Louis Varney's G5RV Antenna

Louis Varney (G5RV) –SK, served in the Royal Corps of Signals in an HF Interception and DF unit , and was rapidly promoted to Captain. He was demobbed in 1946 and moved to a house in Stony Stratford that had a garden barely 100ft long - and a need for a multi-band HF antenna. Eventually Louis came up with the design now universally known as

"The G5RV Multi-band HF Dipole"

Louis later joined the **Royal Signals Amateur Radio Society (RSARS Member 795).** The renowned G5RV is the legacy Louis left the amateur radio fraternity. He never made a penny out of his invention, that has been copied by many, improved by some , studied by many others using computers, and manufactured and sold by many companies worldwide.

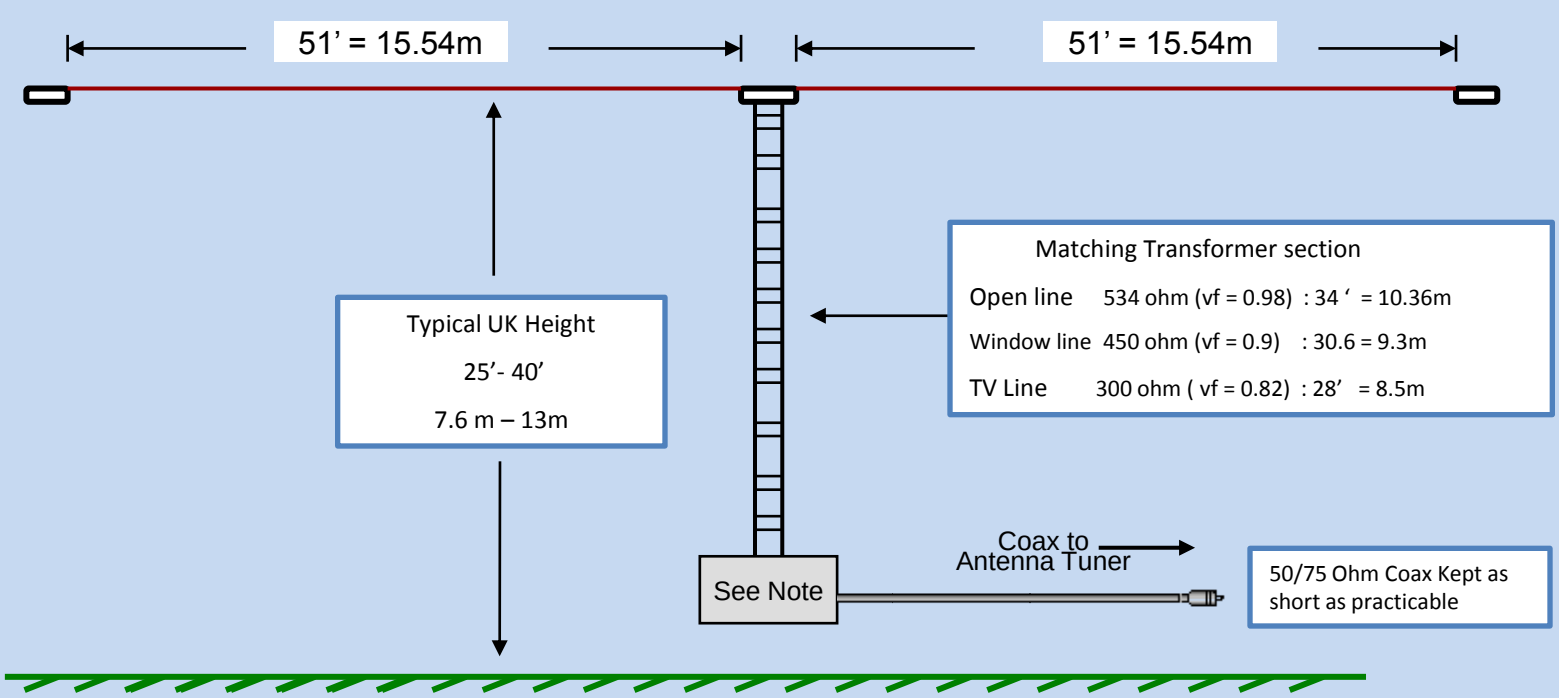
*The following study was carried out using the Freeware MMANA (**M**ethod of **M**oments - **ANA**lysis) program, an produced as a tribute to the Society's famous member.*

http://mmhamsoft.amateur-radio.ca/

Note :- This publication only deals with the G5RV using the 300 ohm feeder .

Mario Chomicz
G8ODE RSARS 1691

Louis Varney's Classic G5RV



NOTE S

1. **Louis Varney mentions that he used a choke BALUN . This can made from 12-15m of coax forming a 7-9 turns coil, and tie-wrapped to form a circle 20-25 cm diameter.**

2. **If the G5RV is erected lower than 12 metres, ensure that the ladder line is well clear of the ground and other objects .**

Drawn by G8ODE RSARS 1691

SOME IMPORTANT NOTES FOR THIS G5RV ANTENNA STUDY

Although the G5RV can operate 80m-10m, this study has only selected 6 frequencies. The primary reason for this is because of the limitation of the MMANA “Calculate TAB (Page) which can only display 6 results on the computer screen at any one time. Since this page cannot be saved as a file, a “Print-Screen” image had to be made and imported into PowerPoint for annotation etc . This was also the case for all the other images

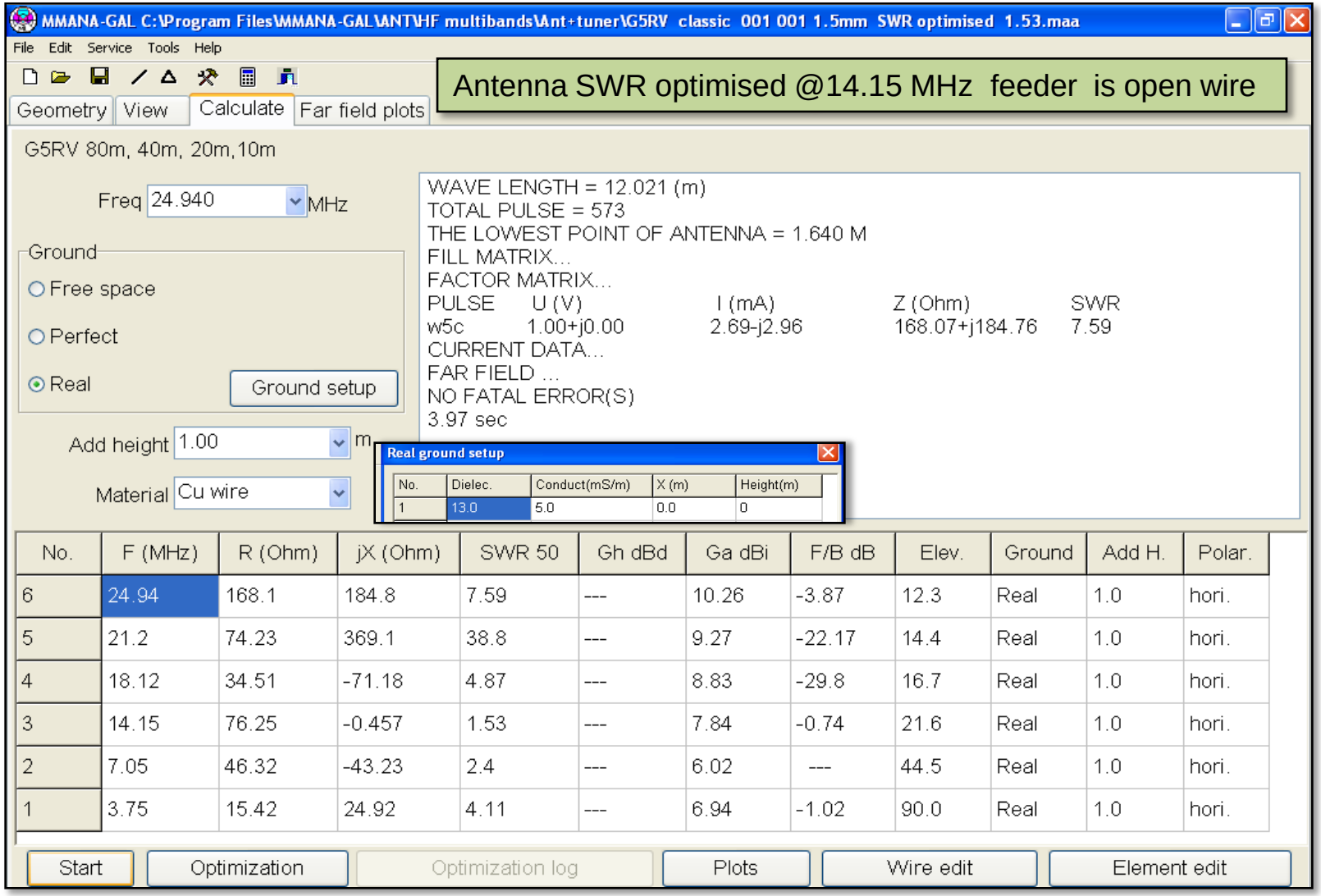
The study only investigates the horizontal Far Fields as these predominantly produce the “low Angle” radiation used in DX QSOs. It was therefore felt that these would be of most interest .

One thing to notice is the current which is displayed as a magnitude value. This can be seen to vary in size and relates to the impedance of the antenna as seen by the transceiver for the various frequencies studied.

The G5RV’s open wire ladder line acts as a variable matching transformer reducing the impedance presented at the centre feed point to more easily managed values. This enables the antenna matching unit (ATU) connected to the transceiver to easily adjust the SWR to a value close to 1:1. Only on the 20m band does this open wire line behave as a 1:1 ratio transformer. The SWR values shown on the “Calculate “ page indicate the values the ATU has to reduce to a value close to 1:1 .

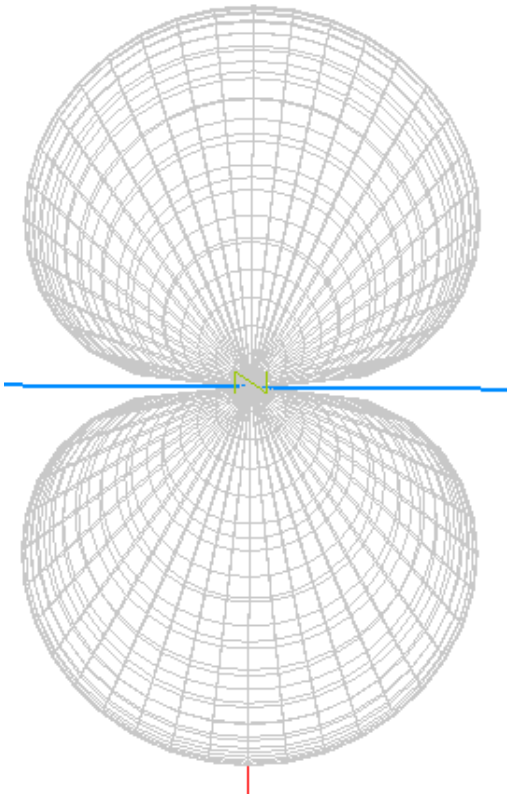
Classic G5RV-Flat top T Radiation Patterns

With vertical 300R feeder 12.66 m long model & bottom @ +1m

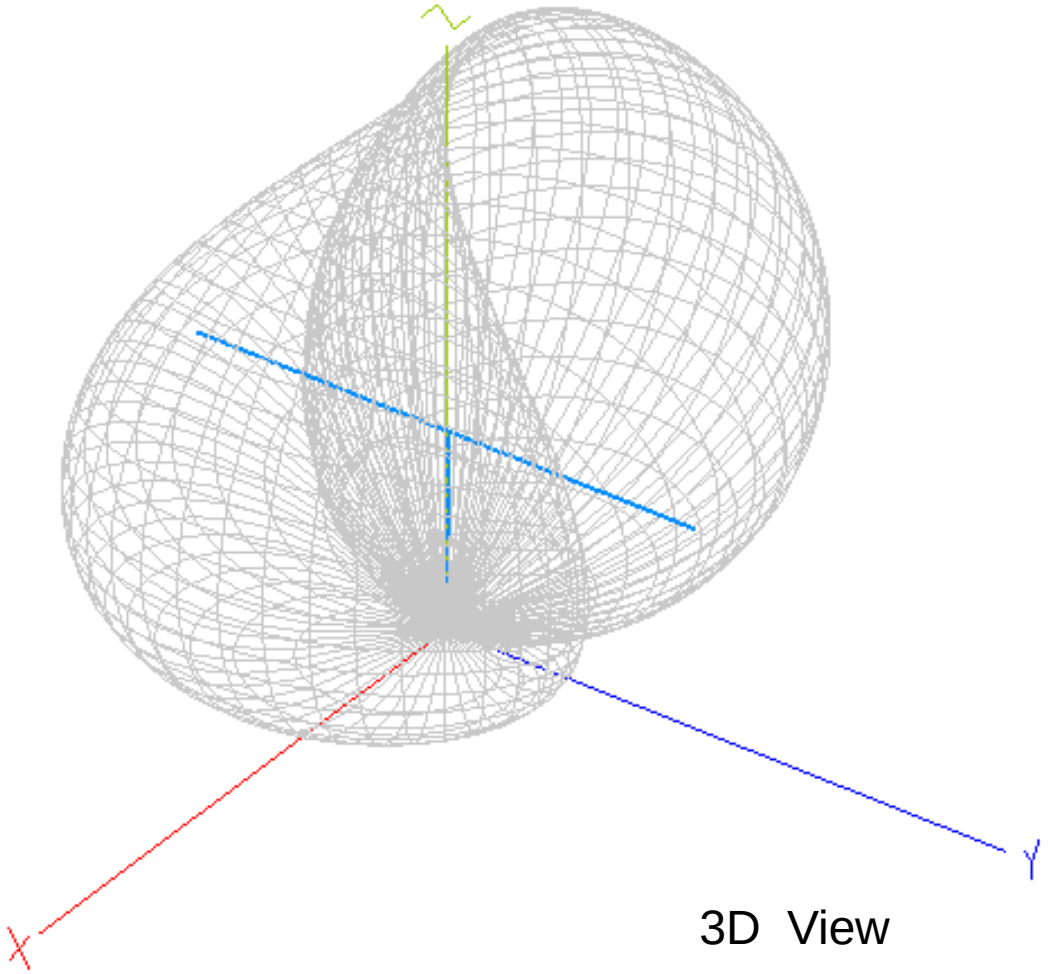


No.	F (MHz)	R (Ohm)	jX (Ohm)	SWR 50	Gh dBd	Ga dBi	F/B dB	Elev.	Ground	Add H.	Polar.
6	24.94	168.1	184.8	7.59	---	10.26	-3.87	12.3	Real	1.0	hori.
5	21.2	74.23	369.1	38.8	---	9.27	-22.17	14.4	Real	1.0	hori.
4	18.12	34.51	-71.18	4.87	---	8.83	-29.8	16.7	Real	1.0	hori.
3	14.15	76.25	-0.457	1.53	---	7.84	-0.74	21.6	Real	1.0	hori.
2	7.05	46.32	-43.23	2.4	---	6.02	---	44.5	Real	1.0	hori.
1	3.75	15.42	24.92	4.11	---	6.94	-1.02	90.0	Real	1.0	hori.

3.75 MHz Horizontal Radiation Patterns



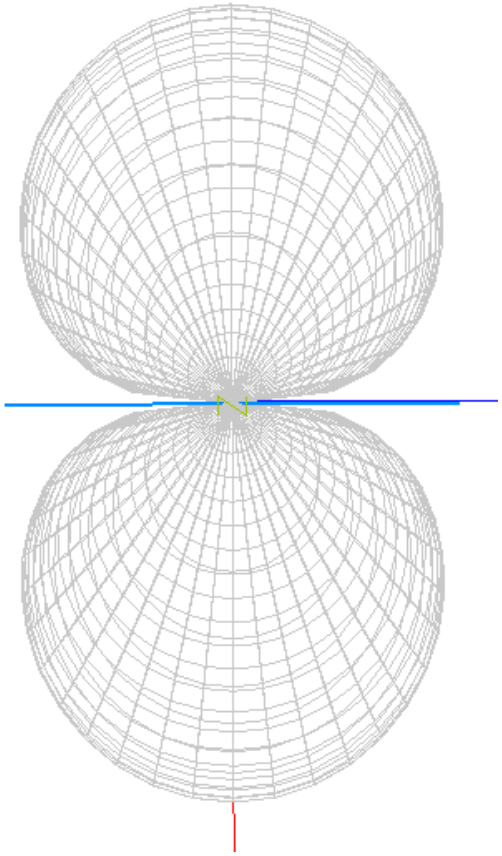
Plan View



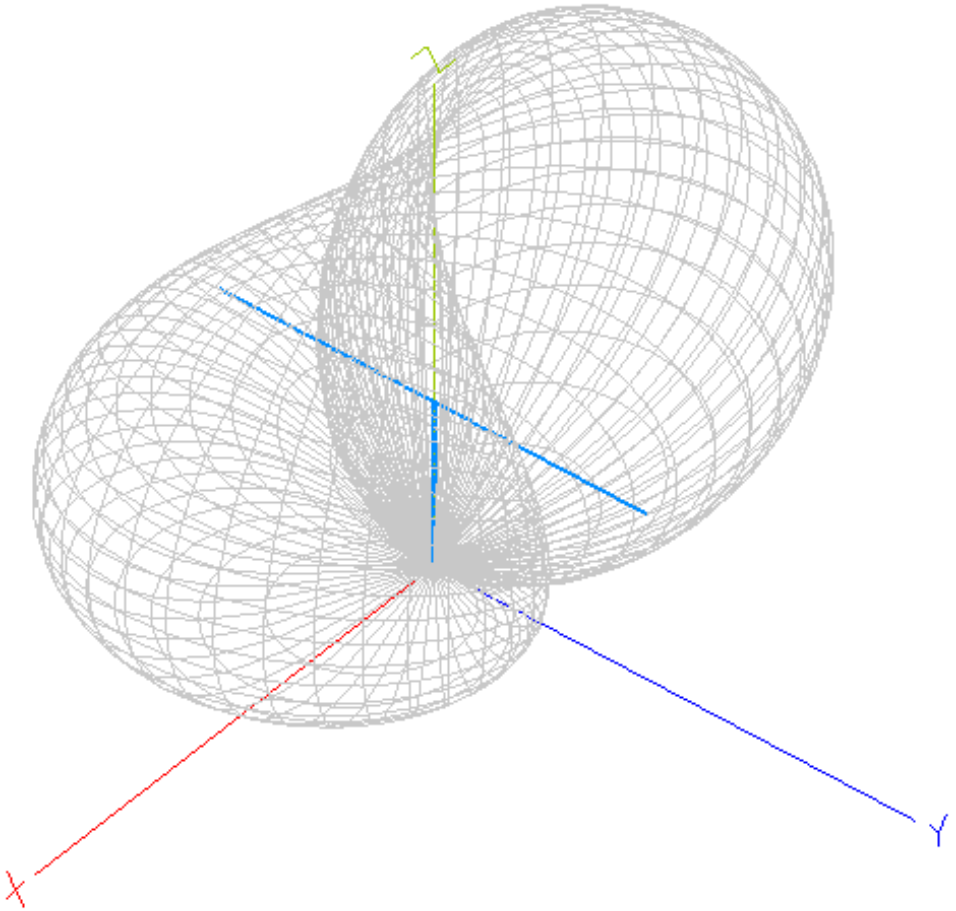
3D View

Classic G5RV-Flat top T
Radiation Patterns
300R feeder bottom @ +1m above
"Real" Ground & Antenna optimised
for SWR 1.53 :1 @ 14.15 MHz

7.05 MHz Horizontal Radiation Patterns



Plan View



3D View

Classic G5RV-Flat top T
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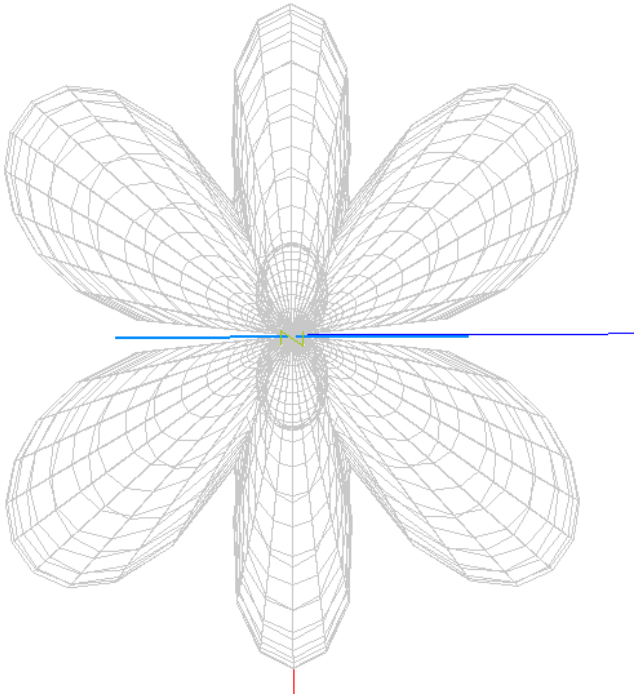
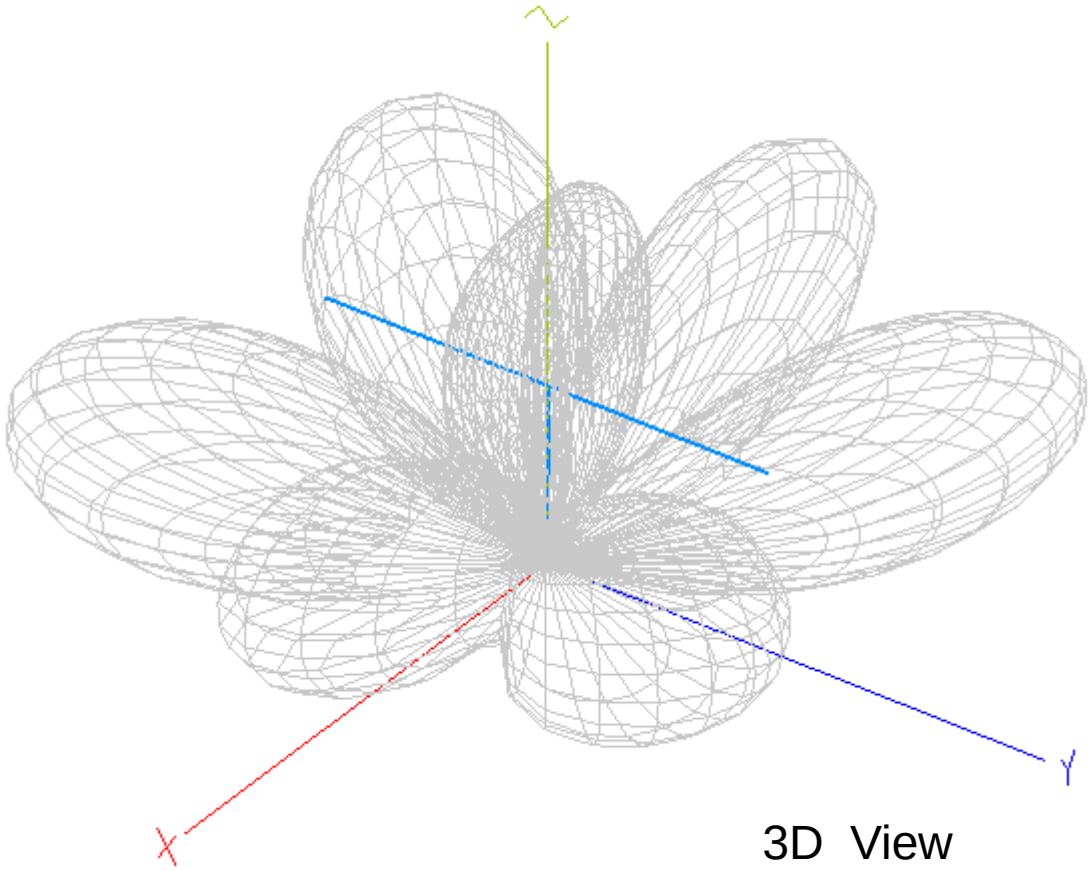
300R feeder bottom @ +1m above
"Real" Ground & Antenna optimised
for SWR 1.53 :1 @ 14.15 MHz

14.15 MHz Horizontal Radiation Patterns



Plan View



3D View

Classic G5RV-Flat top T
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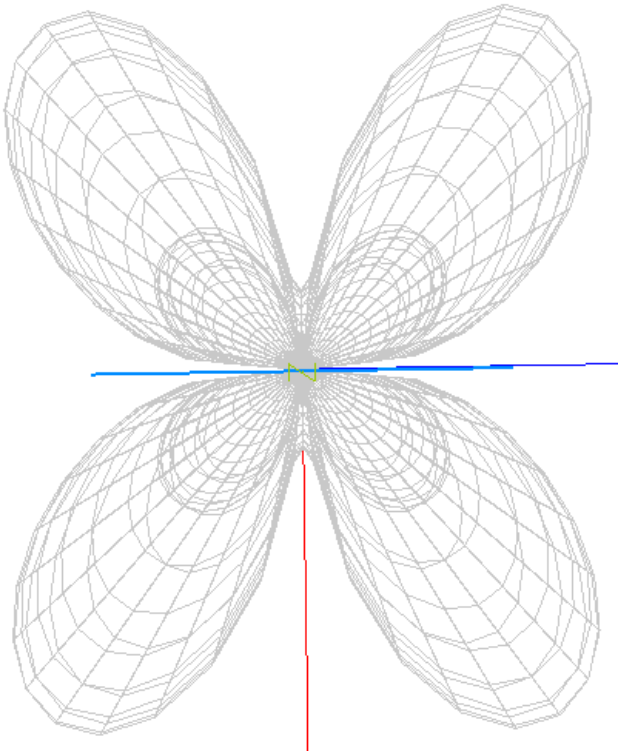
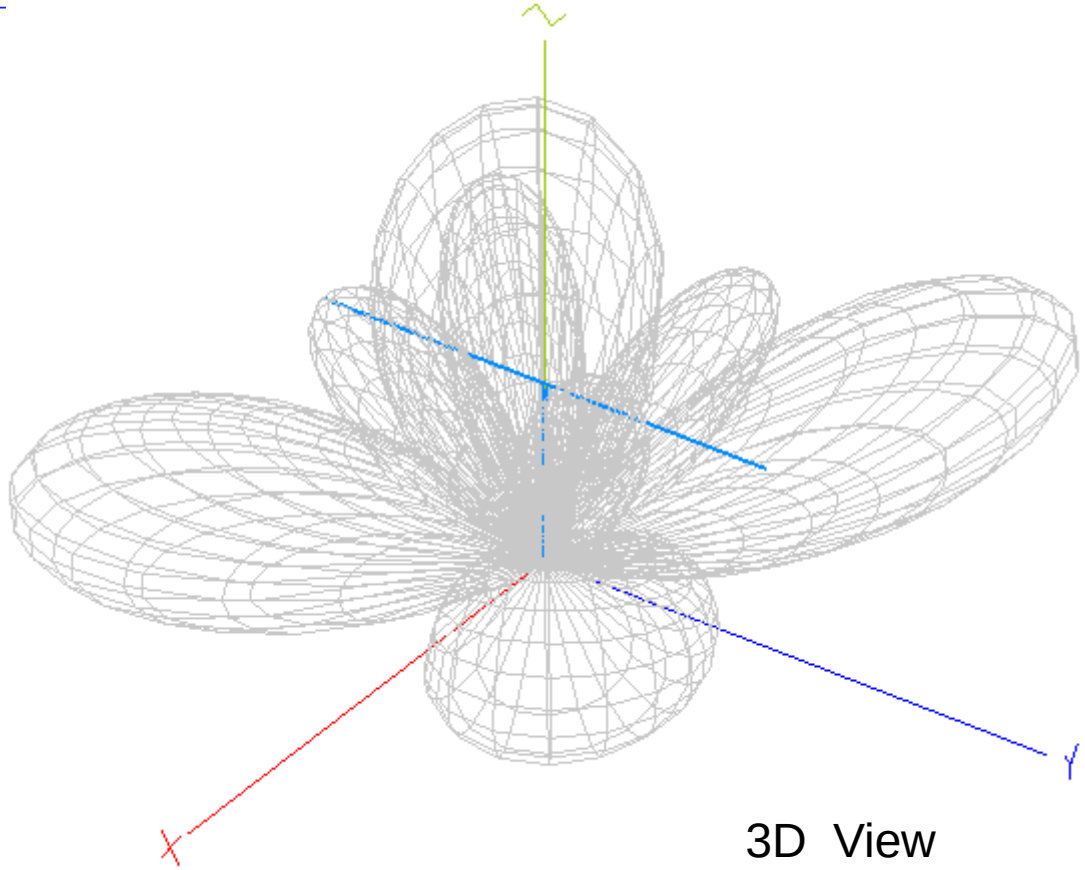
for SWR 1.53 :1 @ 14.15 MHz

18.12 MHz Horizontal Radiation Patterns



Plan View



3D View

Classic G5RV-Flat top T
Radiation Patterns
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"Real" Ground & Antenna optimised
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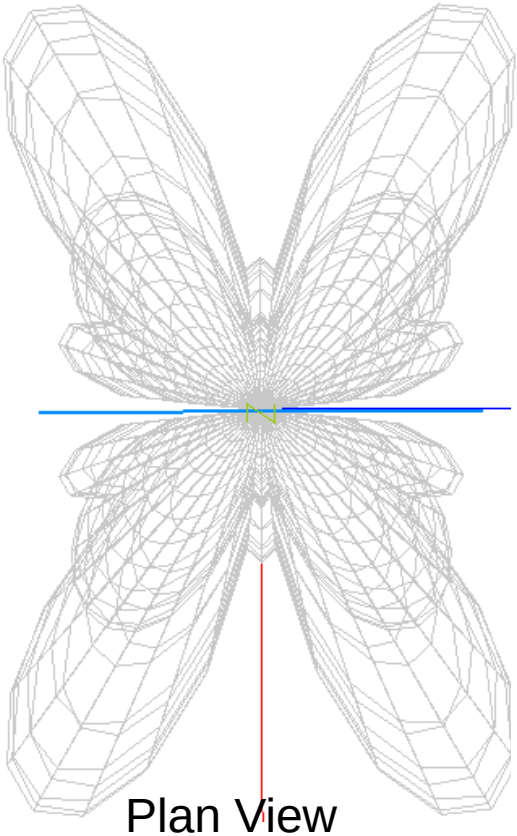
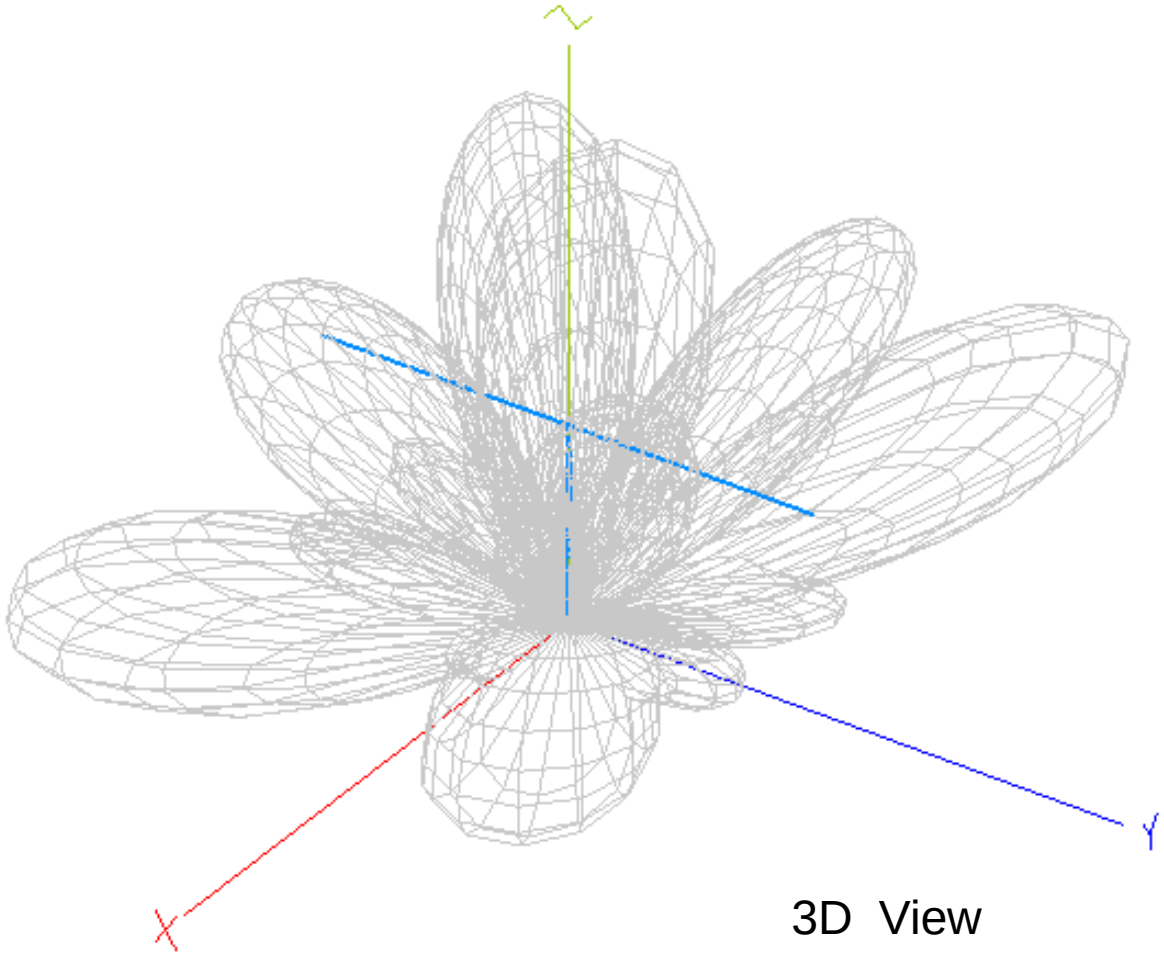
21.20 MHz Horizontal Radiation Patterns



Plan View



3D View

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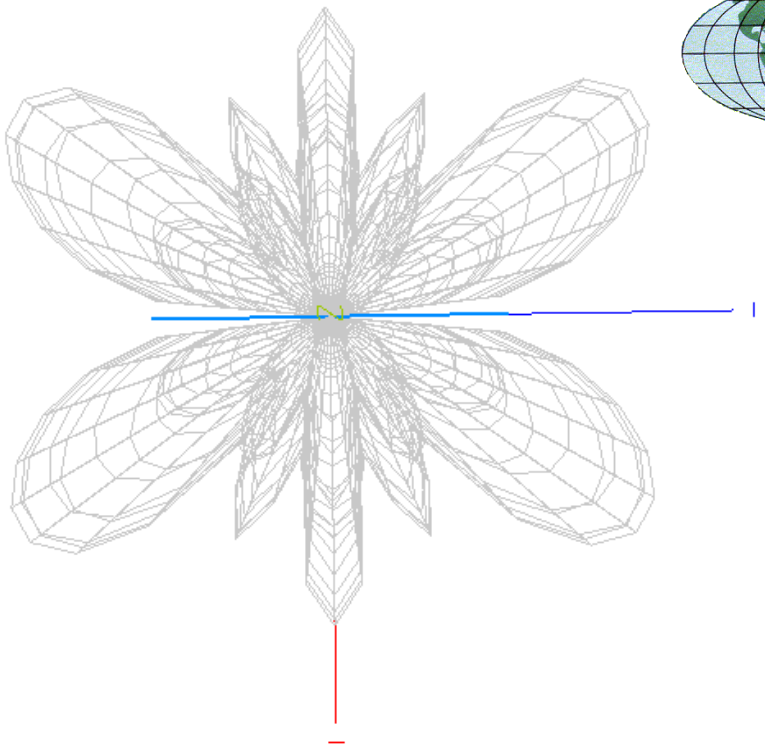
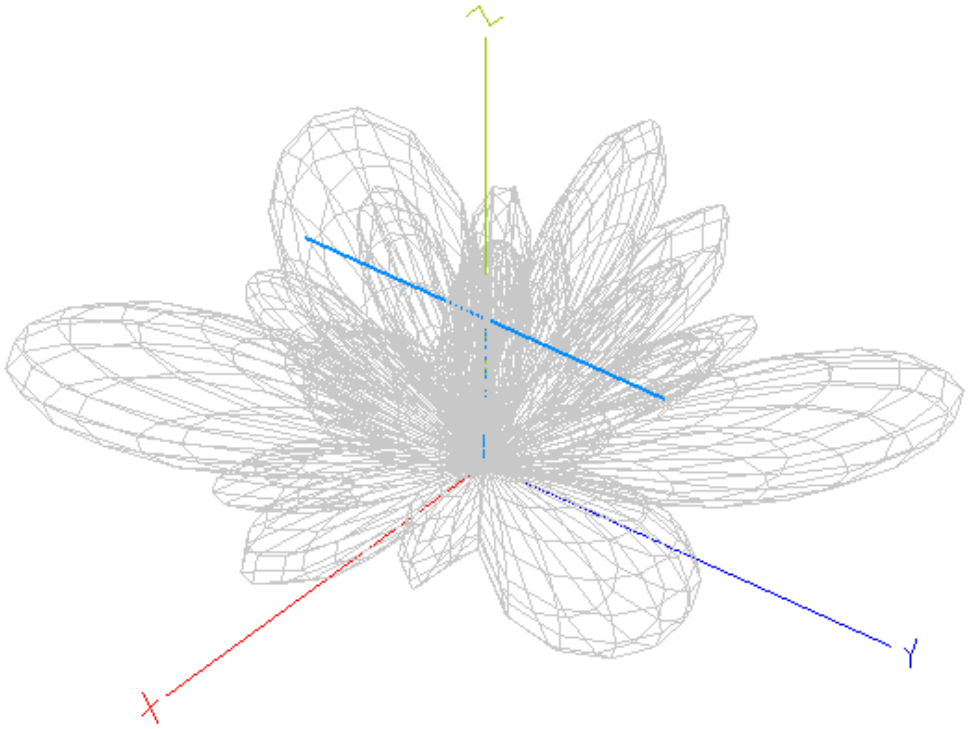
for SWR 1.53 :1 @ 14.15 MHz

24.94MHz Horizontal Radiation Patterns



Plan View



Classic G5RV-Flat top T
Radiation Patterns
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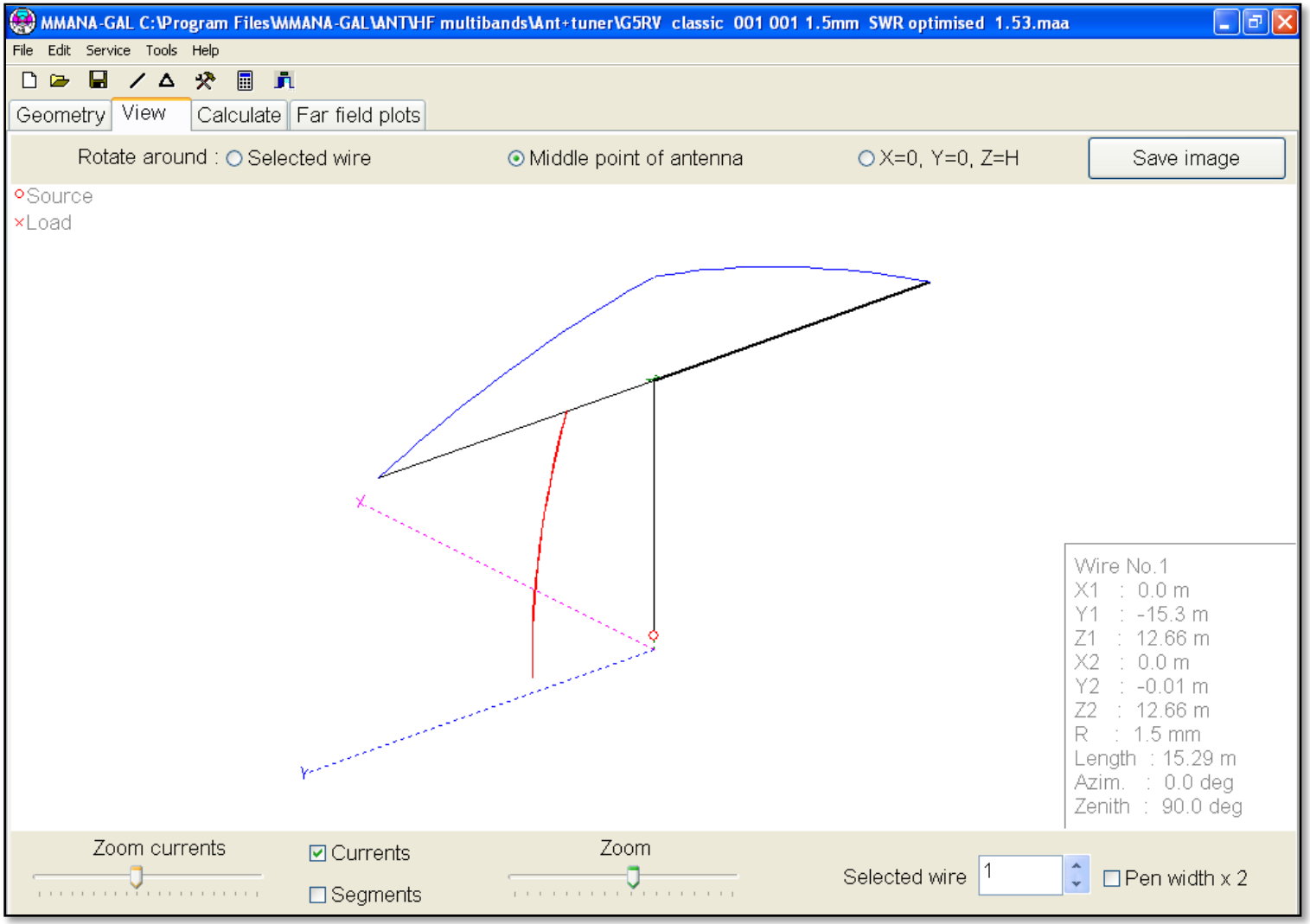
for SWR 1.53 :1 @ 14.15 MHz

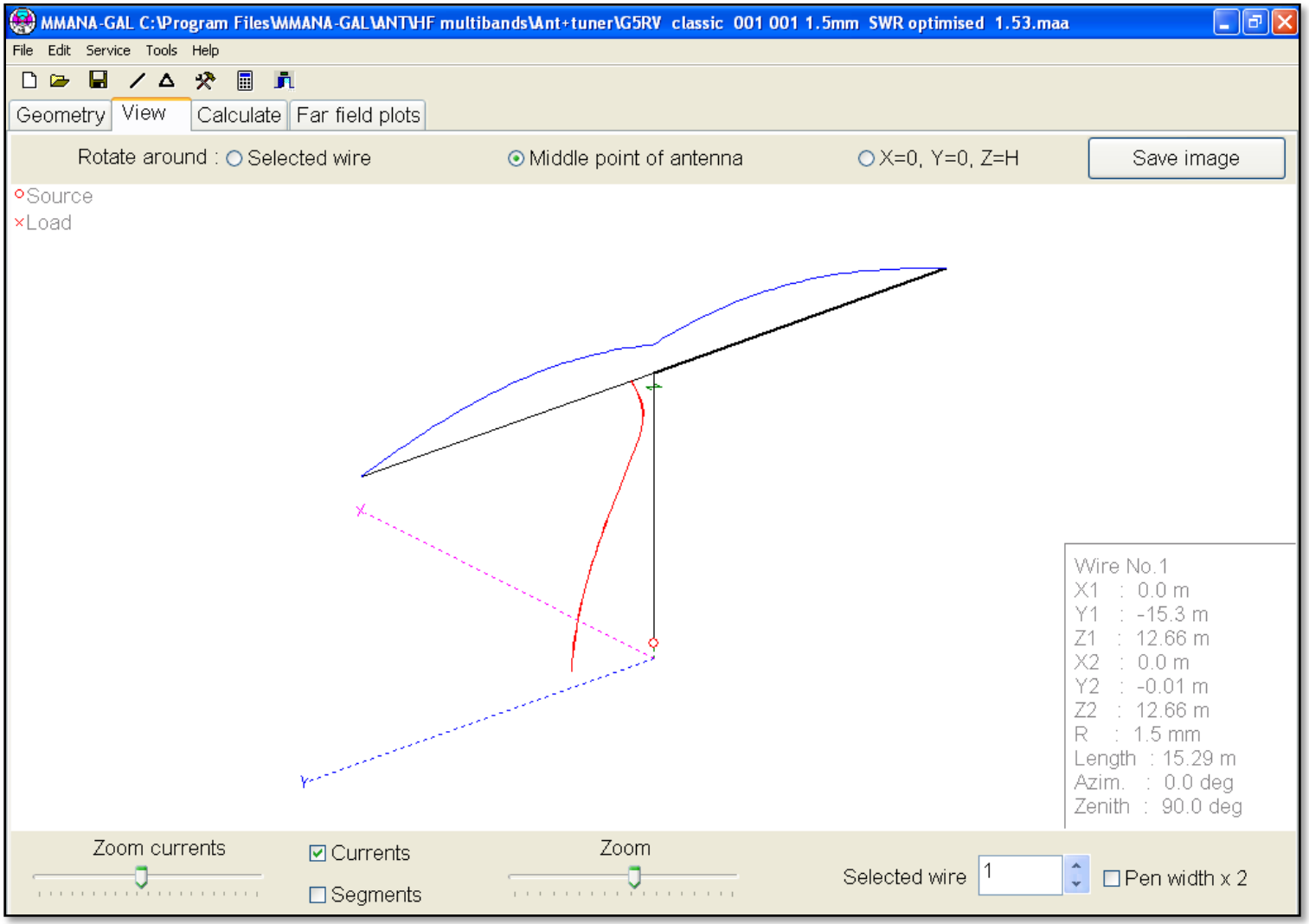
3.75 MHz



Classic G5RV-Flat top T Radiation Patterns

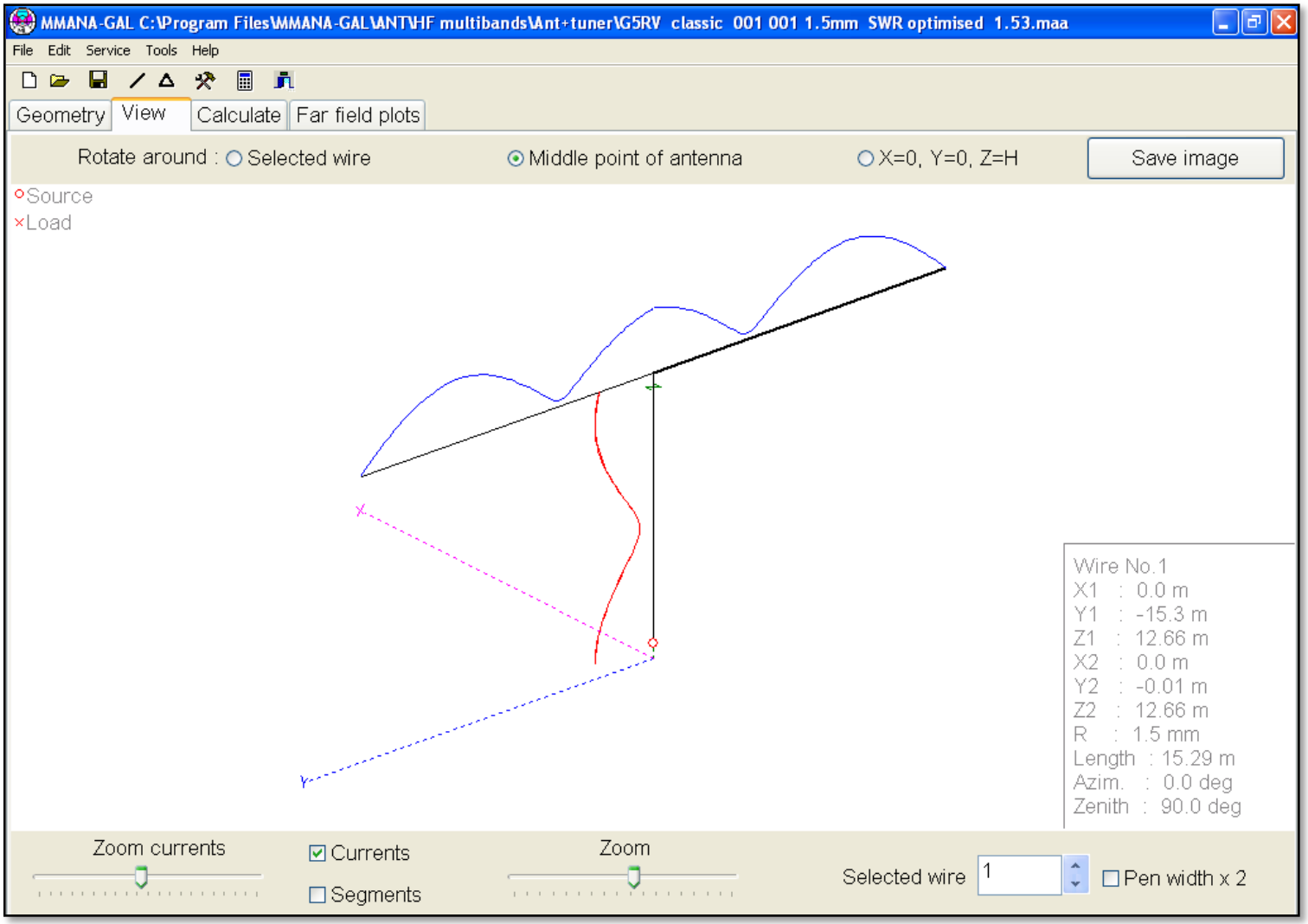
300R feeder bottom @ +1m above "Real" Ground &
Antenna optimised for SWR 1.53 :1 @ 14.15 MHz

7.05 MHz



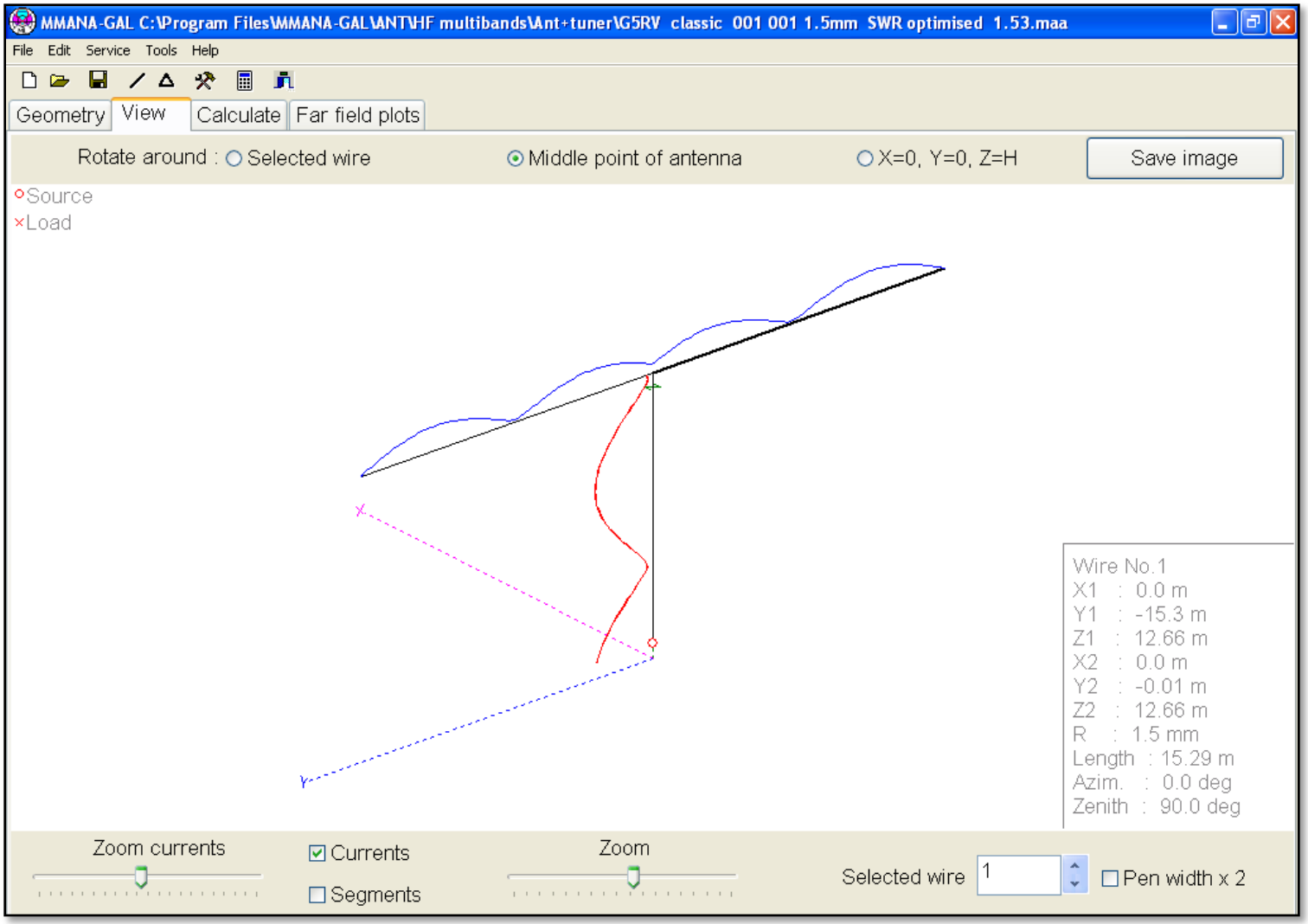
Classic G5RV-Flat top T Radiation Patterns
300R feeder bottom @ +1m above "Real" Ground &
Antenna optimised for SWR 1.53 :1 @ 14.15 MHz

14.15 MHz



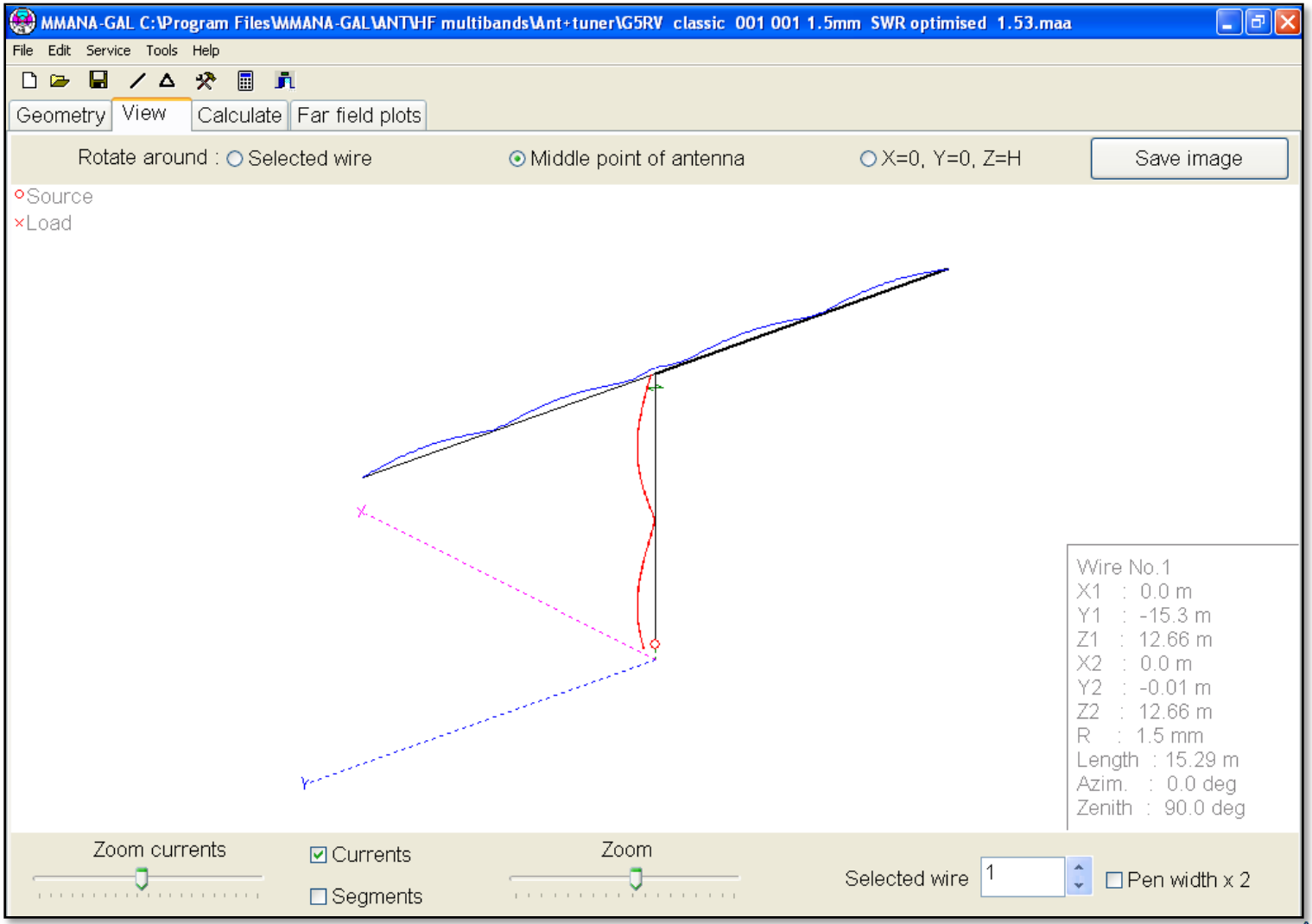
Classic G5RV-Flat top T Radiation Patterns
300R feeder bottom @ +1m above "Real" Ground &
Antenna optimised for SWR 1.53 :1 @ 14.15 MHz

18.12 MHz



Classic G5RV-Flat top T Radiation Patterns
300R feeder bottom @ +1m above "Real" Ground &
Antenna optimised for SWR 1.53 :1 @ 14.15 MHz

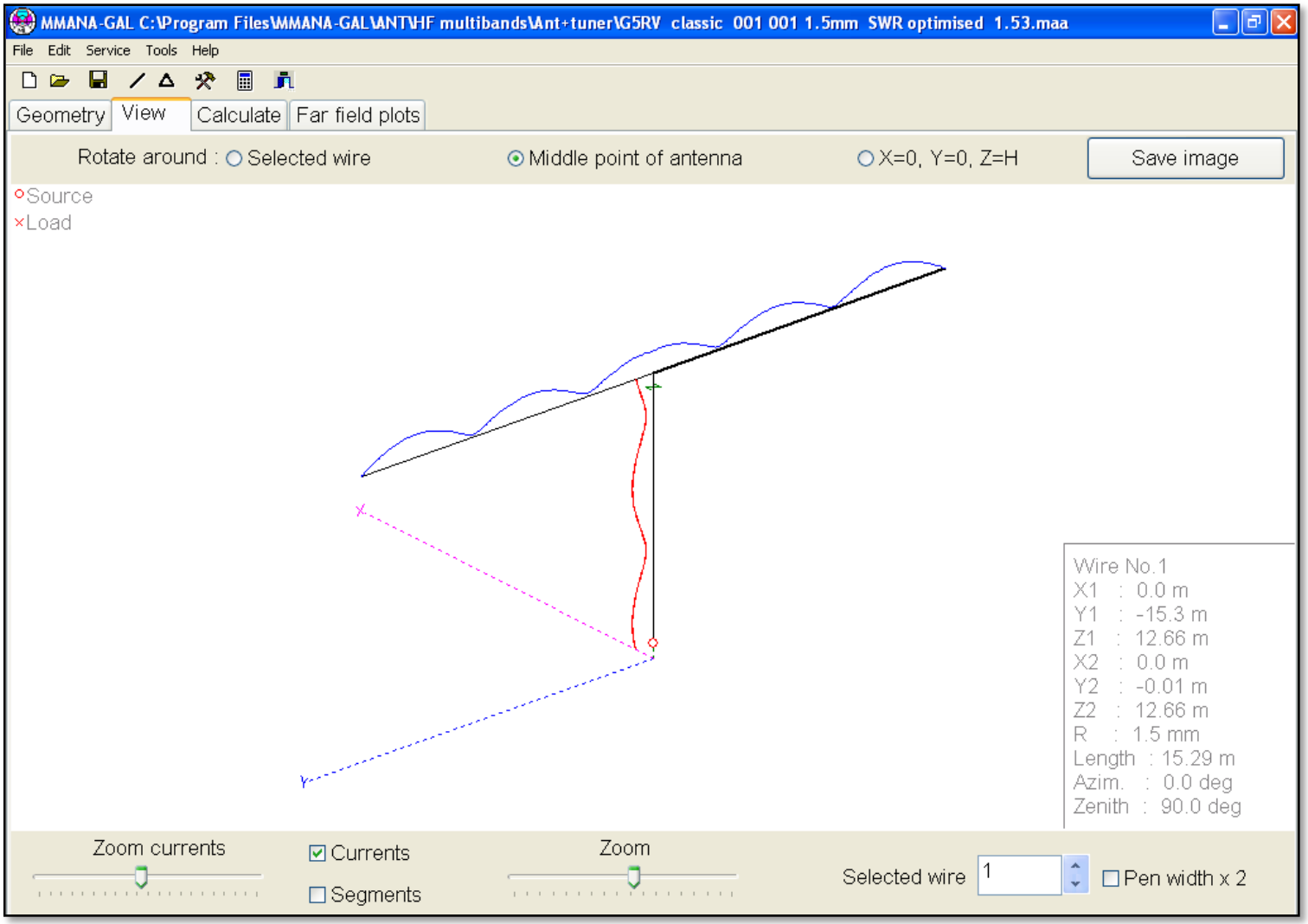
21.20 MHz



Classic G5RV-Flat top T Radiation Patterns

300R feeder bottom @ +1m above "Real" Ground &
Antenna optimised for SWR 1.53 :1 @ 14.15 MHz

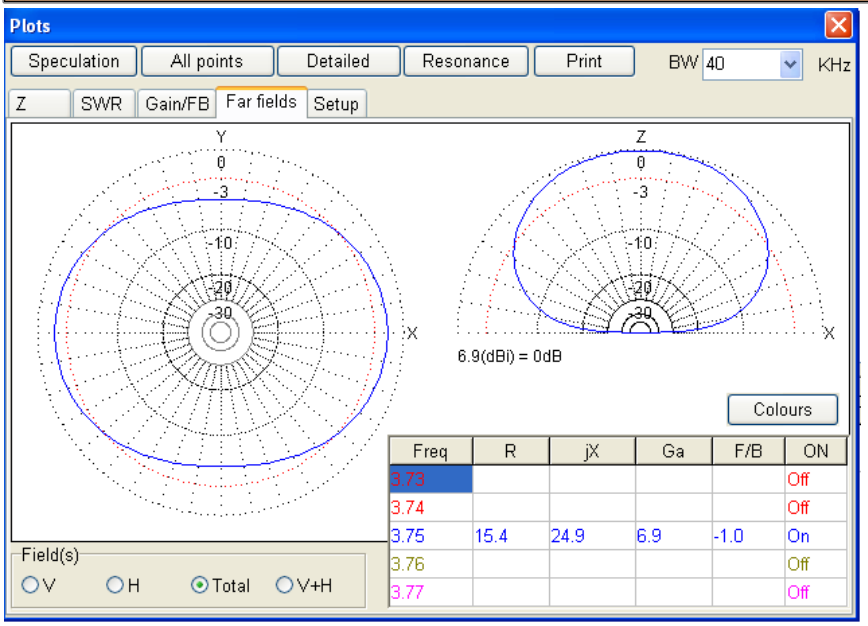
24.940 MHz

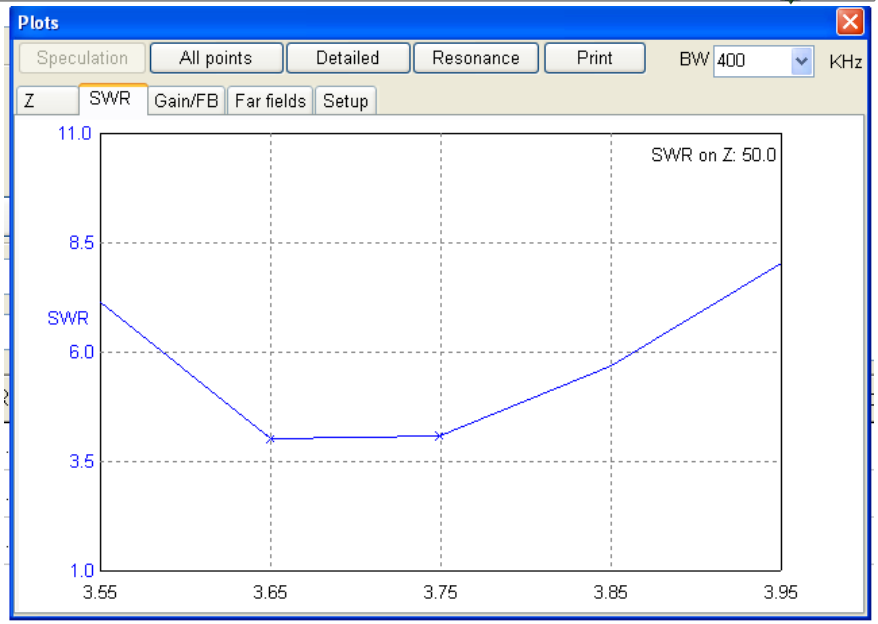


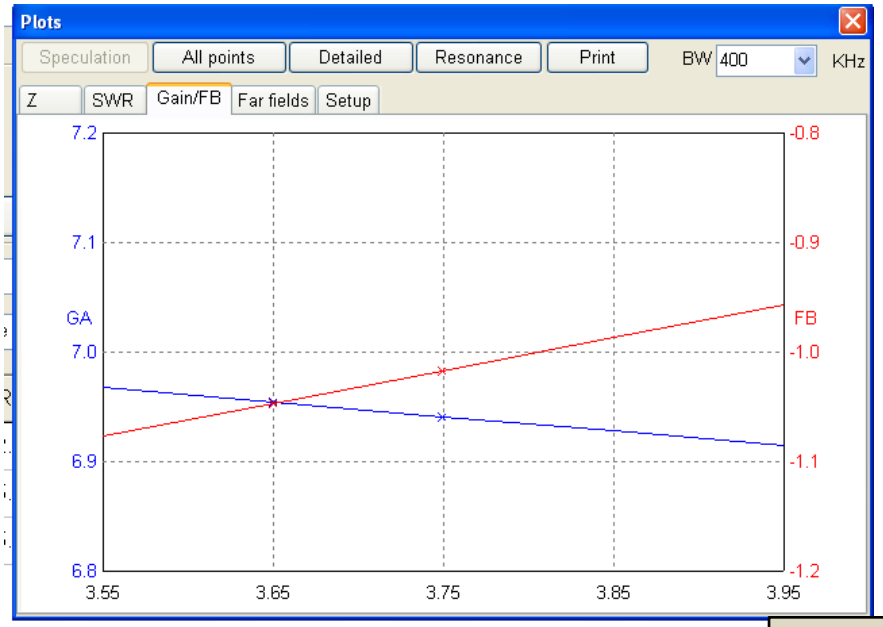
Classic G5RV-Flat top T Radiation Patterns
300R feeder bottom @ +1m above "Real" Ground &
Antenna optimised for SWR 1.53 :1 @ 14.15 MHz

Classic G5RV-Flat top T Radiation Patterns

300R feeder bottom @ +1m above "Real" Ground & Antenna optimised for SWR 1.68 :1 @ 14.15 MHz



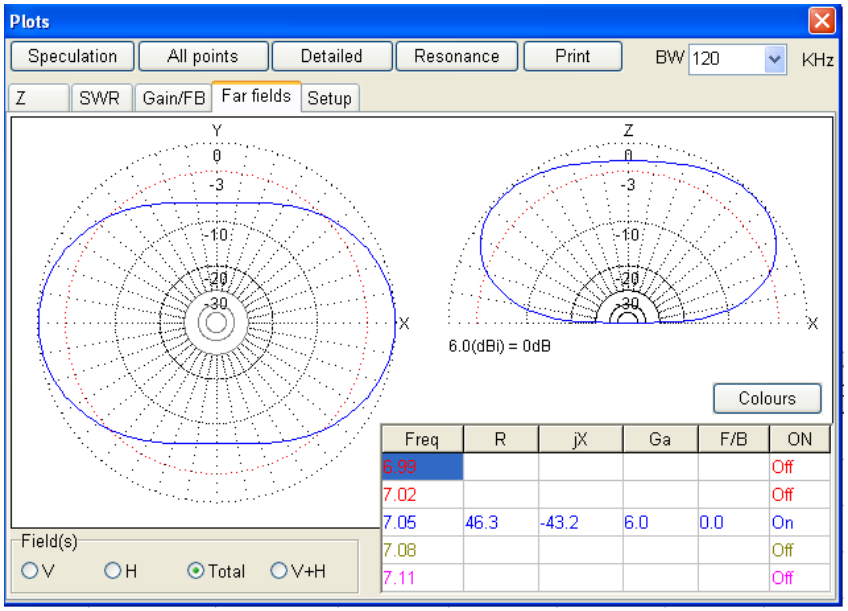


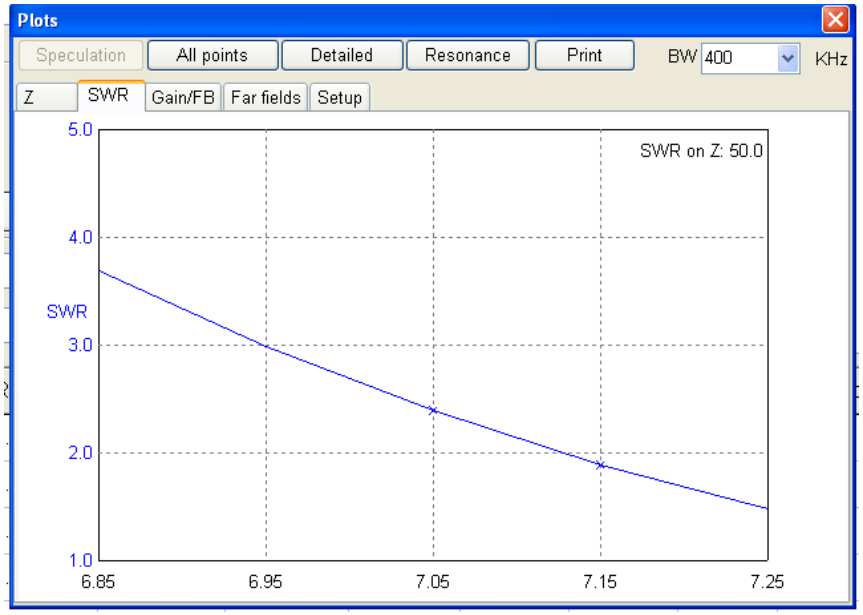


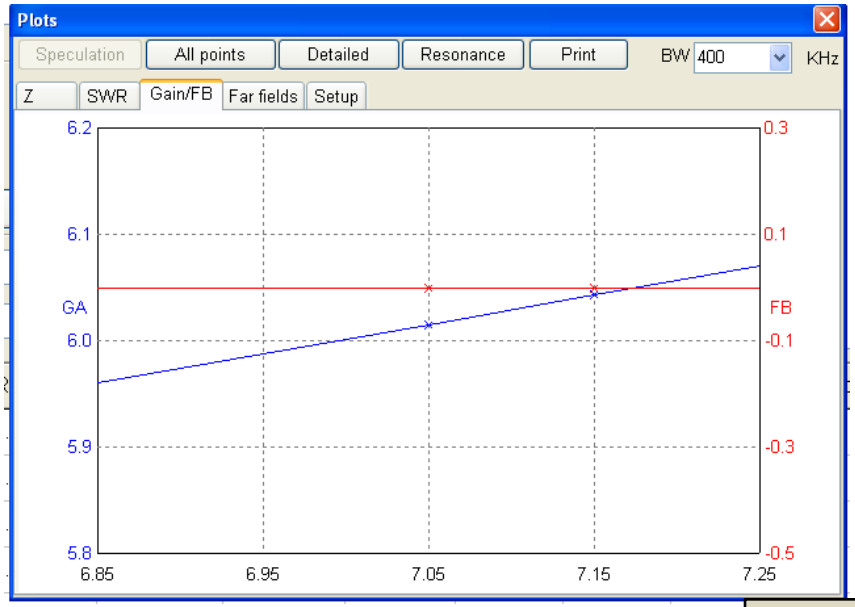
3.75 MHz

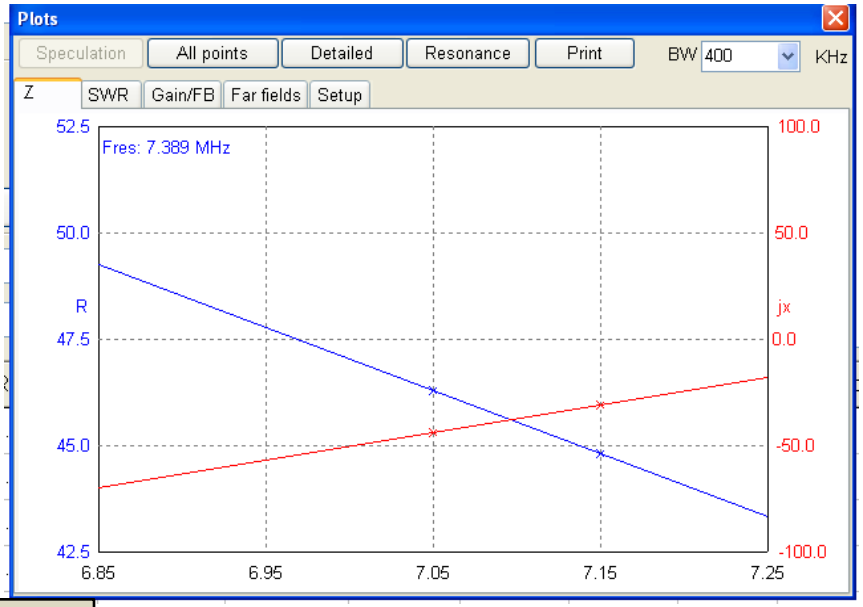
Classic G5RV-Flat top T Radiation Patterns

300R feeder bottom @ +1m above "Real" Ground & Antenna optimised for SWR 1.53 :1 @ 14.15 MHz





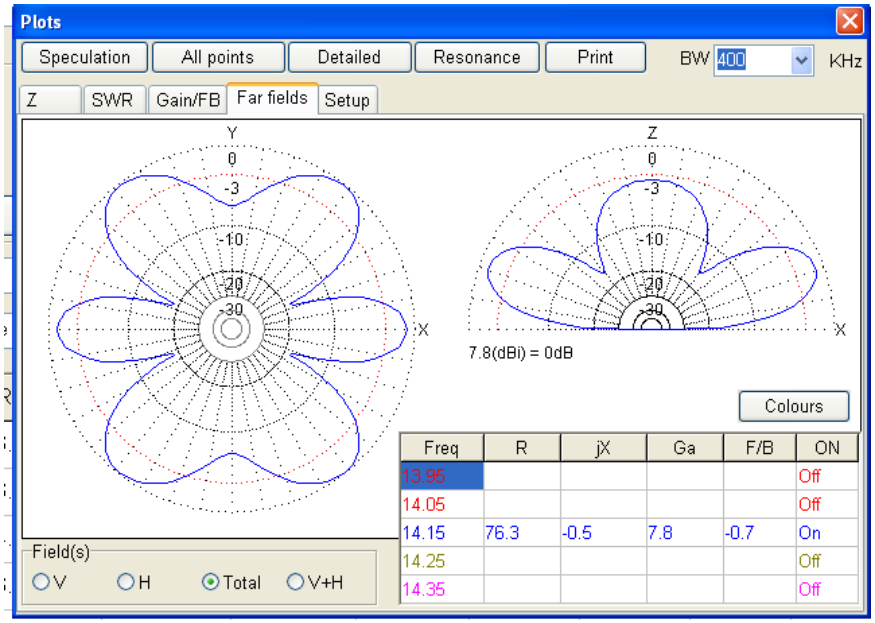


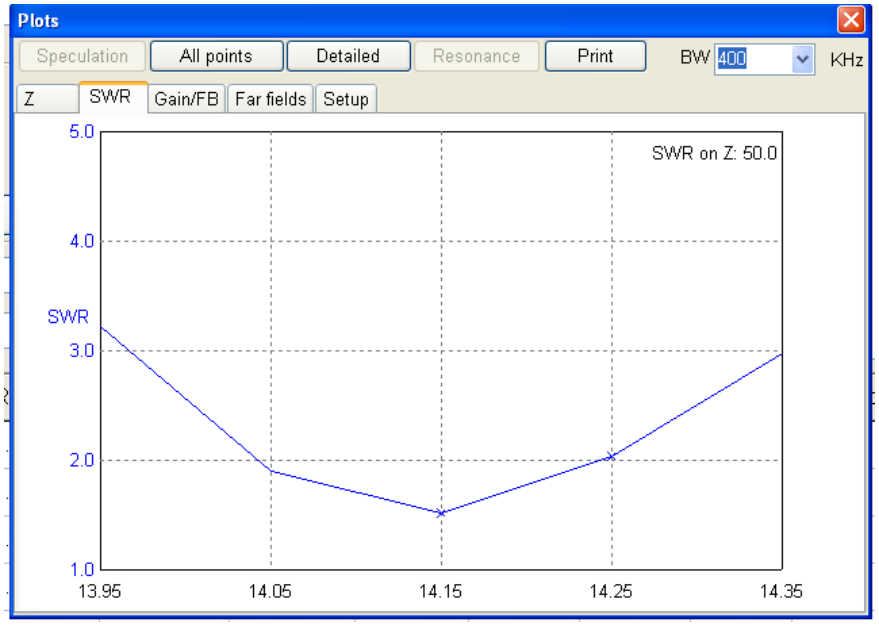


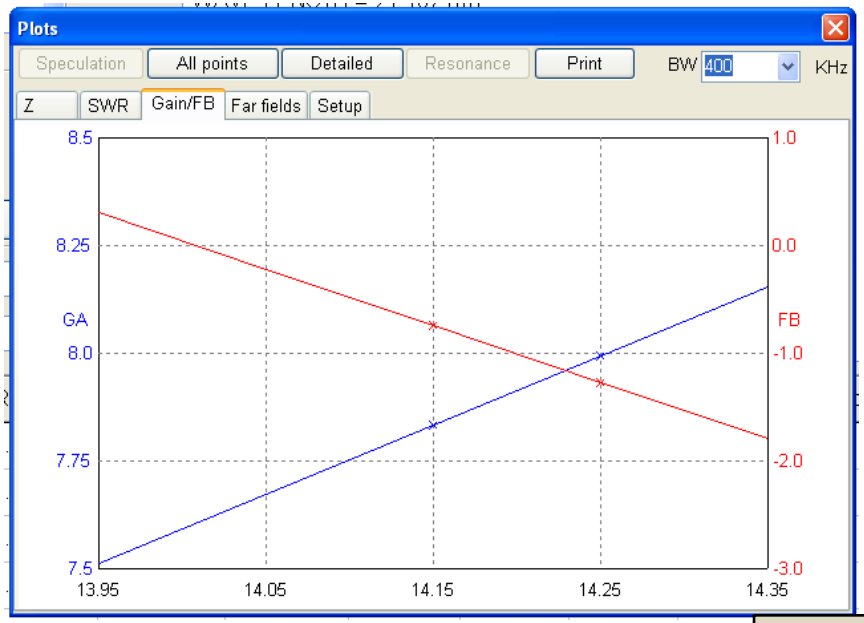
7.05 MHz

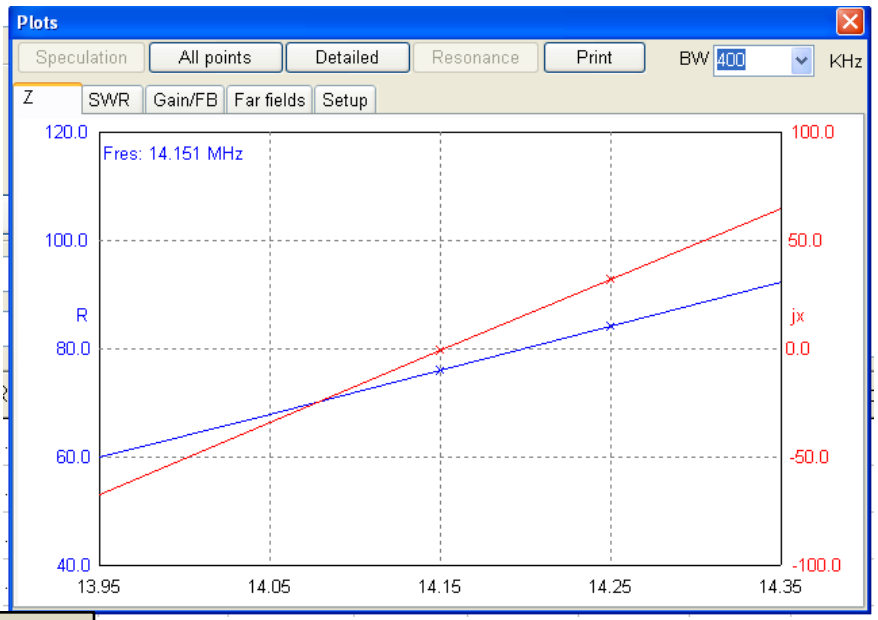
Classic G5RV-Flat top T Radiation Patterns

300R feeder bottom @ +1m above "Real" Ground & Antenna optimised for SWR 1.53 :1 @ 14.15 MHz





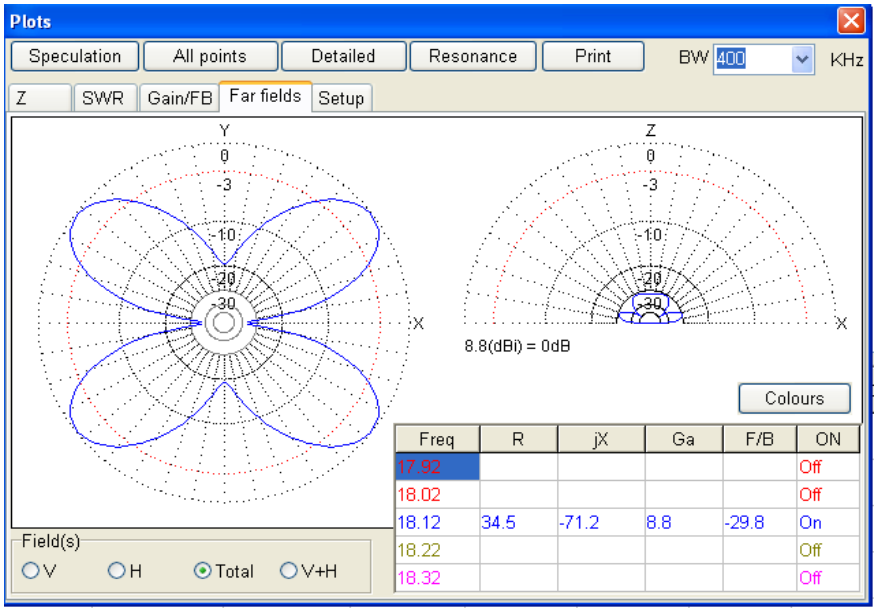


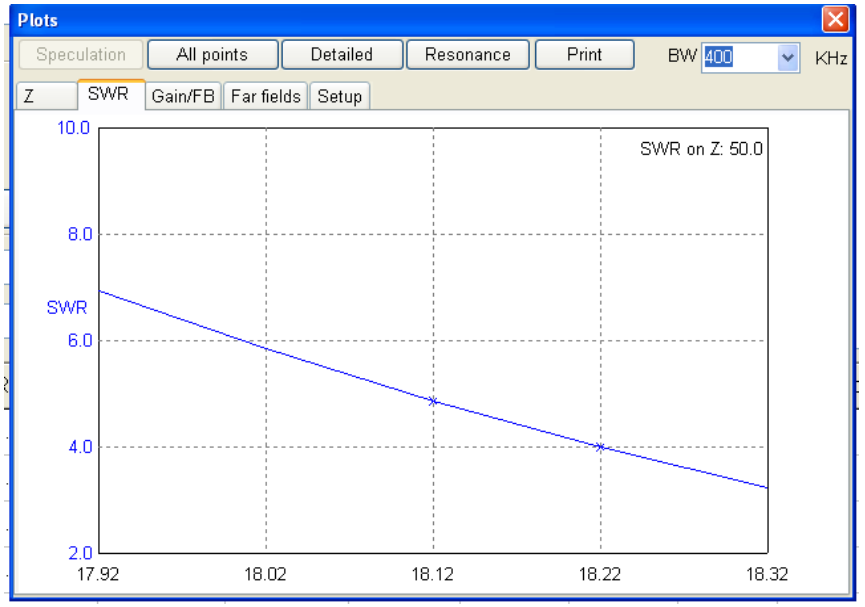


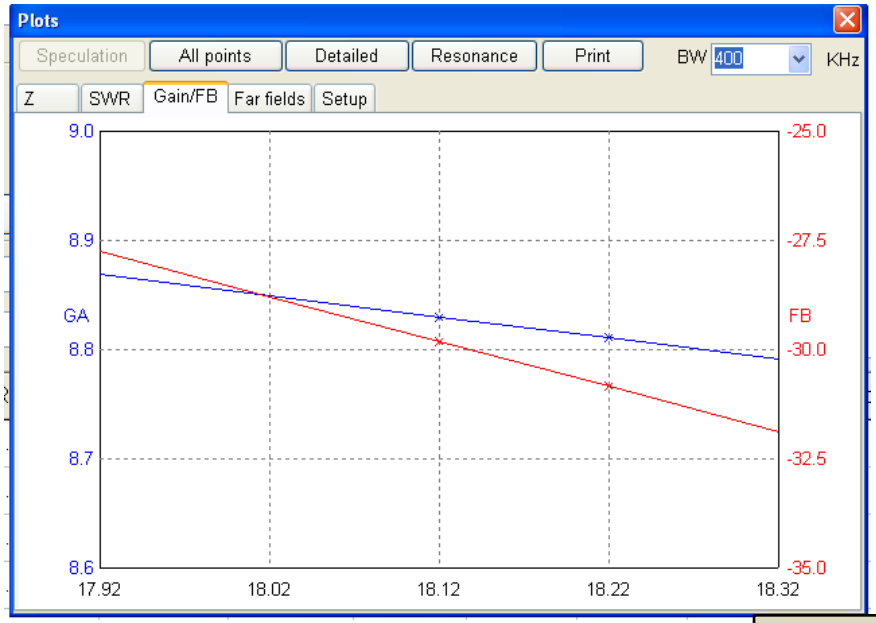
14.15 MHz

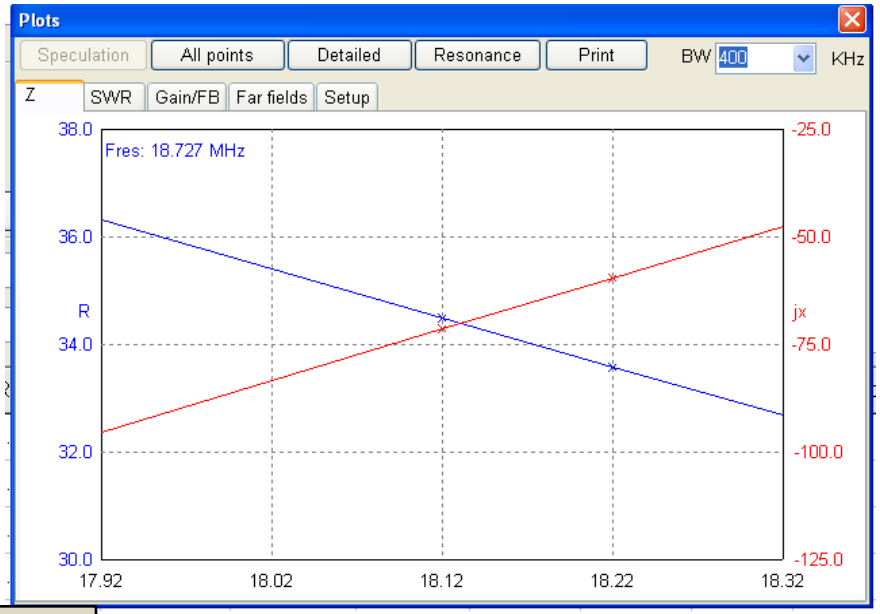
Classic G5RV-Flat top T Radiation Patterns

300R feeder bottom @ +1m above "Real" Ground & Antenna optimised for SWR 1.53 :1 @ 14.15 MHz





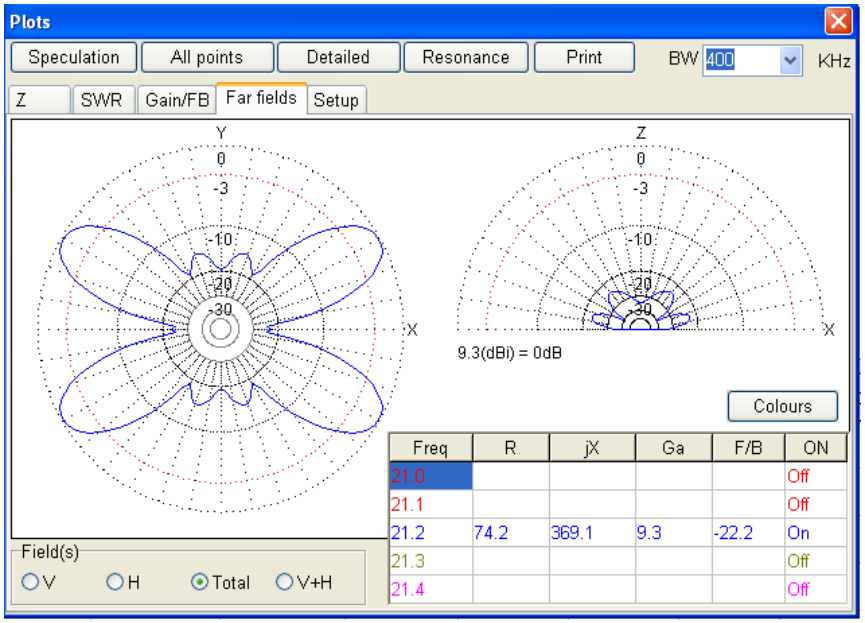


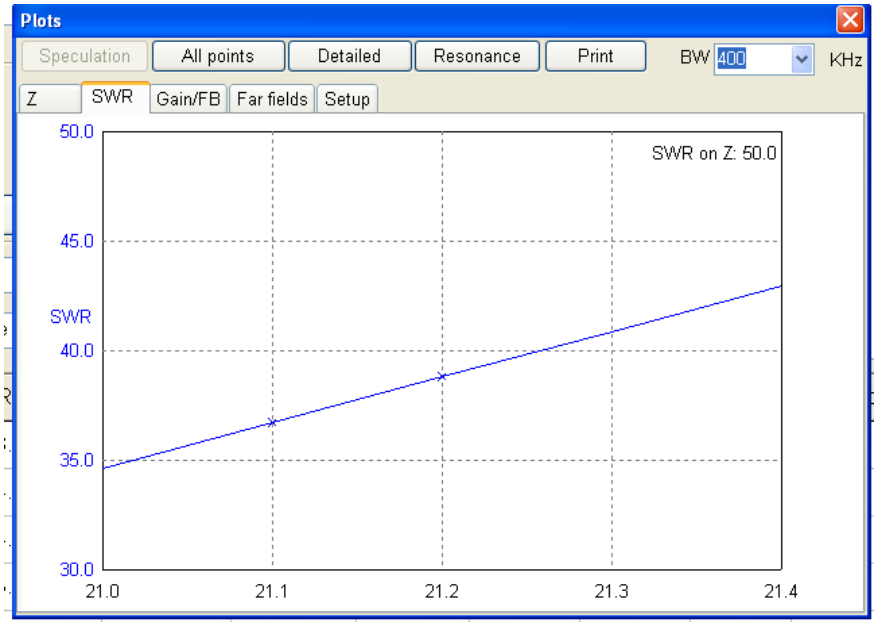


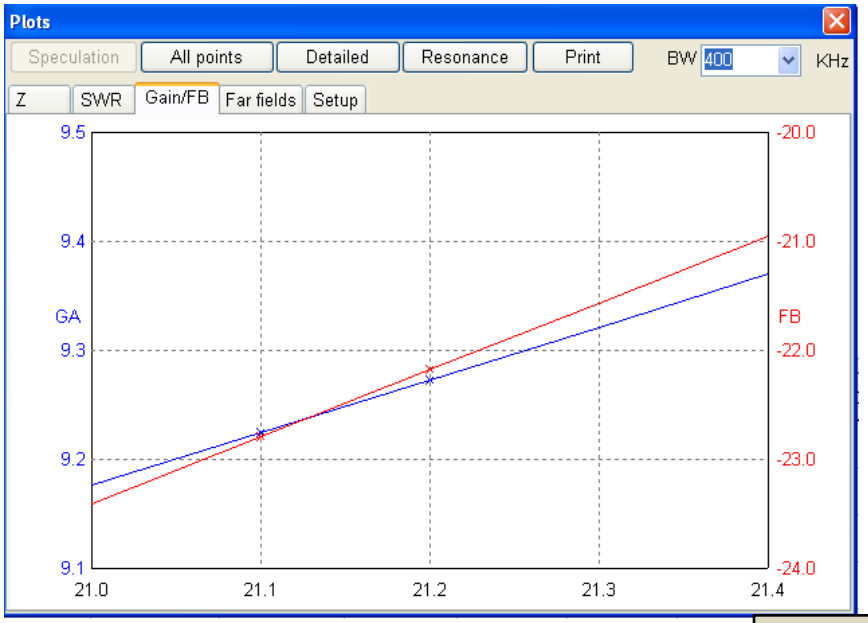
18.12 MHz

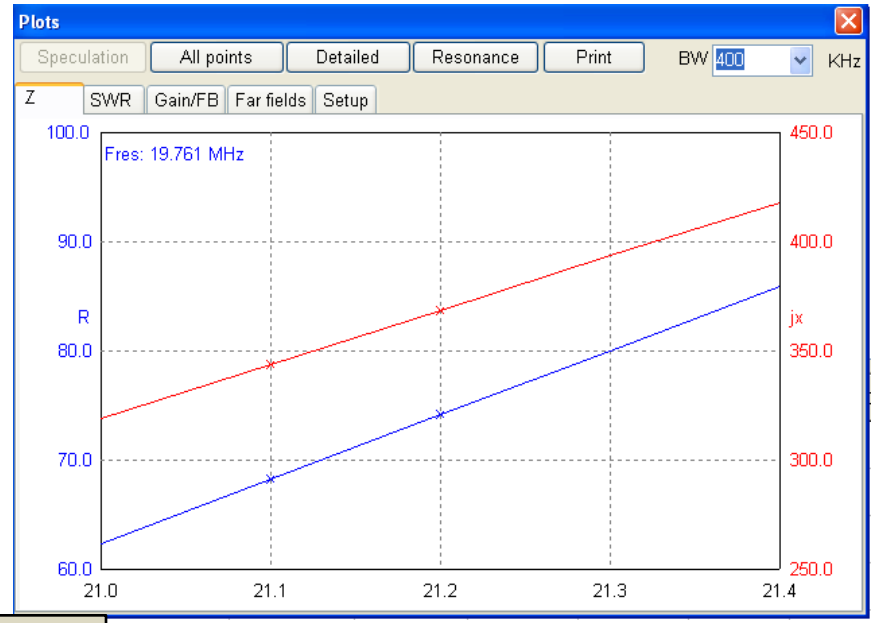
Classic G5RV-Flat top T Radiation Patterns

300R feeder bottom @ +1m above "Real" Ground & Antenna optimised for SWR 1.53 :1 @ 14.15 MHz









21.20 MHz

Classic G5RV-Flat top T Radiation Patterns

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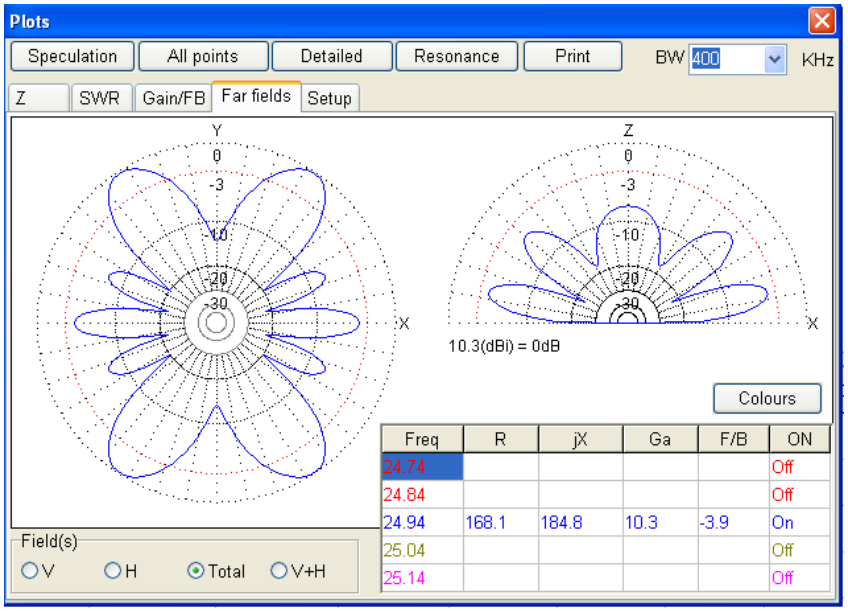
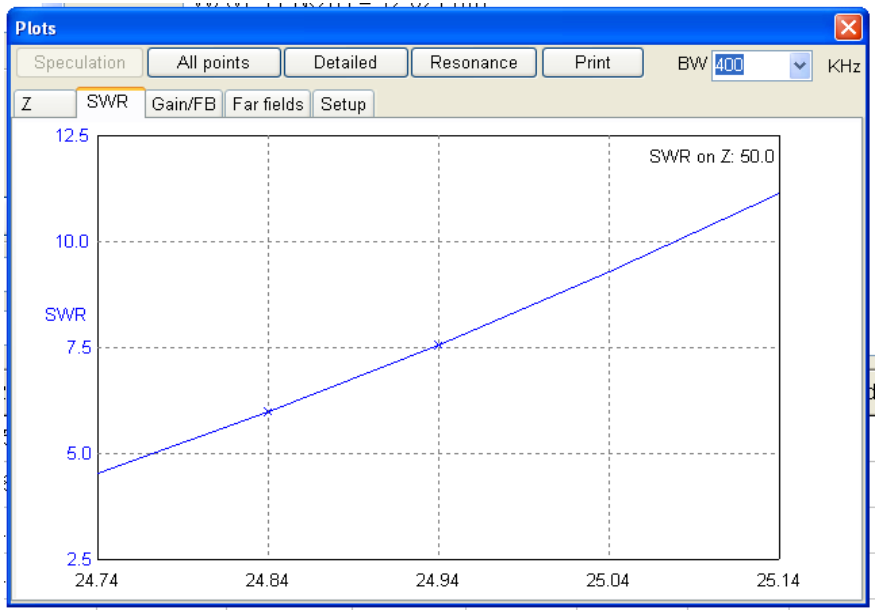
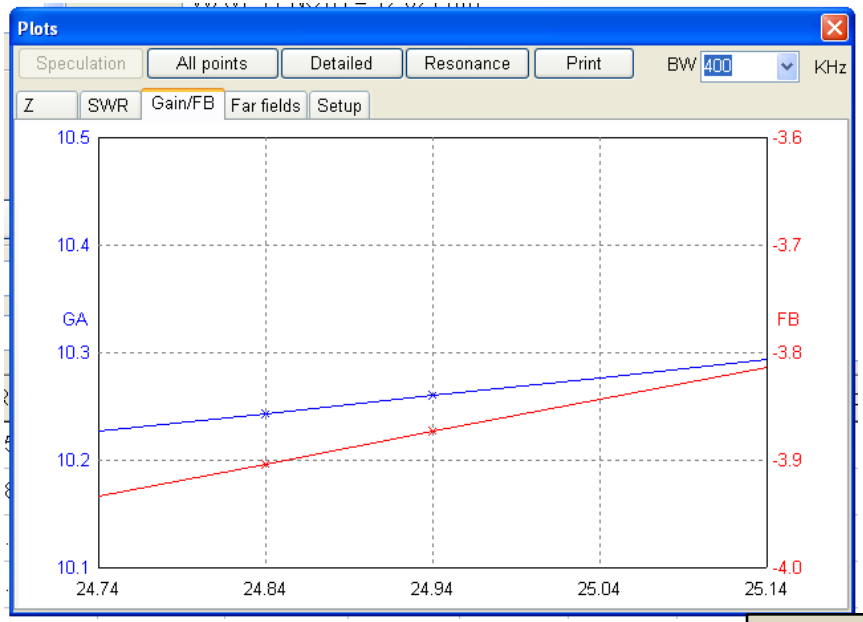
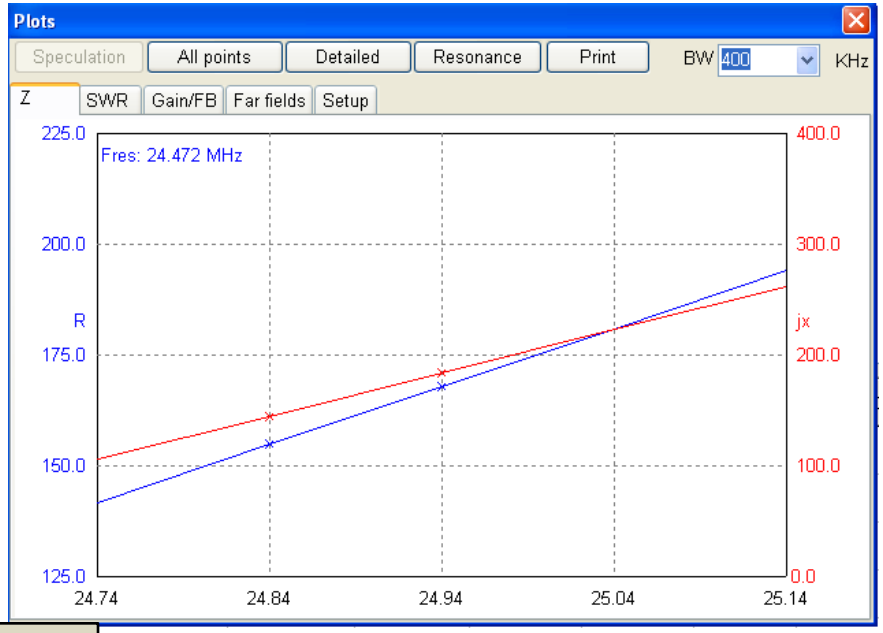




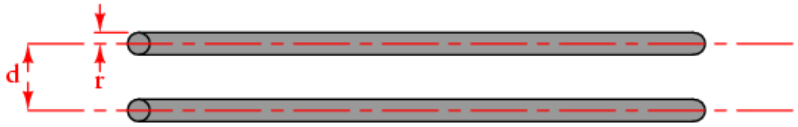




24.94 MHz

NOTES:-

The MMANA Program comes with a library of antenna models, one of which is the G5RV. There are also some transmission lines modelled . The simple checks at the beginning of this study indicated that the section of "300 ohm" transmission line used in the MMANA-GAL model appeared to be a very close approximation to the ideal. It also gave some confidence that the program would yield reasonable results for the G5RV. SEE APPENDIX A& B



$$Z_0 = \frac{276}{\sqrt{k}} \log \frac{d}{r}$$

Where,

Z_0 = Characteristic impedance of line
d = Distance between conductor centers
r = Conductor radius
k = Relative permittivity of insulation between conductors

The MMANA-GAL G5RV model provides reasonable results, that closely match those of other studies that can be viewed on the internet. The effects of the ground conditions in the real world will obviously modify the way in which the G5RV operates . This study used the default values provided by the designers of the program . Hopefully the results are close to the G5RV Louis Varney operated from his QTH in West Sussex England

APPENDIX A

Classic G5RV-Flat top T Radiation Patterns

Check of the vertical 300R feeder 5 m long model & bottom @ +1m

MMANA-GAL C:\Program Files\MMANA-GAL\ANT\Feeders\1.5mm (001-001) 5metre line 300R x.maa

File Edit Service Tools Help

Geometry | View | Calculate | Far field plots

Freq 24.940 MHz

Ground
- Free space
- Perfect
- Real — Ground setup

Add height 1 m

Material Cu wire

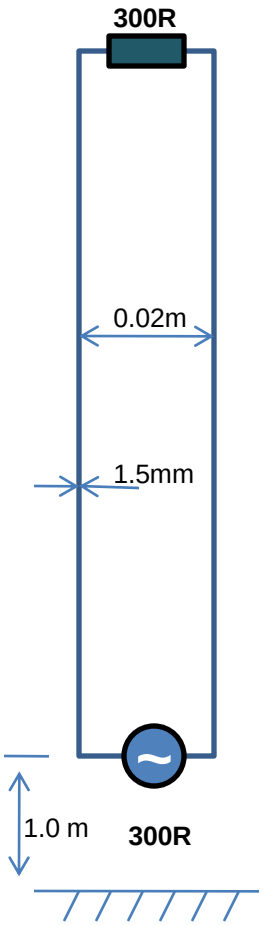
```
WAVE LENGTH = 12.021 (m)
TOTAL PULSE = 56
THE LOWEST POINT OF ANTENNA = 2.000 M
FILL MATRIX...
FACTOR MATRIX...
PULSE     U (V)          I (mA)          Z (Ohm)          SWR
w4        1.00+j0.00     3.02+j0.16      329.73-j17.62    1.12
CURRENT DATA...
FAR FIELD ...
NO FATAL ERROR(S)
0.09 sec
```

Real ground setup

No.	Dielec.	Conduct(mS/m)	X (m)	Height(m)
1	13.0	5.0	0.0	0

No.	F (MHz)	R (Ohm)	jX (Ohm)	SWR 300	Gh dBd	Ga dBi	F/B dB	Elev.	Ground	Add H.	Polar.
6	24.94	329.7	-17.62	1.12	---	-42.92	---	30.5	Real	1.0	hori.
5	21.2	339.2	-7.546	1.13	---	-45.7	---	34.2	Real	1.0	hori.
4	18.12	365.6	8.019	1.22	---	-48.56	---	37.8	Real	1.0	hori.
3	14.15	361.2	33.46	1.24	---	-52.95	---	44.5	Real	1.0	hori.
2	7.05	318.1	31.85	1.13	---	-63.54	-0.84	90.0	Real	1.0	vert.
1	3.75	305.6	19.42	1.07	---	-73.0	-1.32	90.0	Real	1.0	vert.

5 m long
Test Txm Line



NOTE -1 MMANA-GAL cannot model insulation dielectric , consequently the transmission line has to be modelled as an open wire feeder - shown in the diagram at the side. A 5m length of line was used for the initial check -- Results are within acceptable limits.

APPENDIX B

Classic G5RV-Flat top T Radiation Patterns

Check of the vertical 300R feeder 11 m long model & bottom @ +1m

MMANA-GAL C:\Program Files\MMANA-GAL\ANT\Feeders\1.5mm (001-001) 11 metre line 300R x.maa

File Edit Service Tools Help

Geometry | View | Calculate | Far field plots

Freq 24.940 MHz

Ground
- Free space
- Perfect
- Real — Ground setup

Add height 1 m

Material Cu wire

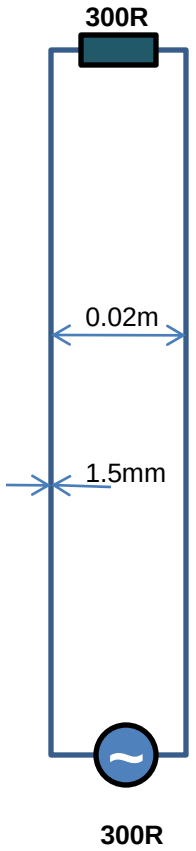
```
WAVE LENGTH = 12.021 (m)
TOTAL PULSE = 96
THE LOWEST POINT OF ANTENNA = 2.000 M
FILL MATRIX...
FACTOR MATRIX...
PULSE     U (V)          I (mA)          Z (Ohm)          SWR
w4        1.00+j0.00     3.00+j0.09      332.70-j10.29    1.11
CURRENT DATA...
FAR FIELD ...
NO FATAL ERROR(S)
0.2 sec
```

Real ground setup

No.	Dielec.	Conduct(mS/m)	X (m)	Height(m)
1	13.0	5.0	0.0	0

No.	F (MHz)	R (Ohm)	jX (Ohm)	SWR 300	Gh dBd	Ga dBi	F/B dB	Elev.	Ground	Add H.	Polar.
12	24.94	332.7	-10.29	1.11	---	-42.76	---	47.3	Real	1.0	hori.
11	21.2	326.2	16.27	1.1	---	-44.08	---	18.0	Real	1.0	hori.
10	18.12	302.6	10.26	1.04	---	-44.94	---	21.4	Real	1.0	hori.
9	14.15	312.3	-42.36	1.15	---	-47.59	---	26.7	Real	1.0	hori.
8	7.05	425.8	45.64	1.45	---	-57.78	---	46.2	Real	1.0	hori.
7	3.75	346.7	74.75	1.31	---	-65.96	-0.96	90.0	Real	1.0	vert.

11 m long
Test Txm Line



NOTE -2 The second check used the same Appendix A MMANA –GAL model , but the length increased to 11m - close to what would be used in practice. -- Results confirmed the model is within acceptable limits for use with the G5RV Antenna model.