

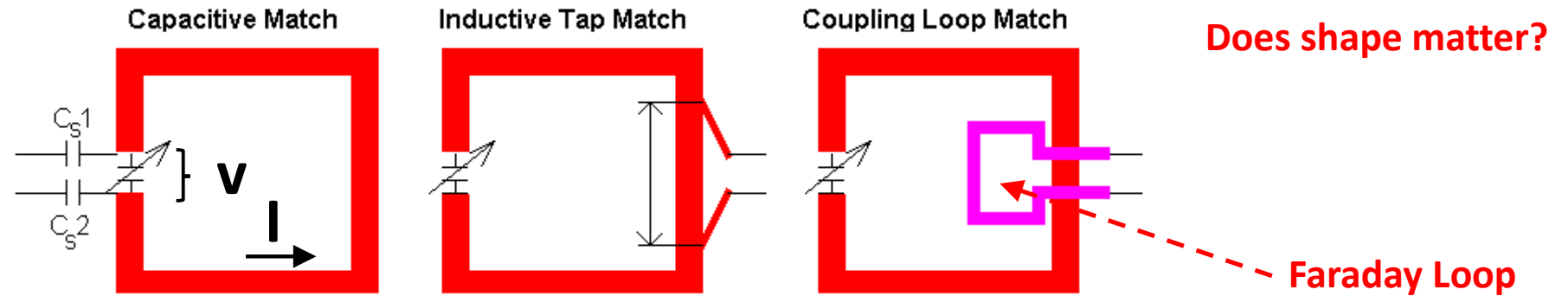
High Power Magnetic Loop Antennas

Bill Leonard N0CU

Mag Loop Feed Circuits

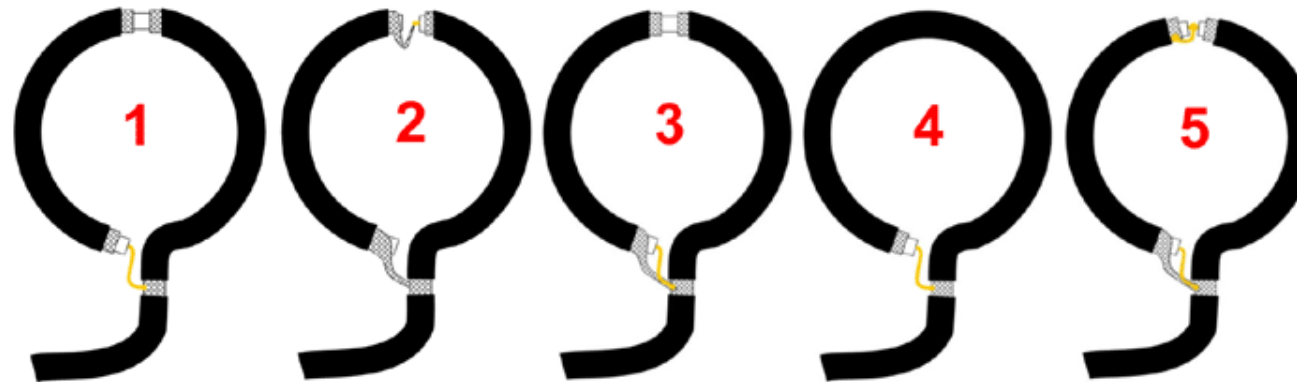
Circumference should be between $1/8$ & $1/4 \lambda$

I is \sim constant around loop



The Faraday **coupling loop** configuration was used for impedance matching in this project. Circumference of the Faraday loop is **$1/5$ of the main loop circumference**. With 10 feet chosen for the main loop circumference, a circumference of 2 feet was used for the Faraday coupling loop.

Frank Doerenberg (N4SPP) suggests [five configurations](#) for constructing the coupling loop. **Configuration #4 was chosen** due to its simplicity and ease of construction. This configuration does not split the coax at any point as the other configurations do.



Safety

- **RF Voltage:**
 - **Magnetic Loops can have 10-20 KV of RF energy**
 - RF burns are nasty and don't heal quickly
 - When are they potentially lethal???
 - Most HF ham antennas don't exceed $500 V_{PEAK}$ at the feed point
 - Ex: 1500 W into 50 ohm yields $387 V_{PEAK}$
- **Unsafe Field Strength (100 W transmit power):**
 - <13 ft @ 14 MHz
 - <10 ft @ 28 MHz
 - Do these guidelines still apply in the near field of a magnetic antenna?

AlexLoop on 40 M

Specified Bands: 40-10 M
Circumference: 9 ft (~3 ft diameter)
Diameter of Conductor: 0.5 in
Frequency: 7 MHz
Transmitter Power: **10 W**

Using Mag Loop Calculator “66pacific.com”*

Antenna efficiency: **6%** (-12.2 dB below 100%)

Antenna bandwidth: **10.1 kHz**

Tuning Capacitance: 324 pF

Capacitor voltage: **699 volts RMS**

Resonant circulating current: **9.95 A**

Radiation resistance: **0.003 ohms**

Loss Resistance: 0.047 ohms

Quality Factor (Q): 696

Probably very optimistic

5000 watts into 50 ohm load
(Requires a special low loss capacitor)

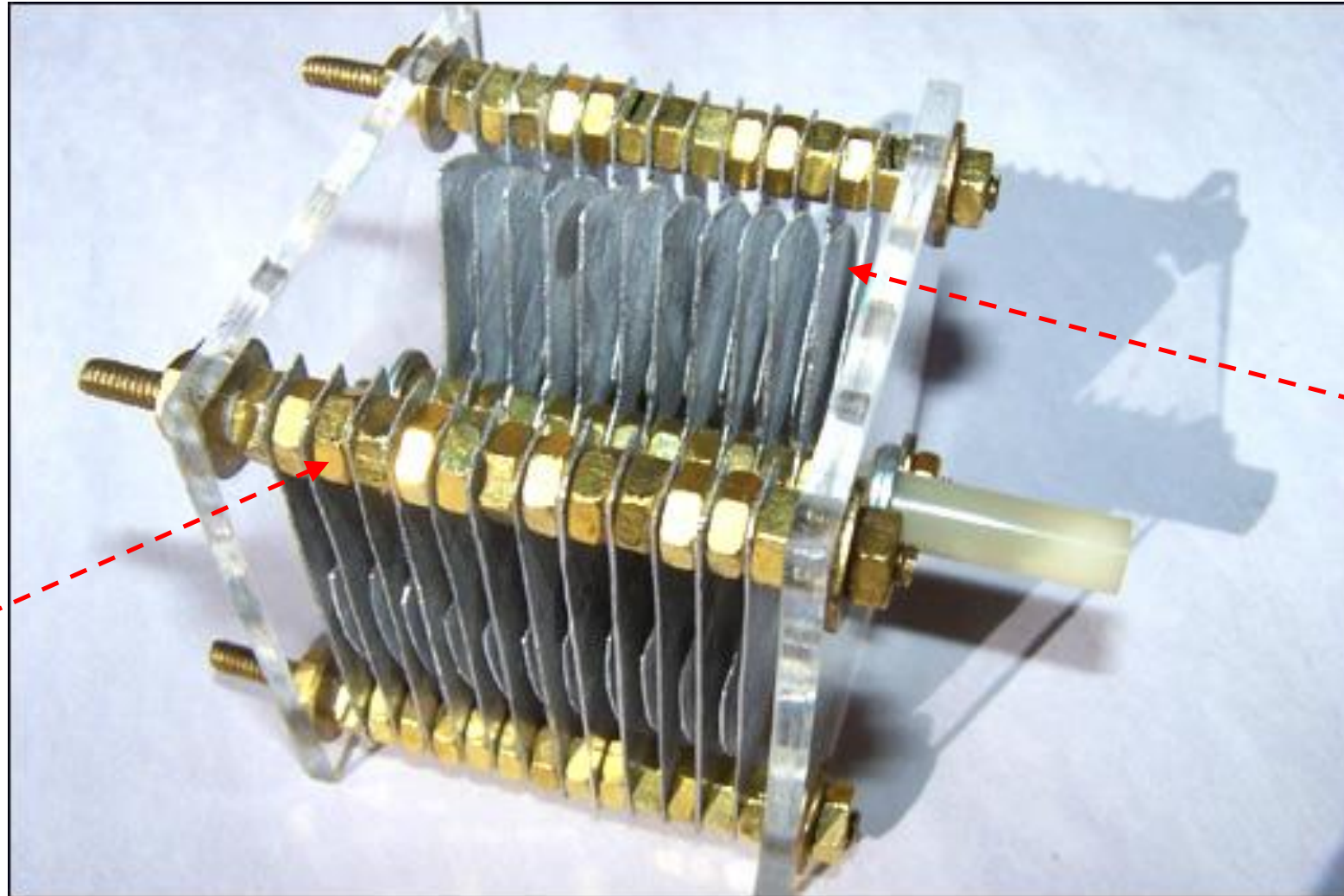
Mechanical connections
can have high loss

*-For octagonal shaped loops

-Capacitor loss not included (can be 0.030 to >0.100 ohms with air variable caps)

AlexLoop Butterfly Tuning Capacitor

Butterfly style reduces contact losses



Mechanical
connections
???

3KV requires
0.12 in. spacing

Conductor Diameter

Circumference: 9 ft (~3 ft diameter)
Frequency: 7 MHz
Transmitter Power: 100 W

Diameter of Conductor: 2.0 in

Antenna efficiency: **20%** (-6.9 dB below 100%)
Antenna bandwidth: **2.01 kHz**
Tuning Capacitance: 220 pF
Capacitor voltage: **5,999 volts RMS**
Resonant circulating current: **58.0 A**
Radiation resistance: 0.003 ohms
Loss Resistance: 0.012 ohms
Quality Factor (Q): 3,476

Diameter of Conductor: 3.0 in

Antenna efficiency: **28%** (-5.6 dB below 100%)
Antenna bandwidth: **1.35 kHz**
Tuning Capacitance: 201 pF
Capacitor voltage: **7,658 volts RMS**
Resonant circulating current: **67.6 A**
Radiation resistance: 0.003 ohms
Loss Resistance: 0.008 ohms
Quality Factor (Q): 5,178

Freq drift due to heating??

- 1) At 7 MHz the circumference should be between 17 and 34 feet
- 2) Conductors can be too small or too large
- 3) An air variable with 0.25 in plate spacing is only good for 5KV

Loop Size

Diameter of Conductor: 2.0 in
Frequency: 7.0 MHz
Transmitter Power: 1000 W

Circumference: 9 ft (~3 ft diameter)

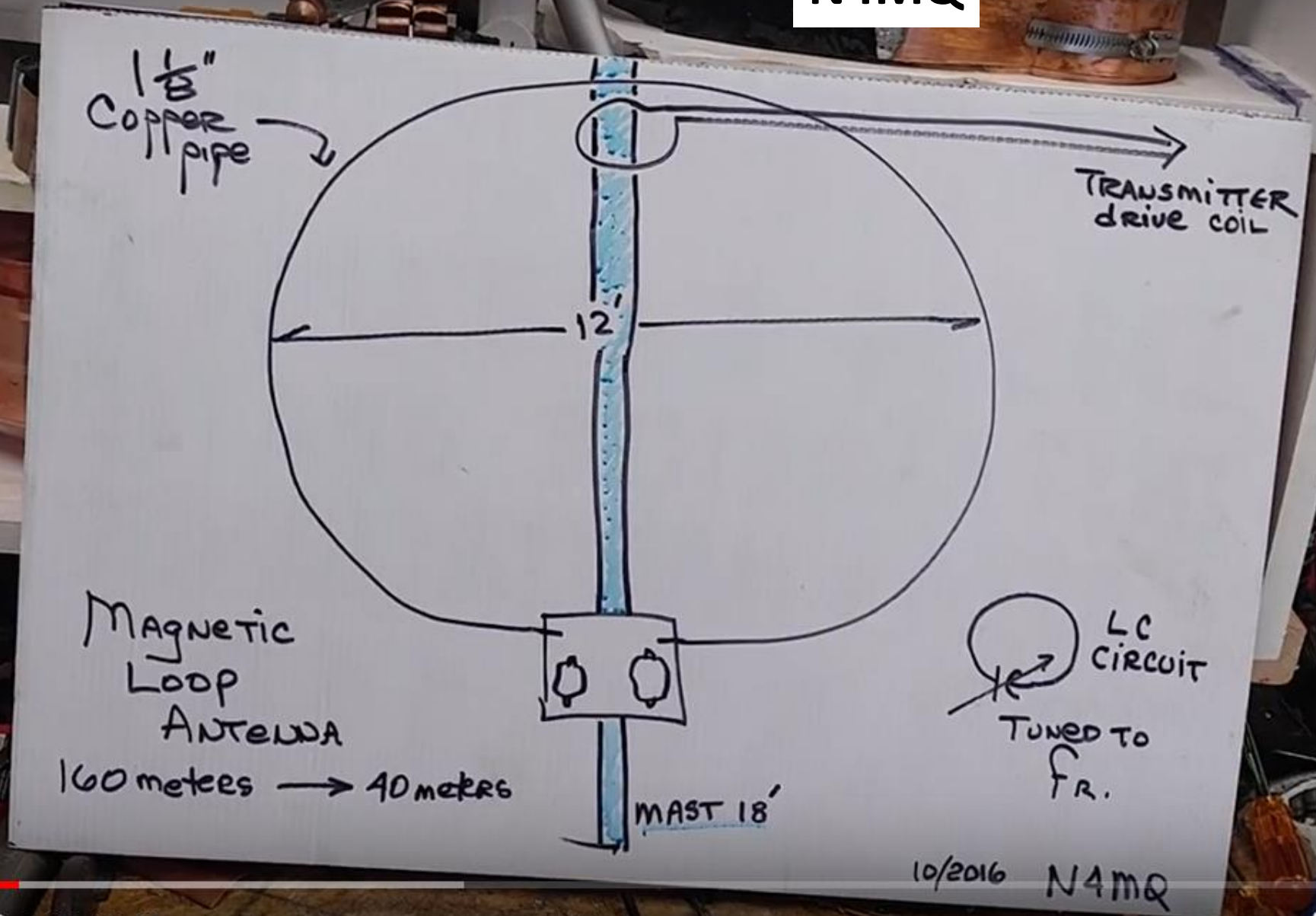
Antenna efficiency: **20%** (-6.9 dB below 100%)
Antenna bandwidth: **2.01 kHz**
Tuning Capacitance: 220 pF
Capacitor voltage: **18,970 volts RMS**
Resonant circulating current: **183 A**
Radiation resistance: 0.003 ohms
Loss Resistance: 0.012 ohms
Quality Factor (Q): 3,476

Circumference: 38 ft (~12 ft diameter)

Antenna efficiency: **95%** (-0.2 dB below 100%)
Antenna bandwidth: **24.3 kHz**
Tuning Capacitance: 39 pF
Capacitor voltage: **12,954 volts RMS**
Resonant circulating current: **22.2 A**
Radiation resistance: 0.963 ohms
Loss Resistance: 0.050 ohms
Quality Factor (Q): 288

Circumference should be between 17 and 34 feet

N4MQ



Frequency

Circumference:	38 ft (12 ft diameter)
Diameter of Conductor:	1.125 in
Transmitter Power:	1000 W

Frequency: 1.8 MHz

Antenna efficiency: **9%** (-10.7 dB below 100%)
Antenna bandwidth: **1.32 kHz**
Tuning Capacitance: 655 pF
Capacitor voltage: **13,584 volts RMS (19,200 volts PEAK)**
Resonant circulating current: **101 A**
Radiation resistance: **0.004 ohms**
Loss Resistance: 0.045 ohms
Quality Factor (Q): 1,367

Circumference should be between 66.3 and 133 feet

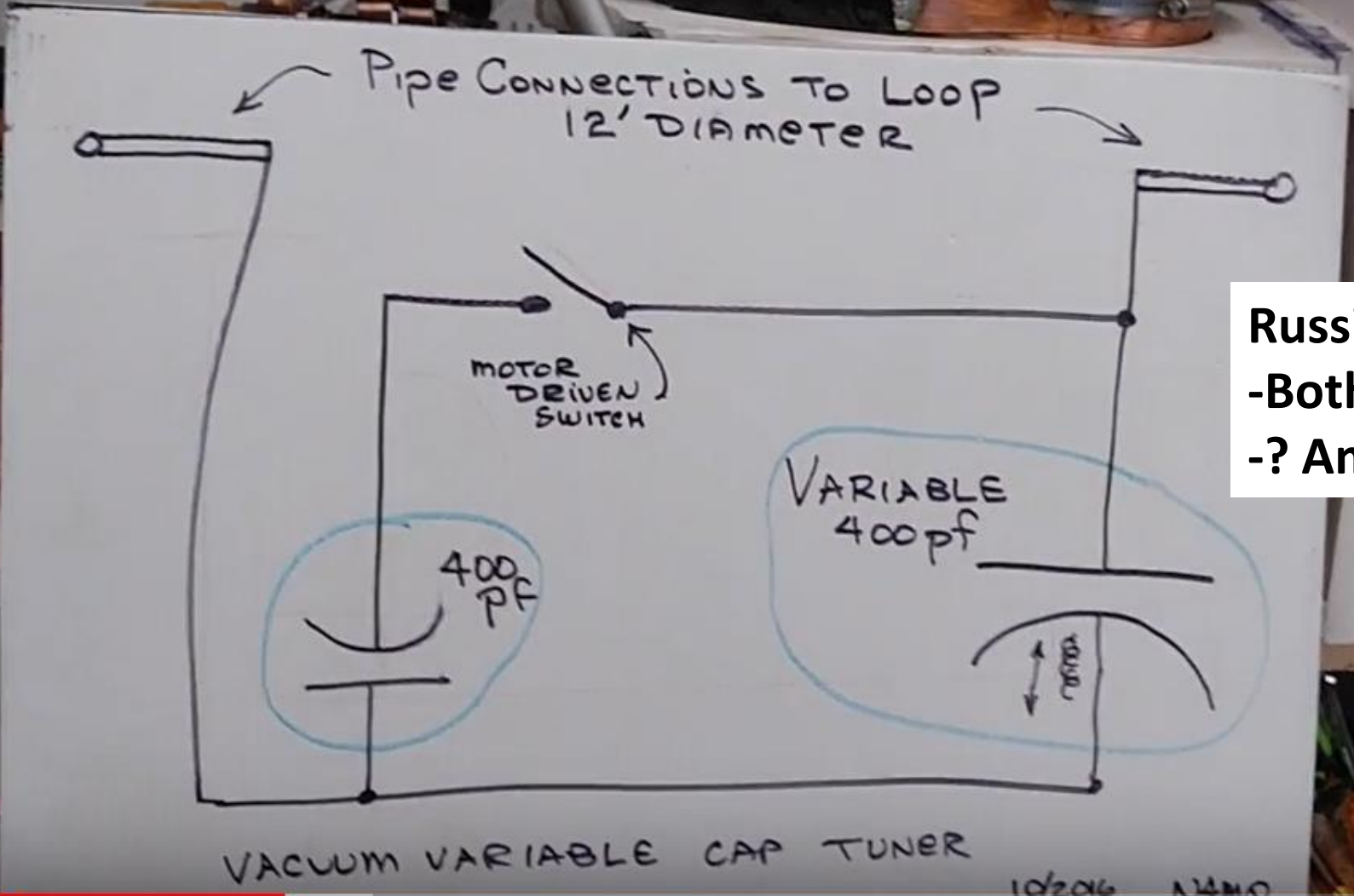
Frequency: 7.0 MHz

Antenna efficiency: **92%** (-0.4 dB below 100%)
Antenna bandwidth: **28.1 kHz**
Tuning Capacitance: 43 pF
Capacitor voltage: **11,440 volts RMS**
Resonant circulating current: **21.8 A**
Radiation resistance: **0.963 ohms**
Loss Resistance: 0.089 ohms
Quality Factor (Q): 249

Circumference should be between 17 and 34 feet

Magnetic loop antenna for 160-40 meters 1KW

Only capable of 300W with 15KV caps



Russian caps
-Both rated for 45 KV
-? Amp rating



youtube.com switched to full screen (Esc to exit).

Okay Exit now X



Magnetic loop antenna for 160-40 meters 1KW



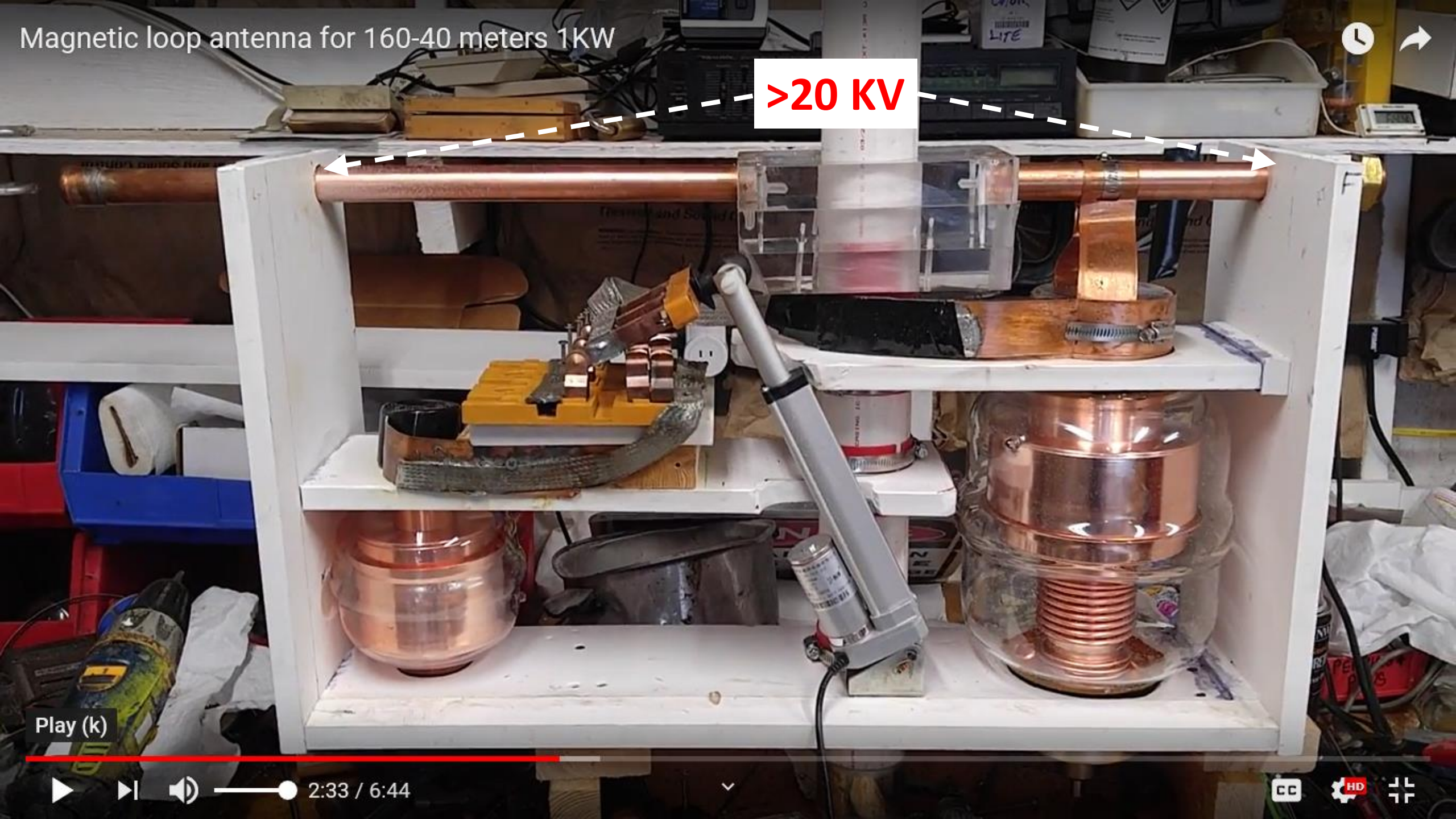
Play (k)

▶ ⏪ 🔊 2:33 / 6:44

CC HD

Magnetic loop antenna for 160-40 meters 1KW

>20 KV



Play (k)

2:33 / 6:44

Magnetic loop antenna for 160-40 meters 1KW



18 inches tall



Magnetic loop antenna for 160-40 meters 1KW



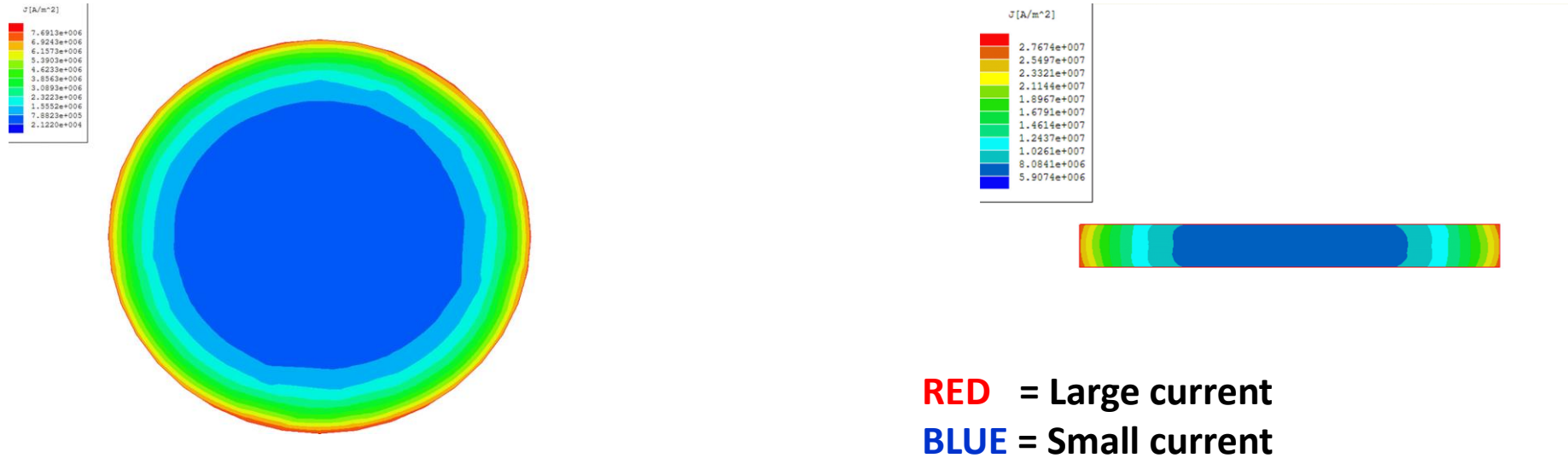
Mute (m)

▶ ⏪ 🔊 🔊 3:55 / 6:44



RF Impedance of Flat Conductors

- RF current density is highest at the points where the curvature is greatest.



EETimes: Power Tip 26: Current distribution in high-frequency conductors
https://www.eetimes.com/document.asp?doc_id=1278215

Commercial High Power Mag Loops

- Cirro Mazzone (I3VHF)

The screenshot shows a web browser window displaying the website <https://www.loopantennai3vhf.com/>. The page features three product listings for magnetic loop antennas, each with a price tag overlaid on the image. The browser's address bar shows the URL, and the top navigation bar includes links for 'Cirro Mazzone Radiocomunicazione', 'SHOP', and 'AFTED'. The Windows taskbar at the bottom shows the time as 1:15 PM on 1/25/2019.

Model	Frequency Range	Power	Price
BABY LOOP	40-10 M	450-1000W	\$2100
MIDI LOOP	80-20 M	300-800W	\$2500
THE STEALTH LOOP	40-10 M	125W	\$1800

BABY LOOP
BABY LOOP 6.6 - 29.8MHz
Antenna loop magnetica HF dai 40 ai 10 metri in copertura continua. In alluminio.

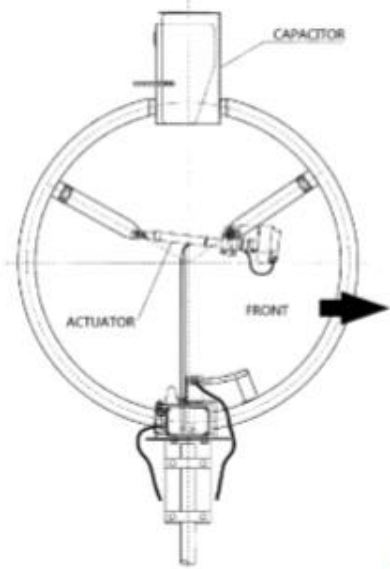
MIDI LOOP
MIDI LOOP 3.5 - 14.5MHz
Antenna loop magnetica HF dai 80 ai 20 metri in copertura continua. In alluminio.

THE STEALTH LOOP
STEALTH LOOP 6.6 - 29.8MHz
Antenna loop magnetica HF dai 40 ai 10 metri in copertura continua. In alluminio.

Sold by DX Engineering

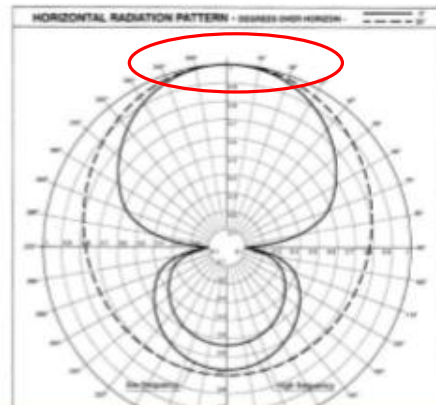
Electrical and mechanical specifications of BABY LOOP

Electrical specifications



- Continuous frequency coverage 6.6-29.8 MHz
- S.W.R. 1.3:1 (typical)
- Front to back ratio: 6 dB
- Front to side ratio: 25 dB
- 50 Ohm input with gamma match short circuited (electrostatic discharge protection)
- Negligible noise and harmonics
- $L = 3 \mu\text{H}$ $Q = 1.100$ at 7 MHz
- $C = 400 \text{ pF}$ at 17 KV r.m.s.
- Power rating: 450 W up to a 21 MHz **
- 1 KW from 22 to 29.8 MHz**
- Bandwidth: 4 KHz @ 7 MHz
- 6 KHz @ 14 MHz
- 12KHz @ 21 MHz
- 20KHz @ 28 MHz
- Gain compared to $\lambda/2$ dipole (1 point "S" = 6 dB)
- 4 dB @ 7 MHz
- 0.3 dB @ 28 MHz

****NOTE:**
with this LOOP ANTENNA the peak power is equal to the continuous power



Mechanical specifications

Antenna diameter 1.0m (39.8in)

Loop Antenna by I3VHF video

fully handmade

???



T.I.G solder
(Tungsten Inert Gas)

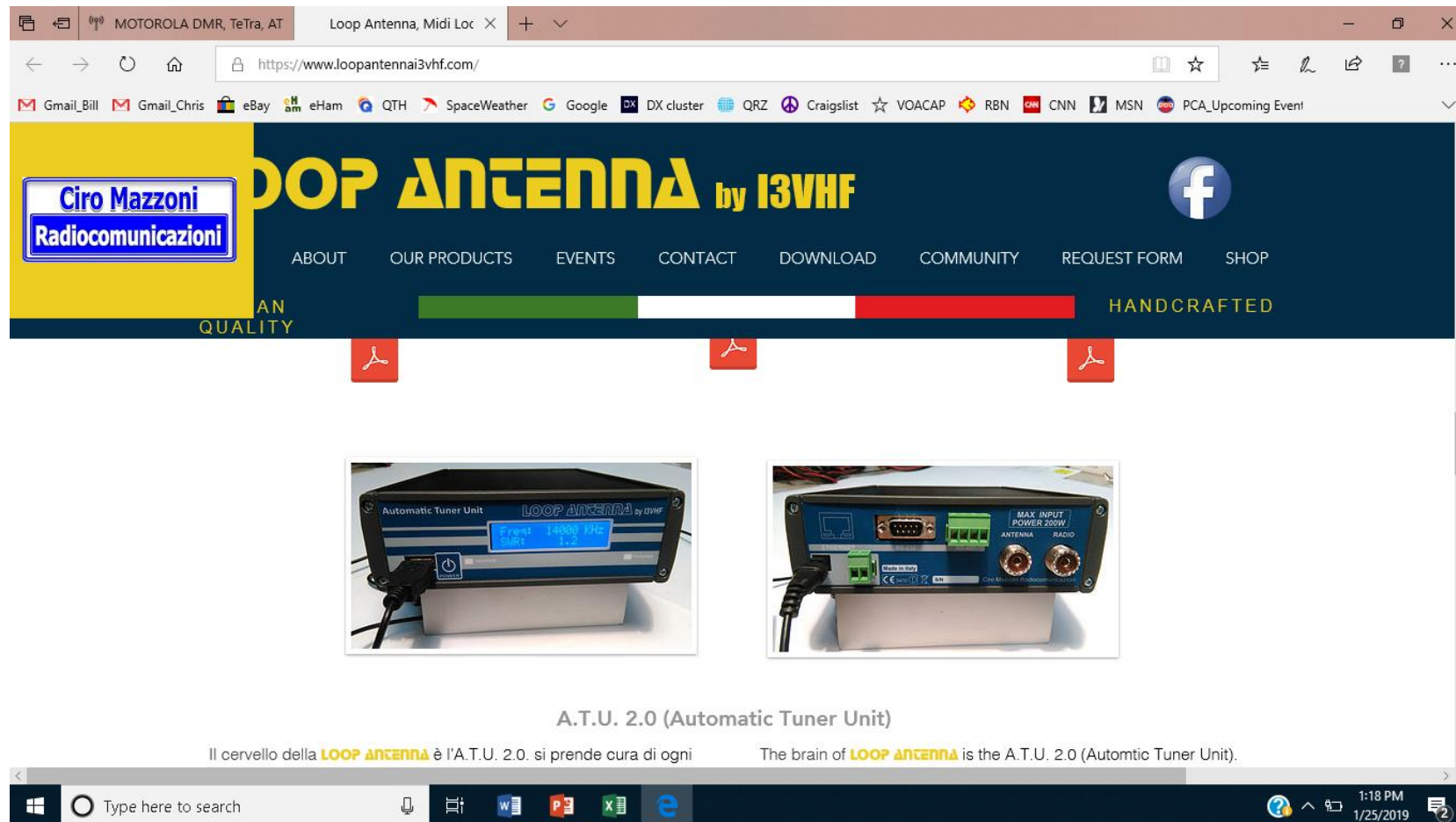
0:55 / 2:20



Commercial High Power Mag Loops

- Cirro Mazzone (I3VHF)

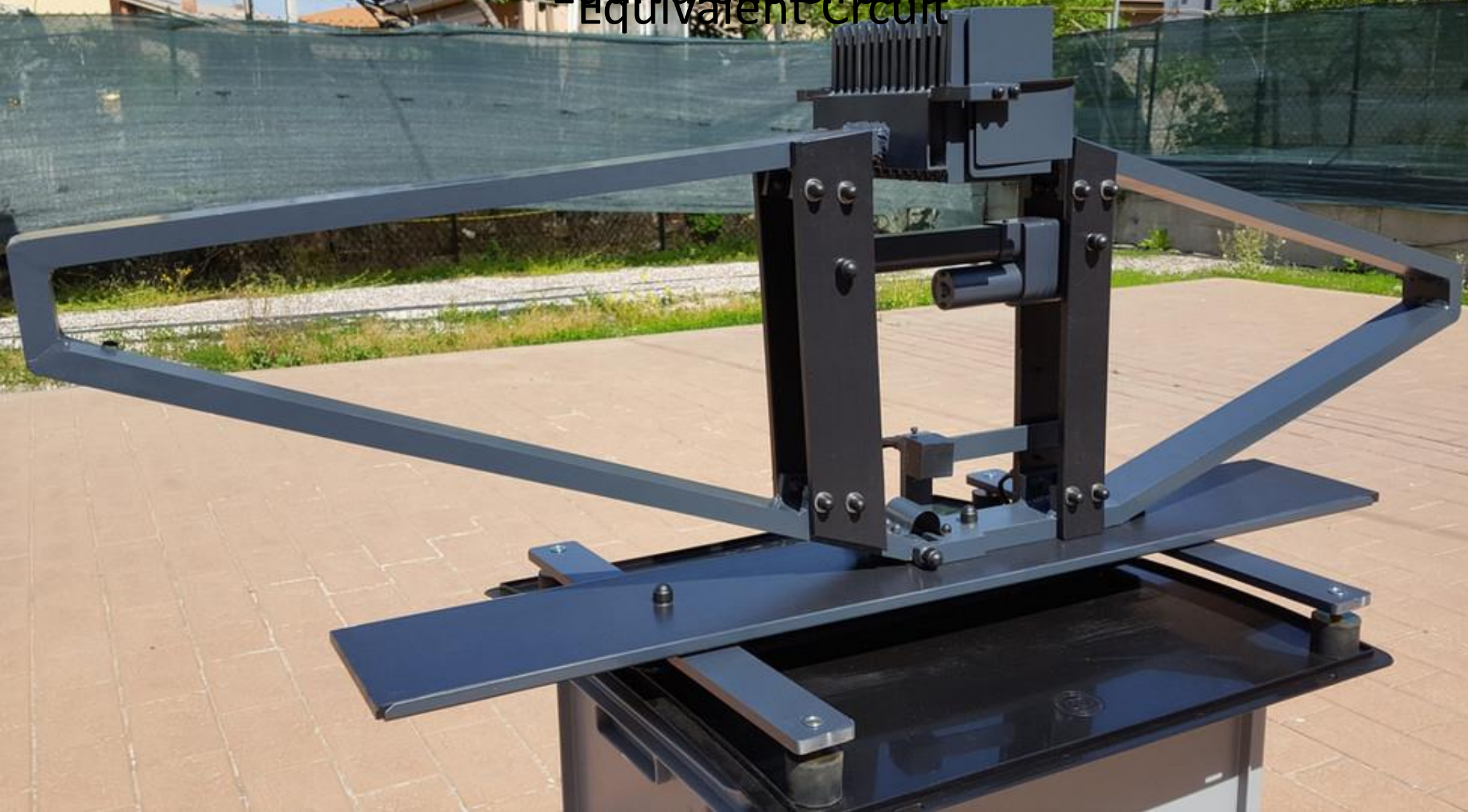
A.T.U. 2.0 (Automatic Tuner Unit)



The screenshot shows a web browser window displaying the website for LOOP ANTENNA by I3VHF. The browser's address bar shows the URL <https://www.loopantennai3vhf.com/>. The website header features the logo "Cirro Mazzone Radiocomunicazioni" and "LOOP ANTENNA by I3VHF" in large yellow letters. A navigation menu includes links for ABOUT, OUR PRODUCTS, EVENTS, CONTACT, DOWNLOAD, COMMUNITY, REQUEST FORM, and SHOP. Below the navigation, there are three red download icons. The main content area displays two images of the A.T.U. 2.0 Automatic Tuner Unit. The left image shows the front panel with a digital display showing "FREQ. 1400 MHz" and "MODE 1.3". The right image shows the back panel with various ports and a label that reads "MAX INPUT POWER 200W". Below the images, the text "A.T.U. 2.0 (Automatic Tuner Unit)" is displayed. At the bottom of the page, there is a bilingual description: "Il cervello della LOOP ANTENNA è l'A.T.U. 2.0. si prende cura di ogni" and "The brain of LOOP ANTENNA is the A.T.U. 2.0 (Automatic Tuner Unit)". The Windows taskbar at the bottom shows the search bar, taskbar icons for Word, PowerPoint, Excel, and Edge, and the system tray with the date 1/25/2019 and time 1:18 PM.



Equivalent Circuit
Equivalent Circuit



- select language
- Custom made Coaxial cables
 - Weather stations
 - Two-Way Radios (Transceiver)
 - Radio accessories
 - Antennas (ham radio)
 - HF
 - Beams and Quads
 - Verticals
 - Wireantennas and accessories
 - Portable antennas
 - Spieth Portable Antennas
 - HF Mobile antennas
 - Magnetic loop antennas
 - AMA Loops (Käferlein)
 - Alex-Loop Portable
 - Baby & Midi Loop**
 - BTV Portable Loops
 - Chameleon F-Loop
 - Chameleon P-Loop
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 - CB antennas
 - Toroids for Baluns



Stealth Loop

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effective antenna to users with limited space. It is also tunable as an antenna. The Stealth Loop has a maximum power of 125 W CW. Compared to a dipole, it has about 3 dB less signal gain on 40m, and about 0.3 dB more signal gain on 20m. The retuning is about 5 kHz on 40m, and 25 kHz on 20m.

As the well known 'Baby' and 'Midi' loop antennas, the Stealth Loop's side moves by a stepper motor around a central vertical axis. This forms the tuning capacitor of the antenna. The very wide, flexible steel band which is used for the loop has a low inductivity and lowest resistance. The circumference of the loop is larger than that of the Baby loop. The dimension of the frame of the loop is professionally welded.

At low elevation angles the pattern is also influenced by the loop should be perpendicular to any plane of the antenna. Solid Stealth is very suitable for use in a car, on a balcony or in a van/way/top



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