
RADIO X ARCALA
RADIO ARCALA, OH8X,
FIRST BRANDED AMATEUR
RADIO STATION
23 12:51PM

MISSION STATEMENT

Providing an alternative way to promote amateur radio activity among **young people** by launching a team of skillful participants targeting and conducting competitive activities at **extreme level** as their way of self-education and self-satisfaction to boost interest among those who seek and value **competitive amateur radio** as an option

Arctic Approach Under Aurora Oval

Radiosport on Extreme Level

The Land of Telecommunication

Young People Terms

FEATURED MEMBERS

TRYING TO DO IMPOSSIBLE CREATES GREATEST INNOVATION

A: NORTHERN DIMENSION — ULTIMATE CHALLENGE ON ALL FRONTS

B: COMPETITIVE AMATEUR RADIO — EXTREME SPORT CONCEPT

C: LAND OF TELECOMMUNICATION — PROFESSIONAL APPROACH

D: YOUNG PEOPLE TERMS — MEET, TALK AND DO YOUNG

DRIVERS FOR RADIO ARCALA

- Make ultimate station dream and operating experience come true
- Capitalize on historical heritage and innovative amateur radio in Finland
- Utilize the technical, conceptual and competitive strength of OH8X team
- Attract young people through extreme concepts at Radio Arcala
- Share the Arcala experience throughout the amateur radio community
- Support the academical world with propagation and other post graduate studies

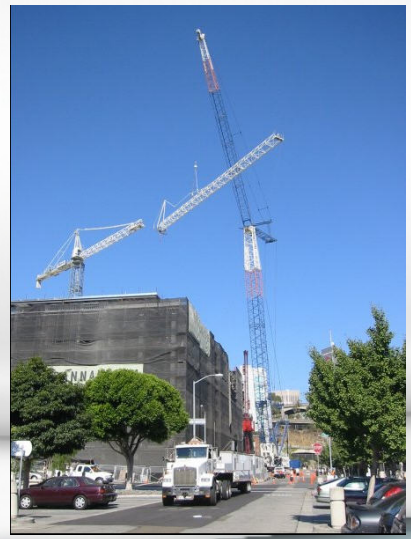
ARCALA MONSTER SHOW

by the Arcala Extreme Professionals

- Episode 1, The Seed
- Episode 2, Doing Ís Believing
- Episode 3, Things Get Serious
- Episode 4, It's a Lift Off
- Episode 5, Can Anyone Hear Us ?
- Episode 6, Back To Earth
- After Play

Episode 1, The Seed

- In late 2006 Toke/OH6RM ”Mister Aluminium” visited Arkala. He gave everyone a picture of his 4 el fullsize 80m yagi from the 80s. It was a nice picture, but didn’t think about it too much.
- In early 2007 Toke visited again. ”80m yagi is a TV antenna, but 160m yagi is a real ANTENNA. No one has ever done it. I have a great idea, how to do it ”.
- Yep, I said. But we have good 4 square, over 1km of beverages and there is LOT OF ICE, you know, and…
- Juha: ”Tell me more. What kind of tower it needs and …”
- Toke: In Jakarta I have seen many 160m yagis, just elements are missing

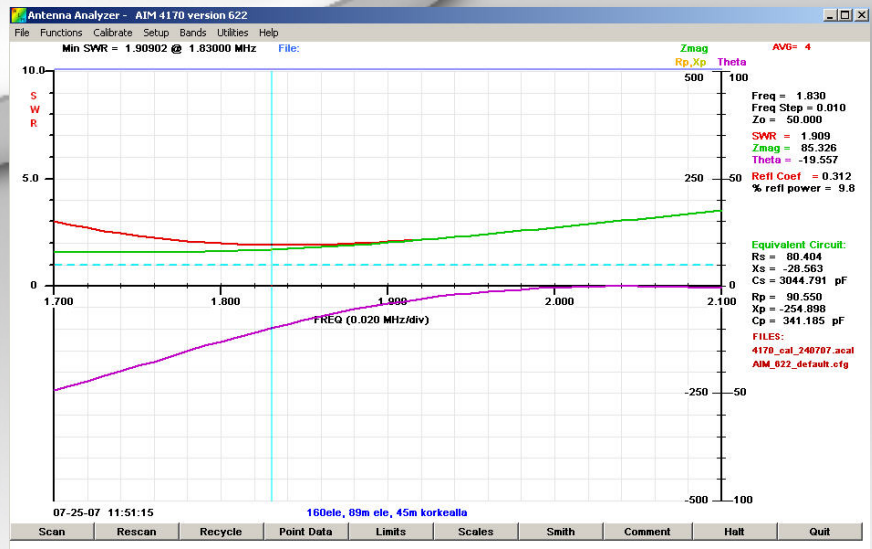


Episode 2, Doing is Believing

- The exploration was started from the element
  - Can it be constructed to stand the ice and wind ?
  - Does it behave electrically like an element ?
- In July 2007 the first trials were done in Tokelandia on 80m and especially on 160m elements
  - The 160m element was full size 88m element and looked robust.
  - But it didn't behave like a conventional yagi element !??
  - SWR dipped OK, but things looked strange.
- More brainpower was needed. We asked Olavi OH5BR and later Pekka OH1TV to join the team with all their deep antenna expertise.

Episode 2, Doing is Believing

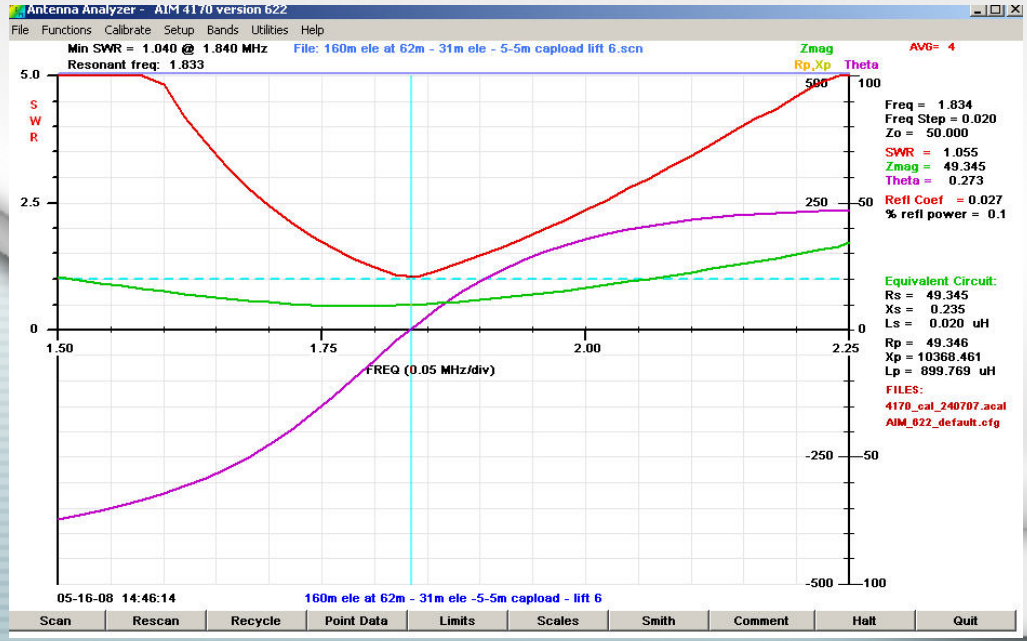
- **Things worked, but didn't work**
- **Can you figure out what is wrong ?**



Episode 2, Doing is Believing

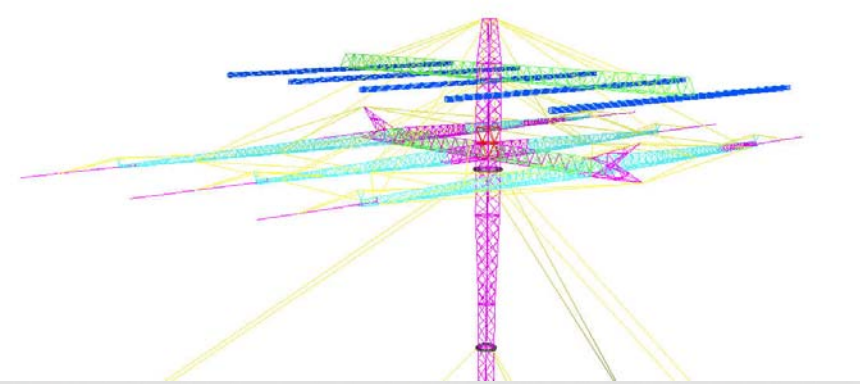
Precise Modelling and Careful Verification

- Pekka realized fast, what was wrong and what needed to be done.
- A thick and strongly tapering element is capacitive at the feed point.
- An accurate model of the element was created and compensation calculated for the the feed point.



Episode 3, Things Get Serious

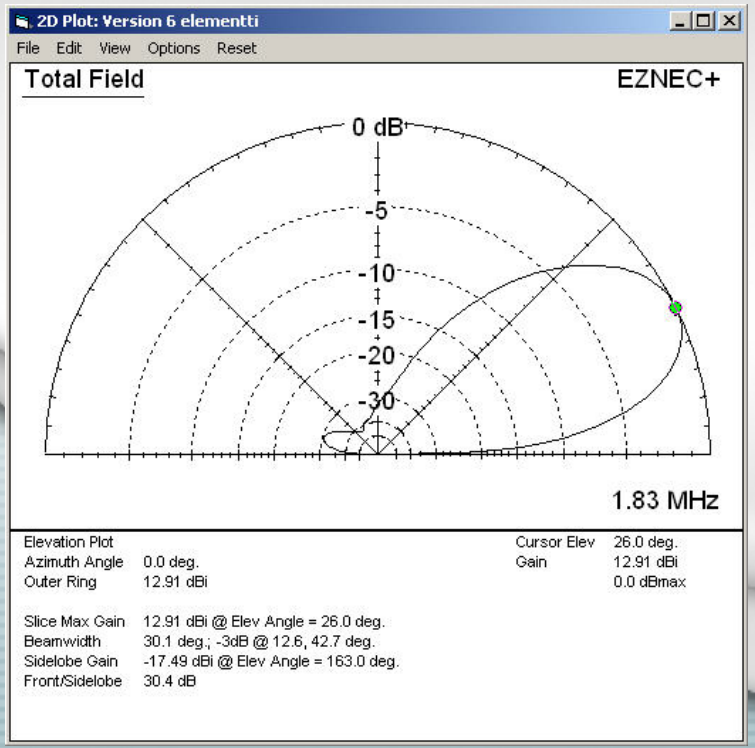
- Mechanical plan and simulations
  - Static and dynamic
  - Ice and wind loading
  - Phillystran used to guy elements
- Precise electrical simulations
  - Element modelling
  - Antenna modelling
  - Full system 80/160,
  - Load/match modelling
- Complex iterations between mechanical and electrical performance.
- Construction permit was obtained without any problems
  - Finnish antenna restrictions are quite ok outside urban areas. There are few other 100m towers with 5km radius (M1 and telecom)
  - Lights and special colouring are needed

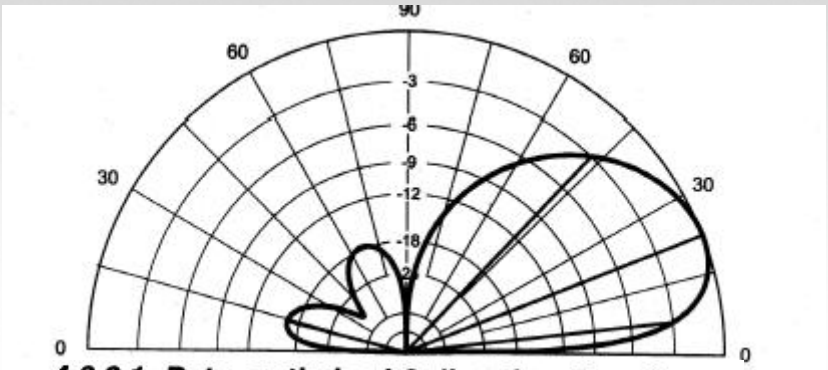


Episode 3, Things Get Serious

160m el yagi at 8m vs. full size 4 square

- Adding capacitive hats improves 3 element performance by stronger coupling and makes life easier with shorter element. Relevant for any 3 element design, doesn't help in eg. 5 el.
- Two segments: 1830kHz and 1865kHz
- Instant 180 direction change for forward and backward.
- 160m detuning needed for 80m





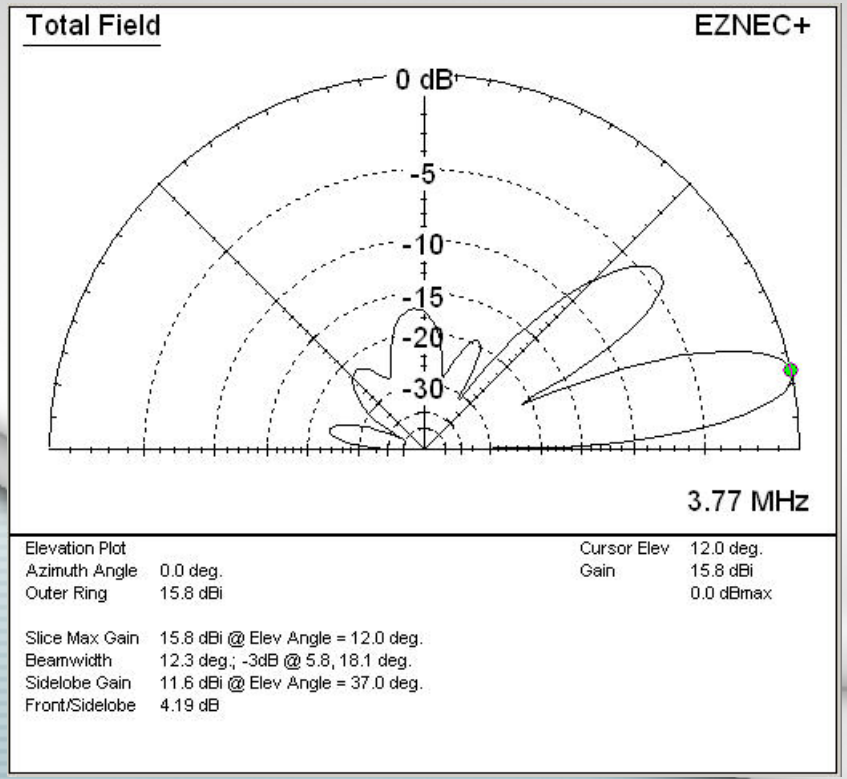
4.8.2.1. Data, optimized 8-direction Four-Square

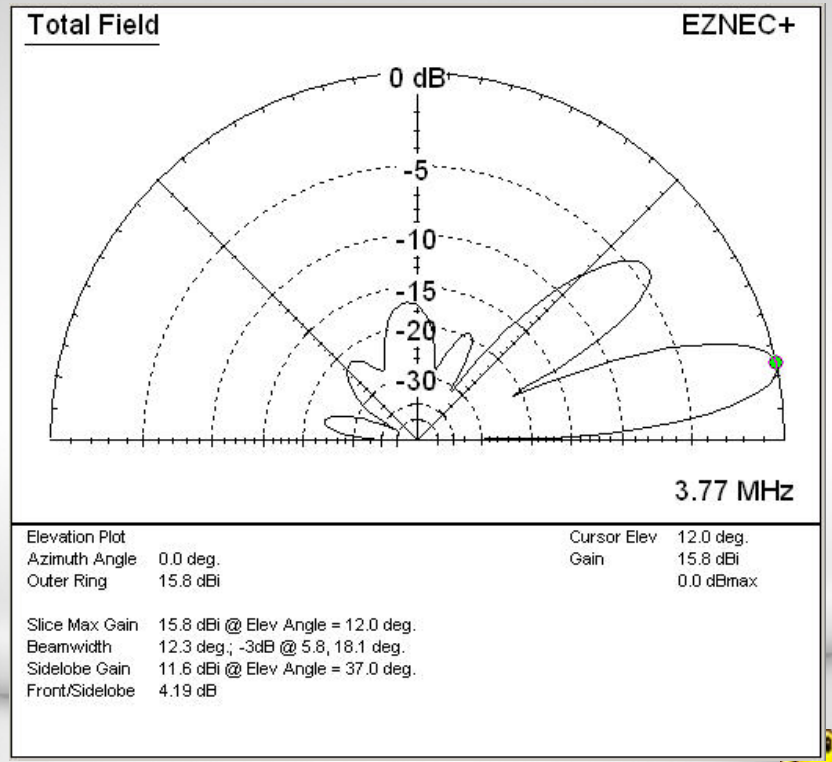
Side of square: λ/4
Feed currents: I4 = I3 = 1 /–105° A (front)
I1 = I2 = 1 /0° A (back)
Gain: 5.92 dBi (optimized regular Four-Square configuration: 7.25 dBi)
3-dB beamwidth: 113°
RDF = 9.72 dB
DMF = 16.5 dB
Feed-point impedances:
Z4 = Z3 = 81.8 + *j* 15 Ω (front)
Z1 = Z2 = 13.2 – *j* 26.3 Ω (back)

Episode 3, Things Get Serious

80 m 5 element yagi at 90m vs. 2 over 2 yagis at 55m and 95m

- In reality, a 2 element yagi F/B is much worse
- Today Arcala has 2 el yagi operational at 55m, next summer 2nd will be back at 95m.





Episode 3, Things Get Serious

- Measurements in the ‘Arcala antenna lab’
- Open area far from any antennas to avoid any interaction
- Boom and other possible effects were included.
- 160m element was tuned down to 1cm accuracy
- Correlation between simulation and real element was the key !
- Measurements lasted for a week

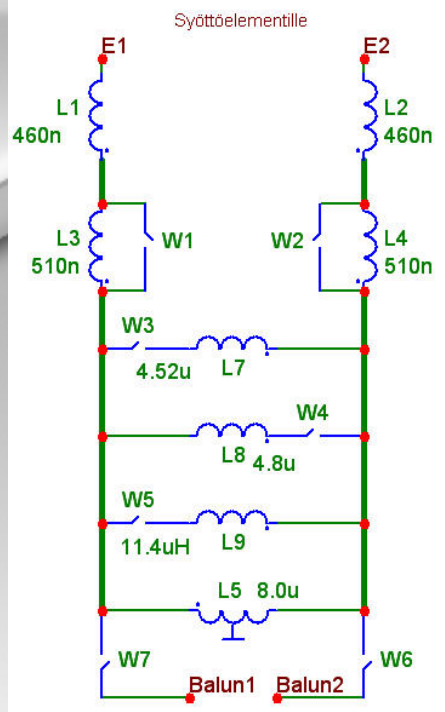

160m element with boom


80m element with boom

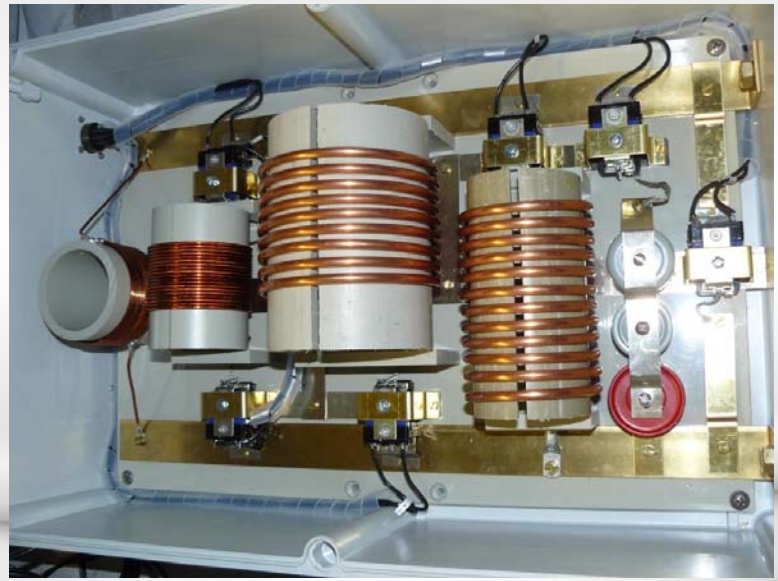

Results looking good: OH1TV, OH8NC, OH5BR (l-r)

Episode 3, Things Get Serious

- Making the match boxes
- Simulations and precise measurements
- Fixed interface to antenna



Some of the most professional antenna amateurs in Finland at OH8LK Lauri Kuokkanen, UltraCrea Oy



Episode 4, It's a Lift Off

- Construction started in September due to some delays in the gigantic (3.5m) guy wire bearings
- Nordic weather starts to be challenging in October and sometimes impossible in Nov/Dec
- Days are short in December, 9am to 3pm
- Difficulties to find large crane and skilful operator

Episode 4, It’s a Lift Off

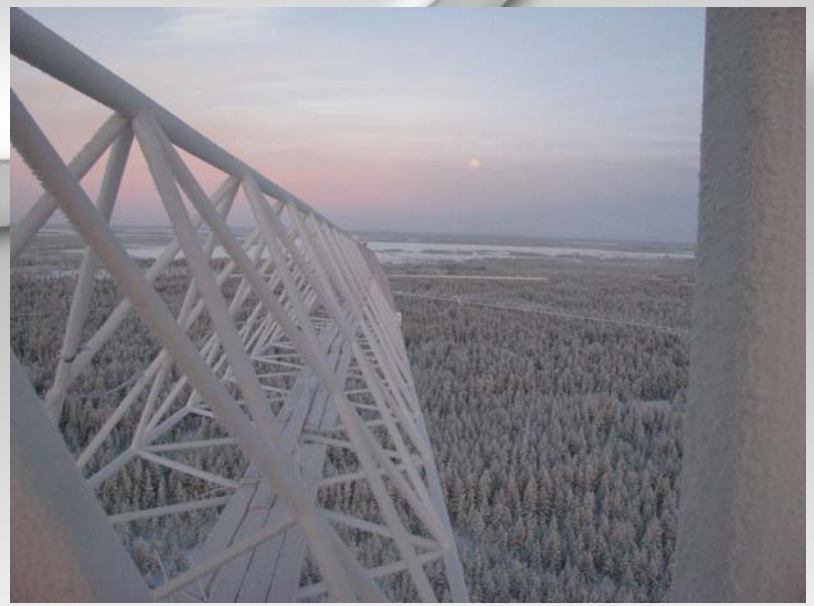

160 element hoisted in absolute fog


OH6RM Toke with 80m elements


OH8SR, Markku at -15C at 80m


Rotator, 7kW, 2000 kg, 2.5min/round

Episode 4, It’s a Lift Off



Episode 5, Can Anyone Hear Us ?

Tower is up, but doesn't do anything.

- The motor needs a 18 kW inverter for smooth start/stop and heavy filtering - total 50 kg of hw.
- Integration to station control, first manual usage.
- **First testing - plan is to get on the air for Top Band contest next week end.**

Episode 6, Back to Earth

- Antenna will be officially augmented into operation with traditional Northern ceremonies - **IT'S CELEBRATION TIME !**
- Find 'final' correlation between simulations and real world
  - Some tuning maybe needed
- Integrate the antenna to Arcala automation system
  - Rotator control, Antenna control
  - Remote control
- Article(s) to the ham radio magazines
- Use in the contests and DXing to get more experience
- Spring / summertime to improve some installations, that were tough to implement in the darkness and ice

After Play

- Careful electrical simulations
- Professional mechanical design, simulations
- Careful verification with real element
  - Complex impedance correlation is needed, not just SWR
  - Lab with no interactions to anything, far from the other antennas
- Ultimate preciseness: 160 element to 1 cm accuracy
- Thick lattice structures are capacitive regardless of the length, you need to compensate with coil.
  - Elements can be made physically equal and tuning with coil
  - -> easier tuning, easy bi-directionality
- Strongly tapered element doesn't behave linearly, the end structures have overly strong impact, including eg. truss attachments
- Capacitive hat is beneficial for 3 element yagi (not for eg. 5 element)
- Complex mechanical and electrical project
  - Get experts from key areas
  - Spend time at the drawing board and simulator
  - Schedules slip, reserve time
  - Different cultures and languages - mechanics engineer, electrical engineer, crane operator, tower climbers, city officials,


Thank You
NOSTURILIIKE SULKALA OY