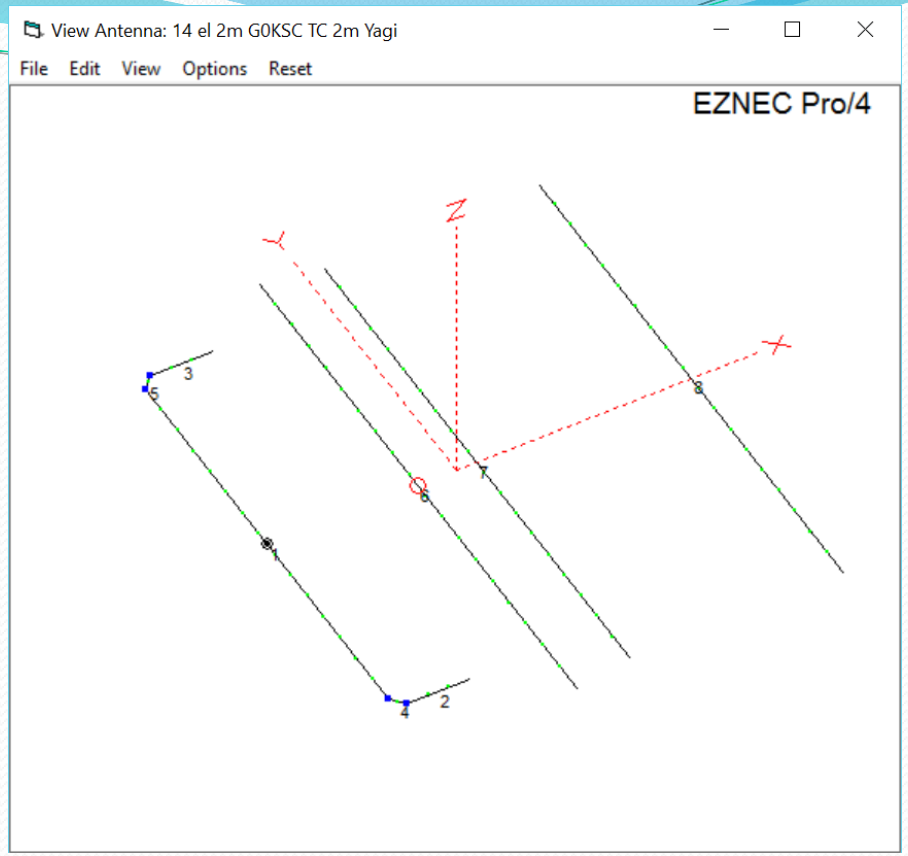
Bent Elements within Yagis

Performance and efficiency improvements for the modern Yagi

By Justin Johnson G0KSC

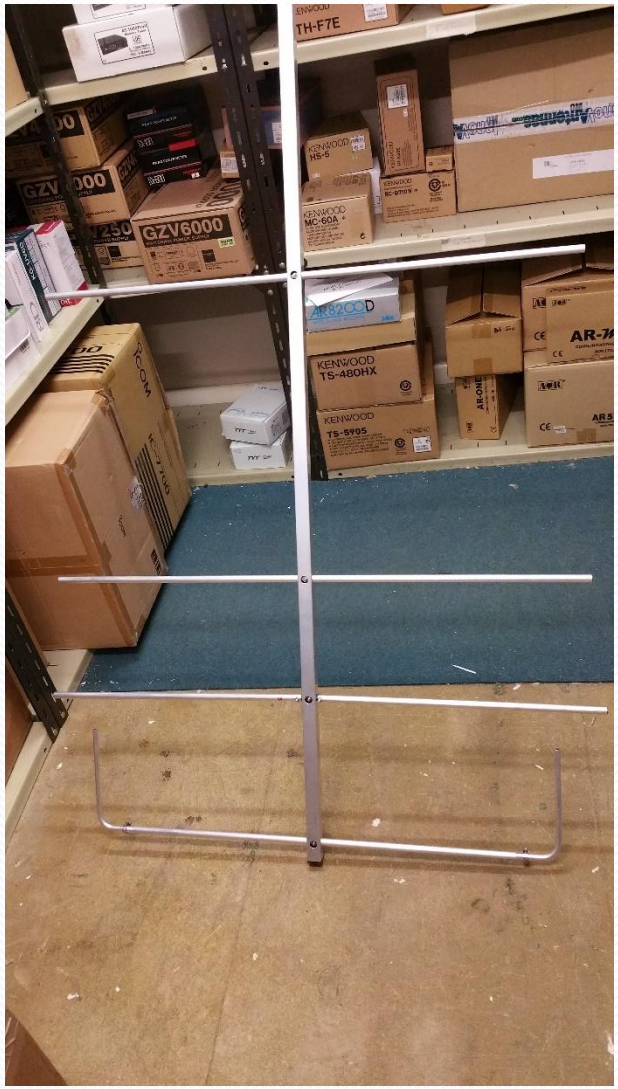
Agenda

- G0KSC?
  - Signal to Noise Ratio in Yagis
  - Be smart - Hear & be Heard!
- Why Bent Elements?
- Traditional Matching Avoidance
  - Modelling errors
  - Matching losses not measured
- Bent Element Advantages Missed?
- Notes on NEC model replication
- Variations of Bent Elements
  - OP-DES (half Moxon), K6STI ‘V’, Bent Reflector (UA9TC)
- Advantages of Lower Impedance Yagis
- OWA and OP-DES Enhancement examples
- Questions



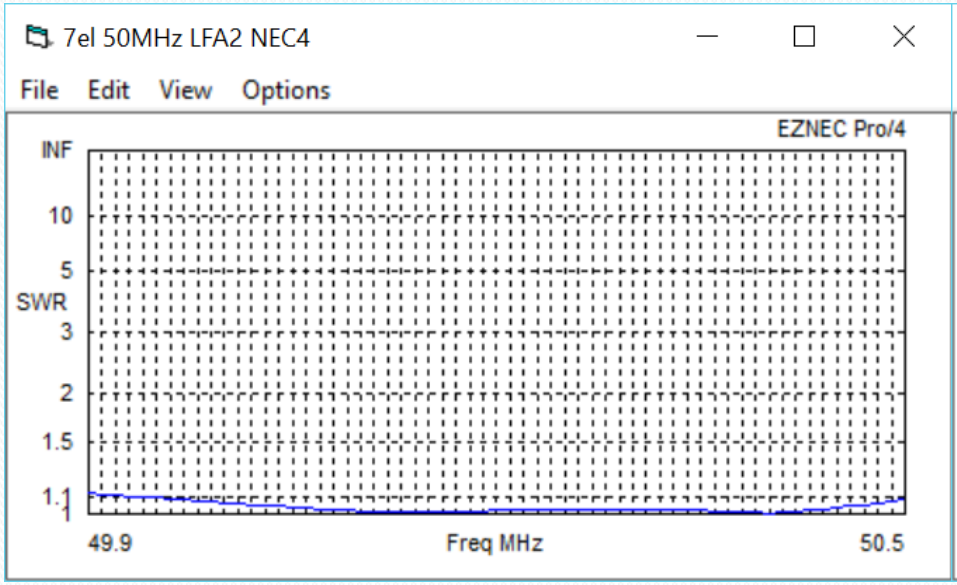
Why Bent Elements?

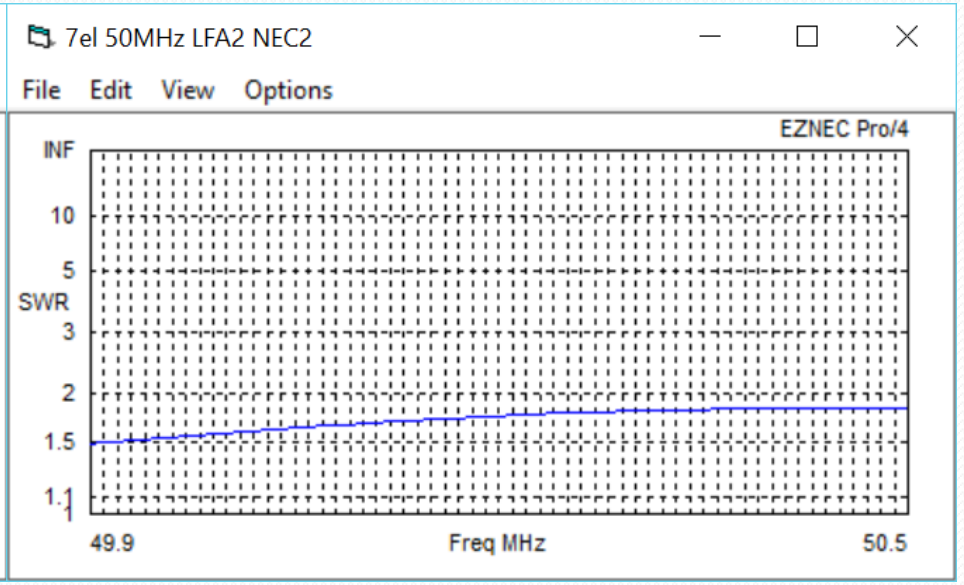
- Increase impedance to 50Ω
  - Without matching device
  - Model followed and not ‘missed’
  - Due to modelling errors
- Native impedance ‘lower’
  - Increased performance
  - Increased bandwidth
- 50Ω OWA boom optimised 40Ω
  - Increased bandwidth
  - Increased performance



Traditional Matching Methods

- Matching losses unknown
- VHF/UHF noise implications
- Taper errors hidden by matching (inc. tapered el correction)
- Errors induced through bends and tapers in NEC





Bent Element Advantages Missed?

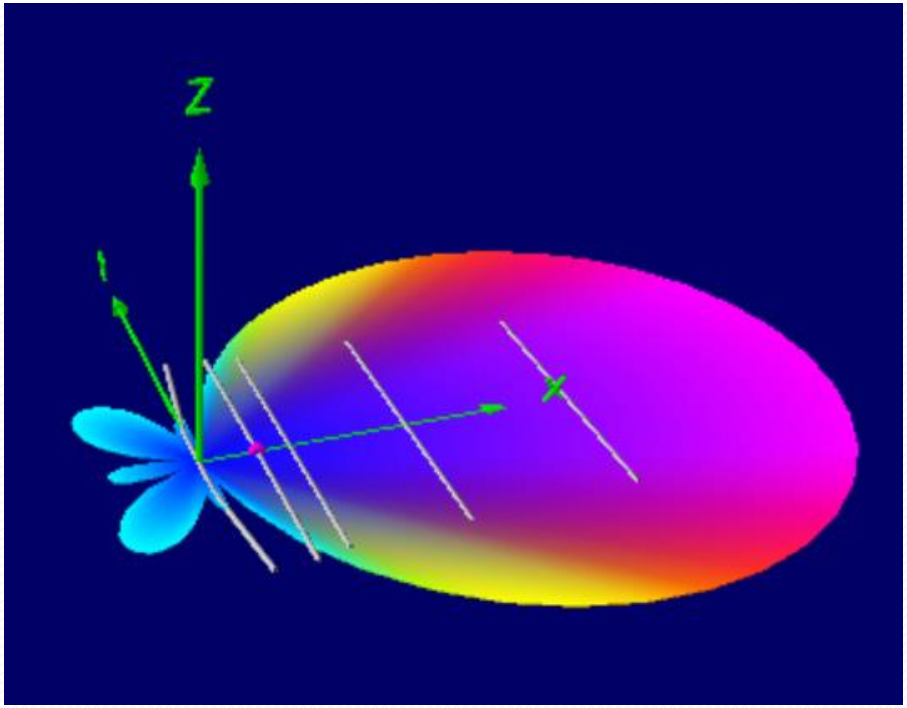
- Real World results not as expected?
  - Errors in modelling software
- NEC2 (with tapered element correction) inaccurate
  - Inaccuracies hidden by matching devices
  - Performance is not ‘as model’
- Experimenters may have been disillusioned?
  - Poor results
  - Given up as a bad job
- With no matching:
  - If it is wrong, you know its wrong

Notes on NEC model replication

- Driven element ‘no tails’
- Perfect coax to dipole connection in model
- Tail length should be as short as possible
- DE *WILL* need to be shortened to achieve model
- If adjustment has to be mode on the DE
  - Do we want to adjust other elements?
  - Easier achievement of model with one element adjustment?
- Straight elements – fine
- No bends – fine
- Taper / Bend scenario plus DE? Accuracy reduces

Variations of Bent Elements

- Moxon was first?
- K6STI ‘V’ dipole for wideband Yagis - Broadcast
  - DG7YBN adoption of VHF/UHF ham use
- UA9TC ‘U’ reflector
- G0KSC ‘semi-V’ reflector
  - LFA2 models
- G0KSC OP-DES – Half Moxon?
  - Driven element enhancement
- Bent reflector on OWA
  - OWA2?

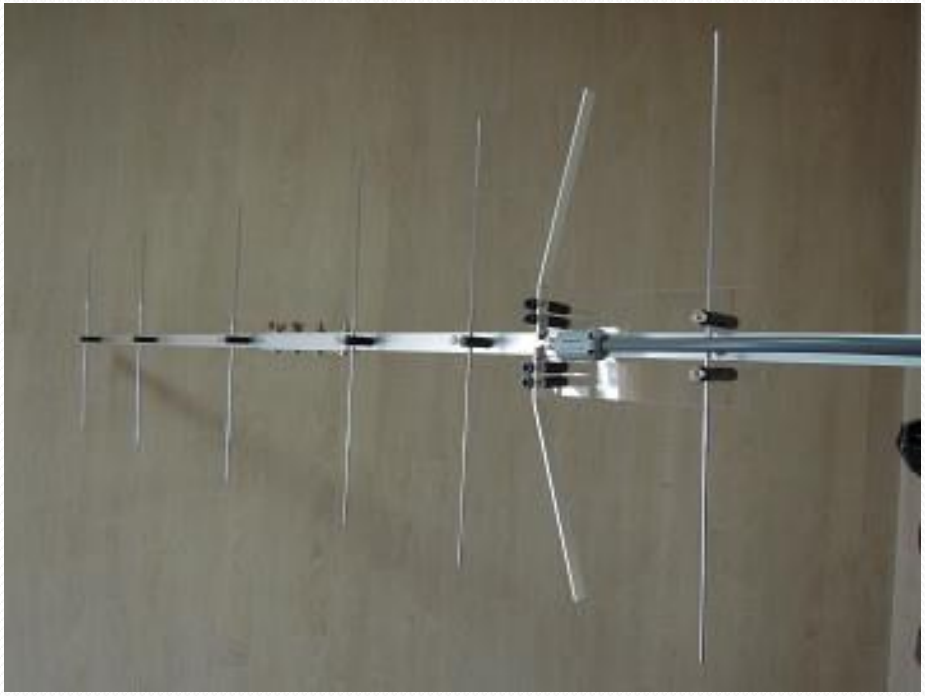


Moxon – First Bent el. Matching?

- Moxon first with bent element matching in Yagis
  - 2 element direct feed Yagi
  - Uncharacteristic performance, high F/B, high gain
  - Per foot of boom

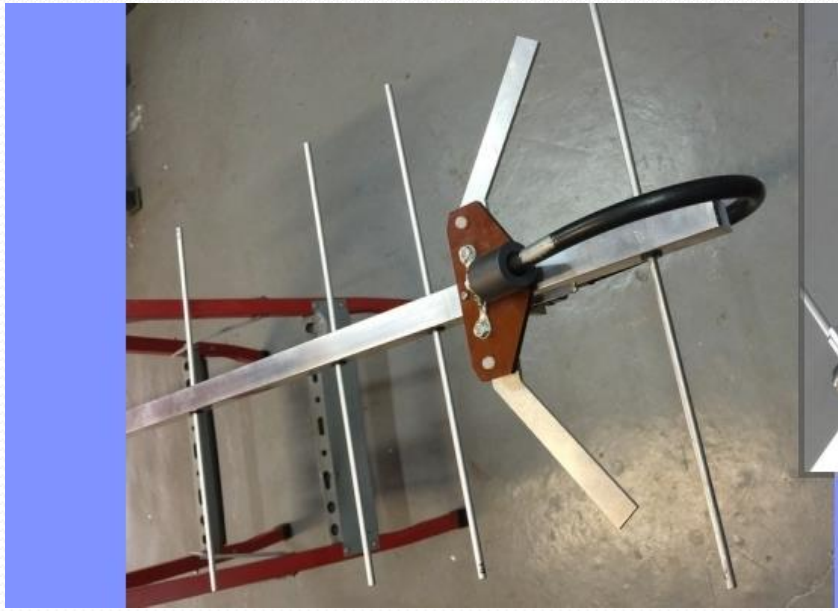
K6STI ‘V’ Dipole

- Broadcast band solution
  - Wide bandwidth, constant impedance
    - Lowered impedance helps provide broadband performance
- Impedance increase
- Self-matching dipole
- One element to adjust



DG7YBN Adaption for Ham use

- DG7YBM VHF/UHF Yagis using V dipoles
- Excellent results
- ‘Real World’ replications more difficult

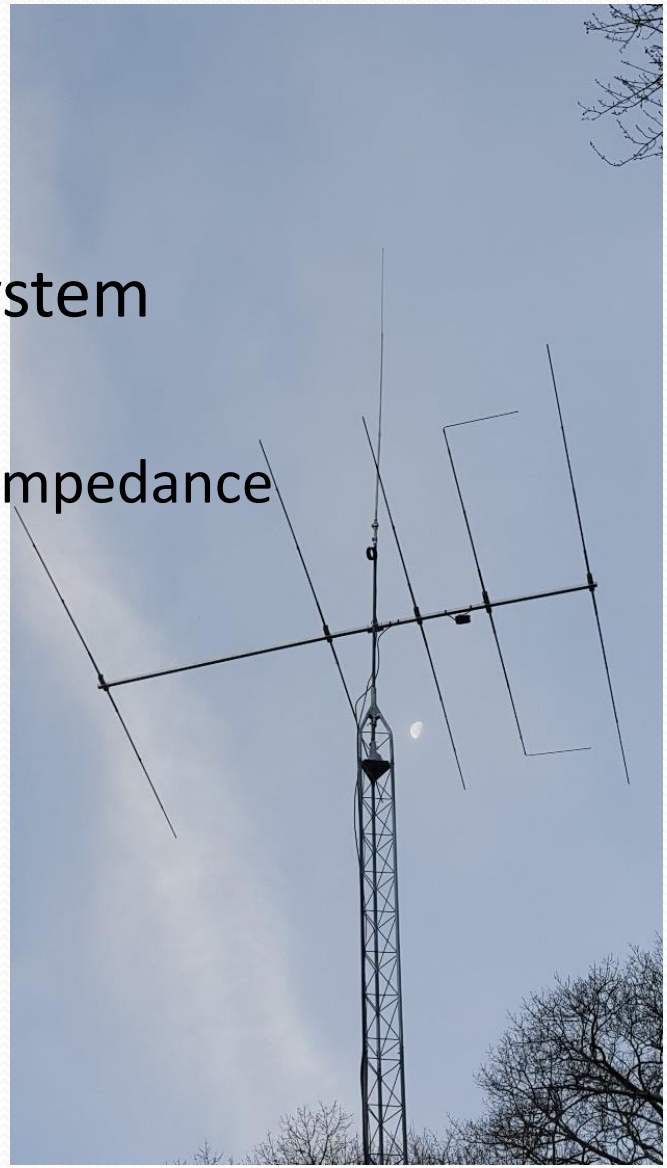


UA9TC ‘U’ Reflector method

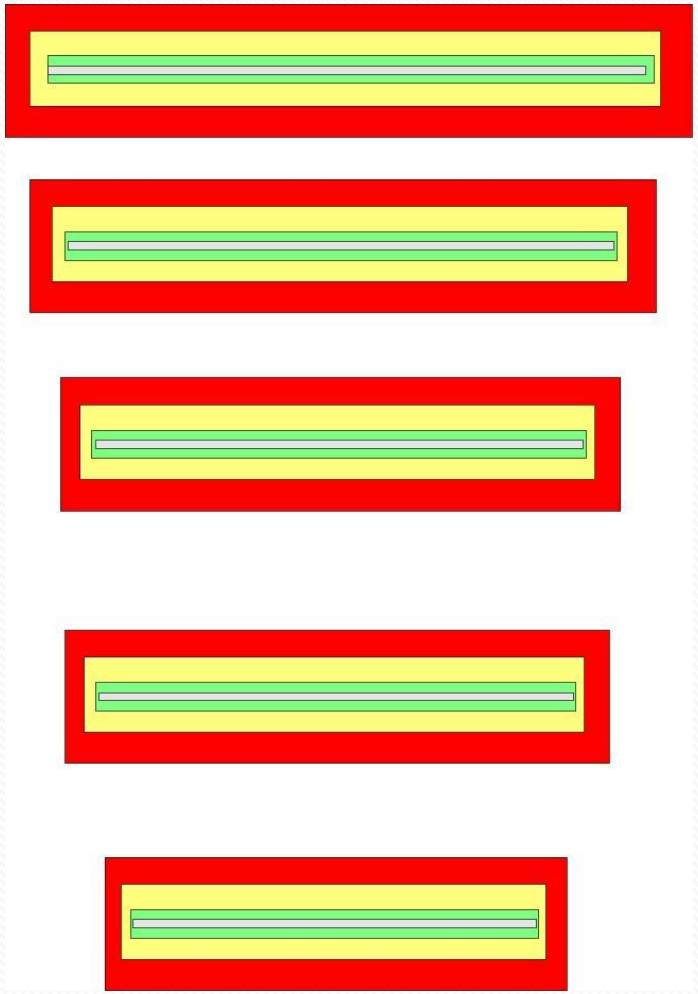
- ‘U’ reflector method is easier to model accurately
- Extremely good patterns and bandwidth possibilities
- Easier build replication
- Final adjustment
  - Driven Element
  - *And* Reflector

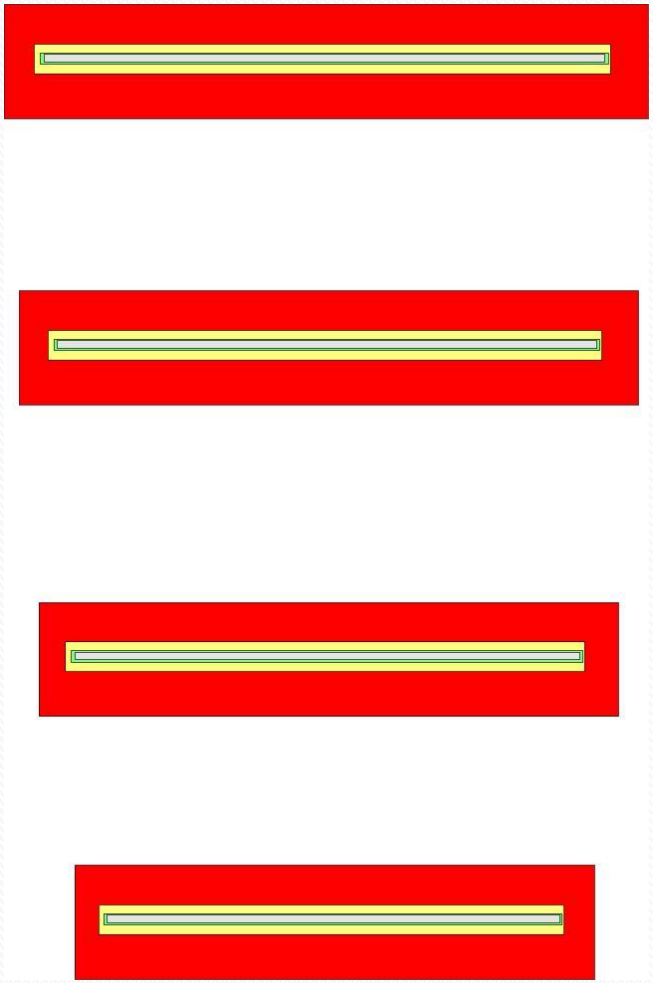
G0KSC OP-DES Yagi

- 5el 28MHz 15’ boom
- Opposing Phase Driven Element System
- 50 Ohm Direct feed
  - Driven element tips bent to increase impedance
  - Opposing phase at each end
  - Cancellation of side lobes
- Very wide/flat bandwidth
- Very close spaced ‘driver cell’
- Excellent Performance



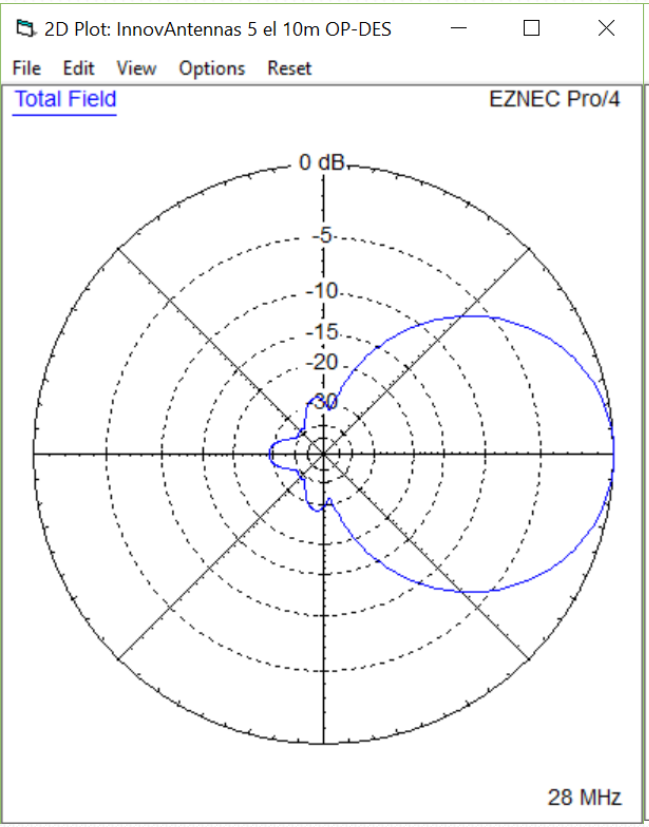
Wideband tolerance to Change

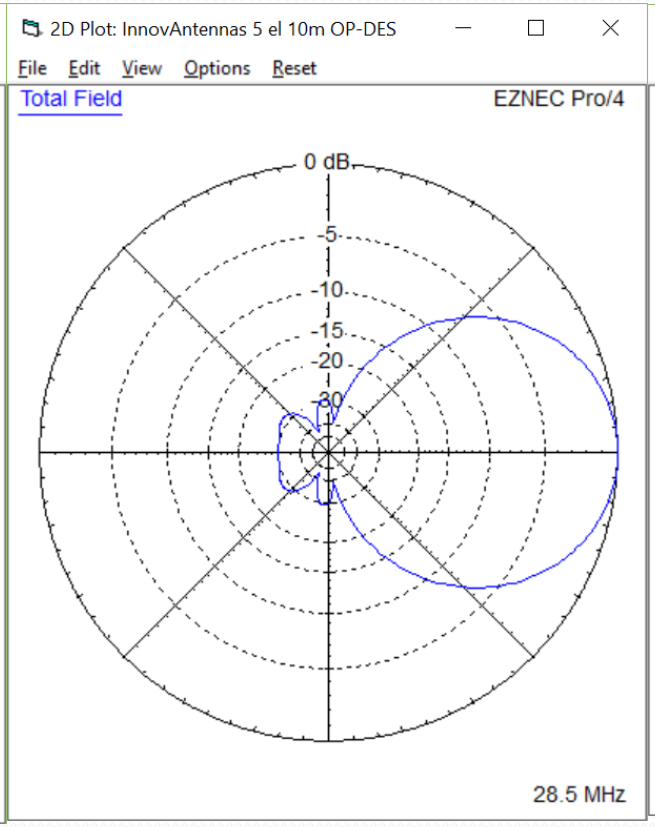


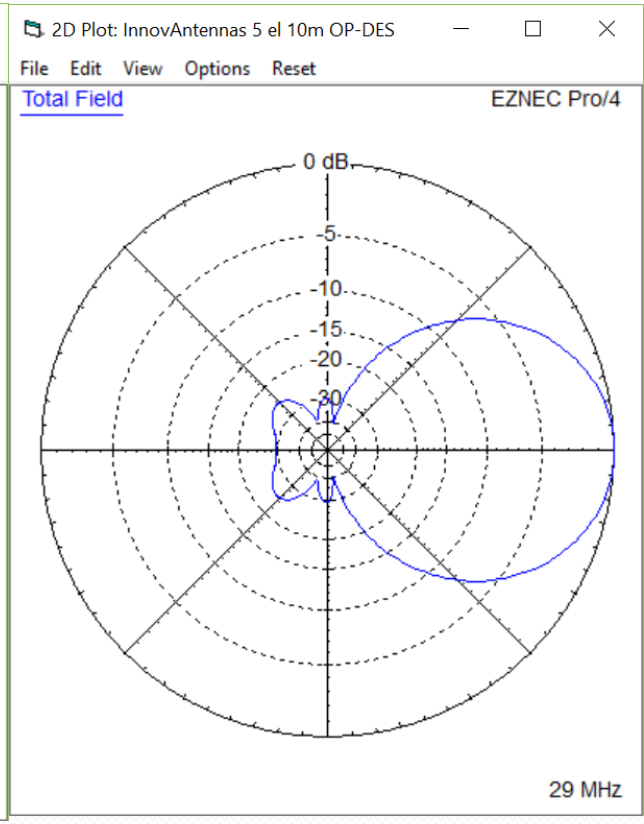


G0KSC OP-DES Yagi

- Pattern across 1MHz – 28MHz to 29MHz

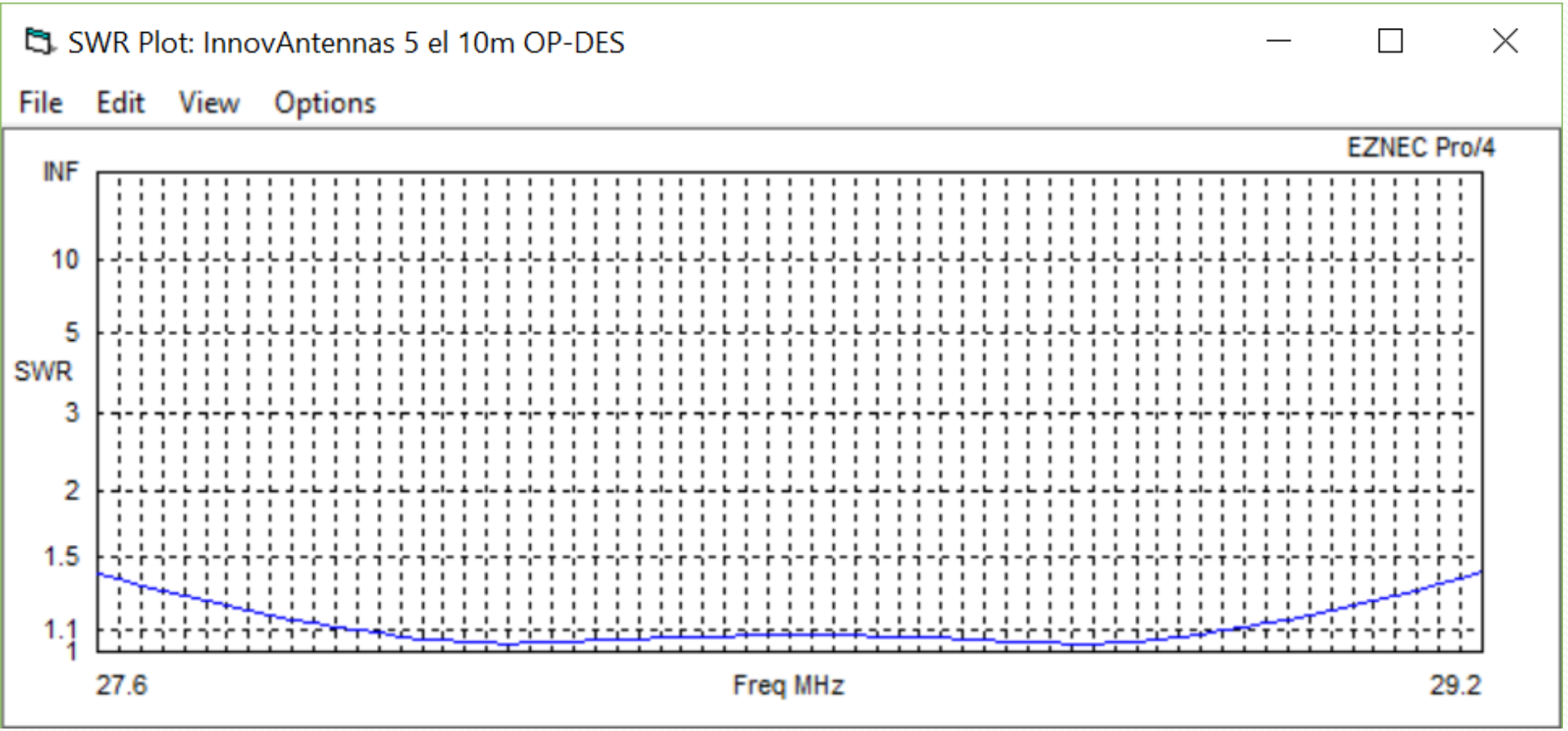






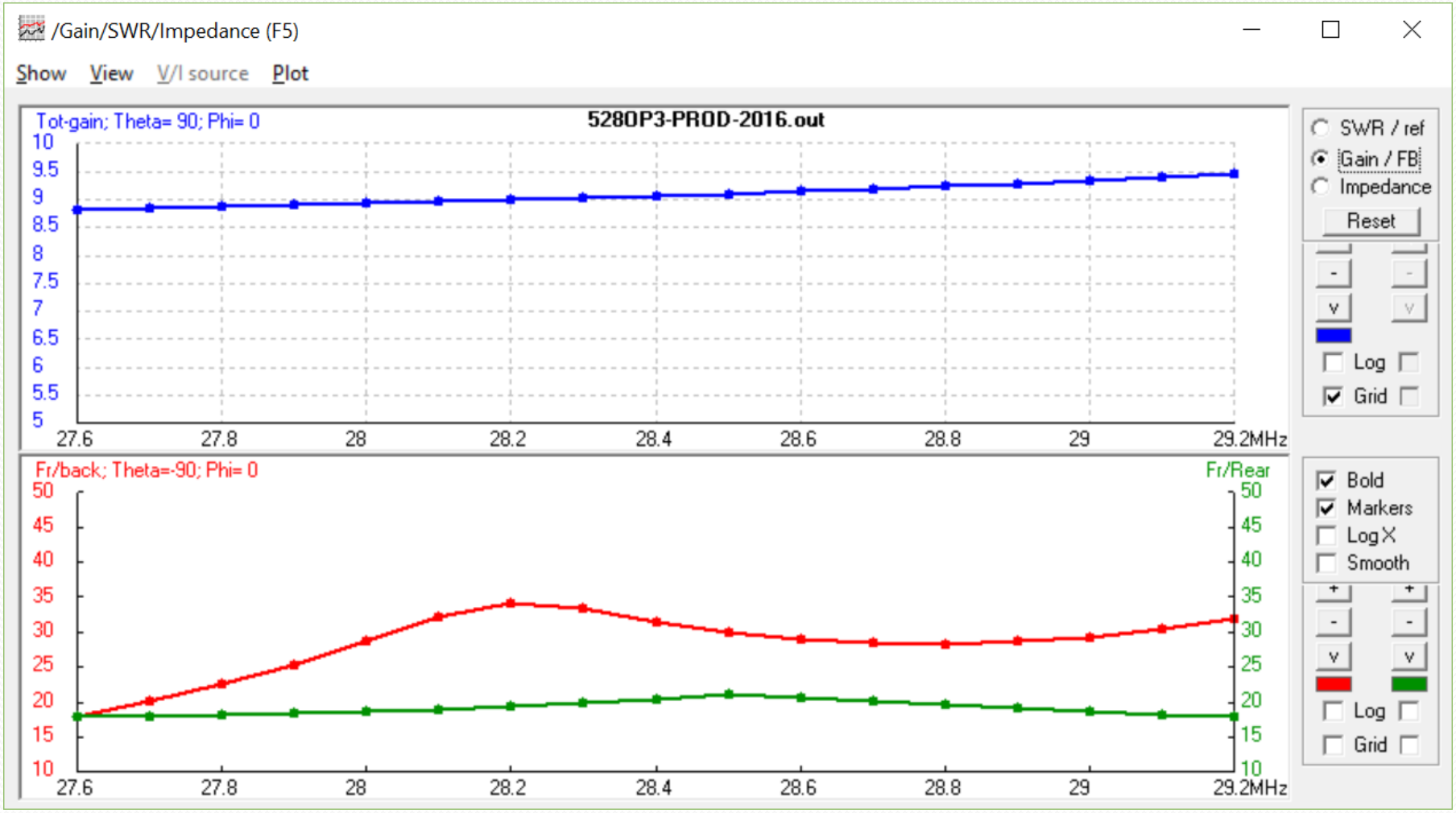
G0KSC OP-DES Yagi

- SWR across 1.6MHz – 27.6MHz to 29.2MHz



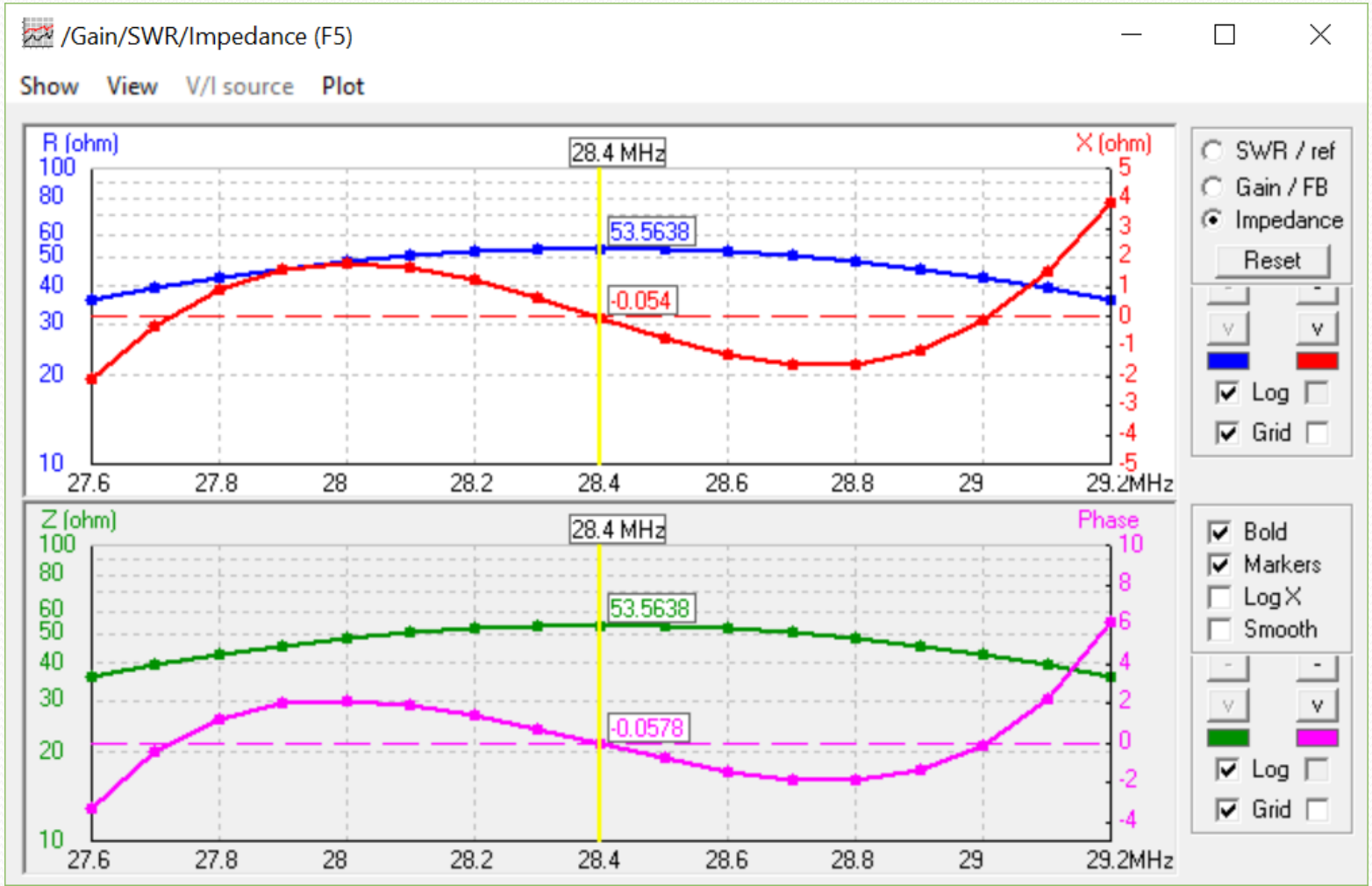
G0KSC OP-DES Yagi

- 1.6MHz – Gain, Front to Back & Front to Rear



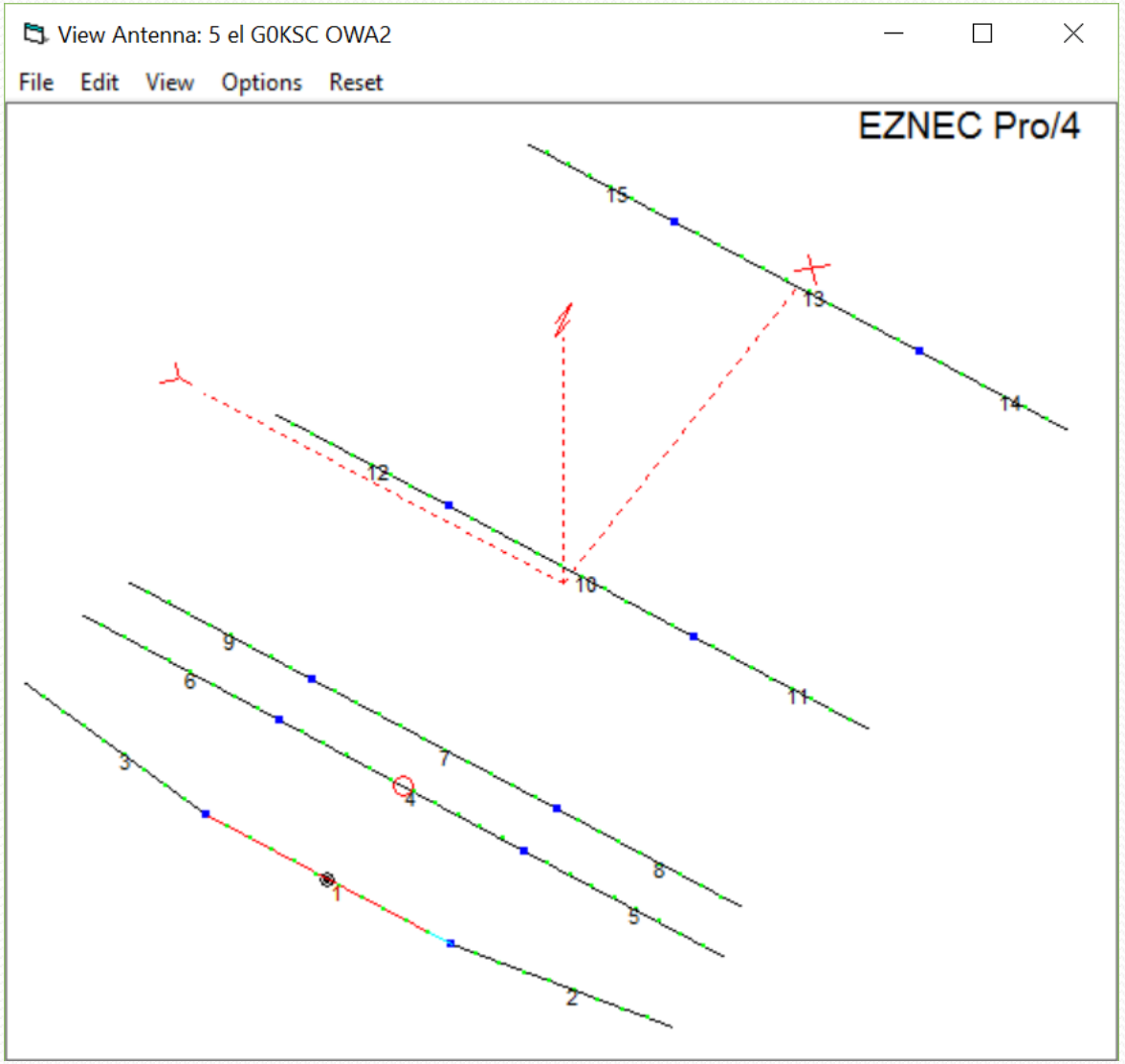
G0KSC OP-DES Yagi

- Impedance 1.6MHz



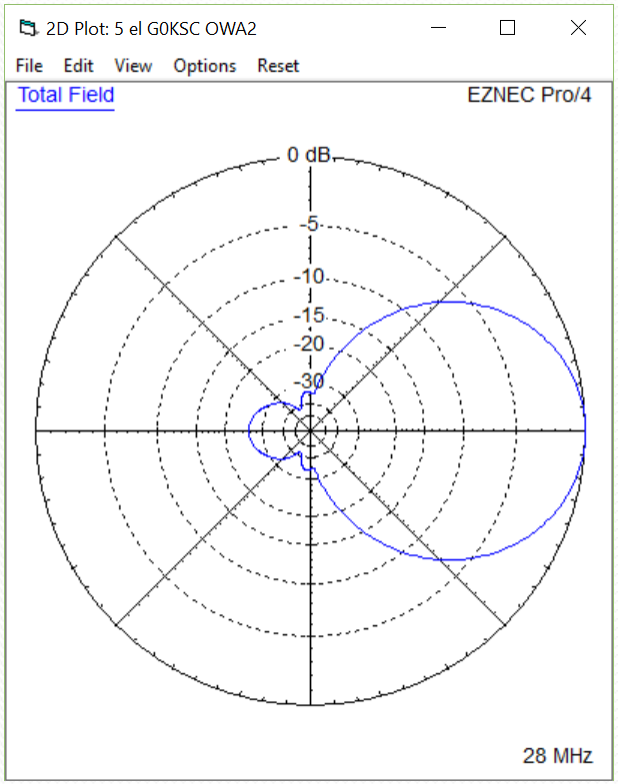
G0KSC OWA2 – Bent Reflector

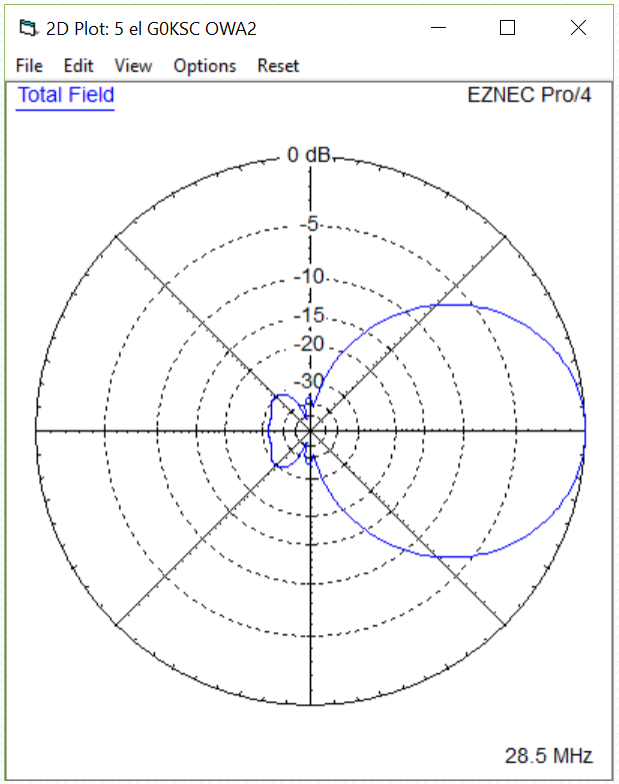
- 5el 19’ Boom

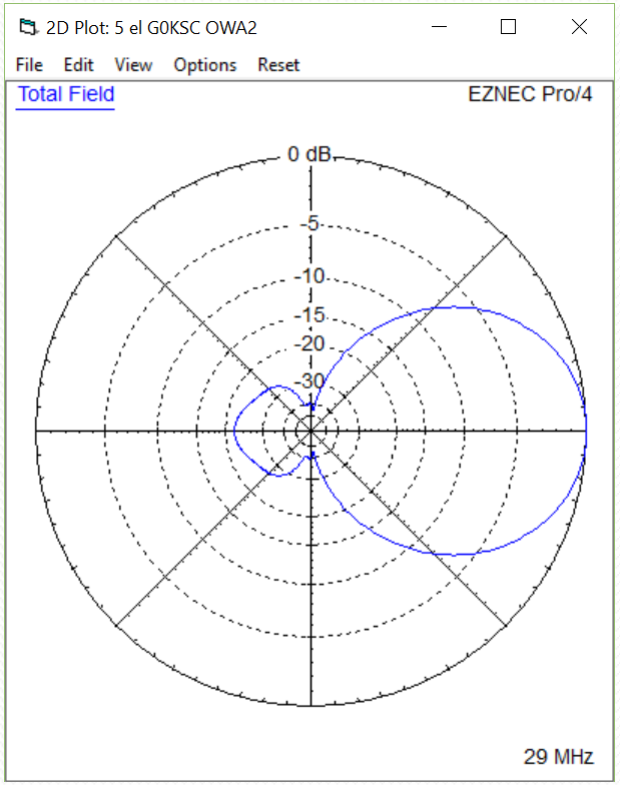


G0KSC OWA2 – Bent Reflector

- 28MHz to 29MHz Pattern

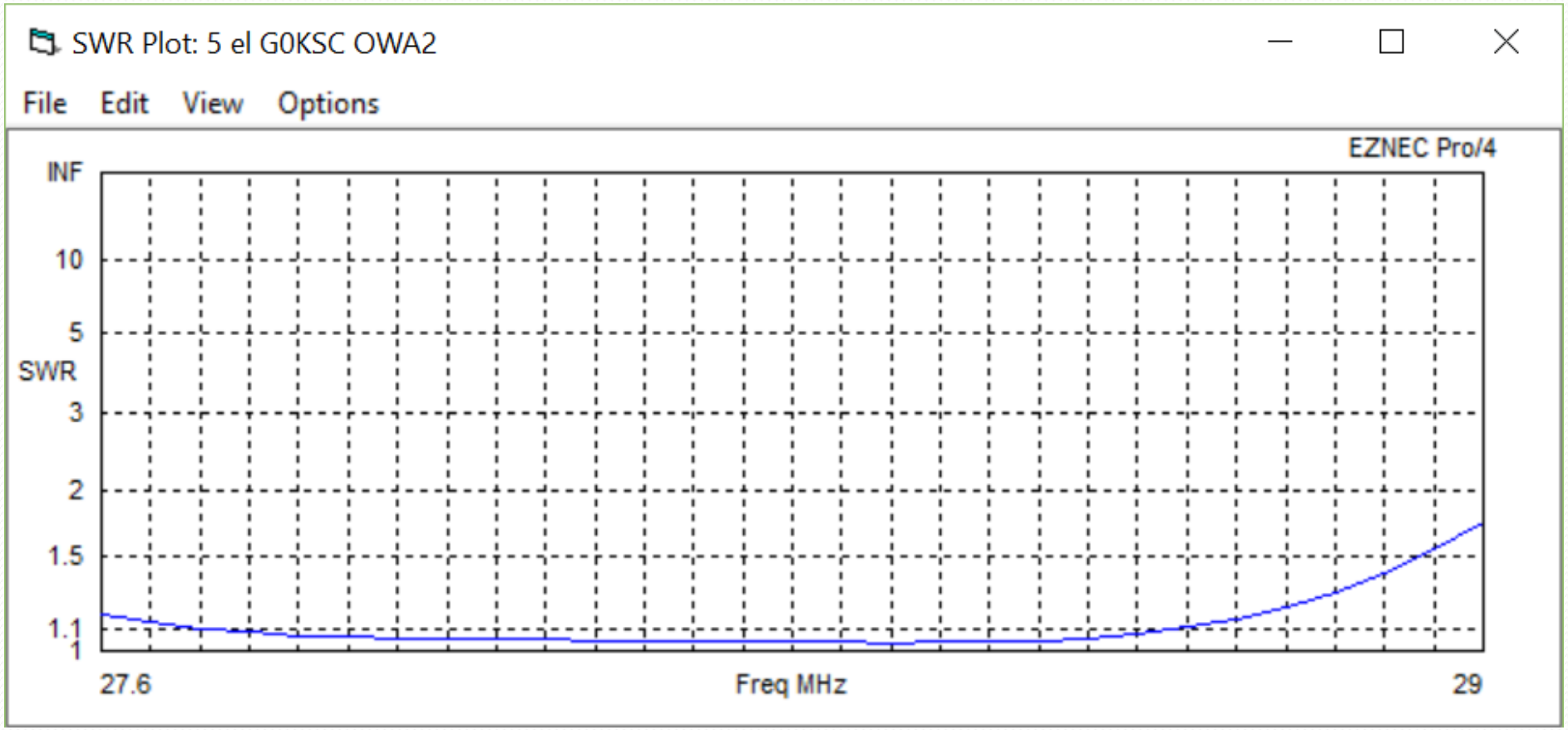






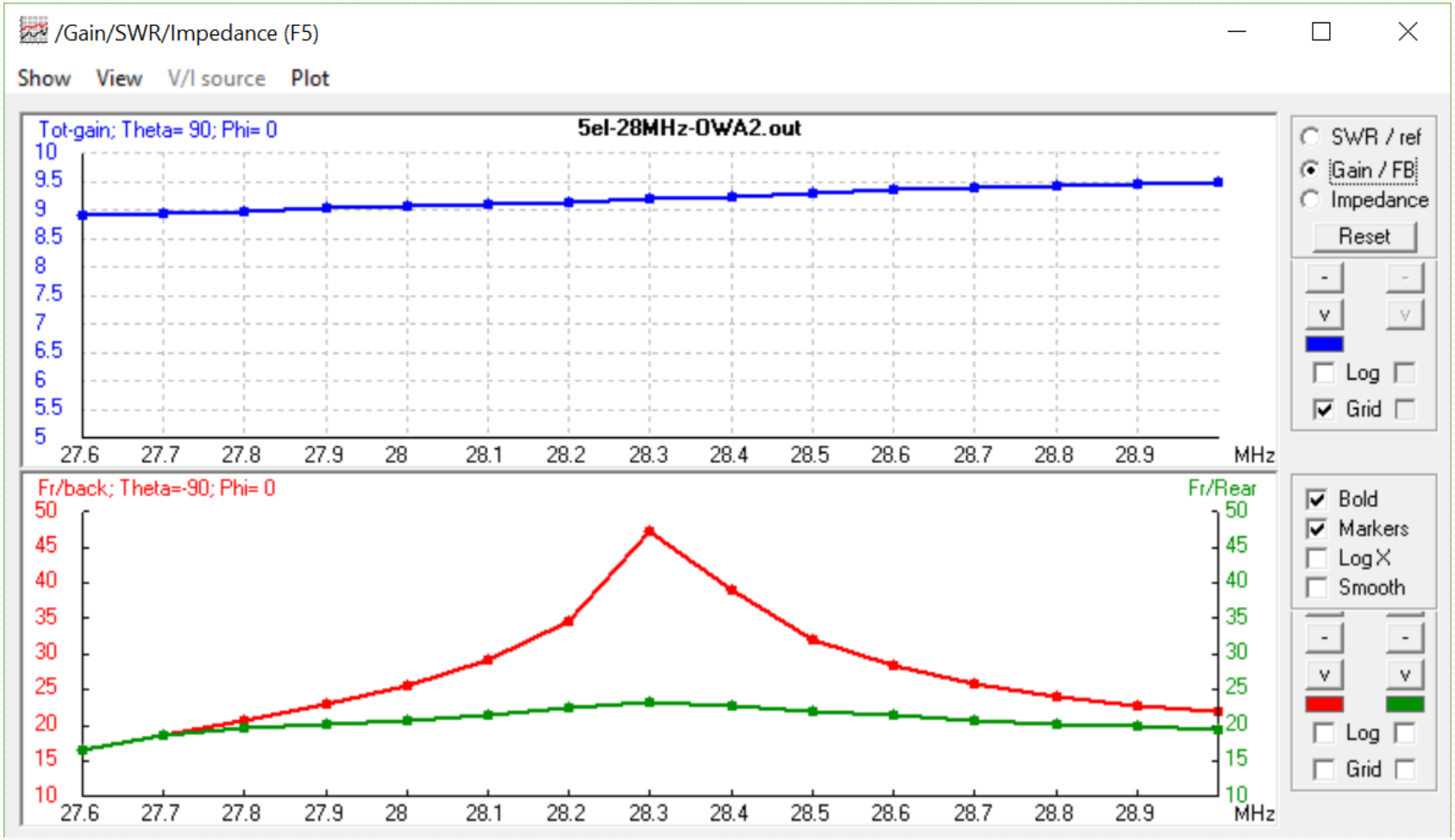
G0KSC OWA2 – Bent Reflector

- SWR 27.6MHz to 29.0MHz



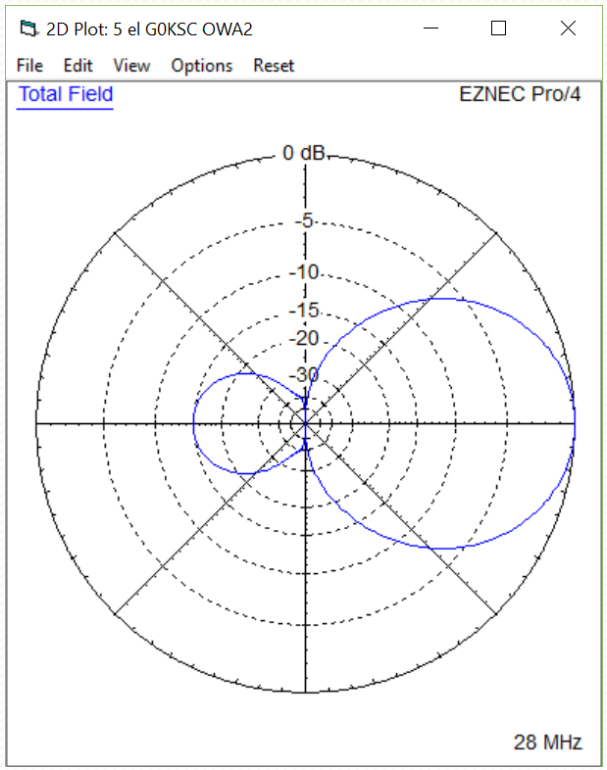
G0KSC OWA2 – Bent Reflector

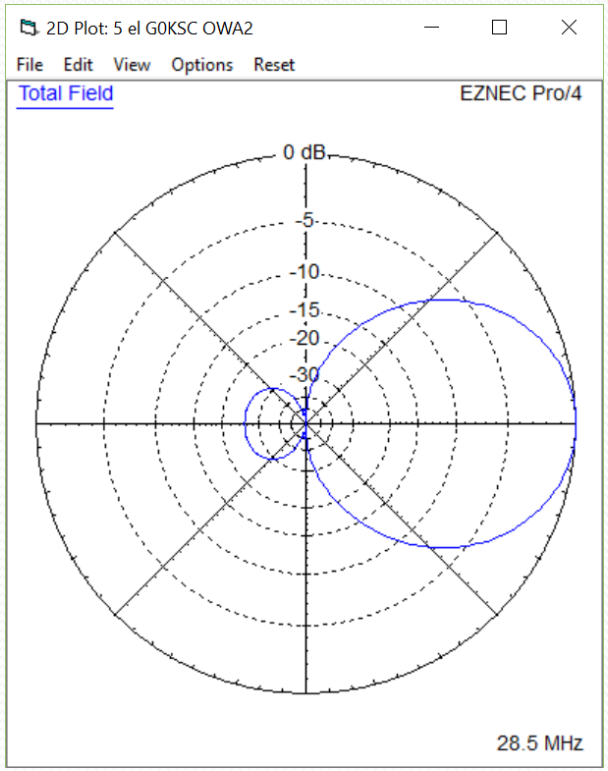
- Impedance and Front to Back, Front to Rear

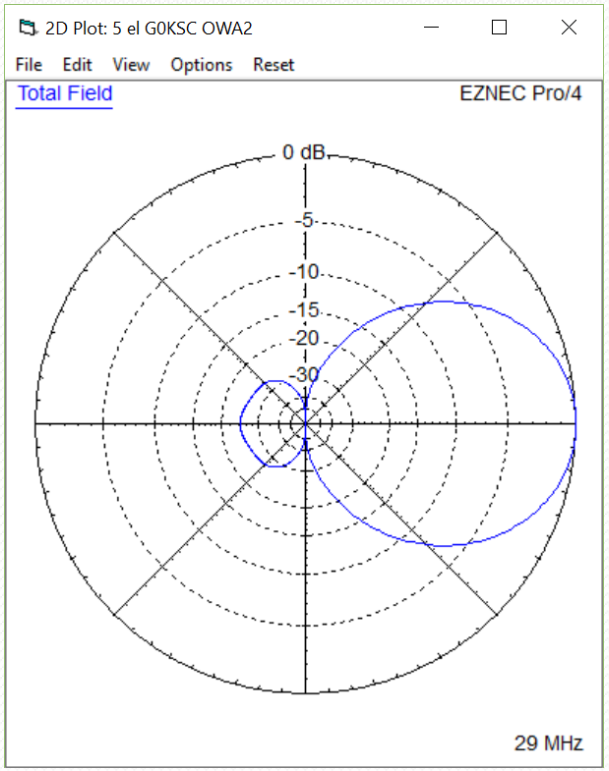


G0KSC OWA2 – Bent Reflector

- Straighten reflector? Pattern

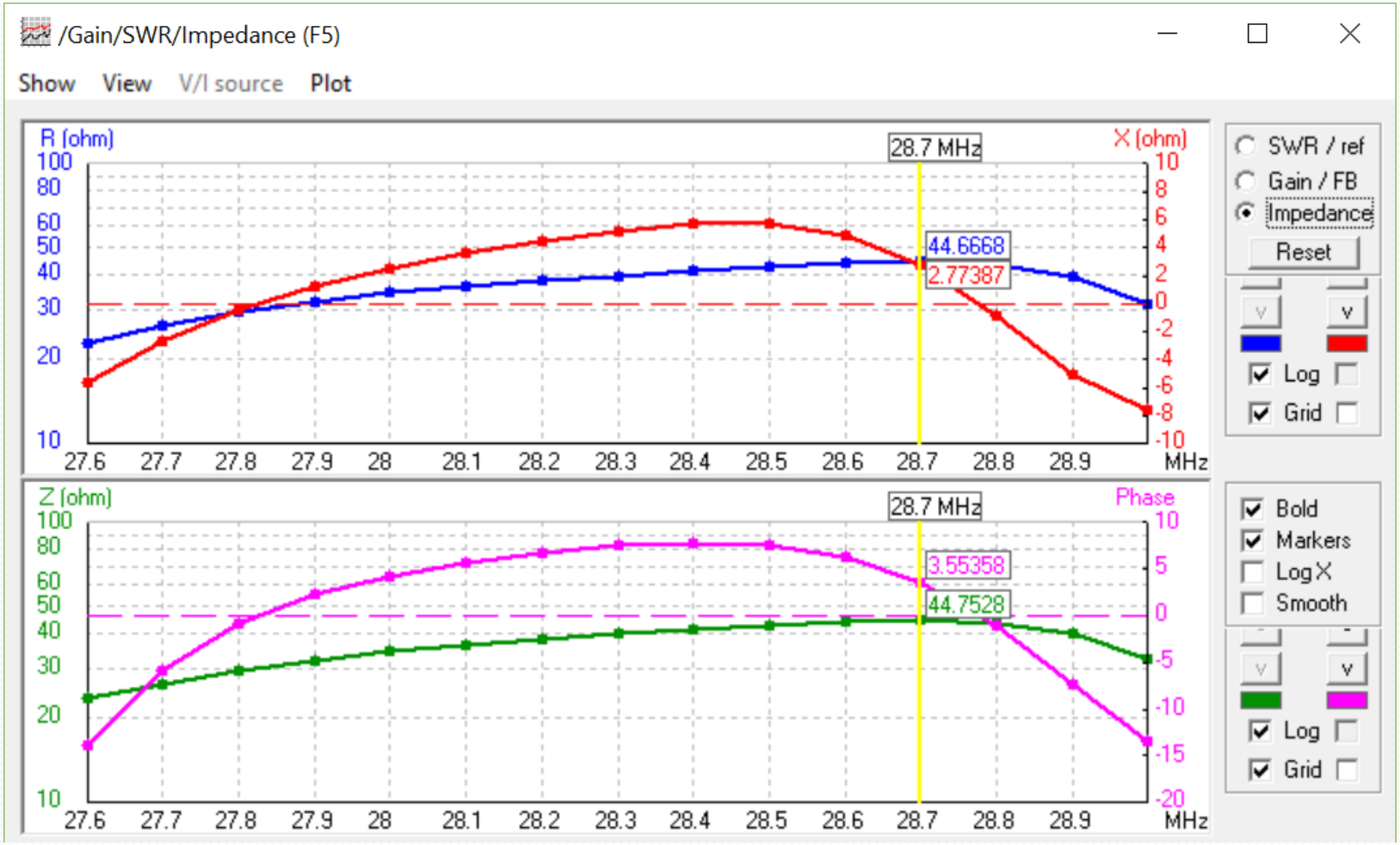






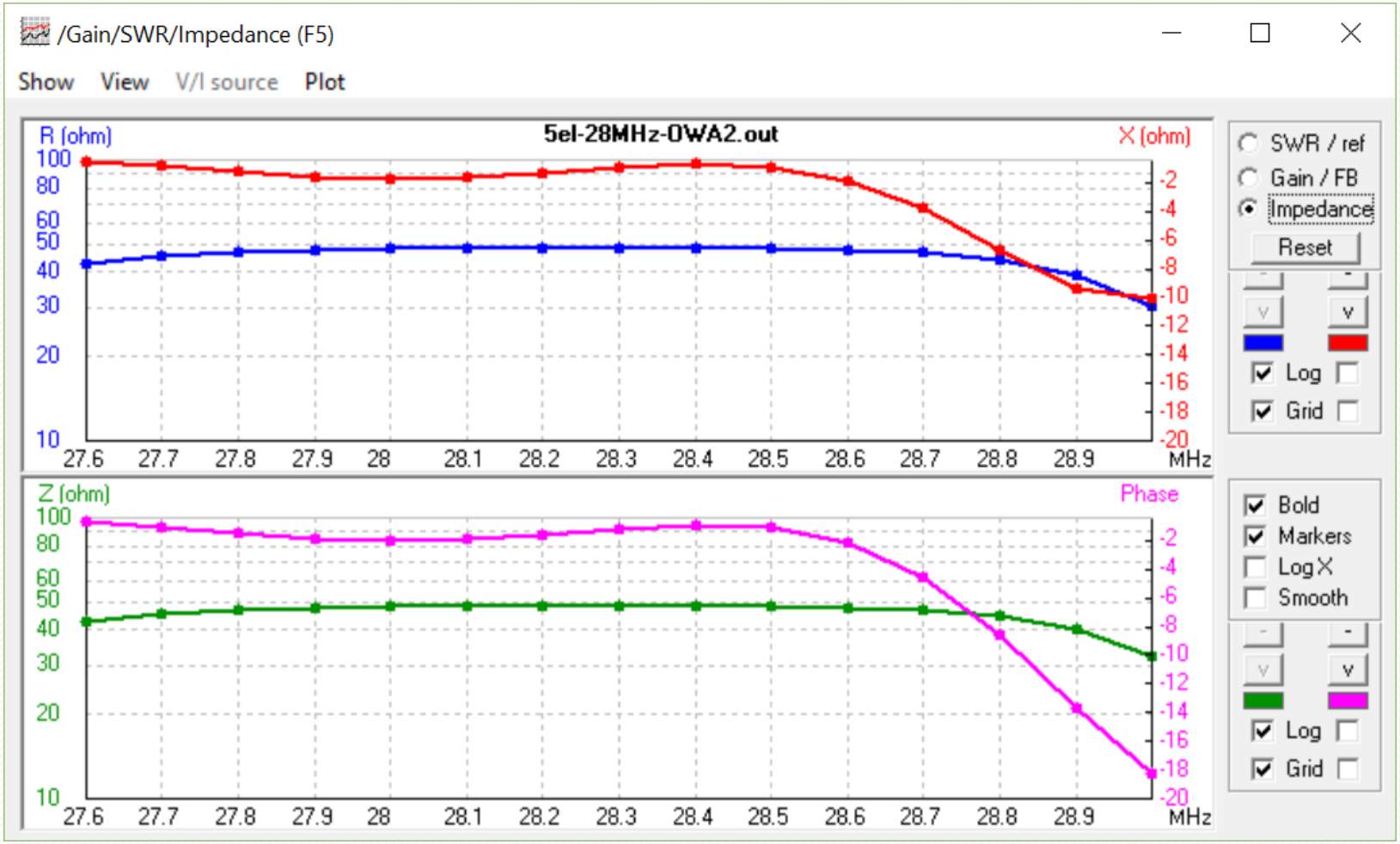
G0KSC OWA2 – Straight Reflector

- Straighten reflector? Impedance 22.9Ω to 46.7Ω



G0KSC OWA2 – Bent Reflector

- Straighten reflector? Impedance 30.5Ω to 48.5Ω



Questions?

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