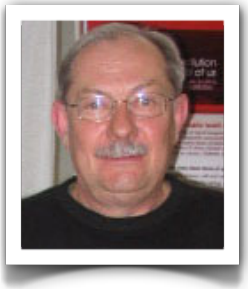
What are GS units?

GS units (dirty electricity) presented as a function of voltage & frequency

Magda Havas



Ralph Frederick

Trent University, Peterborough, Ontario, Canada
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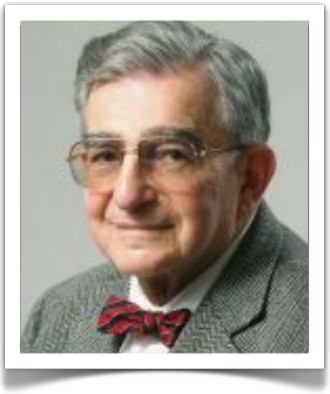
December 2009.



Martin Graham

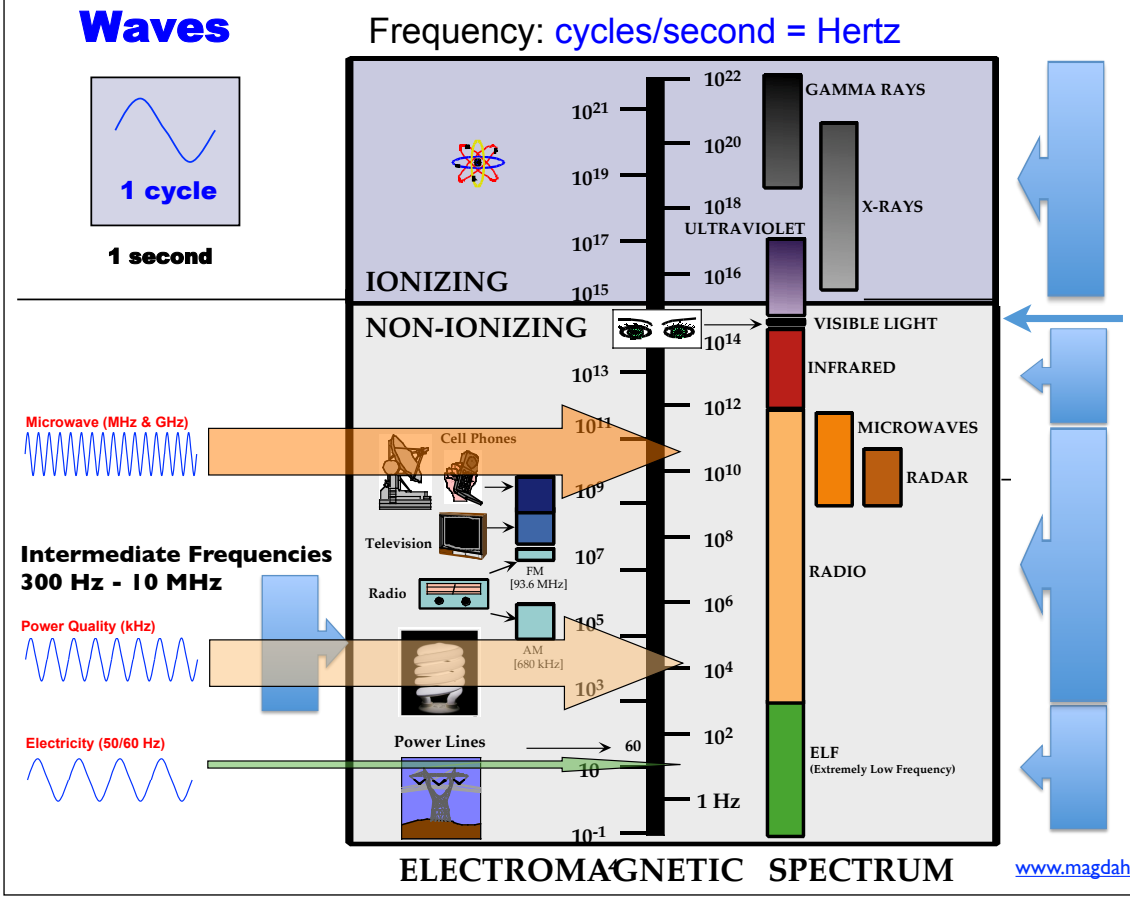
Dave Stetzer

The Graham Stetzer filter (GS filter) and the microsurge meter (see next slide) were designed by **Dr. Martin Graham**, Professor Emeritus at UC Berkeley, based on discussions and joint research with **Dave Stetzer**, a power quality expert and President of Stetzer Electric in Blair Wisconsin.

Graham Stetzer Filter & Microsurge Meter

The **microsurge meter** is an inexpensive tool designed to measure **poor power quality** commonly referred to as **dirty electricity** on electrical wires. It works optimally for frequencies between **4 and 150 kHz**. The microsurge meter on the left shows a reading of **488 GS units**.

The Graham Stetzer filter (**GS filter**) reduces high frequency **transients** and **harmonics** on electrical wires and thus improves **power quality**. It works for frequencies between **4 and 100 kHz**. With one GS filter plugged into the same circuit, the **dirty electricity** drops from **488 to 39 GS units**.



What is a GS unit?

Dave Stetzer:

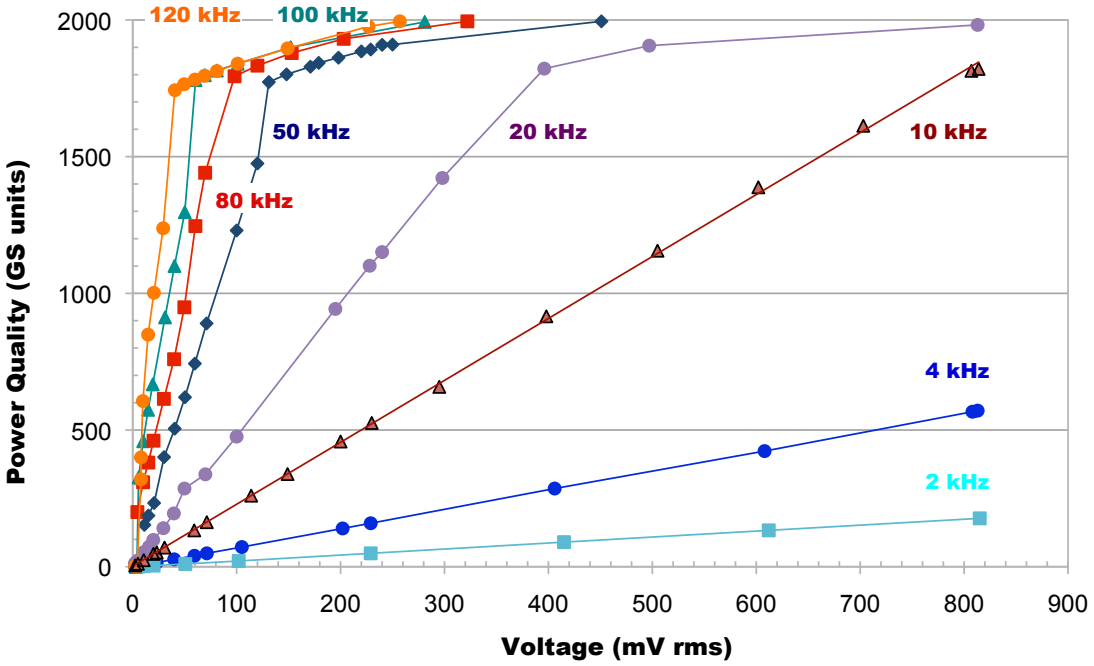
*A **GS unit** is a measure of the **energy** on electrical wires generated by high frequency transients and harmonics and is influenced by **voltage** amplitude and **frequency**.*

What we did.

Frequency generator:

1. dialed in a frequency: from 2 to 120 kHz
2. altered voltage
3. measured power quality (microsurge meter)
4. graphed the results (see Figures 1 to 3)

Fig 1. GS units as a function of voltage at different frequencies



We used a frequency generator. The values are the actual values we obtained. The microsurge meter (that measures the GS units) was linear up to approximately 1750 GS units. This meter is designed for 4 to 150 kHz. It was still linear at 2 kHz. The equations for the linear part of these functions and the R2 values are provided on slide 10.

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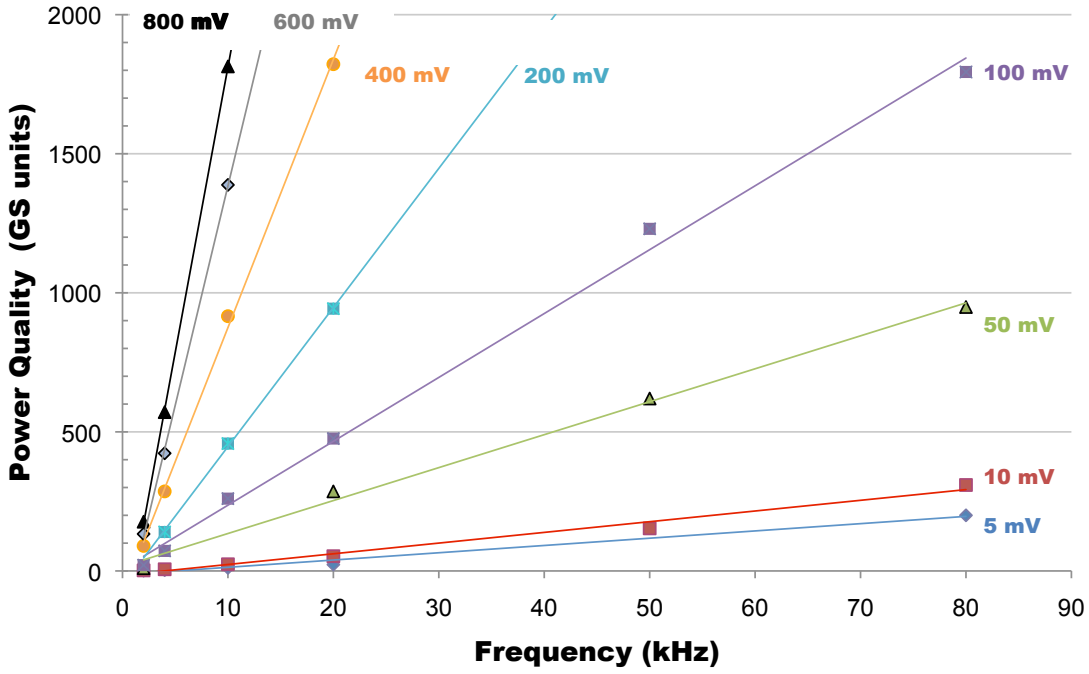
Fig 2. GS units as a function of frequency at different voltages.



We used a frequency generator and graphed the results in Figure 1. The values in Figure 2 are taken from the equations generated by Figure 1 for the linear portion of the functions. The microsurge meter (that measures the GS units) was linear up to approximately 1750 GS units. The equation for the linear part of this function and the R2 values are provided on slide 10.

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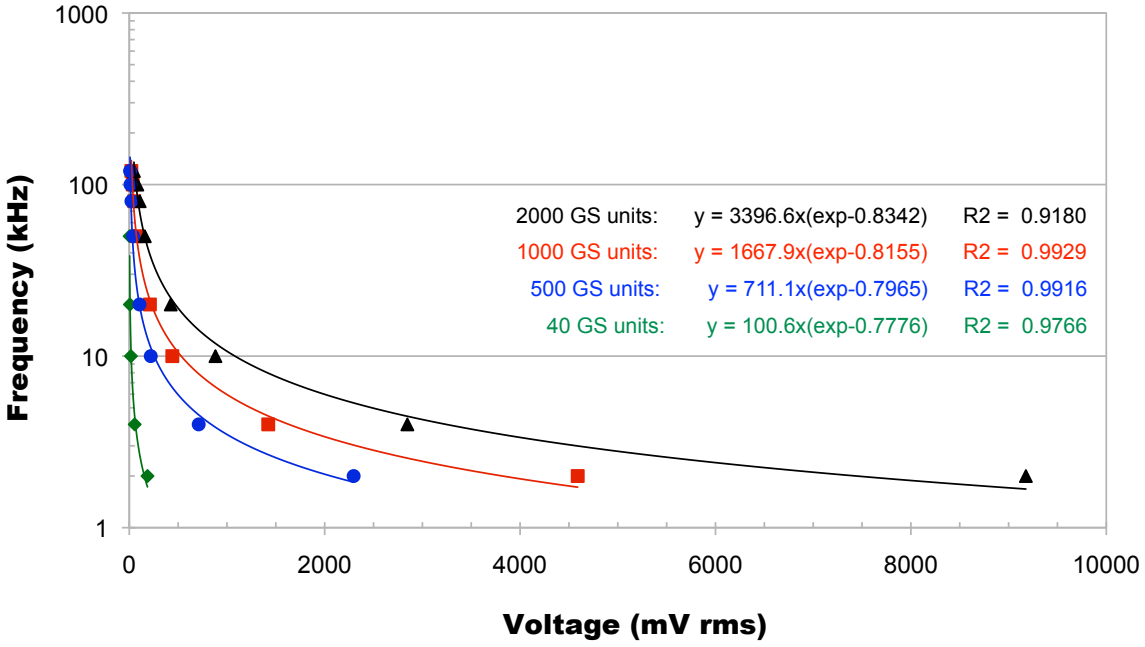
Fig 3. GS units as a function of voltage and frequency.



We used a frequency generator and measured dirty electricity using a microsurge meter. The functions were generated by best fit using excel software.

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Figure 1. GS units as a function of voltage and frequency.

Frequency (kHz)	y=mx+b m	for linear part of function b	RR2	linear range (mV rms)
2	0.218	0.6069	0.99997	5-800
4	0.7023	-1.0851	0.99997	2-800
10	2.2654	2.0152	0.99971	2-800
20	4.6864	10.726	0.9989	2-400
50	12.26	7.7584	0.9914	10-120
80	17.717	112.02	0.99106	5-100
100	21.416	238.2	0.99735	6-50
120	31.409	340.33	0.97803	10-30
x-axis =	voltage	mV (rms)		
y-axis =	power quality	GS units		
legend =	frequency	kHz		

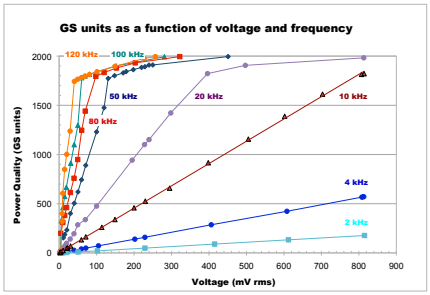

Fig 1.

Figure 2. GS units as a function of frequency and voltage.

Voltage (mV rms)	y=mx+b m	based on linear part of equations b	in Fig. 1 RR2
5	2.616	-13.09	0.98662
10	3.8457	-15.23	0.98544
50	11.845	16.131	0.99532
100	22.967	6.7408	0.9959
200	50.015	-53.173	0.99943
400	96.418	-89.265	0.99875
600	157.79	-193.54	0.9996
800	205.21	-240.46	0.9999
x-axis =	frequency	kHz	
y-axis =	power quality	GS units	
legend =	voltage	mV (rms)	

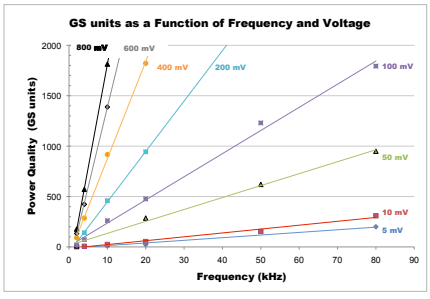

Fig 2.

Figure 3. GS units as a function of voltage and frequency.

Power Quality (GS units)	y=mx(expb) m	b	RR2
40	100.6	-0.7776	0.9766
500	711.1	-0.7965	0.9916
1000	1667.9	-0.8155	0.9929
20000	3396.6	-0.8342	0.9918
x-axis =	voltage	mV (rms)	
y-axis =	frequency	kHz	
legend =	power quality	GS units	

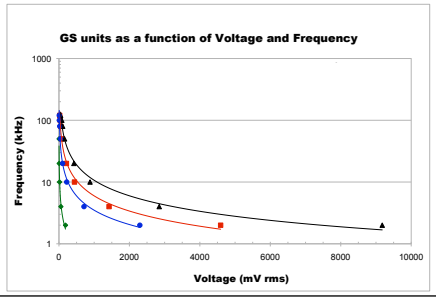

Fig 3.

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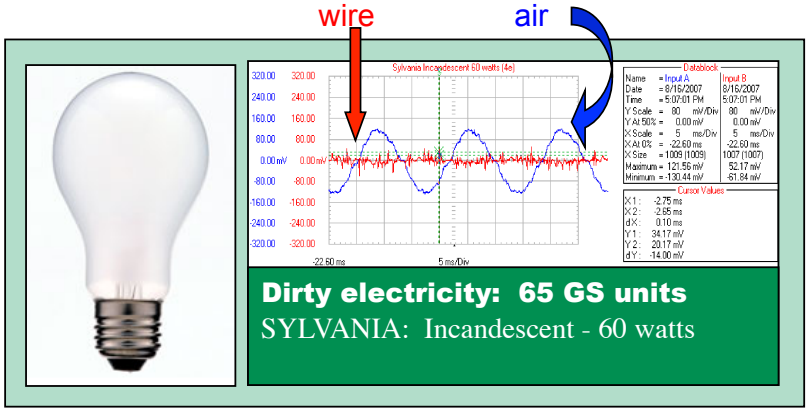
"But the energy is on the **wire** and doesn't radiate through the **air** into the **room**."

It that were the case, how do you explain the following results?

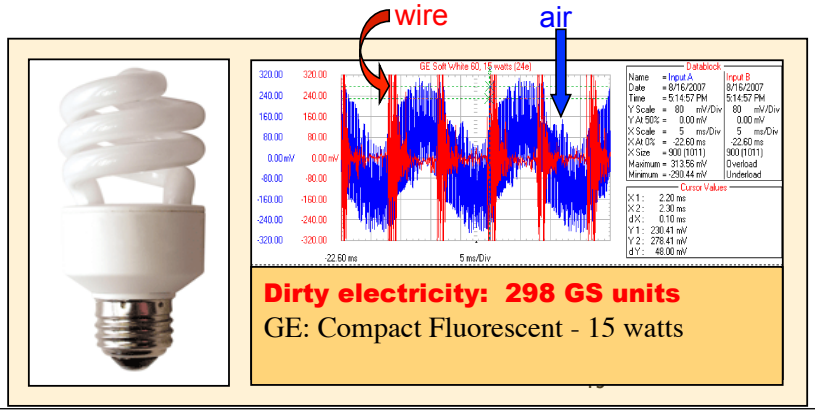
Fluke 196 Scope Meter

(measurements by Dave Stetzer and Magda Havas)

Incandescent vs CFL Bulb



ON or OFF



ON

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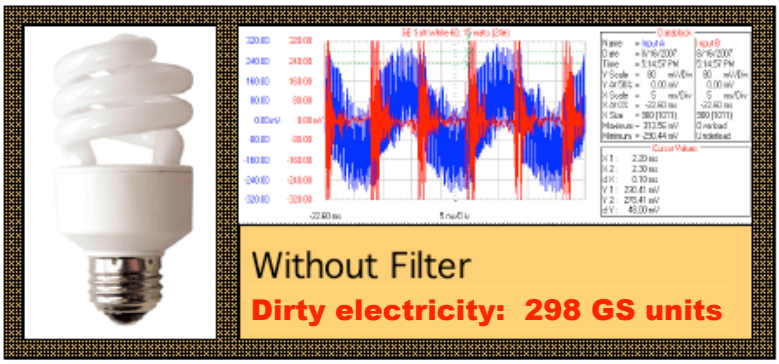
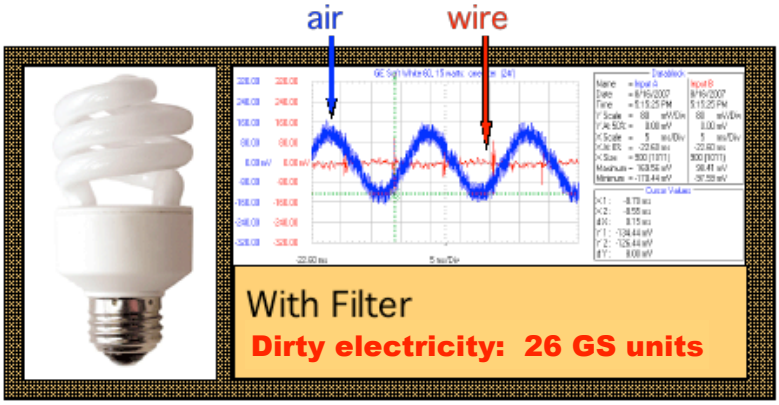
Effect of Filters: GE CFL - 15 watts

GS filter





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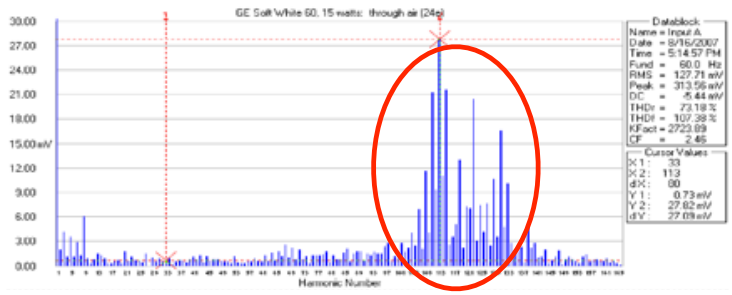
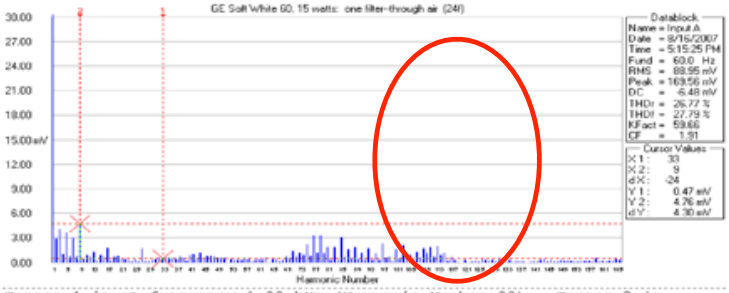
Note: 30 mV scale



air

GS filter

Note: 30 mV scale



Cursor 1 is at frequency 1.98 kHz (Harmonic Number 33). Cursor 2 is at the frequency with maximum amplitude 0.54 kHz (Harmonic Number 9).

2 ..... kHz 10

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What this clearly shows is that the energy radiates through the air and can be reduced with a GS filter.

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For more information about Dirty Electricity visit the following websites:

www.magdahavas.com

www.electricalpollution.com

www.stetzerelectric.com