The LFA (Loop Fed Array) Yagi

Not a traditional Yagi in many ways!

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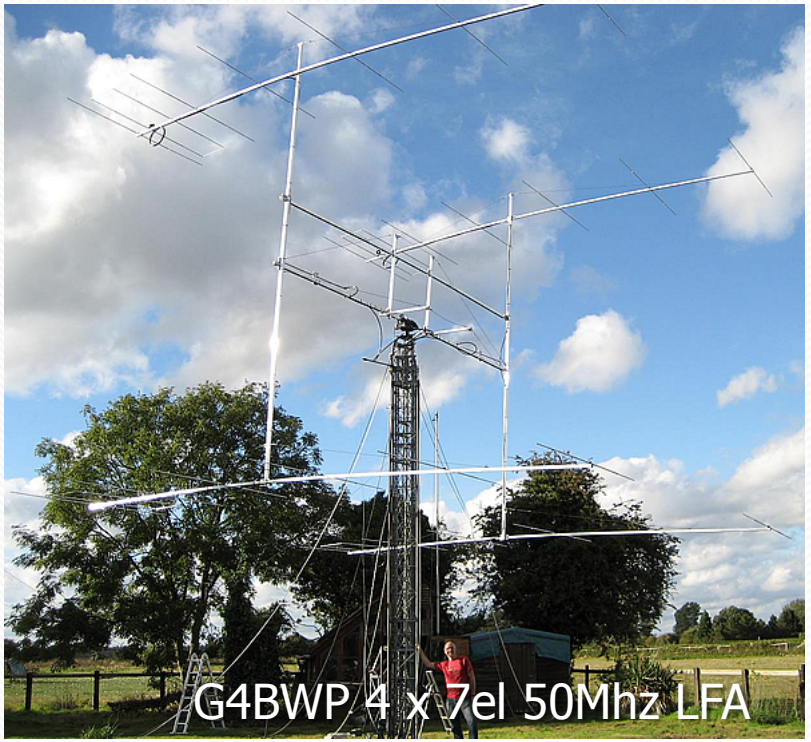
InnoVAntennas.com
Performance through Innovation

FORCE 12

Agenda

- Who is G0KSC?
- The LFA Yagi, what is it?
- LFA Yagi benefits
  - Including design principles
- Design to real World transition?
- Installation and results



Who is G0KSC?

- Focus on low-noise antennas due to noisy UK location
- YU7EF the father of all LN Yagis!
  - Gain, Gain, Gain culture
  - SNR in receiver chain but not antenna?
- Removal of noise through pattern
  - Matching loss (matching devices)
  - Closed loops
- LFA Yagi, OP-DES, LFA-Q, OWL
- Design for commercial apps.
  - Government, military
- Best performance LN for VHF?
  - VE7BQH list


G0KSC @ K5AND OCT 2013

The LFA Yagi – What is it?

- Closed rectangular loop
  - Flat laid on boom
- Pattern, Impedance, B/W
- 50Ω Direct Feed
  - No matching device
  - QRO capable
- Loop 180 degrees out of phase
- Close spaced Reflector/D1
  - 'driver cell'
- Wide band, flat performance
  - Flat gain & F/R
- Very Low Noise capable
  - Closed loop
  - Tight pattern possible

6 x 7el 50Mhz LFA @ W7EW

LFA-Q Quad-style beam

- All elements up-right ‘LFA loops’ – (YU7XL concept)
- Quad performance advantage to around 7 elements – Rigid setup

LFA Yagi benefits

- Closed loop means QRO capable
  - Lower noise RX?
  - 50 Ohm direct feed- matching loss minimised
  - Quad-style patterns on smaller antennas
- No matching devices
  - Antenna modelled as finished product
  - No ‘foreign objects’ added after design
  - No matching loss
  - Direct feed with 1:1 balun or choke
- All elements and feed point in-line
  - No Elevation plane distortion
  - The perfect X-pol antenna basis!

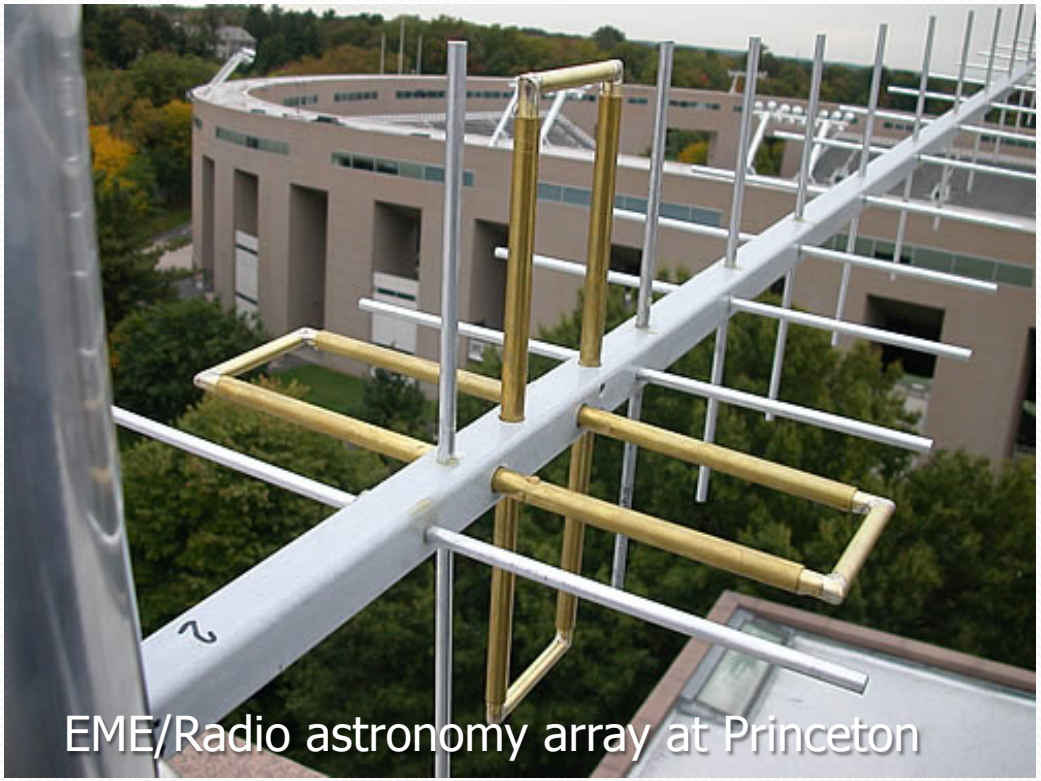
LFA Yagi benefits - continued

- QRO and Pattern Symmetry even at VHF/UHF
  - HB9Q Dish feed system
- Far greater extension to modelling ability with loop
  - Split dipole limitations
  - No matching structures
- Optimisation without lobes
  - Side lobe reduction huge
  - Performance wideband
  - High F/R
  - Minimum Return Loss


HB9Q 432MHz Dish feed 4KW capable

LFA Yagi benefits - continued

- Closer-spaced 'Driver cell' for more bandwidth including performance flat-line
  - Flat-line gain and F/R
- High end Sky temp. & G/T
- Design principles LFA gives
  - Greater control over opt.
  - X-pol distortion minimised
    - Thru-boom elements
    - Minimised eddy current
  - Auto grounded front loop
  - Easy final DE adjustment
    - Eznec assumes zero tails



EME/Radio astronomy array at Princeton

LFA Design Principles

- Traditional Yagi – low impedance means better performance?
- 'Ski Slope' impedance & performance curves
- Poor wet weather results
- shift in bad weather
- YO Trait?
  - YO used extensively
  - YO extended boom
  - YO 'as good as the author!'
- LI means narrow bandwidth?
  - NO! Design principles wrong

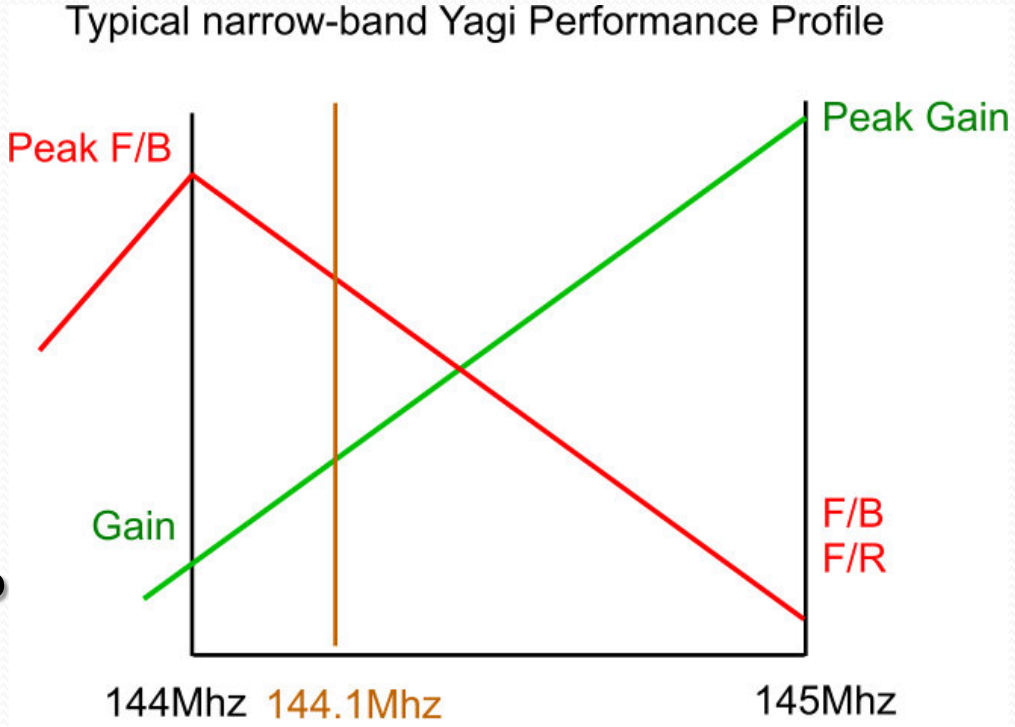
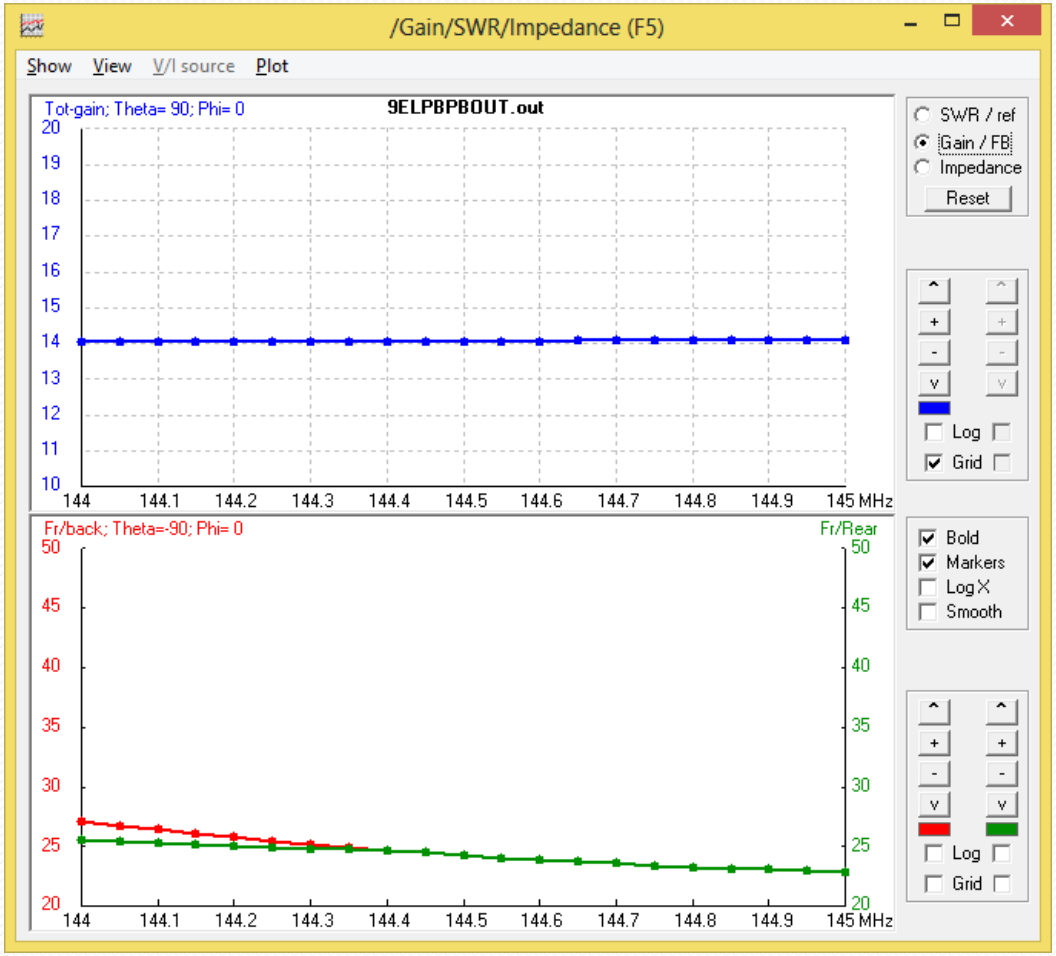


Fig 1

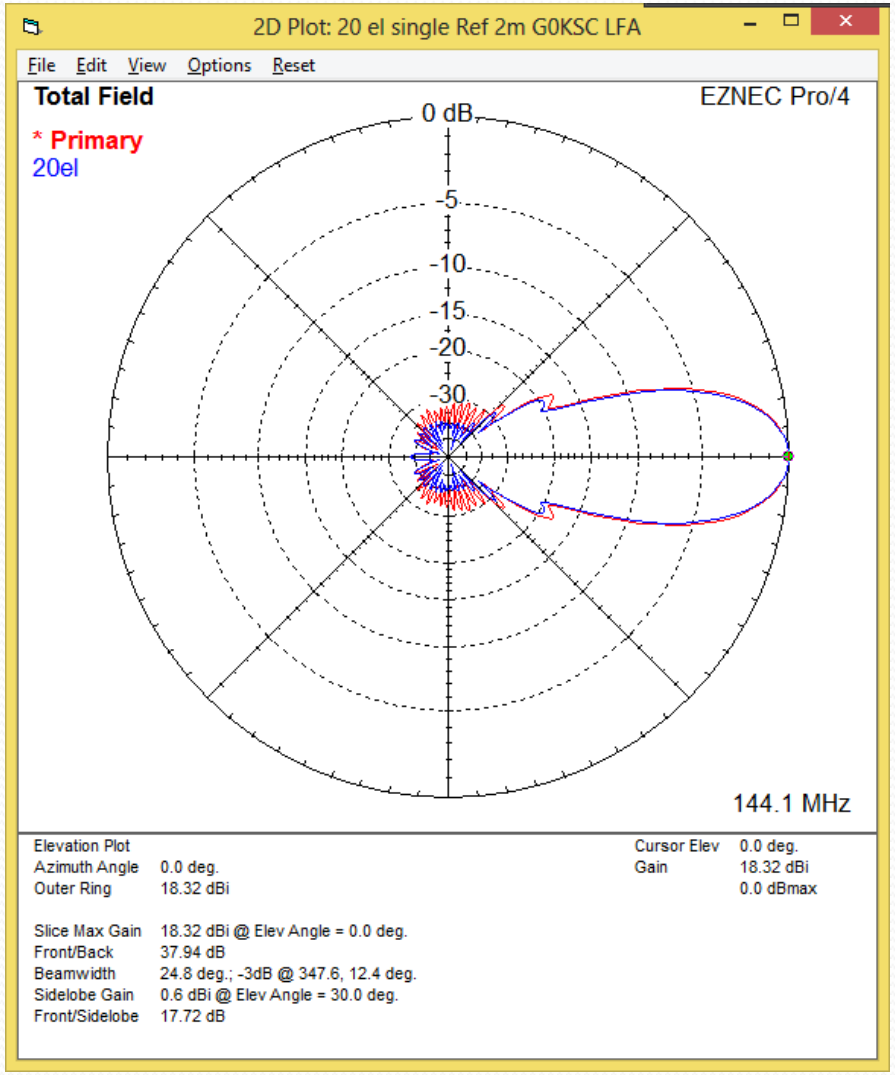
LFA Design principles - continued

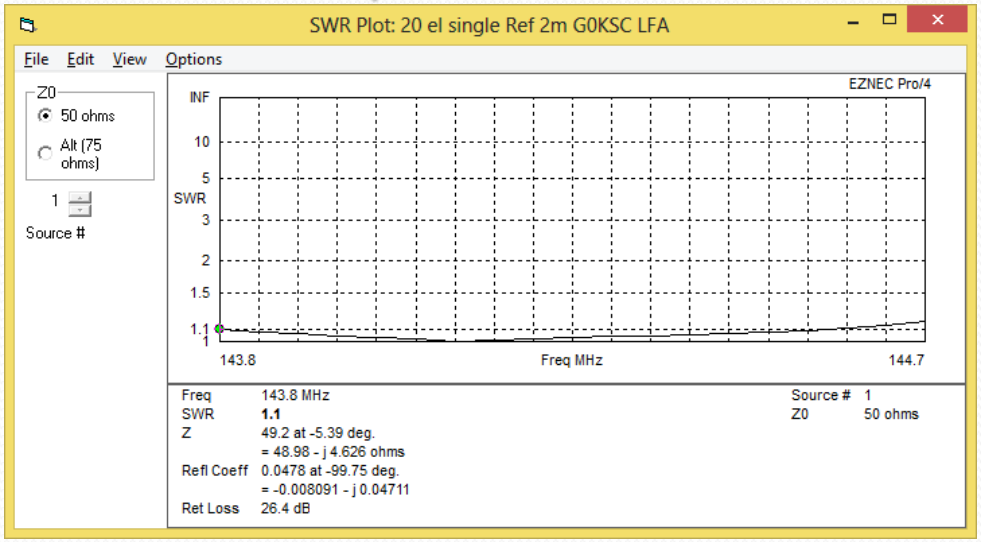
- 9el 144Mhz LFA PBP 14’
- No ‘Ski Slope’
  - Flat-line performance
- No shift in weather
  - It moves but is unseen
- Continuous, reliable
  - Predictable performance



LFA design principles - continued

- 20 el 144Mhz LFA Yagi
- ‘Free build’ G0KSC.co.uk
- Class-leading low temperature
  - 4 antennas = 207 Kelvin
- Excellent G/T results





LFA design principles – continued

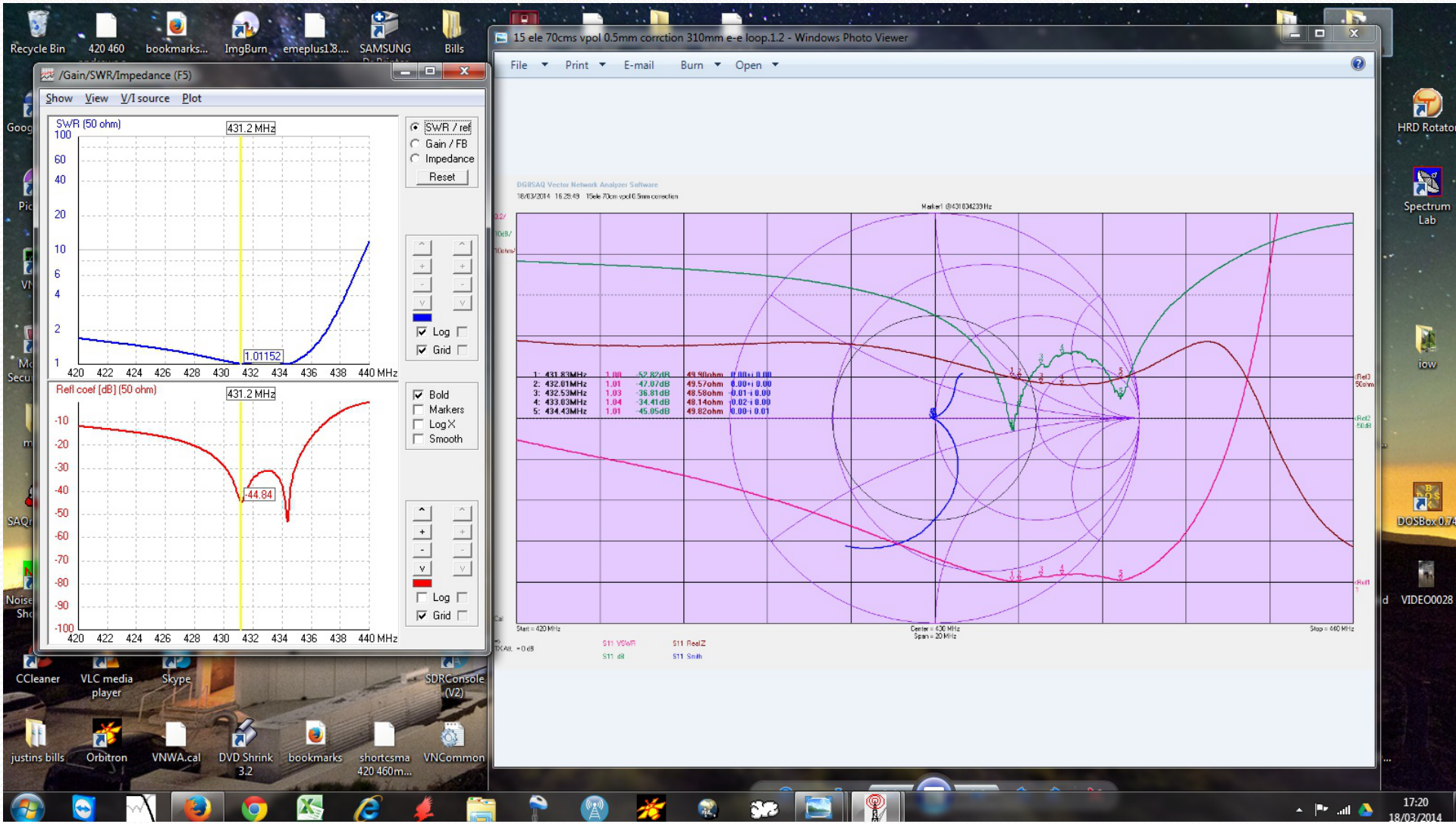
- Lower impedance means more bandwidth, not less!
- DUBUS article discussed OWA v 'lower' impedance Yagi design
- Design provides LI results
  - Without matching device
- Yagis need matching?
  - Driven element control
  - K6STI, DG7YBN, etc.
- Optimisation loop
  - 2 dimensional optimisation
  - Close-spaced 'driver cell'

LFA design principles - Continued

- 'Compressed patterns'
  - Non-conventional optimisation
  - Slight reduction in gain
  - Increased rear suppression
  - -.1dB Gain, + 1-1.5dB suppression
- Noise floor reduction
- 'Quieter' frontend to the RX
- No side-lobes either side of dish
  - AZ/EL reductions
  - Toward ground or left/right
  - Increased SNR
  - Hear and be heard! No QRM!

LFA feed system - HB9Q VHF Dish

LFA Yagi – Design to real world transition?



Installation and results

- Hundreds of independent results online

- LFA-TH6 Antenna Comparison.mp4

Thank you for Listening!