is unfeasible.
  - The power required to run the AMI meter is borne by the homeowner, this was never disclosed to the public that their bill will go up by over ~\$115.00 per year just to power the meter. Also the added load on generating capacity was never used in the justification for the investment required for the deployment of AMI. This gives a false impression on the AMI program reducing energy consumption. It does not save any energy for the consumer or the utility. The current Analog meter does not cost the consumer or the utility any energy to power it.

# Overall Observations of the AMI Meter

- Additional observations
  - The privacy and security of the full AMI program is another exposure that has not been fully disclosed to the consumer. The broad based scenario of incorporating the Internet of Things (IoT) in the home environment and linking it to a meter creates increased exposure of personal information to third parties without consent. The fact that the consumer agreed to the service agreement of the utility for provision of electricity also implies the the consumer has by default agreed to the disclosure of personal information to places not named should be a large concern. Image if this was the case when you buy gas for your vehicle. Should the gas provider require you to ID the type of vehicle you are driving before the pump is tuned on?
  - The utility consistently states the RF emissions of the meters meet FCC requirements, this is a misleading statement, FCC requirements are for the effects of enough ionizing power to cause the brain to heat up 1° C. There have been over 800 peer reviewed independent studies not funded by the industry that have linked this type of low level non ionizing RF radiation to a group of diseases including brain cancer, Parkinson's, Alzheimer's, high blood pressure, Tinnitus, skin rashes and open sores as an example. Industry funded studies do not concur with these findings so this adds to confusion on the health effects attributed to the meters. I have personally met many of the affected consumers and this is no joke or set of psychological conditions.
  - The fact that there is a set of circuit boards in a power meter at all is a large risk, the circuit boards would not be able to withstand a lightning strike or a power surge without an explosive reaction and likely melting of the circuits. This would lead to total destruction of the unit and lead to a possible fire.

# Has the investment in new AMI meters benefited the consumer?

- The utility is passionate about the need for AMI. Their primary benefits are:
  - Reduction in meter reader workforce costs
    - The has been no rebate or discount to the consumer for this savings the utility gains, where did this savings go?
  - Ability to monitor the expanse of outages
    - This may marginally benefit the consumer but communications of their outage existed before via phone anyway. However the savings to the utility has never been remunerated and returned to consumers.
  - Ability to turn off services to non paying consumers without out a “Truck Roll”
    - This will save the utility money, yet the savings are not passed on to the consumer, every time a truck roll is avoided the utility should be sending a check equal to that costs savings to the consumer base.
  - Ability to save energy
    - The AMI meters themselves increases demand for energy capacity and costs the consumer ~115.00 per year in added costs they were never told about. In addition there is a question of fairness in reporting how inductive loads are calculated in the meter readings. The lack of transparency in the data manipulations for inductive loads versus resistive loads has never been elaborated by the utility.
    - The only way this will save energy is to require 100% compliance to Time of Use/Demand response to ration power to consumers. Demand Response policies have never been explained and enumerated to the consumer and many of these policies are already in the pipeline. Federal law requires that if DR is made available in a service area it is to be 100% enforced.
    - See this file





# Has the investment in new AMI meters benefited the consumer?

- The utility is passionate about the need for AMI. Their primary benefits are:
  - Ability to incorporate alternative energy sources
    - This only applies to the utility. The utilities are blocking consumers the ability to sell back to the grid. The utilities have increased their rates to build alternative energy sources and increased their billing to pay for these facilities. However they are also charging the current rates to the customer for what they now obtain for free.
  - Ability to dynamically manage energy demands
    - The use of a network topology for meter reading is a benefit to the utility to possibly obtain real time information to match capacity to demands. However the AMI system is only communicating power consumption on a daily basis so how is this to become a real time system unless the AMI meters begin transmitting demand at an almost constant rate. This has never been communicated to the consumer. The load of data collected if in a real time system would overwhelm the ability to process the data. If the intent is managing capacity to demand is the reason for deploying AMI then collecting the data once a day will not ever accomplish the goal to match capacity to demand. This is the critical flaw in the AMI concept at the point of use and the whole reasoning to deploy AMI and fails to accomplish this goal of dynamically managing the grid when only collecting data once a day. Since the AMI enabled Gas meters rely on the electric AMI meter, and the AMI electric meter justification is dubious with only daily readings the sum of the benefits of AMI is only related to elimination of manual meter readers, which has not resulted in any consumer savings.
  - The need for AMI to reduce energy consumption
    - The most recent report from Michigan LARA estimate from 2014-2015 year predicts residential electric energy consumption as flat, with commercial consumptions reducing and industrial sectors growing by 3 % with a combined increase of 0.8 %. The revised report for 2016-2017 still states the growth as lower than historic values. Why do we need hundreds of millions of added costs to support a flat demand curve? Is this a solution looking for a problem?