

Messungen an EFHW Balun 2/14 vs. 3/21 Windungen

Seit ein paar Jahren benutze ich nun schon eine gekaufte Hyendfed 400 Watt, 8 Band 40m lang mit der Möglichkeit durch einen anzuklebbenden Zusatzdraht und Spule das 160 m Band auch zu nutzen.

Beim Betrieb kristallisierte sich 40m und 20m als die Favoriten heraus. Auf diesen Bändern wurde in Relation zu den anderen Bändern immer bessere Ergebnisse erzielt.

Da der Hyendbalun auf Kompromiss gewickelt ist, (obere und untere Frequenzen noch nutzbar) wollte ich wissen wieviel ein spezieller für die unteren Bänder gewickelte Balun kann.

Also ein Balun 3/21 mit gleichen Kernen gewickelt. Ebenfalls für 400 Watt mit dem gleichen Draht.

Sollte man in der glücklichen Lage sein eine Beam für 20-15-10m zu besitzen, könnte man hier ja noch optimieren und versuchen die Daten für 160-80 zu verbessern und 40 zu halten, vielleicht auch noch 20m.

Nachfolgend die Ergebnisse am Messplatz. Diese müssen dann noch am Draht der Antenne verifiziert werden.

Getestet wurde mit dem Nanovna. Mit 2700 Ohm Abschlusswiderstand.
Kerne jeweils 2xFT240-43.

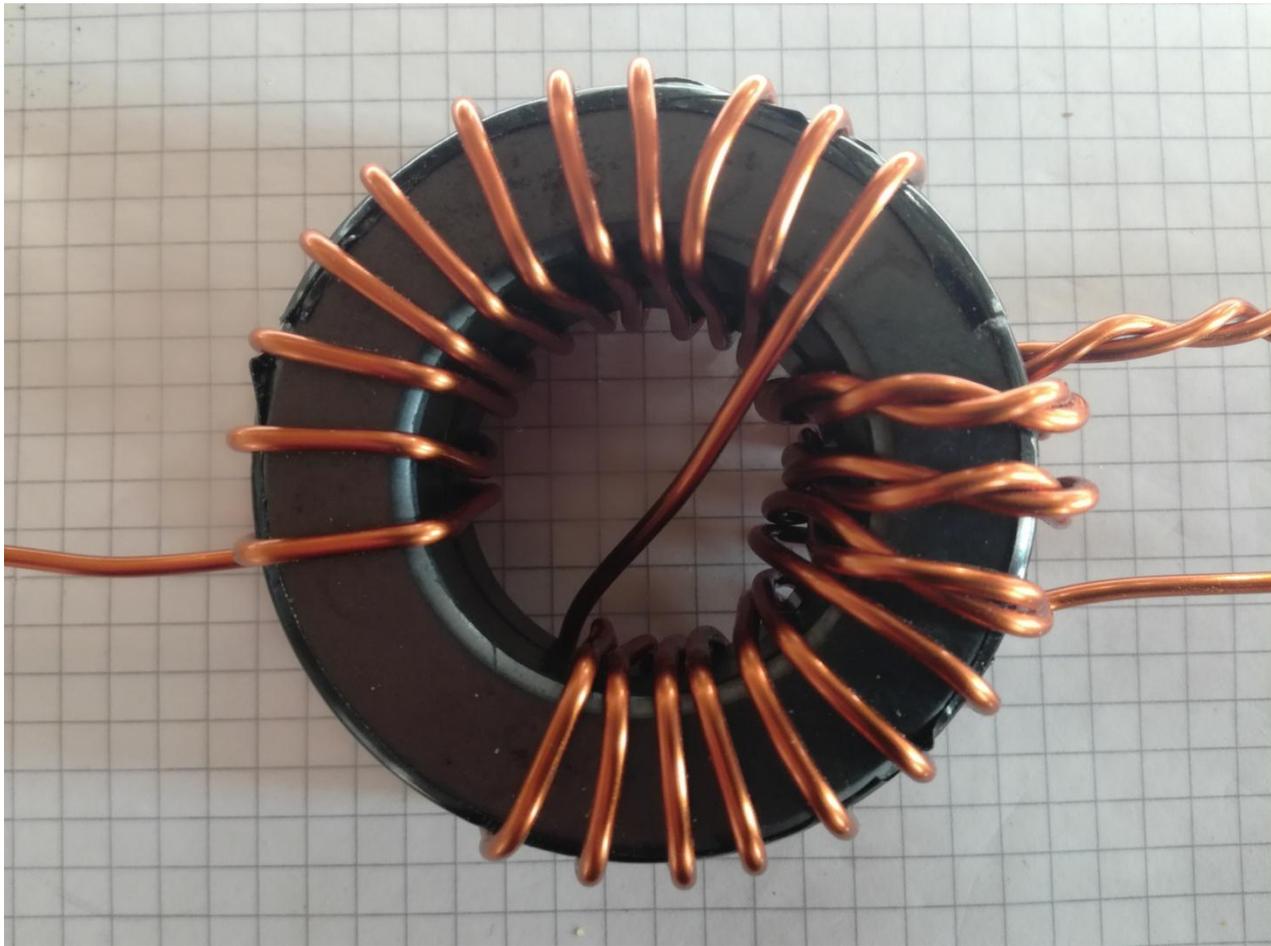
Der gedoppelte Kern mit 2/14 Windungen wurde beim letzten FD von Q07 benutzt.
Der zweiter gedoppelte Kern wurde mit gleicher Drahtstärke bewickelt, jedoch mit 3/21 Windungen, um zu besseren Werten auf 160 und 80 m zu kommen.

Nachfolgend die Ergebnisse als Tabelle und die jeweiligen Übersichts- und Einzelmessungen.

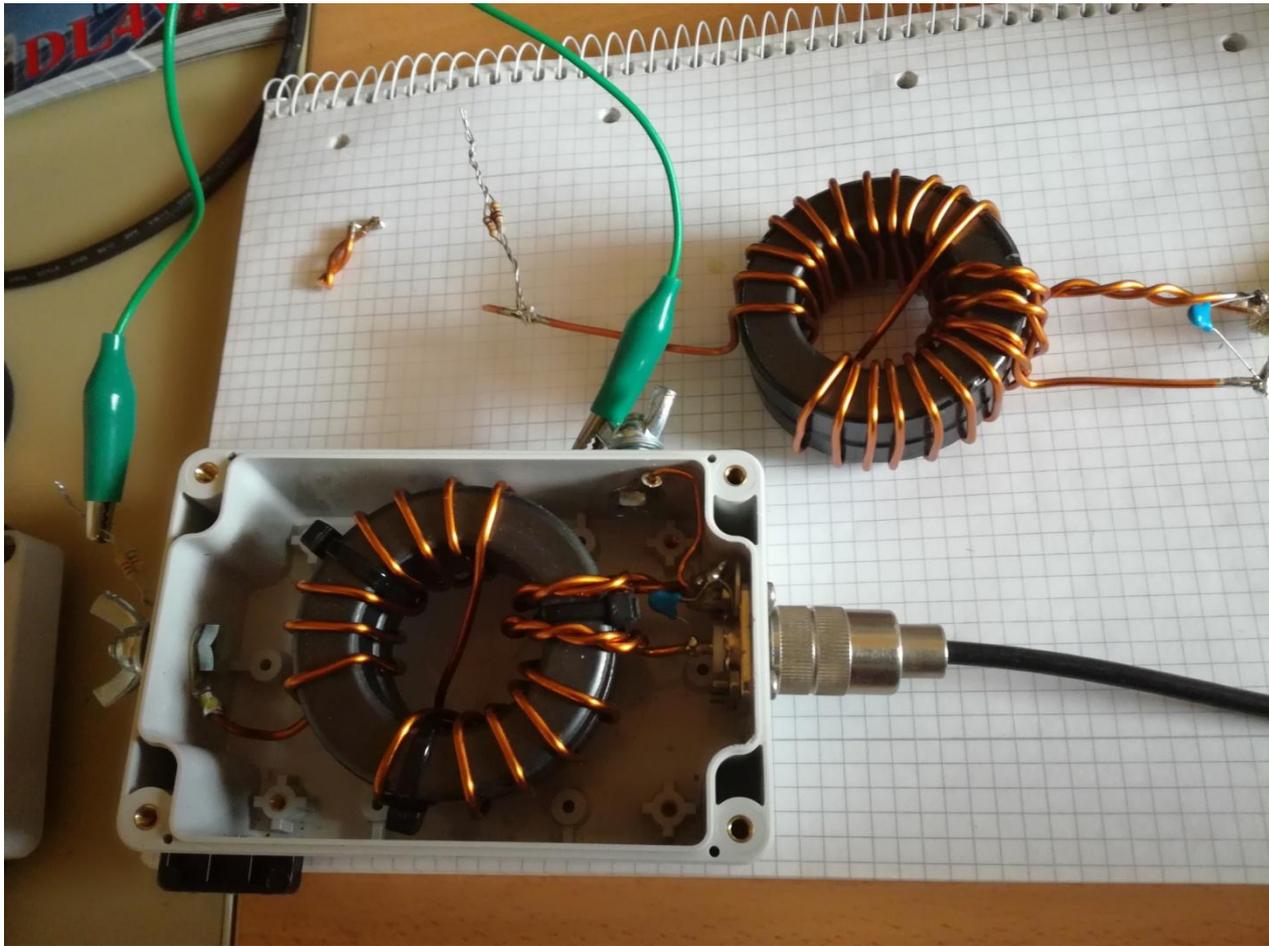
Am Ende auch noch eine Messung der derzeit Installierten Antenne.
(Die eingebauten SWR Messer in den TRX und SWR-Meter zeigen bessere Werte als der VNA)

Fazit: Wer nur die Frequenzen 160-80-40 mit der Langdraht EFHW abdecken will/muss , sollte die Kombi 2xFT240-43 mit 3/21 Windungen benutzen. Bei diesem Balun sind auf dem Messplatz Verbesserungen von 6 bis über 20 dB messbar.

3/21 Wdg. 2xFT240-43 für 160-80-40



FD-Balun 2/14 links, neu 3/21 rechts



2x FT240-43 Kerne	Band	SWR	Rücklaufdämpfung		
2/14 Windungen	20 m	1.6	- 14 dB		
3/21 Windungen	20 m	1.7	- 12 dB	x	gleich
2/14 Windungen	40 m	1.4	- 18 dB		
3/21 Windungen	40 m	1.1	- 24 dB	x	6 dB
2/14 Windungen	80 m	1.5	- 13 dB		
3/21 Windungen	80 m	1.04	- 33 dB	x	20 dB
2/14 Windungen	160 m	3.1	- 6 dB		
3/21 Windungen	160 m	1.27	- 18 dB	x	12 dB

Sweep control

Start Center
 Stop Span
 Segments 290.0kHz/step

Markers

Marker 1
 Marker 2
 Marker 3
 Locked

TDR

Estimated cable length: 2.999 m

Reference sweep

Serial port control

Serial port

Marker 1

Frequency:	8.54000 MHz	VSWR:	1.282
Impedance:	39.53 -j3.62 Ω	Return loss:	-18.155 dB
Series L:	-67.435 nH	Quality factor:	0.092
Series C:	5.1504 nF	S11 Phase:	-158.63°
Parallel R:	39.858 Ω	S21 Gain:	-80.714 dB
Parallel X:	42.804 pF	S21 Phase:	104.65°

Marker 2

Frequency:		VSWR:	
Impedance:		Return loss:	
Series L:		Quality factor:	
Series C:		S11 Phase:	
Parallel R:		S21 Gain:	
Parallel X:		S21 Phase:	

Marker 3

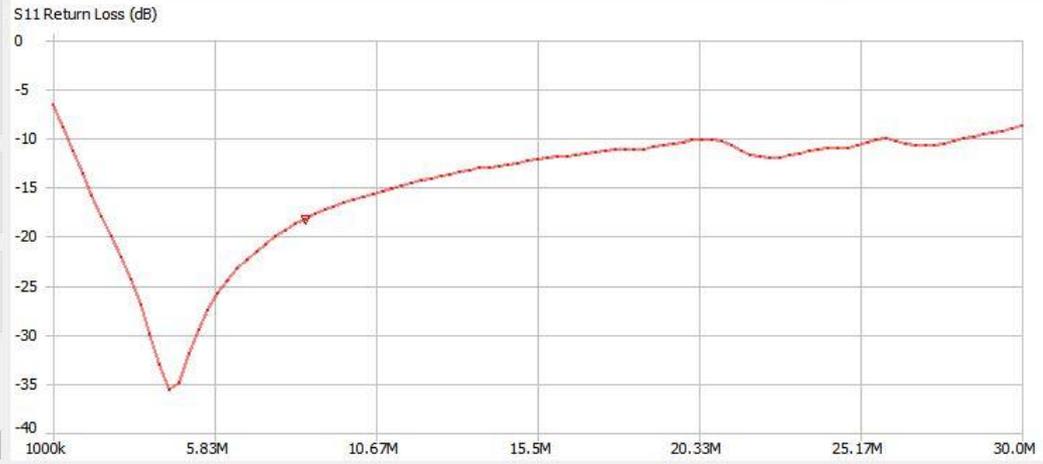
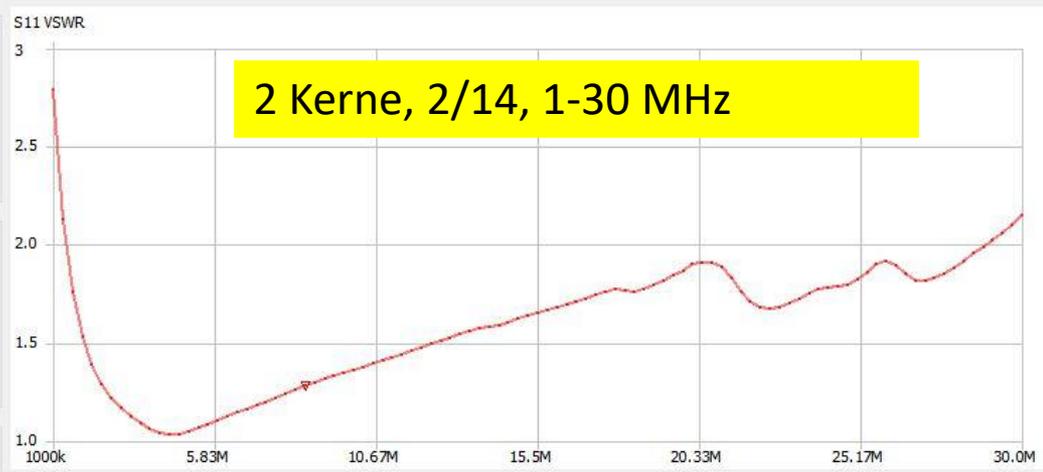
Frequency:		VSWR:	
Impedance:		Return loss:	
Series L:		Quality factor:	
Series C:		S11 Phase:	
Parallel R:		S21 Gain:	
Parallel X:		S21 Phase:	

S11

Min VSWR: 1.034 @ 4.48000MHz
 Return loss: -35.632 dB

S21

Min gain: -93.832 dB @ 23.3300MHz
 Max gain: -73.384 dB @ 25.9400MHz



Sweep control

Start Center
 Stop Span
 Segments 140.0kHz/step

Markers

Marker 1
 Marker 2
 Marker 3

Locked

TDR

Estimated cable length: 703.591 m

Reference sweep

Serial port control

Serial port

Marker 1

Frequency:	1.84000 MHz	VSWR:	3.074
Impedance:	22.22 +j28 Ω	Return loss:	-5.865 dB
Series L:	2.4198 μH	Quality factor:	1.259
Series C:	-3.0919 nF	S11 Phase:	113.62°
Parallel R:	57.44 Ω	S21 Gain:	-77.716 dB
Parallel X:	3.9465 μH	S21 Phase:	127.39°

Marker 2

Frequency:		VSWR:	
Impedance:		Return loss:	
Series L:		Quality factor:	
Series C:		S11 Phase:	
Parallel R:		S21 Gain:	
Parallel X:		S21 Phase:	

Marker 3

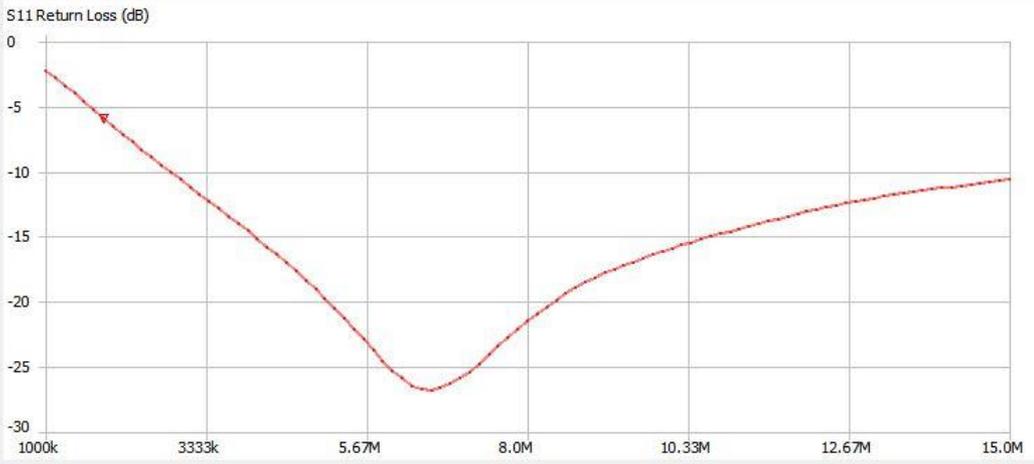
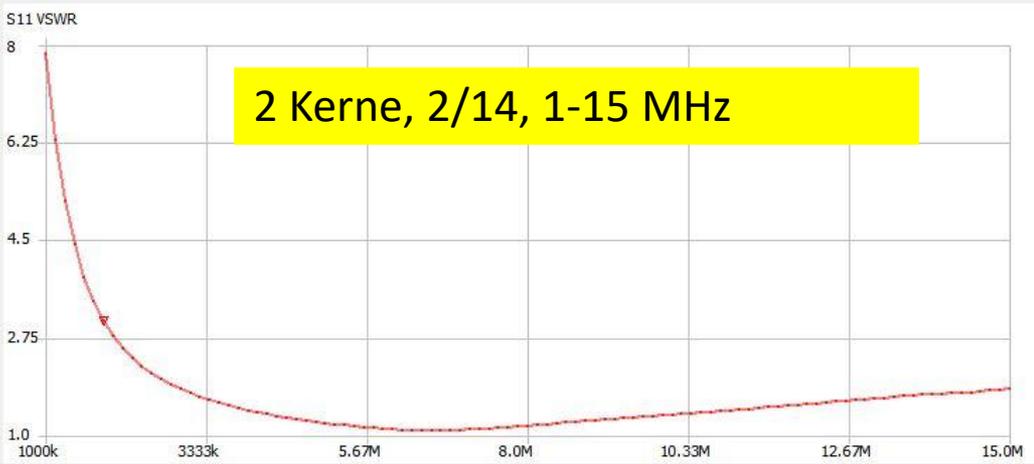
Frequency:		VSWR:	
Impedance:		Return loss:	
Series L:		Quality factor:	
Series C:		S11 Phase:	
Parallel R:		S21 Gain:	
Parallel X:		S21 Phase:	

S11

Min VSWR: 1.096 @ 6.60000MHz
 Return loss: -26.794 dB

S21

Min gain: -93.258 dB @ 15.0000MHz
 Max gain: -74.765 dB @ 11.0800MHz



Sweep control

Start: 3.2MHz | Center: 3.65MHz
 Stop: 4.1MHz | Span: 900kHz
 Segments: 1 | 6.000kHz/step

Sweep settings ...

100%

Sweep | Stop

Markers

Marker 1: 3.665789MHz
 Marker 2:
 Marker 3:

Hide data | Locked

TDR

Estimated cable length: 1.342 m

Time Domain Reflectometry ...

Reference sweep

Set current as reference
 Reset reference

Serial port control

Serial port: COM3 | Rescan
 Disconnect | Manage

Files ... | Calibration ...

Display setup ... | About ...

Marker 1

Frequency: 3.66800 MHz	VSWR: 1.541
Impedance: 43.82 +j19.5 Ω	Return loss: -13.431 dB
Series L: 844.02 nH	Quality factor: 0.444
Series C: -2.2306 nF	S11 Phase: 95.92°
Parallel R: 52.451 Ω	S21 Gain: -80.507 dB
Parallel X: 5.1265 μ H	S21 Phase: 131.49°

Marker 2

Frequency:	VSWR:
Impedance:	Return loss:
Series L:	Quality factor:
Series C:	S11 Phase:
Parallel R:	S21 Gain:
Parallel X:	S21 Phase:

Marker 3

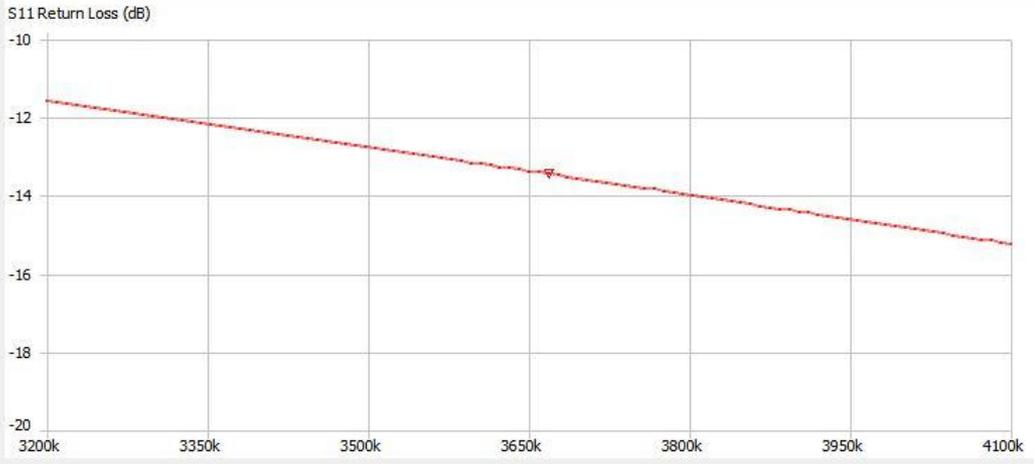
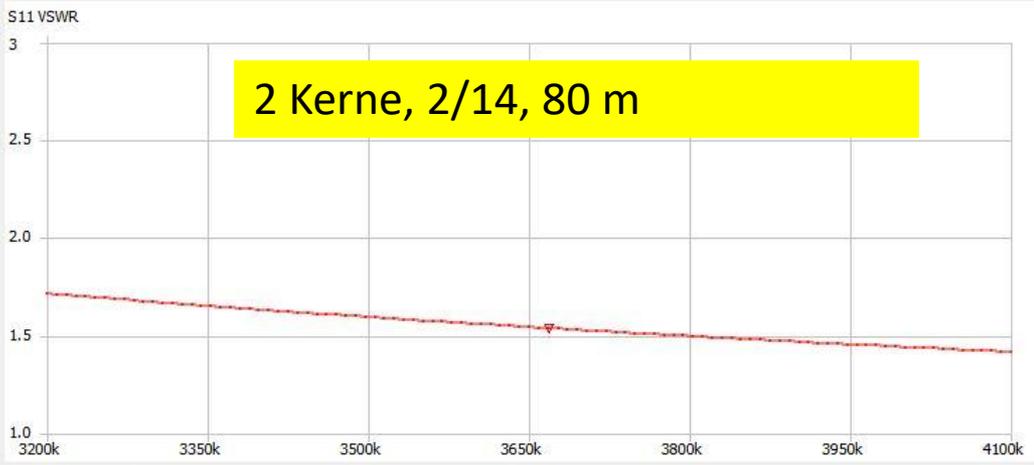
Frequency:	VSWR:
Impedance:	Return loss:
Series L:	Quality factor:
Series C:	S11 Phase:
Parallel R:	S21 Gain:
Parallel X:	S21 Phase:

S11

Min VSWR: 1.419 @ 4.10000MHz
 Return loss: -15.237 dB

S21

Min gain: -102.058 dB @ 3.50600MHz
 Max gain: -74.372 dB @ 3.36200MHz



Sweep control

Start Center
 Stop Span
 Segments 6.000kHz/step

Markers

Marker 1
 Marker 2
 Marker 3

Locked

TDR

Estimated cable length: 5.032 m

Reference sweep

Serial port control

Serial port

Marker 1

Frequency: 1.85200 MHz	VSWR: 3.048
Impedance: 22.43 +j28 Ω	Return loss: -5.918 dB
Series L: 2.4056 μH	Quality factor: 1.248
Series C: -3.07 nF	S11 Phase: 113.43°
Parallel R: 57.362 Ω	S21 Gain: -78.545 dB
Parallel X: 3.9505 μH	S21 Phase: 144.34°

Marker 2

Frequency:	VSWR:
Impedance:	Return loss:
Series L:	Quality factor:
Series C:	S11 Phase:
Parallel R:	S21 Gain:
Parallel X:	S21 Phase:

Marker 3

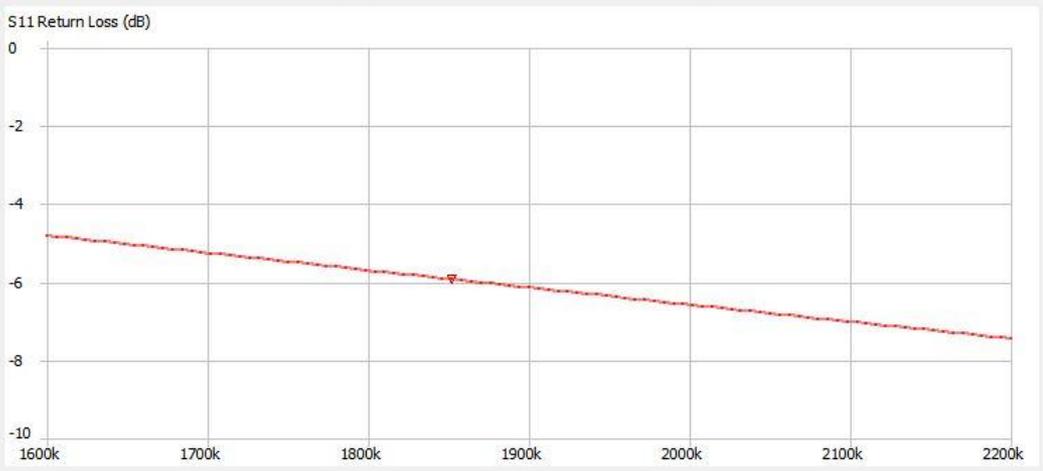
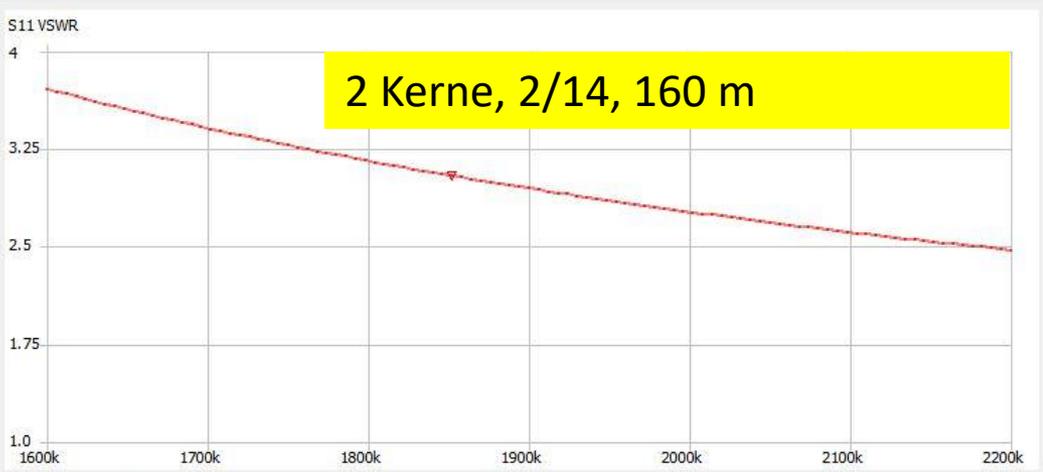
Frequency:	VSWR:
Impedance:	Return loss:
Series L:	Quality factor:
Series C:	S11 Phase:
Parallel R:	S21 Gain:
Parallel X:	S21 Phase:

S11

Min VSWR: 2.475 @ 2.20000MHz
 Return loss: -7.442 dB

S21

Min gain: -88.125 dB @ 2.12200MHz
 Max gain: -75.524 dB @ 2.03800MHz



Sweep control

Start: 1MHz Center: 15.5MHz
 Stop: 30MHz Span: 29MHz
 Segments: 1 290.0kHz/step

Sweep settings ...

100%

Sweep Stop

Markers

Marker 1: 8.56MHz

Marker 2:

Marker 3:

Hide data Locked

TDR

Estimated cable length: 3.436 m

Time Domain Reflectometry ...

Reference sweep

Set current as reference

Reset reference

Serial port control

Serial port: COM3 Rescan

Disconnect Manage

Files ... Calibration ...

Display setup ... About ...

Marker 1

Frequency: 8.54000 MHz	VSWR: 1.114
Impedance: 45.56 +j2.64 Ω	Return loss: -25.354 dB
Series L: 49.142 nH	Quality factor: 0.058
Series C: -7.0676 nF	S11 Phase: 147.70°
Parallel R: 45.715 Ω	S21 Gain: -76.185 dB
Parallel X: 14.721 μH	S21 Phase: 102.64°

Marker 2

Frequency:	VSWR:
Impedance:	Return loss:
Series L:	Quality factor:
Series C:	S11 Phase:
Parallel R:	S21 Gain:
Parallel X:	S21 Phase:

Marker 3

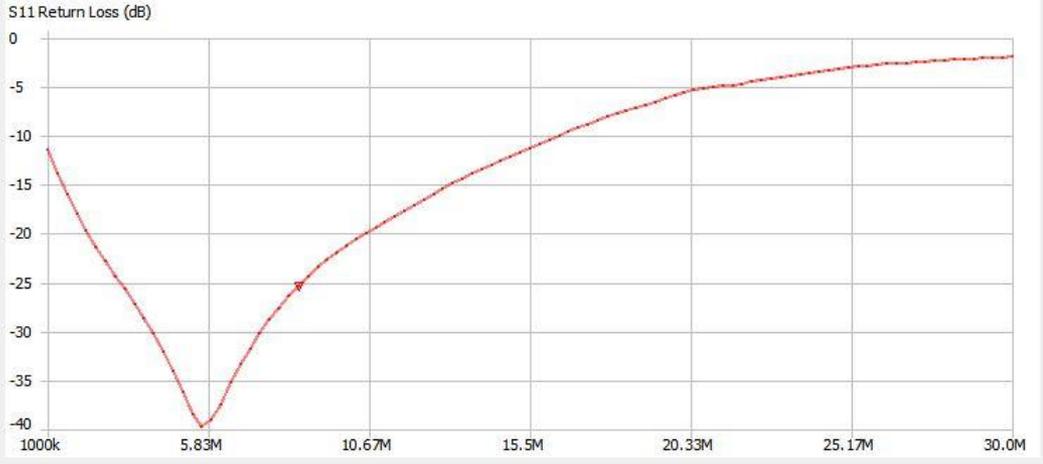
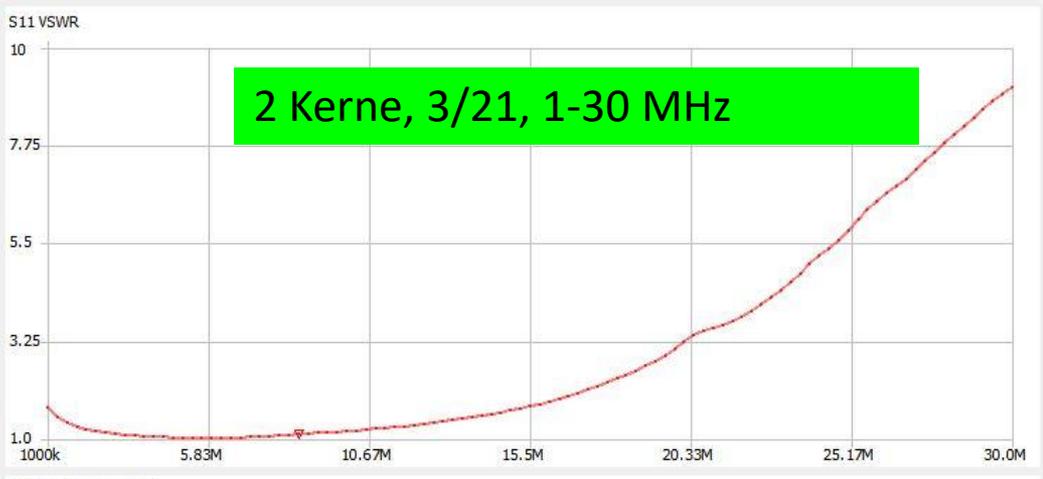
Frequency:	VSWR:
Impedance:	Return loss:
Series L:	Quality factor:
Series C:	S11 Phase:
Parallel R:	S21 Gain:
Parallel X:	S21 Phase:

S11

Min VSWR: 1.021 @ 5.64000MHz
 Return loss: -39.664 dB

S21

Min gain: -113.846 dB @ 30.0000MHz
 Max gain: -75.444 dB @ 6.22000MHz



Sweep control

Start Center
Stop Span
Segments 90.00kHz/step

Markers

Marker 1
Marker 2
Marker 3
 Locked

TDR

Estimated cable length: 14.828 m

Reference sweep

Serial port control

Serial port

Marker 1

Frequency:	VSWR:
Impedance:	Return loss:
Series L:	Quality factor:
Series C:	S11 Phase:
Parallel R:	S21 Gain:
Parallel X:	S21 Phase:

Marker 2

Frequency:	VSWR:
Impedance:	Return loss:
Series L:	Quality factor:
Series C:	S11 Phase:
Parallel R:	S21 Gain:
Parallel X:	S21 Phase:

Marker 3

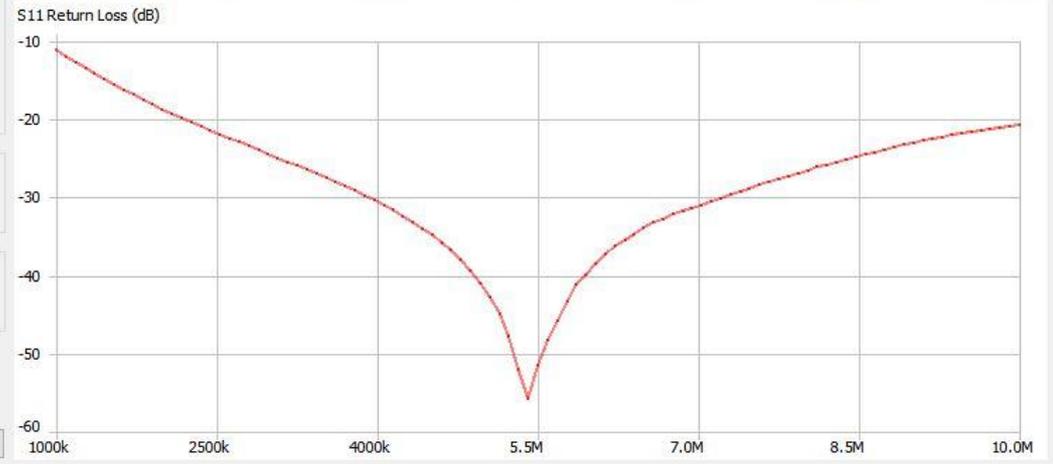
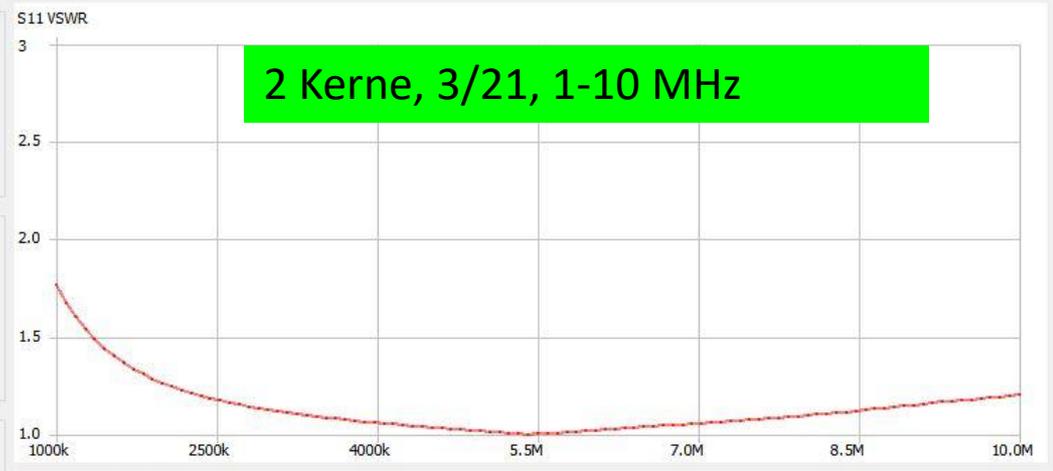
Frequency:	VSWR:
Impedance:	Return loss:
Series L:	Quality factor:
Series C:	S11 Phase:
Parallel R:	S21 Gain:
Parallel X:	S21 Phase:

S11

Min VSWR: 1.003 @ 5.41000MHz
Return loss: -55.814 dB

S21

Min gain: -98.98 dB @ 5.23000MHz
Max gain: -75.436 dB @ 9.64000MHz



Sweep control

Start Center
 Stop Span
 Segments 140.0kHz/step

Markers

Marker 1
 Marker 2
 Marker 3

Locked

TDR

Estimated cable length: 4.96 m

Reference sweep

Serial port control

Serial port

Marker 1

Frequency: 7.16000 MHz	VSWR: 1.131
Impedance: 44.22 +j0.447 Ω	Return loss: -24.223 dB
Series L: 9.9428 nH	Quality factor: 0.01
Series C: -49.694 nF	S11 Phase: 175.30°
Parallel R: 44.227 Ω	S21 Gain: -80.706 dB
Parallel X: 97.195 μ H	S21 Phase: 132.19°

Marker 2

Frequency:	VSWR:
Impedance:	Return loss:
Series L:	Quality factor:
Series C:	S11 Phase:
Parallel R:	S21 Gain:
Parallel X:	S21 Phase:

Marker 3

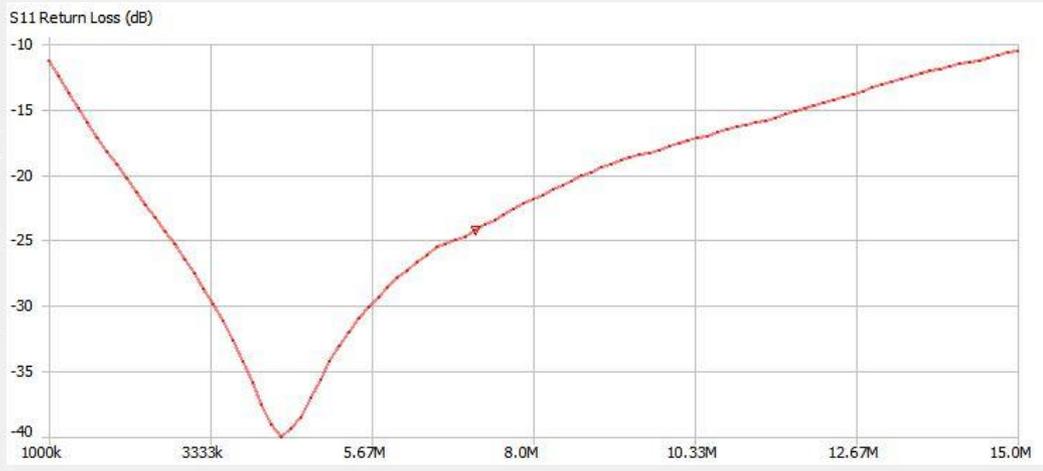
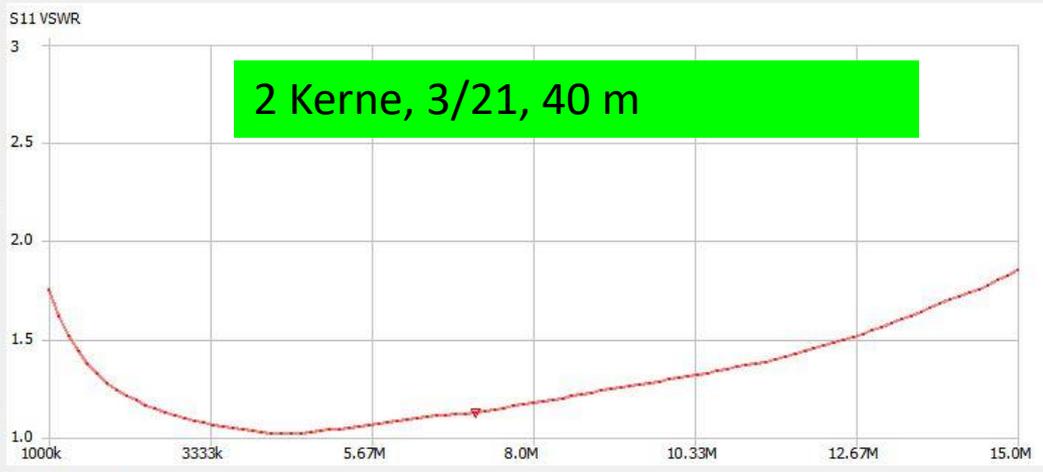
Frequency:	VSWR:
Impedance:	Return loss:
Series L:	Quality factor:
Series C:	S11 Phase:
Parallel R:	S21 Gain:
Parallel X:	S21 Phase:

S11

Min VSWR: 1.02 @ 4.36000MHz
 Return loss: -39.989 dB

S21

Min gain: -88.582 dB @ 14.0200MHz
 Max gain: -75.341 dB @ 5.62000MHz



Sweep control

Start Center
Stop Span
Segments 140.0kHz/step

Markers

Marker 1
Marker 2
Marker 3
 Locked

TDR

Estimated cable length: 4.96 m

Reference sweep

Serial port control

Serial port

Marker 1

Frequency: 3.66000 MHz	VSWR: 1.048
Impedance: 52.34 +j0.467 Ω	Return loss: -32.639 dB
Series L: 20.3 nH	Quality factor: 0.009
Series C: -93.15 nF	S11 Phase: 11.01°
Parallel R: 52.347 Ω	S21 Gain: -79.651 dB
Parallel X: 255.22 μH	S21 Phase: 135.63°

Marker 2

Frequency:	VSWR:
Impedance:	Return loss:
Series L:	Quality factor:
Series C:	S11 Phase:
Parallel R:	S21 Gain:
Parallel X:	S21 Phase:

Marker 3

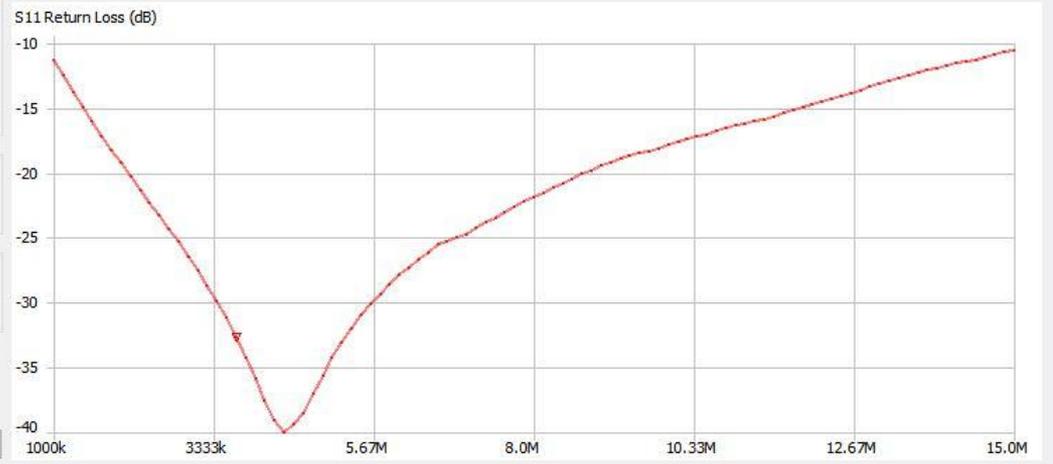
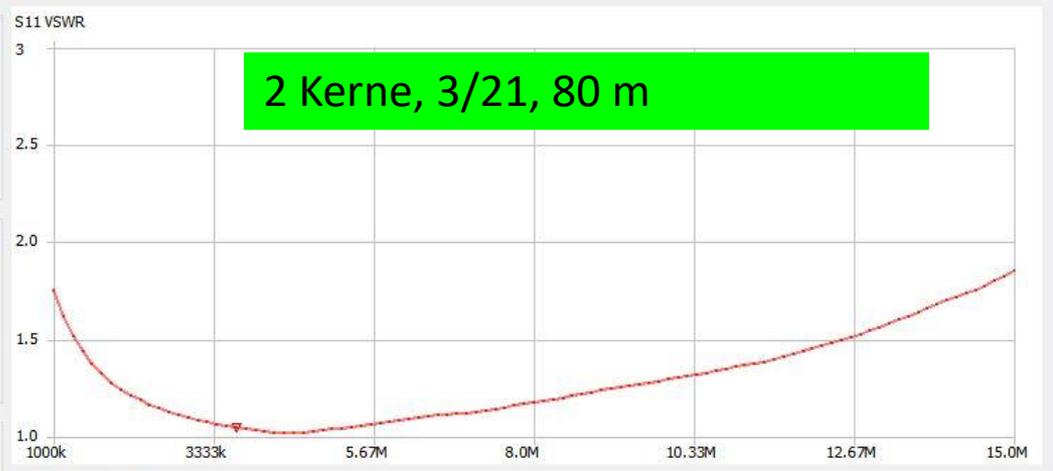
Frequency:	VSWR:
Impedance:	Return loss:
Series L:	Quality factor:
Series C:	S11 Phase:
Parallel R:	S21 Gain:
Parallel X:	S21 Phase:

S11

Min VSWR: 1.02 @ 4.36000MHz
Return loss: -39.989 dB

S21

Min gain: -88.582 dB @ 14.0200MHz
Max gain: -75.341 dB @ 5.62000MHz



Sweep control

Start Center

Stop Span

Segments 140.0kHz/step

Markers

Marker 1

Marker 2

Marker 3

Locked

TDR

Estimated cable length: 4.96 m

Reference sweep

Serial port control

Serial port

Marker 1

Frequency: 1.84000 MHz	VSWR: 1.281
Impedance: 55.57 +j11.8 Ω	Return loss: -18.196 dB
Series L: 1.0233 μH	Quality factor: 0.213
Series C: -7.3111 nF	S11 Phase: 58.41°
Parallel R: 58.085 Ω	S21 Gain: -77.032 dB
Parallel X: 23.597 μH	S21 Phase: 133.02°

Marker 2

Frequency:	VSWR:
Impedance:	Return loss:
Series L:	Quality factor:
Series C:	S11 Phase:
Parallel R:	S21 Gain:
Parallel X:	S21 Phase:

Marker 3

Frequency:	VSWR:
Impedance:	Return loss:
Series L:	Quality factor:
Series C:	S11 Phase:
Parallel R:	S21 Gain:
Parallel X:	S21 Phase:

S11

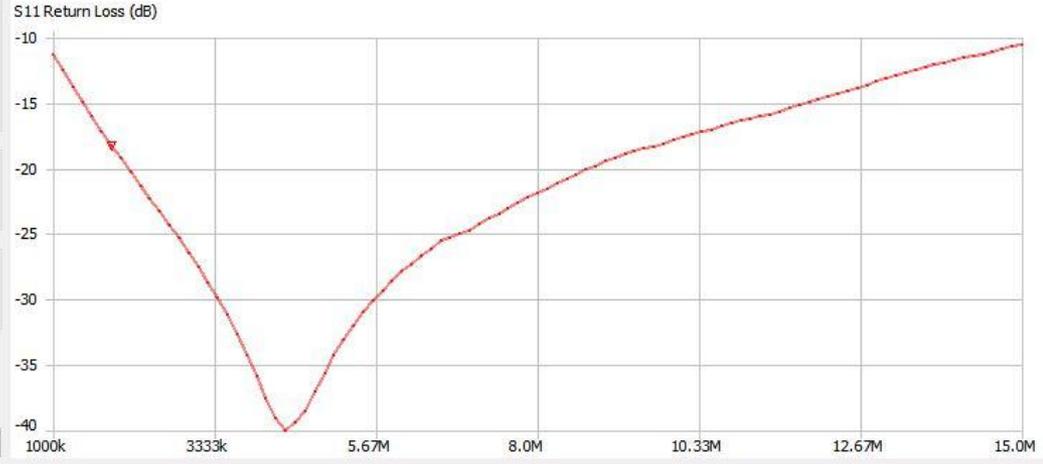
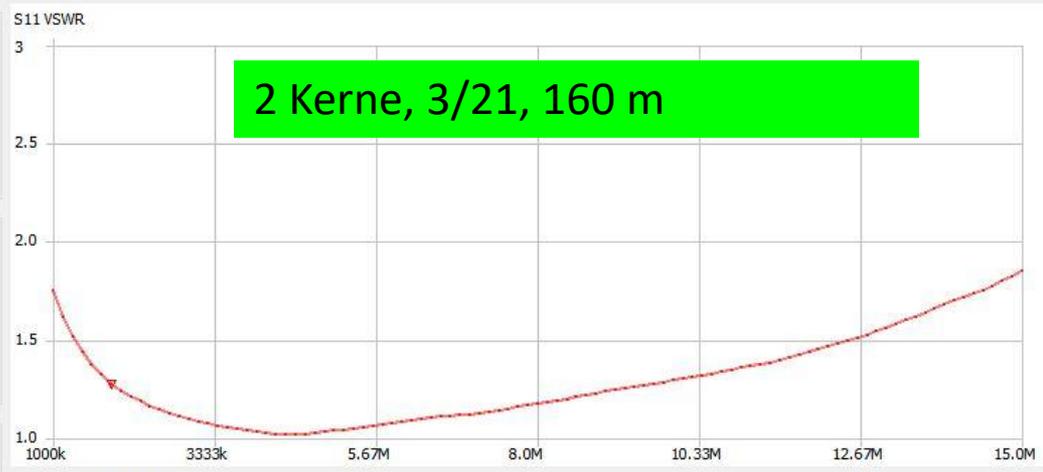
Min VSWR: 1.02 @ 4.36000MHz

Return loss: -39.989 dB

S21

Min gain: -88.582 dB @ 14.02000MHz

Max gain: -75.341 dB @ 5.62000MHz



Installiert Hyendfed gekauft
2 Kerne, 2/14, 1-15 MHz

Sweep control

Start Center

Stop Span

Segments 130.0kHz/step

Sweep settings ...

100%

Sweep Stop

Markers

Marker 1

Marker 2

Marker 3

Hide data Locked

TDR

Estimated cable length: 21.275 m

Time Domain Reflectometry ...

Reference sweep

Set current as reference

Reset reference

Serial port control

Serial port Rescan

Disconnect Manage

Files ... Calibration ...

Display setup ... About ...

Marker 1

Frequency:	7.20000 MHz	VSWR:	1.111
Impedance:	55.44 -j1.13 Ω	Return loss:	-25.557 dB
Series L:	-25.075 nH	Quality factor:	0.02
Series C:	19.486 nF	S11 Phase:	-11.15°
Parallel R:	55.468 Ω	S21 Gain:	-89.386 dB
Parallel X:	8.1534 pF	S21 Phase:	123.64°

Marker 2

Frequency:		VSWR:	
Impedance:		Return loss:	
Series L:		Quality factor:	
Series C:		S11 Phase:	
Parallel R:		S21 Gain:	
Parallel X:		S21 Phase:	

Marker 3

Frequency:		VSWR:	
Impedance:		Return loss:	
Series L:		Quality factor:	
Series C:		S11 Phase:	
Parallel R:		S21 Gain:	
Parallel X:		S21 Phase:	

S11

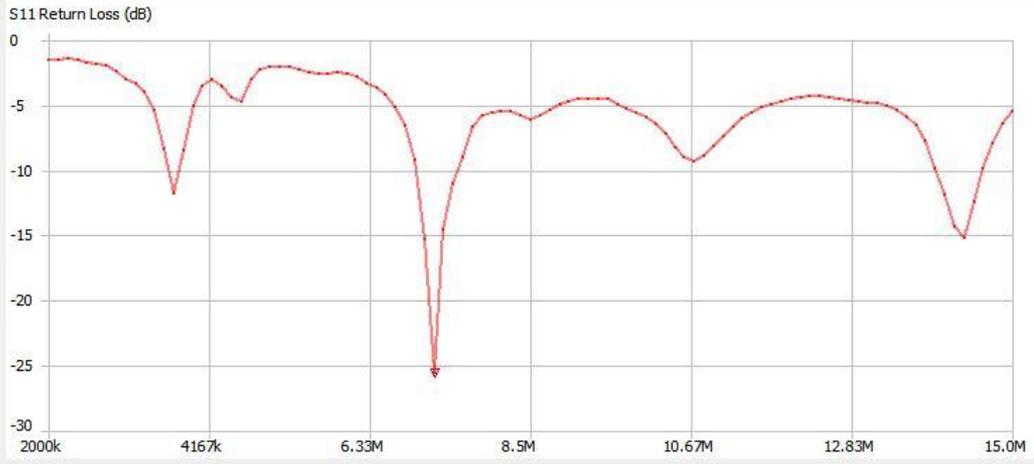
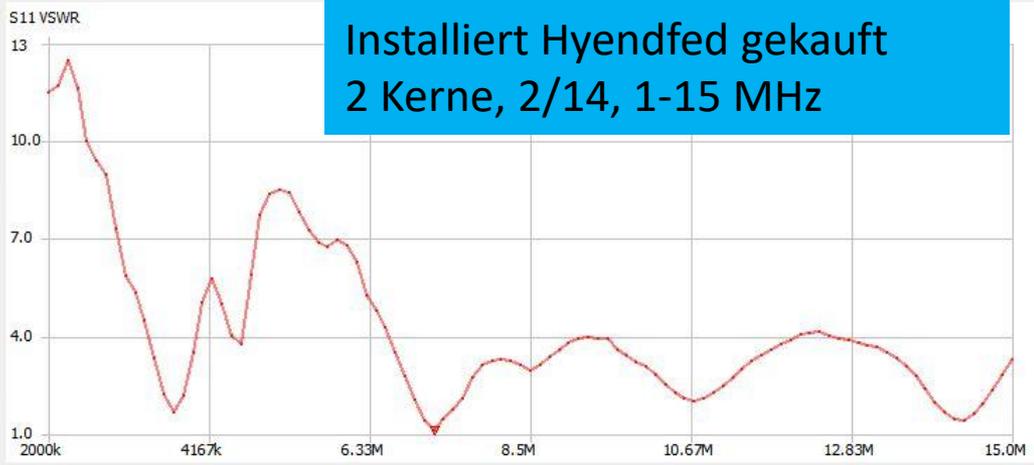
Min VSWR: 1.111 @ 7.20000MHz

Return loss: -25.557 dB

S21

Min gain: -89.386 dB @ 7.20000MHz

Max gain: -75.641 dB @ 4.08000MHz



Installiert Hyendfed gekauft
2 Kerne, 2/14, 40 m

Sweep control

Start: 6.8MHz Center: 7.1MHz

Stop: 7.4MHz Span: 600kHz

Segments: 1 9.000kHz/step

Sweep settings ...

100%

Sweep Stop

Markers

Marker 1: 7.185965MHz

Marker 2

Marker 3

Hide data Locked

TDR

Estimated cable length: 16452.353 m

Time Domain Reflectometry ...

Reference sweep

Set current as reference

Reset reference

Serial port control

Serial port: COM3 Rescan

Disconnect Manage

Files ... Calibration ...

Display setup ... About ...

Marker 1

Frequency: 7.18400 MHz	VSWR: 1.093
Impedance: 53.4 -j3.08 Ω	Return loss: -27.064 dB
Series L: -68.321 nH	Quality factor: 0.058
Series C: 7.1837 nF	S11 Phase: -40.54°
Parallel R: 53.573 Ω	S21 Gain: -78.030 dB
Parallel X: 23.884 pF	S21 Phase: 137.24°

Marker 2

Frequency:	VSWR:
Impedance:	Return loss:
Series L:	Quality factor:
Series C:	S11 Phase:
Parallel R:	S21 Gain:
Parallel X:	S21 Phase:

Marker 3

Frequency:	VSWR:
Impedance:	Return loss:
Series L:	Quality factor:
Series C:	S11 Phase:
Parallel R:	S21 Gain:
Parallel X:	S21 Phase:

S11

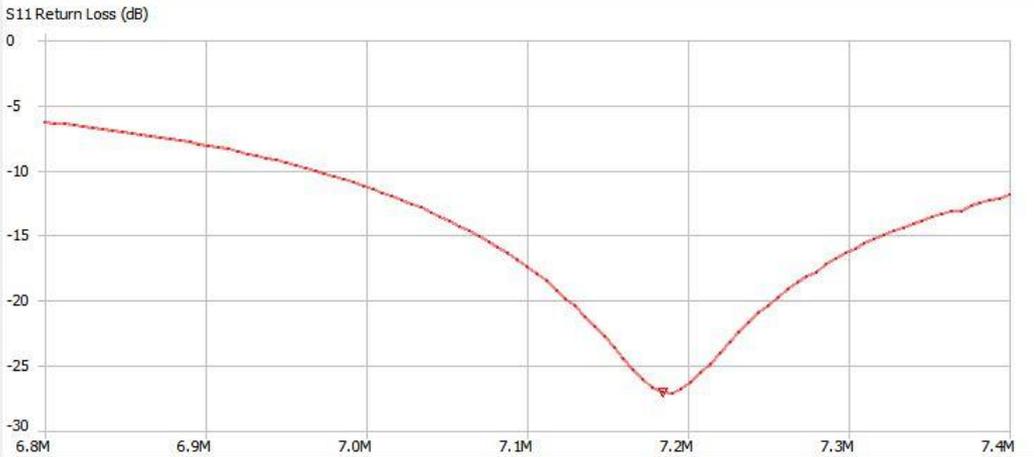
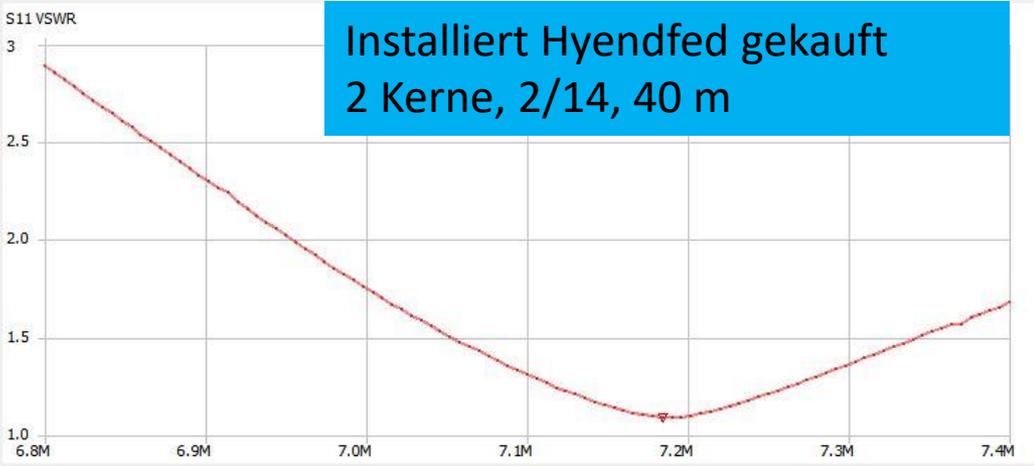
Min VSWR: 1.092 @ 7.19000MHz

Return loss: -27.097 dB

S21

Min gain: -92.662 dB @ 7.37600MHz

Max gain: -75.979 dB @ 7.35800MHz



Sweep control

Start: 3.2MHz Center: 3.65MHz
 Stop: 4.1MHz Span: 900kHz
 Segments: 1 140.0kHz/step

Sweep settings ...

100%

Sweep Stop

Markers

Marker 1: 3.702632MHz

Marker 2: []

Marker 3: []

Hide data Locked

TDR

Estimated cable length: 141.573 m

Time Domain Reflectometry ...

Reference sweep

Set current as reference

Reset reference

Serial port control

Serial port: COM3 Rescan

Disconnect Manage

Files ... Calibration ...

Display setup ... About ...

Marker 1

Frequency:	3.70400 MHz	VSWR:	1.695
Impedance:	59.26 +j27.5 Ω	Return loss:	-11.774 dB
Series L:	1.183 μH	Quality factor:	0.465
Series C:	-1.5607 nF	S11 Phase:	57.27°
Parallel R:	72.051 Ω	S21 Gain:	-78.962 dB
Parallel X:	6.6635 μH	S21 Phase:	128.89°

Marker 2

Frequency:		VSWR:	
Impedance:		Return loss:	
Series L:		Quality factor:	
Series C:		S11 Phase:	
Parallel R:		S21 Gain:	
Parallel X:		S21 Phase:	

Marker 3

Frequency:		VSWR:	
Impedance:		Return loss:	
Series L:		Quality factor:	
Series C:		S11 Phase:	
Parallel R:		S21 Gain:	
Parallel X:		S21 Phase:	

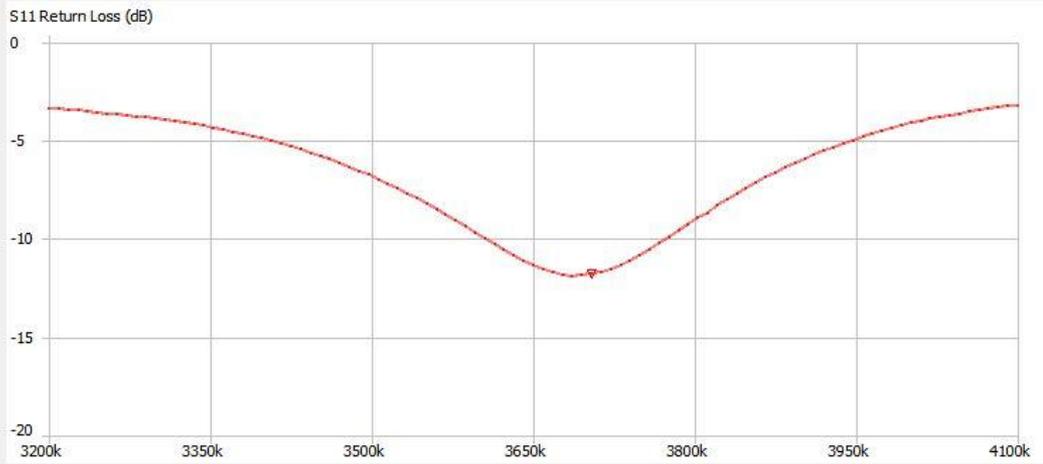
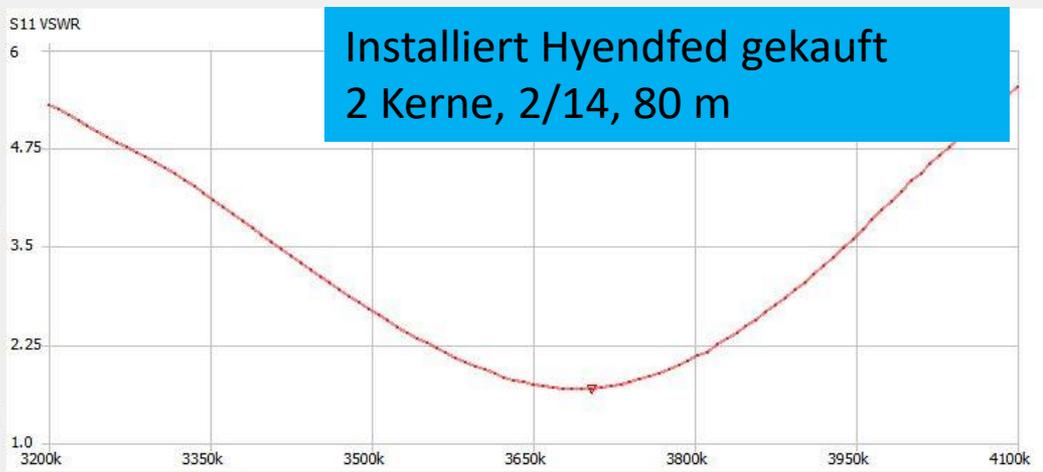
S11

Min VSWR: 1.686 @ 3.68600MHz
 Return loss: -11.853 dB

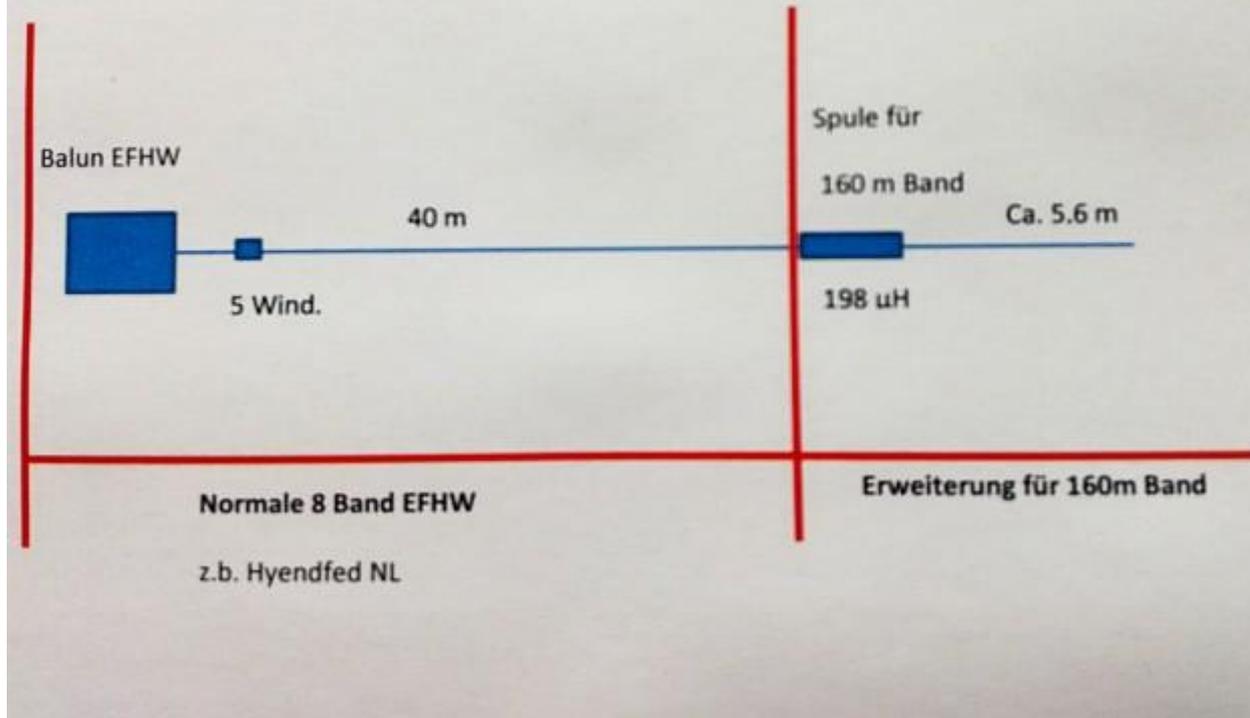
S21

Min gain: -91.483 dB @ 3.92900MHz
 Max gain: -74.003 dB @ 3.58700MHz

Analysis ...

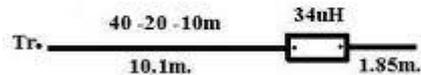
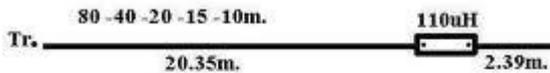


Erweiterung für 160m (DL4VAI)

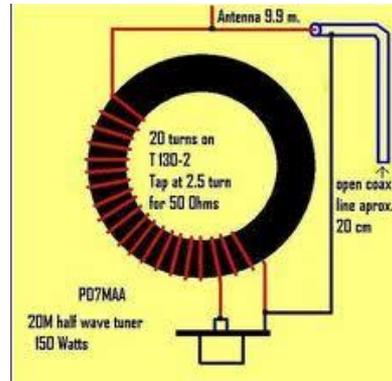


Viel Spaß beim Bauen und Testen.

Vy 73 de DL4VAI



110uH coil : 260 turns 1mm. cul. 34uH coil : 90 turns 1mm. cul close wound on a 19mm pvc tube start tuning the long wire on the high bands.



49:1 Transformer Primary 2 Turns. Secondary 14 turns (Total turns)

To End Fed Half Wave Antenna.

Parts List

Toroid Core:
Mouser Part #623-5943003801
240-43 Toroid 12.7mm x 61mm

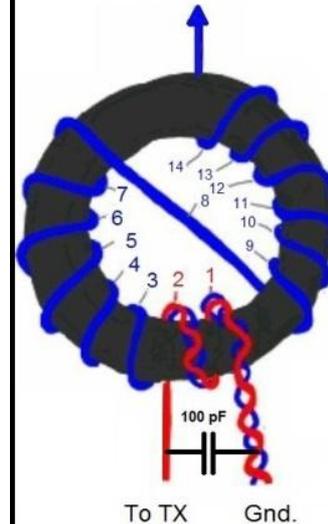
*Use 1, 2 or 3 cores depending on transmitter output to be used.

Capacitor:
Mouser Part #81-DHR4E4C221K2BB
100 - 110 pF. You can use TWO 220 pF @ 15 kV in series.

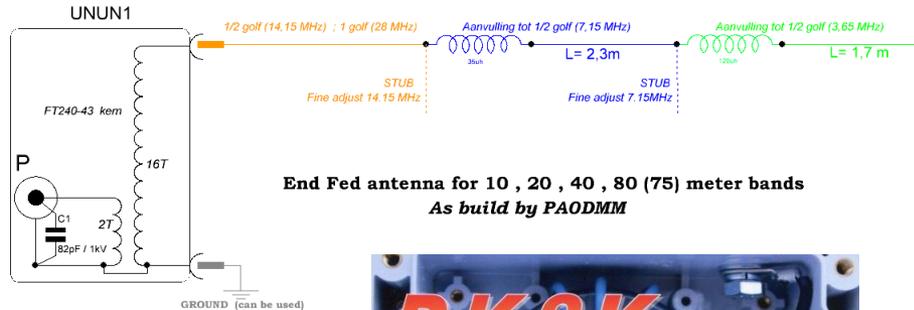
Antenna:
80m - 10m use a 134' wire.
40m - 10m use a 67' wire, etc.

Wire:
14 gauge enameled wire. **

** When using 3 toroid cores start with a Primary wire of ~13" and Secondary of ~80" long. 1 & 2 cores will use less wire.

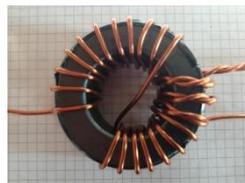
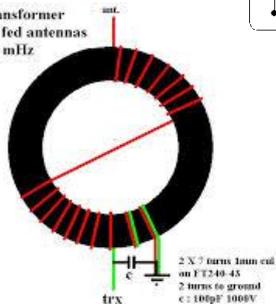


Revised: 07/14/2017 - K1TA



End Fed antenna for 10 , 20 , 40 , 80 (75) meter bands
As build by PAODMM

1:49 transformer for end fed antennas 3.5 - 30 mHz



DL4VAI, OV Q07, 03.2020