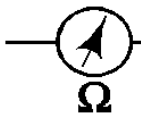


Keeping an Eye on Your Tower and RF System



**Resonant
Results, Ltd.**

RF Systems Specialists & Infrared Testing

A Quiet Lunch



Ever Have a Really Bad Day?

Think of These When You Do.

Having a Bad Day #3



Having a Bad Day #2



Having a Bad Day #1





Having A Bad Day #1 Runner Up



Program Topics

- Routine and Emergency Site Visits.
- Monitoring Reflected Power.
- Repurposing Rigid Transmission Lines.
- Tower Codes and Regulations

Site Visits



The master FM transmitter building



Taj Mahal or Little House on the Prairie

Stop Look & Listen

What is Different?



After Dark



Now take a look up.



The Mowing Crew Blows It



Lost Time Maker



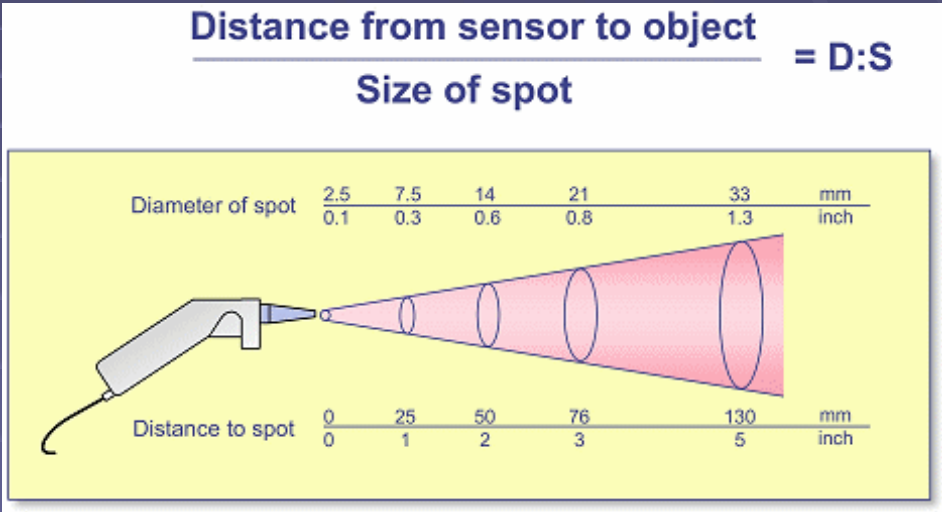
A Live Mouser



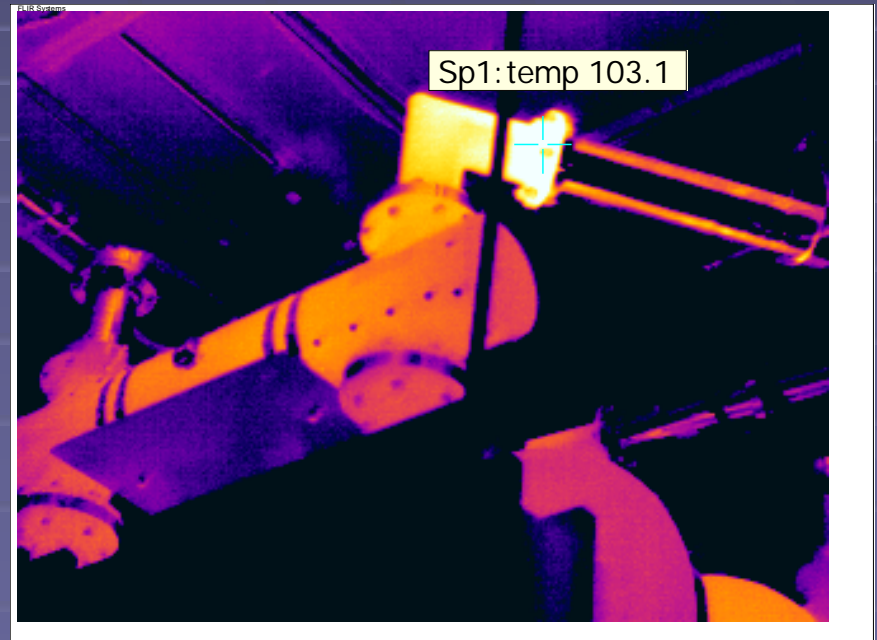
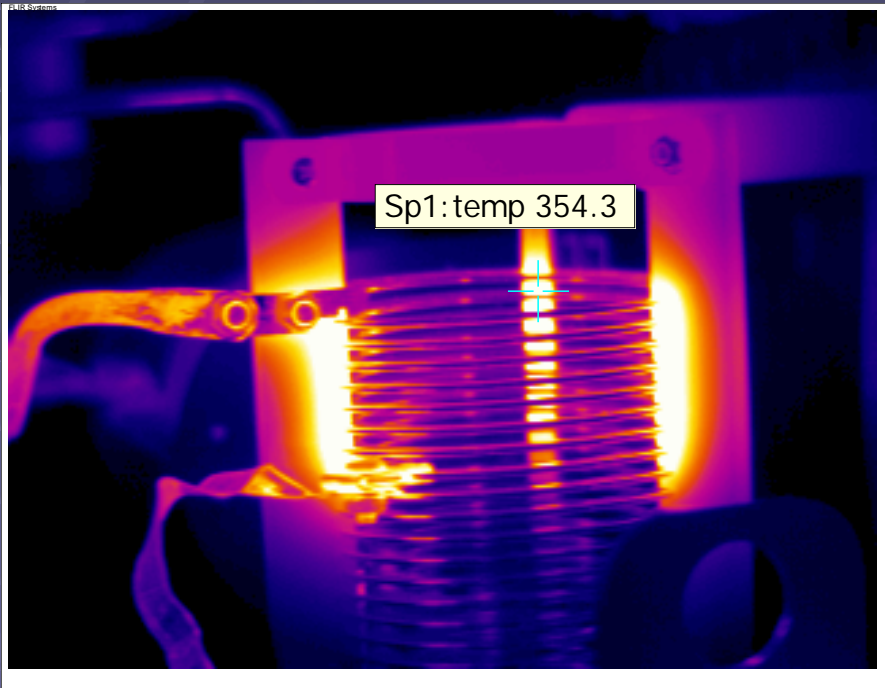
The Tin Cat



Infrared Testing Instruments



Infrared Testing

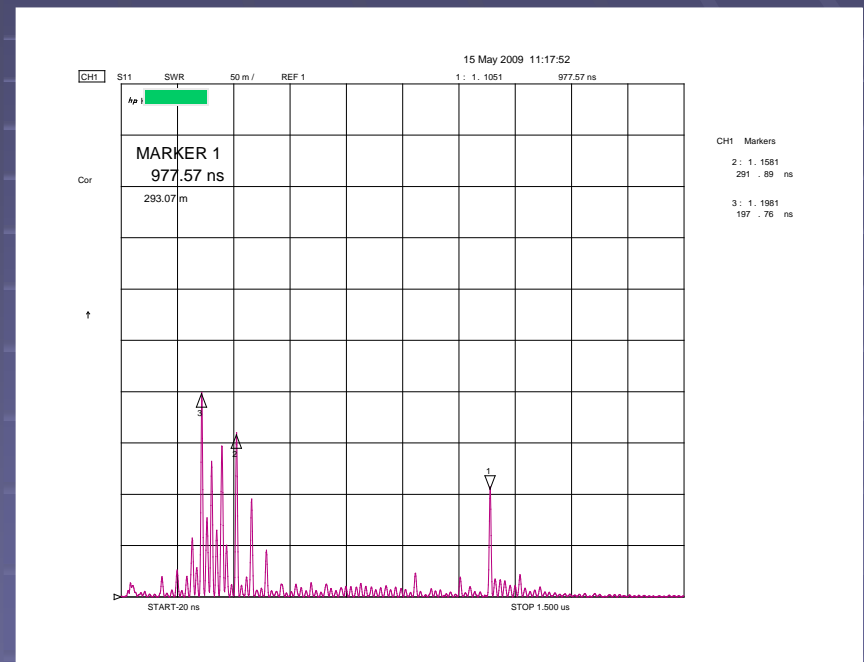


RF Systems

&

Monitoring Reflected Power

Transmitter Resets

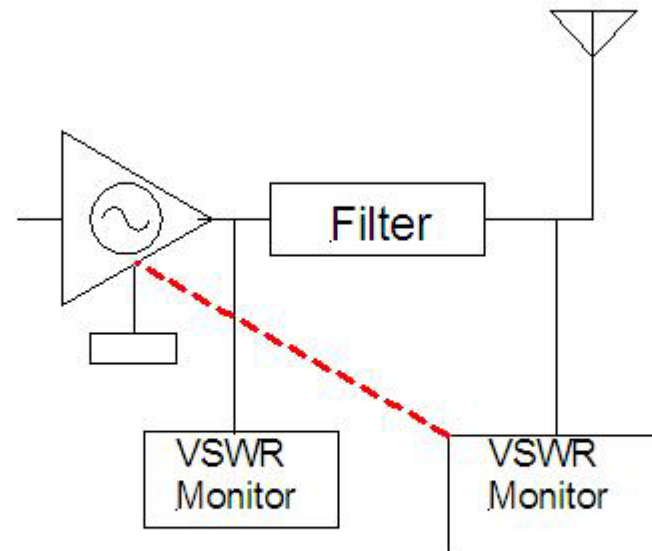


Two Transmitters with 3 Resets Each

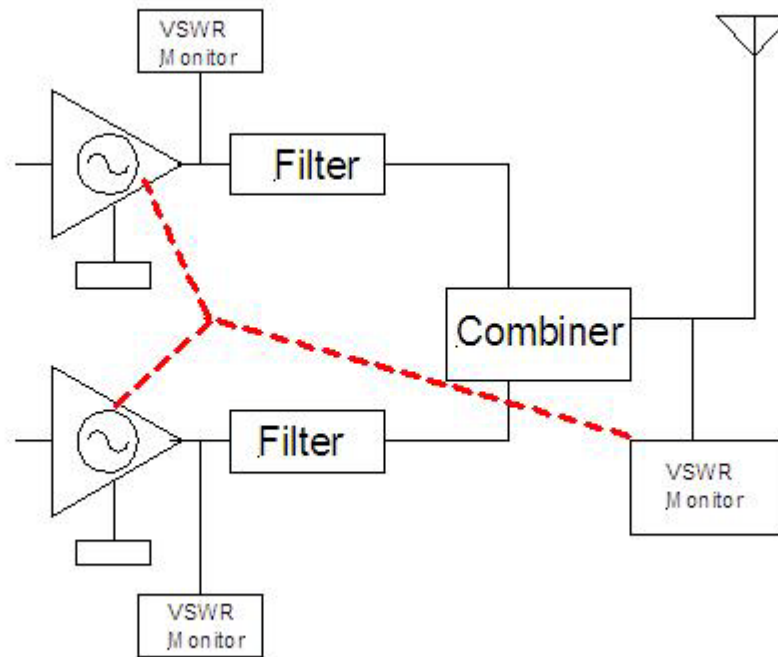
$$VSWR = \frac{1 + \sqrt{R_{ref} / F_{or}}}{1 - \sqrt{R_{ref} / F_{or}}}$$

Forward Power	Reflected Power	Percentage	VSWR	Return Loss
1,000 w	30 w	3%	1.4:1	15.5 db
1,000 w	20 w	2%	1.32:1	17.4 db
1,000 w	10 w	1%	1.2:1	20.8 db
1,000 w	5 w	0.5%	1.15:1	23.1 db
1,000 w	2.5 w	0.25%	1.10:1	26.4 db
1,000 w	1.0 w	0.10%	1.06:1	30.71 db
1,000 w	0.7 w	0.07%	1.04:1	34.1 db

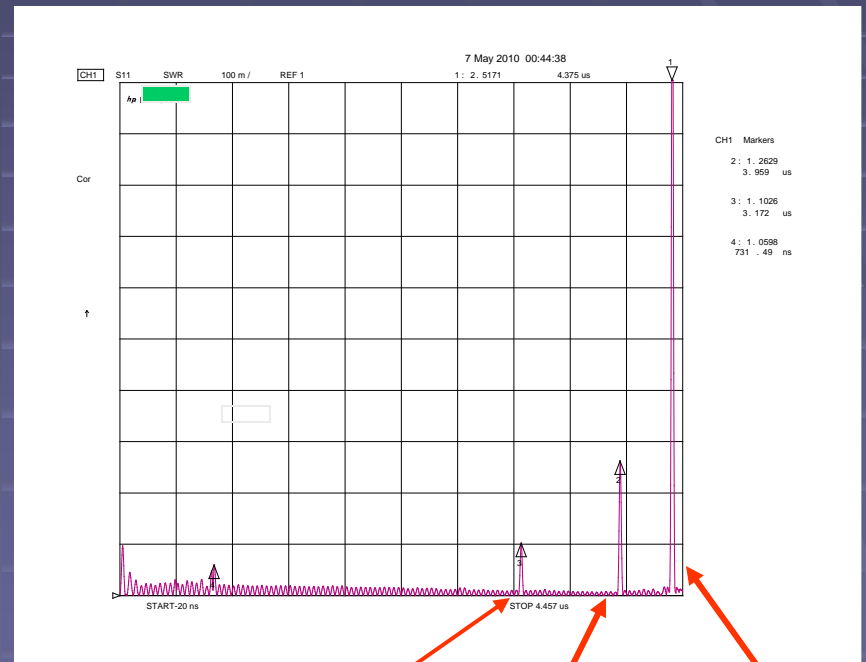
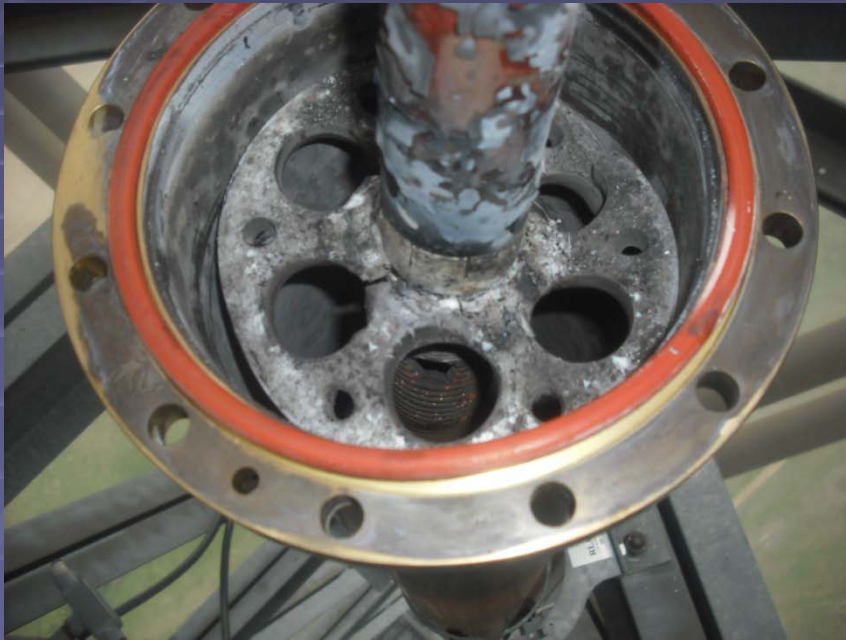
Single Amplifier



Dual Amplifier



Multiple Resets



#3

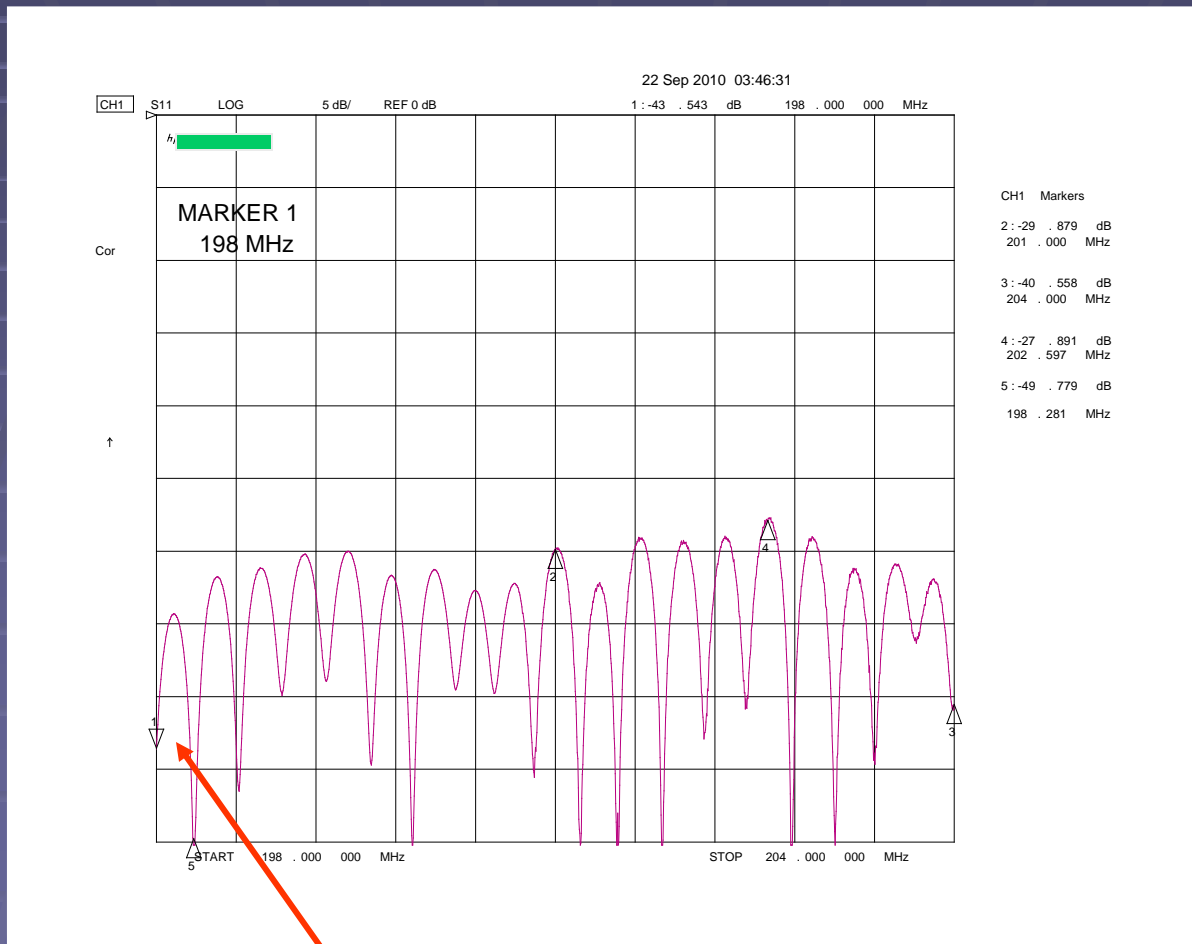
#2

#1

After A Burn Out Bring in the Hi Pot

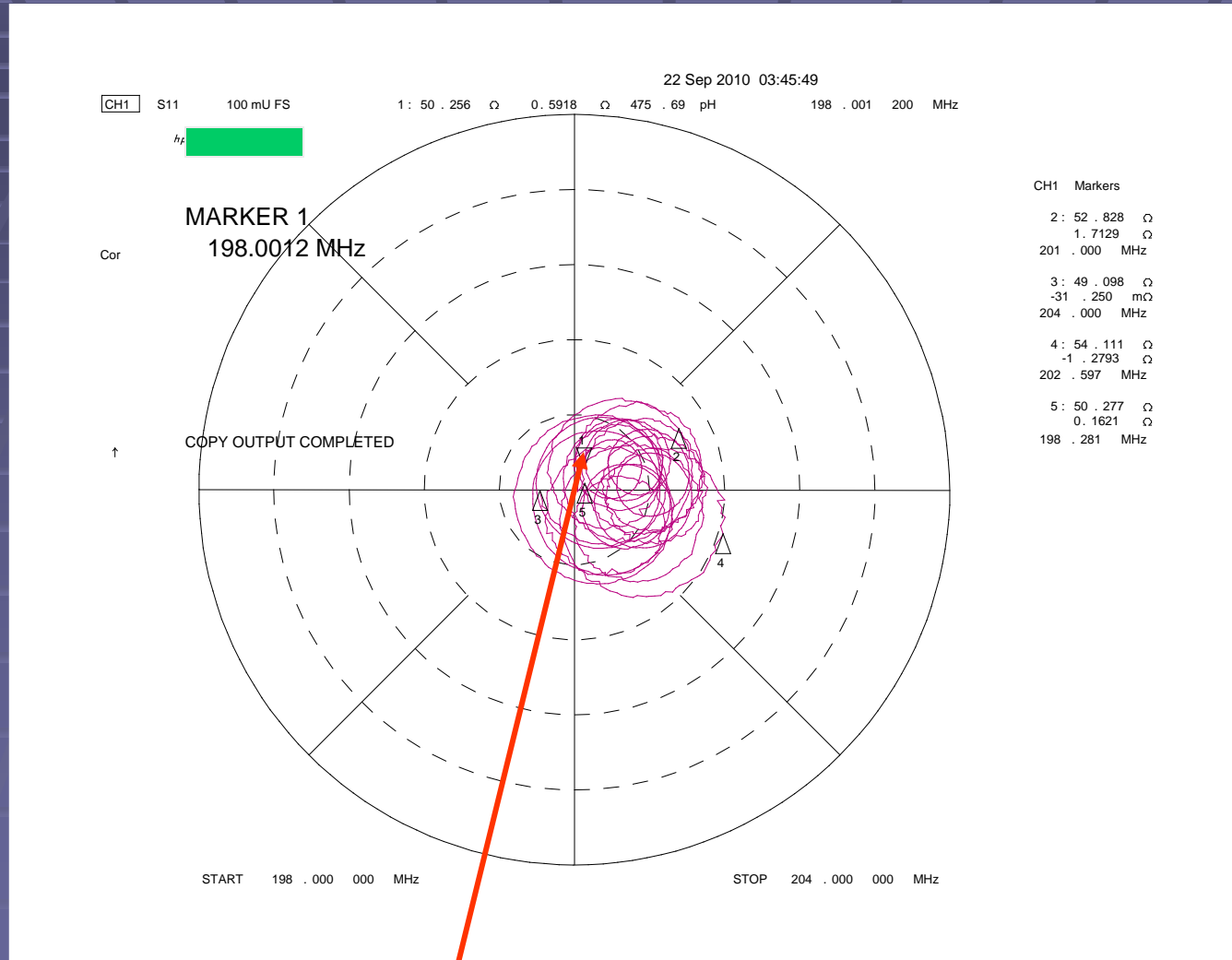


Antenna Plots



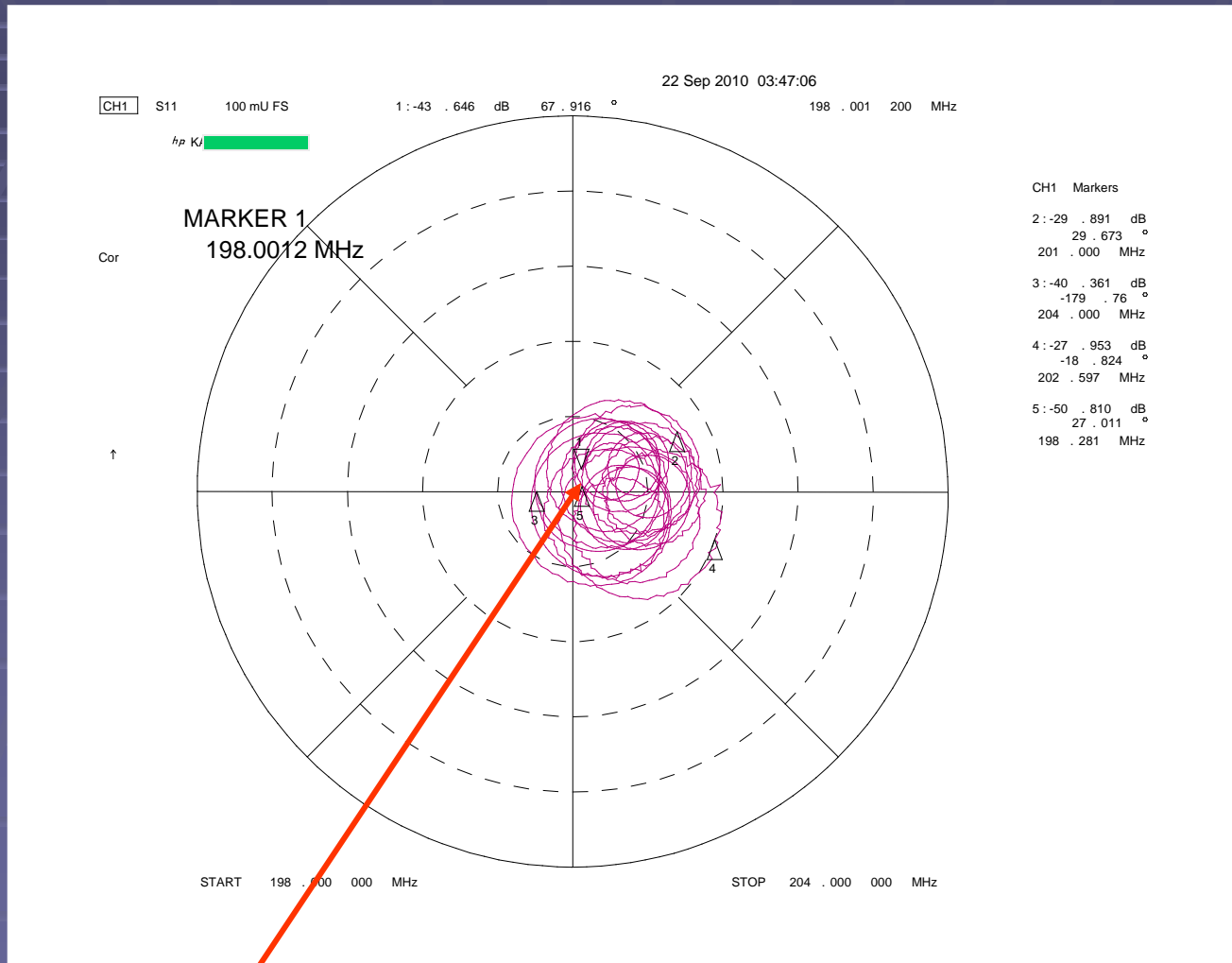
Marker One = -43.5 db

Smith Plot



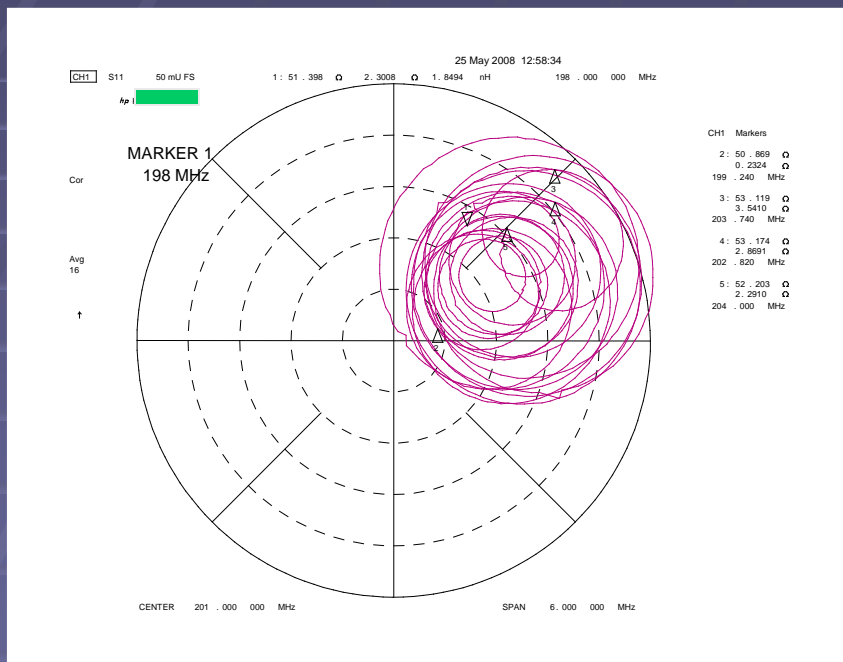
Marker One = $50.2\Omega + j0.59$

Polar Plot

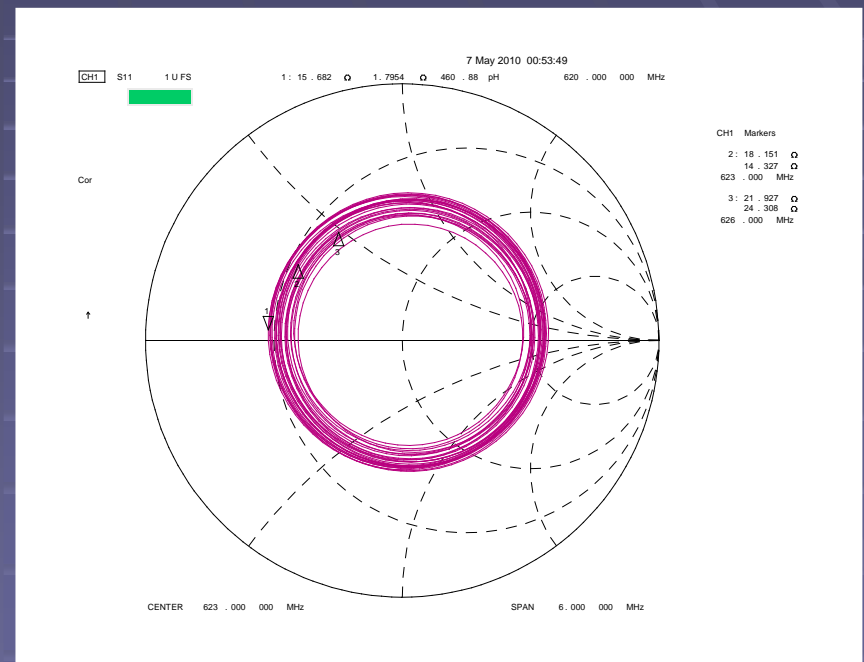


Marker One = -43.6 db + 67°

Phase Data

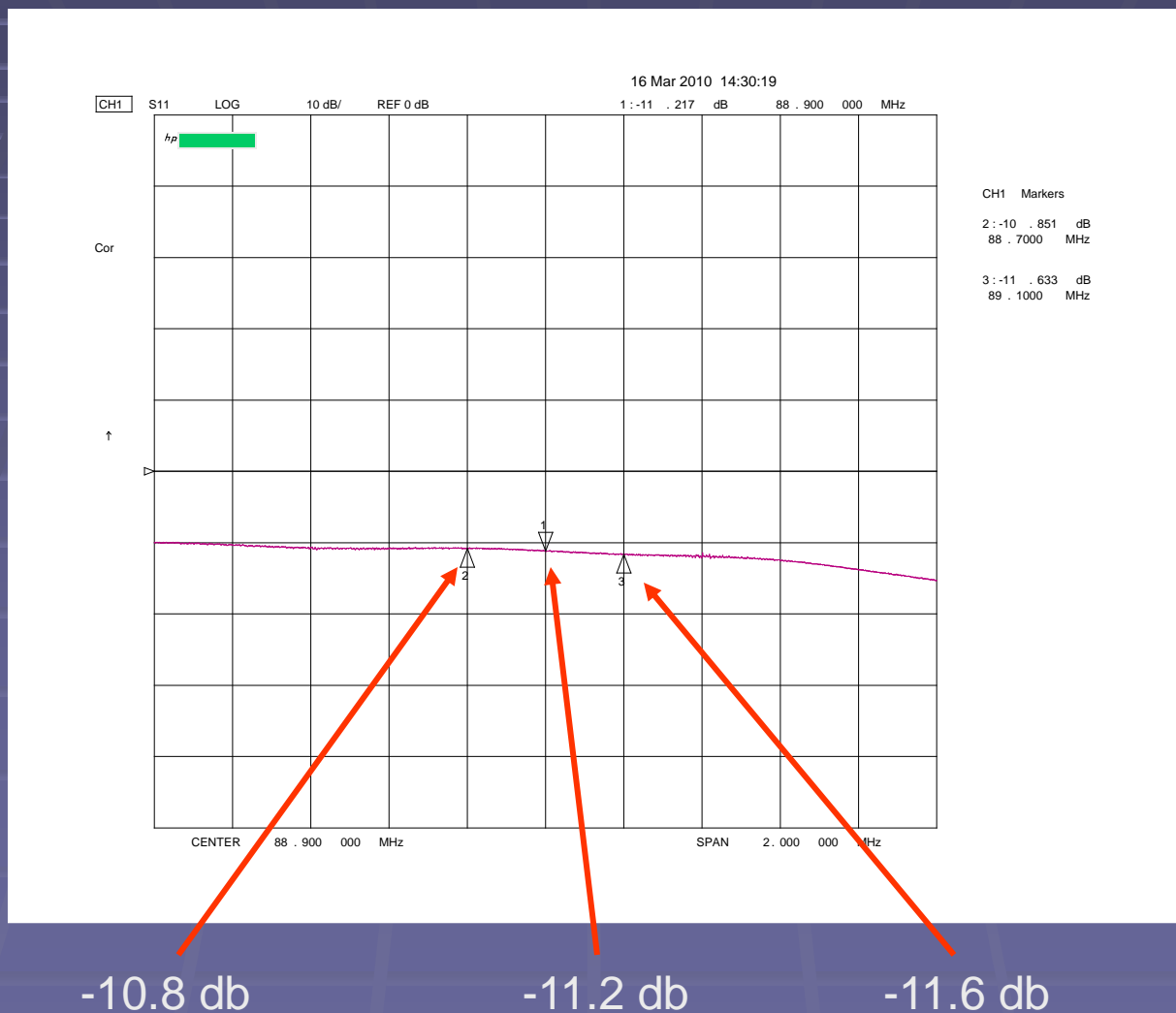


Near End Mismatch



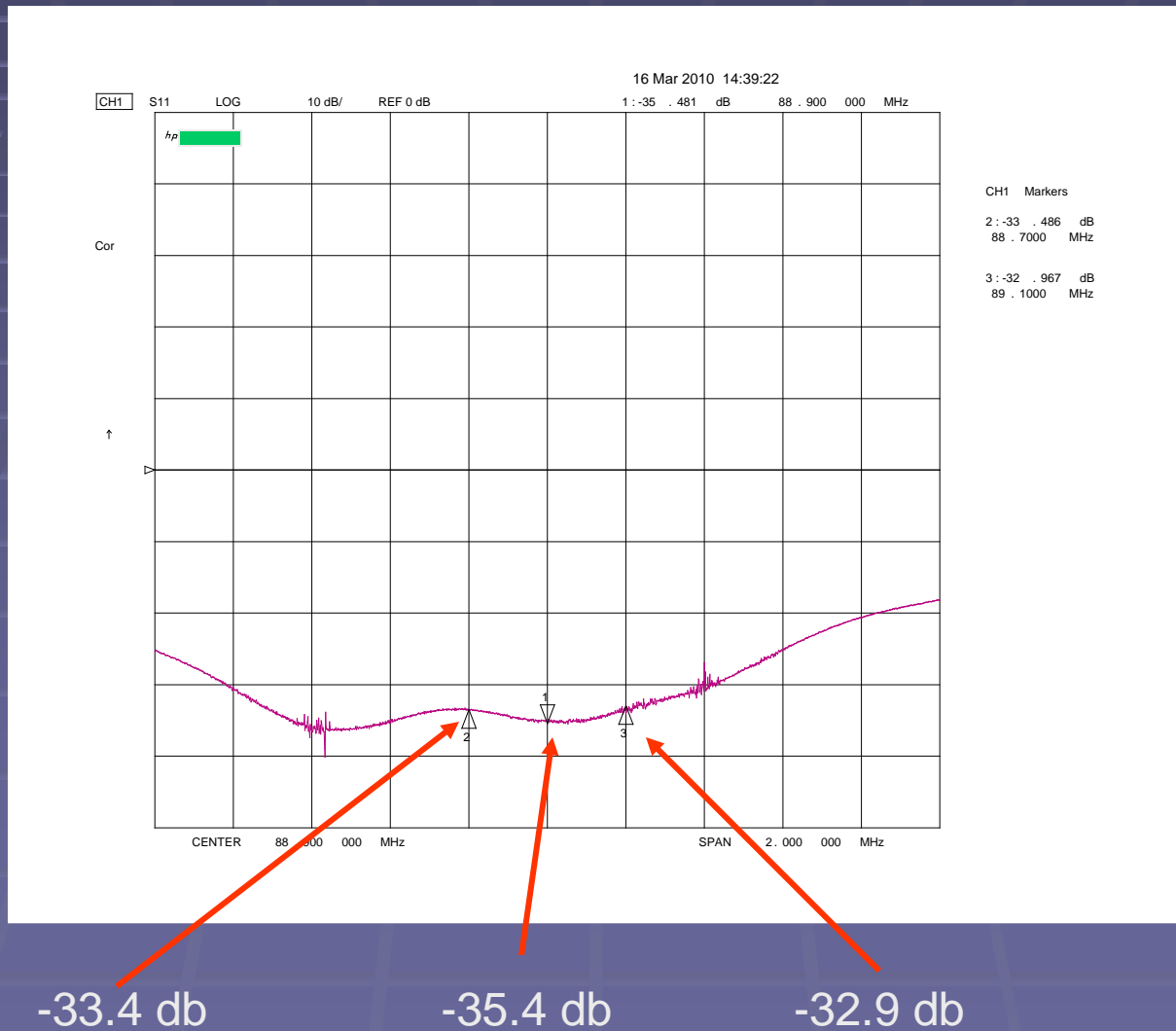
Far End Mismatch

Typical FM Antenna Fine Matcher Not Optimized



FM Antenna

Fine Matcher Optimized



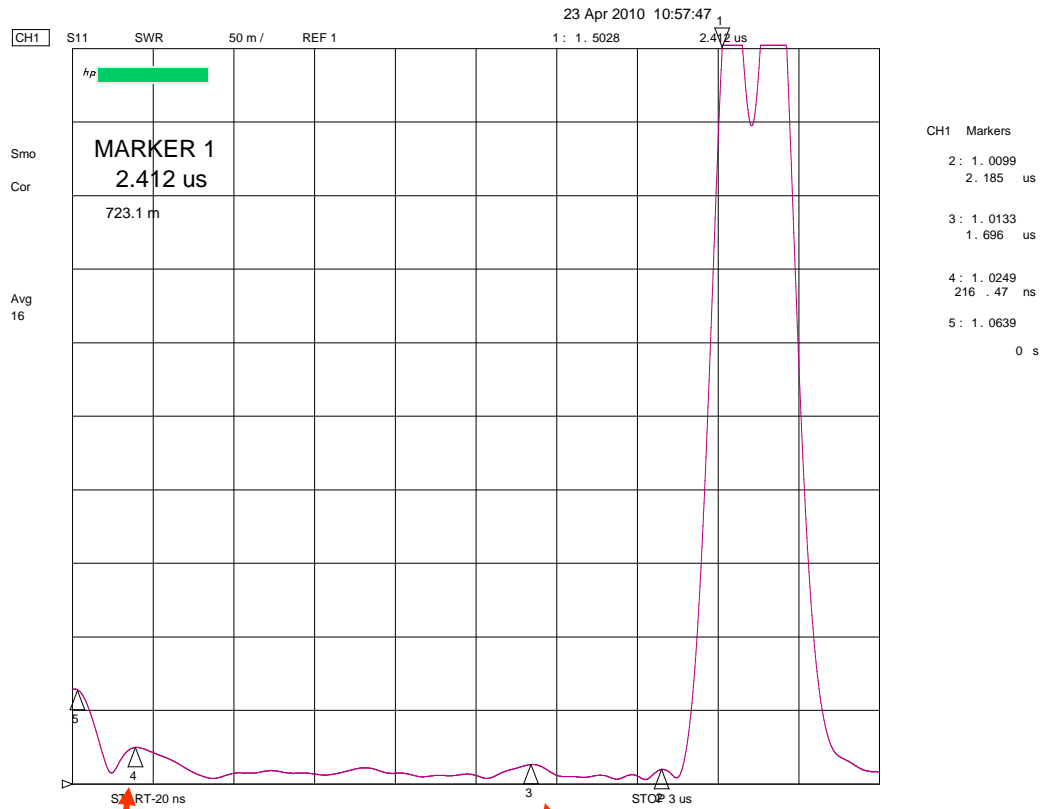
Being Inventive



Repurposing Rigid Transmission Line

TV Channels requiring 20' line sections										
2	3	4	5	6	7	8	11	12	14	15
18	19	22	23	27	31	35	39	43	44	47
48	51	52	55	56	60	64	68			
TV Channels requiring 19 3/4' line sections										
16	20	24	28	32	36	40	41	45	49	53
57	61	65	66	69						
TV Channels requiring 19 1/2' line sections										
9	10	13	17	21	25	26	29	30	33	34
37	38	42	46	50	54	58	59	62	63	67
FM frequencies requiring 20' line sections 88.1 through 95.9 MHz and 100.1 through 107.9 MHz										
FM frequencies requiring 19' line sections 96.1 through 99.9 MHz										
All FM frequencies can be use on 17 1/2' line sections										

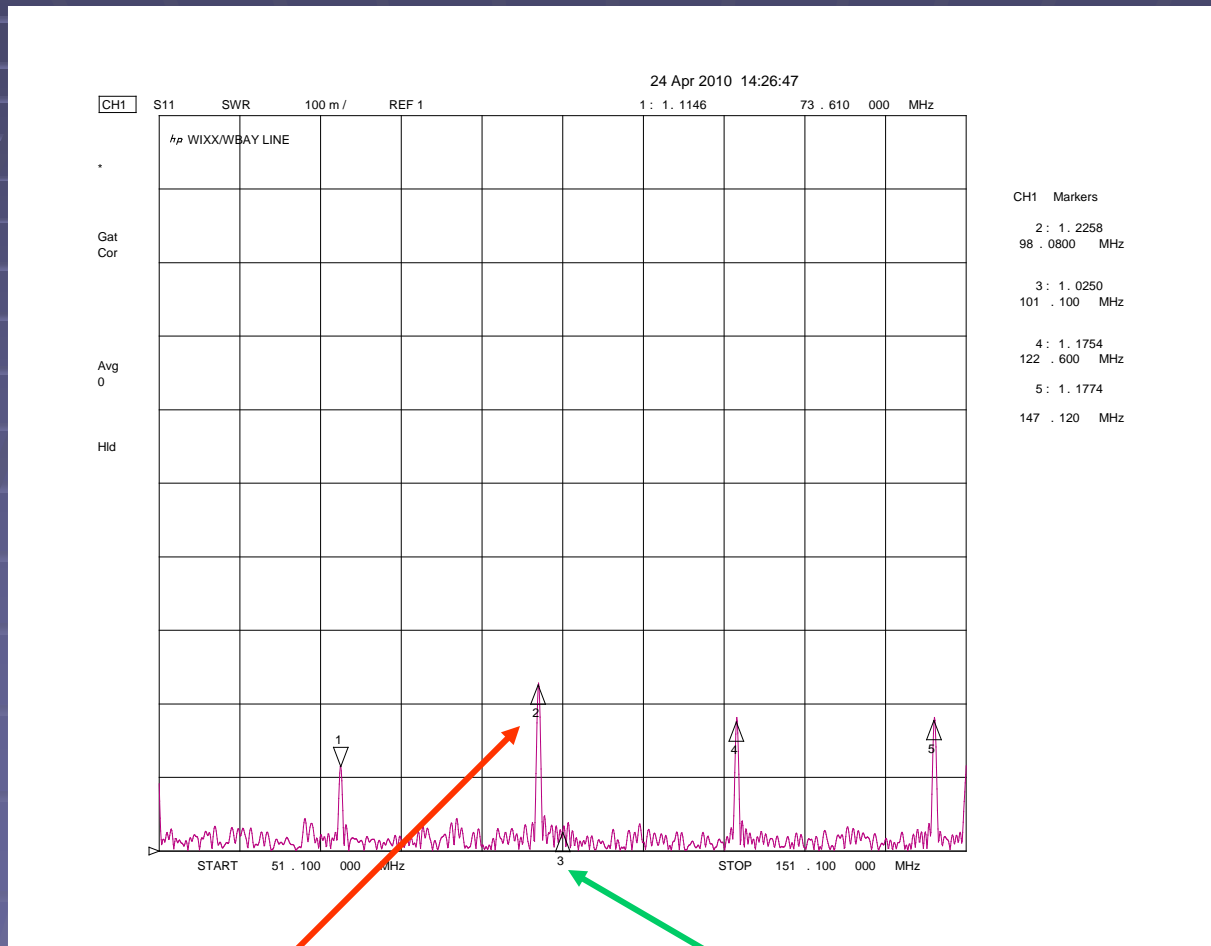
10 MHz Span Time Domain



1.02:1

1.009:1

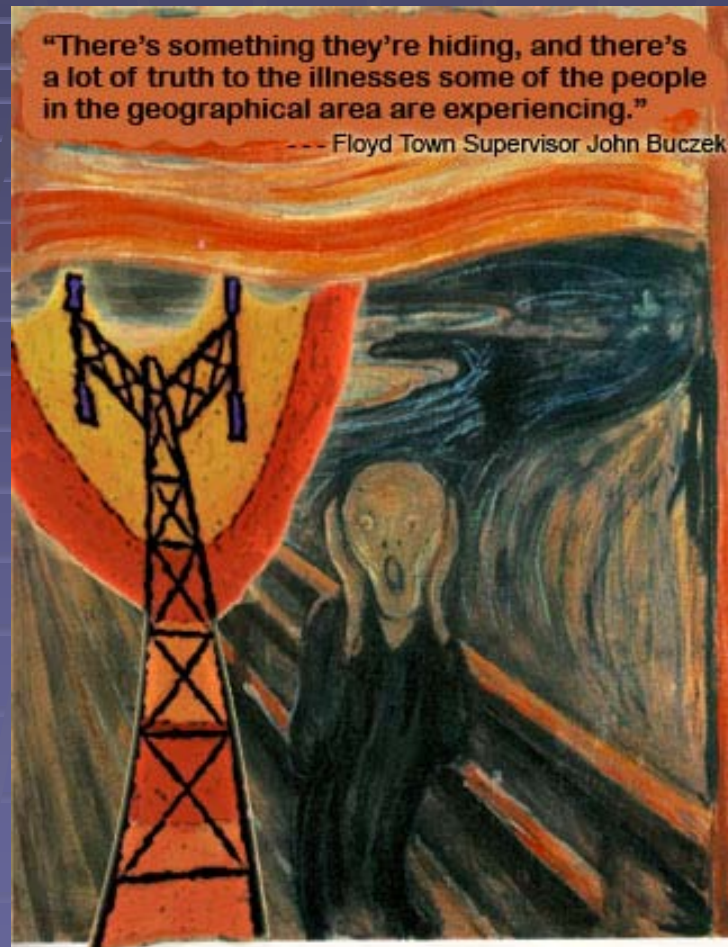
100Mhz Span/ Line Vertical Run



98.08 MHz= 1.22:1

101.1 MHz= 1.02:1

Tower Codes and Regulations



EIA TIA 222 G Tower Design

Enacted 1/1/2006

- Wind Load Calculations are according to 3 second wind gust data by NOAA.
- Ice Loads escalate with overall height.
- Seismic loads are calculated by geographic location.
- All Three loading criterions will be determined by county location.

EIA TIA 222 G

Structure Categories

Category 1: Low hazard to human life and non critical services.

Category 2: Substantial hazard to human life and services can be accessed by alternate methods.

Category 3: Substantial hazard to human life and essential facilities.

EIA TIA 222 G

- Eliminates “Normal Soil”, plan on a geotechnical report for all foundation designs.
- All antenna side arms are recognized as an extension of the tower, and must be designed as such.
- All existing towers that are loaded beyond the original scope must meet 222 G.

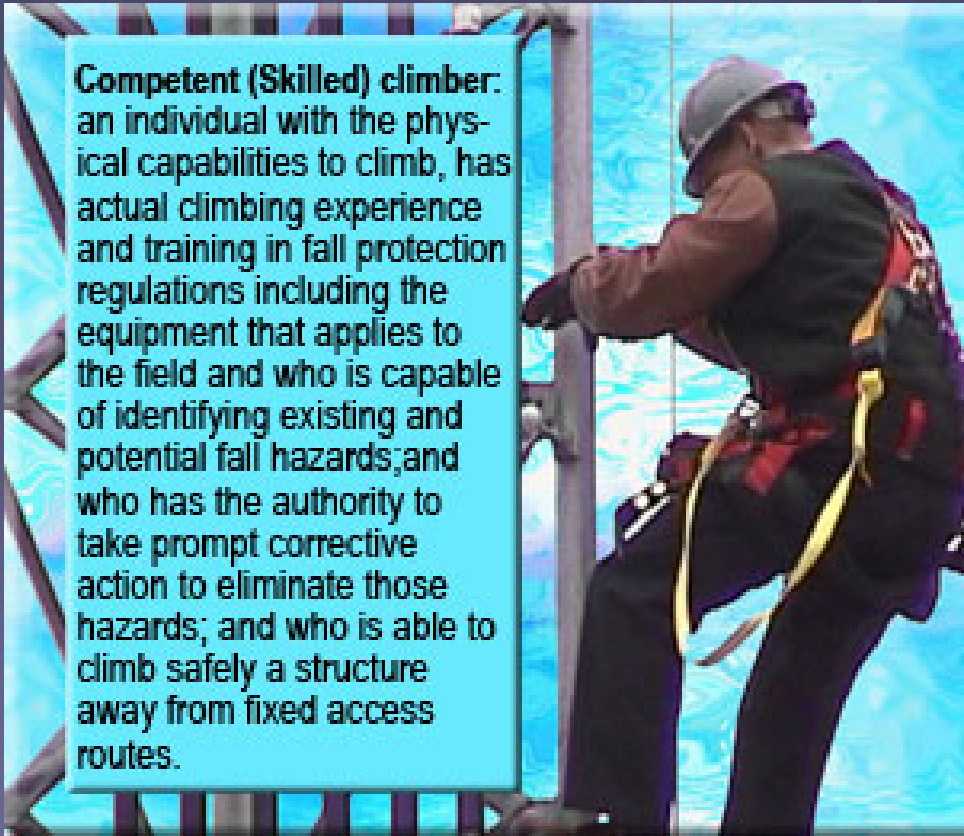
Beyond Original Loading



EIA/TIA 222 G

Contractor Requirements

- Classifications of Climbers.
 1. Competent (Skilled)
 2. Basic Climber



Competent (Skilled) climber: an individual with the physical capabilities to climb, has actual climbing experience and training in fall protection regulations including the equipment that applies to the field and who is capable of identifying existing and potential fall hazards; and who has the authority to take prompt corrective action to eliminate those hazards; and who is able to climb safely a structure away from fixed access routes.

EIA/TIA 222 G

Contractor Requirements



- Gin Pole and Erecting Standards

Each Pole should be certified and have a load chart on site.

OSHA and the Tower Industry

September 10, 2010

The Chairman of the National Association of Tower Erectors announces that the partnership with OSHA is over after 15 years.



Free Climbing is Not OK



FAA Studies



53' Drill Bit



Thank You Very Much



Richard Wood
Resonant Results, Ltd

Nationwide Service
24/7

From Build out
To Burn out