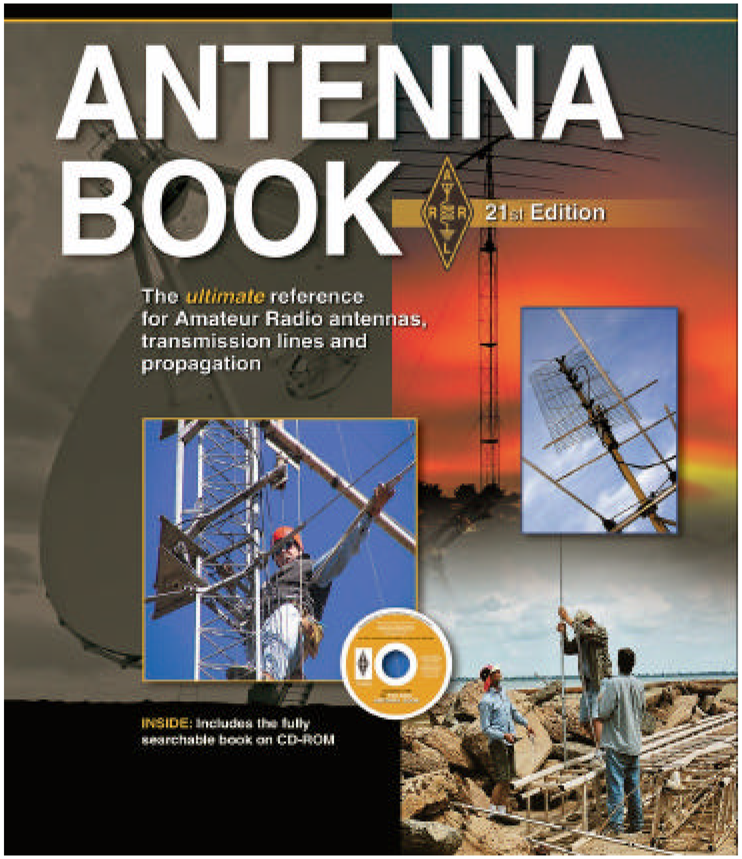
What's New in the 21st Edition of *The ARRL Antenna Book*?

By R. Dean Straw, N6BV
Senior Assistant Technical Editor, ARRL

Dayton, May 2007



What's New in the 21st Edition of *The ARRL Antenna Book*?

It's hard to imagine that this is the fifth Edition of *The ARRL Antenna Book* for which I've been Handling Editor! Goodness, how time flies.

Changes in the 21st Edition

- About 20% of the book changed materially.
- The complete printed book is on the CD-ROM bundled with the book, just like the 20th Edition. Plus there are software programs and data on the CD-ROM.

Changes in the 21st Edition

- I received tremendous help from the following contributors:
  - Roy Lewallen, W7EL – Chap 8, Multielement Arrays
  - Rudy Severns, N6LF -- Chap 27, Measurements

Changes

Here are some examples of the kind of changes you'll find in the paper book.

As usual, you'll find lots of comparisons of antennas thanks to the latest computer modeling software.

Here are some highlights from Chapter 6, **Low-Frequency Antennas**.

Chap 6, Low-Frequency Antennas

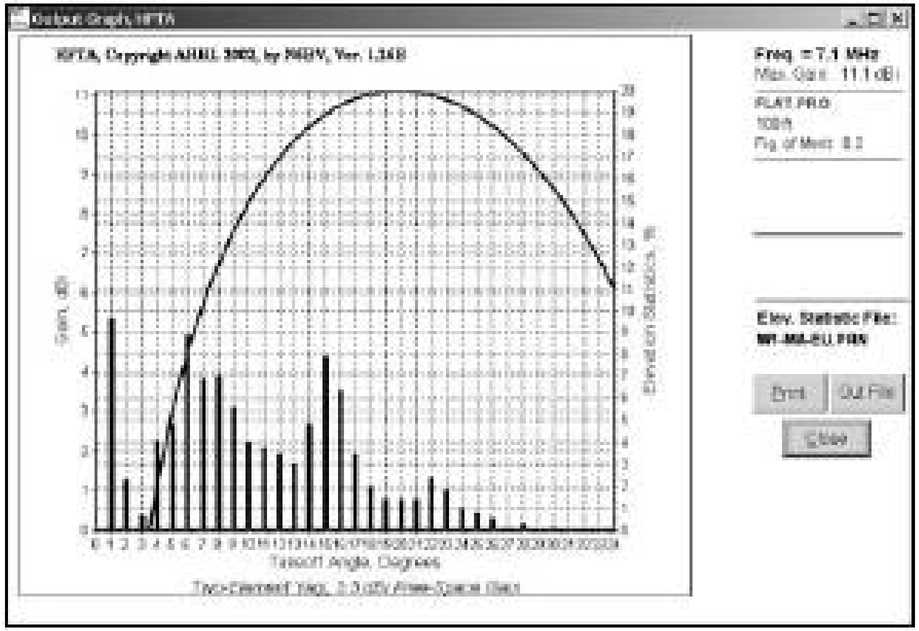


Fig 1—Screen capture from *HFTA* (HF Terrain Assessment) program showing elevation response for 100-foot high dipole over flat ground on 7.1 MHz, with bar-graph overlay of the statistical elevation angles needed over the whole 11-year solar cycle from New England (Boston) to all of Europe. Even a 100-foot high antenna cannot cover all the necessary angles.

The importance of low angles for low-band DXing.

Chap 6, Low-Frequency Antennas

NVIS

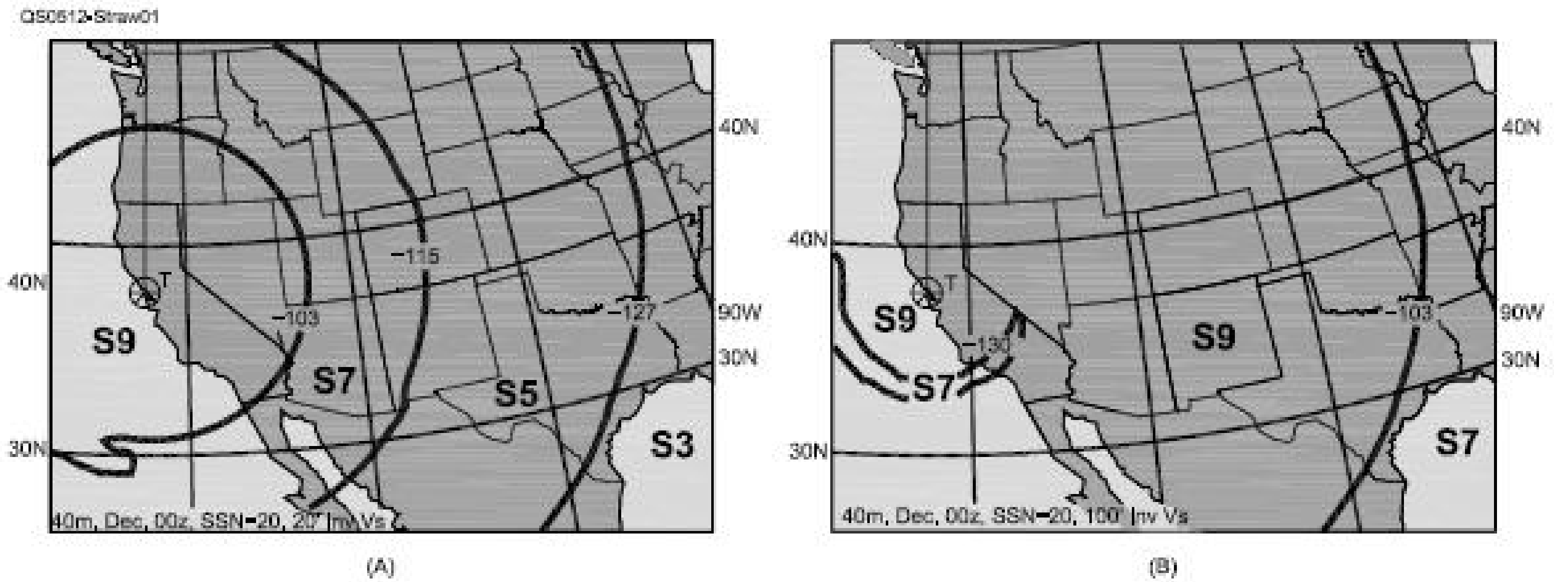


Fig 7—At A, Predicted 40 meter geographic coverage plot for a 100 W transmitter in December at 0000 UTC (near sunset), for a SSN (Smoothed Sunspot Number) of 20. The antennas used are 20 foot-high inverted V dipoles. At B, 40 meter coverage for same date and time, but for 100 foot-high flattop dipoles. Most of California is well covered with S9 signals in both cases, but there is more susceptibility in the higher dipole case to thunderstorm crashes coming from outside California, for example from Arizona or even Texas. Such noise can interfere with communications inside California.

More coverage of NVIS techniques.

Chap 6, Low-Frequency Antennas

NVIS

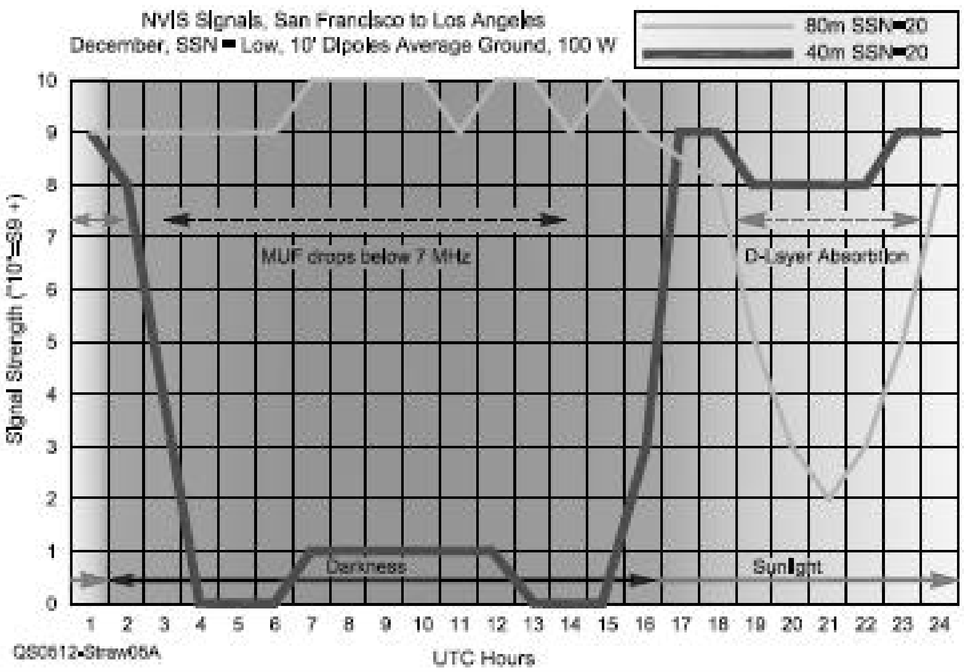


Fig 11—VOACAP calculations for a 350 mile path from San Francisco to Los Angeles, using 10 foot-high flattop dipoles. This plot shows the signal strength in S Units ("S10" = S9+10) for a worst-case month/SSN combination—winter solstice, in December, for a low level of solar activity (SSN = 20). The 40-meter signal drops to a very low level during the night because the MUF drops well below 7.2 MHz. The 80-meter signal drops in the afternoon because of D-layer absorption. For 24-hour communications on this path, the rule of thumb is to select 40 meters during the day and 80 meters during the night.

More coverage of NVIS techniques.

Chap 6, Low-Frequency Antennas

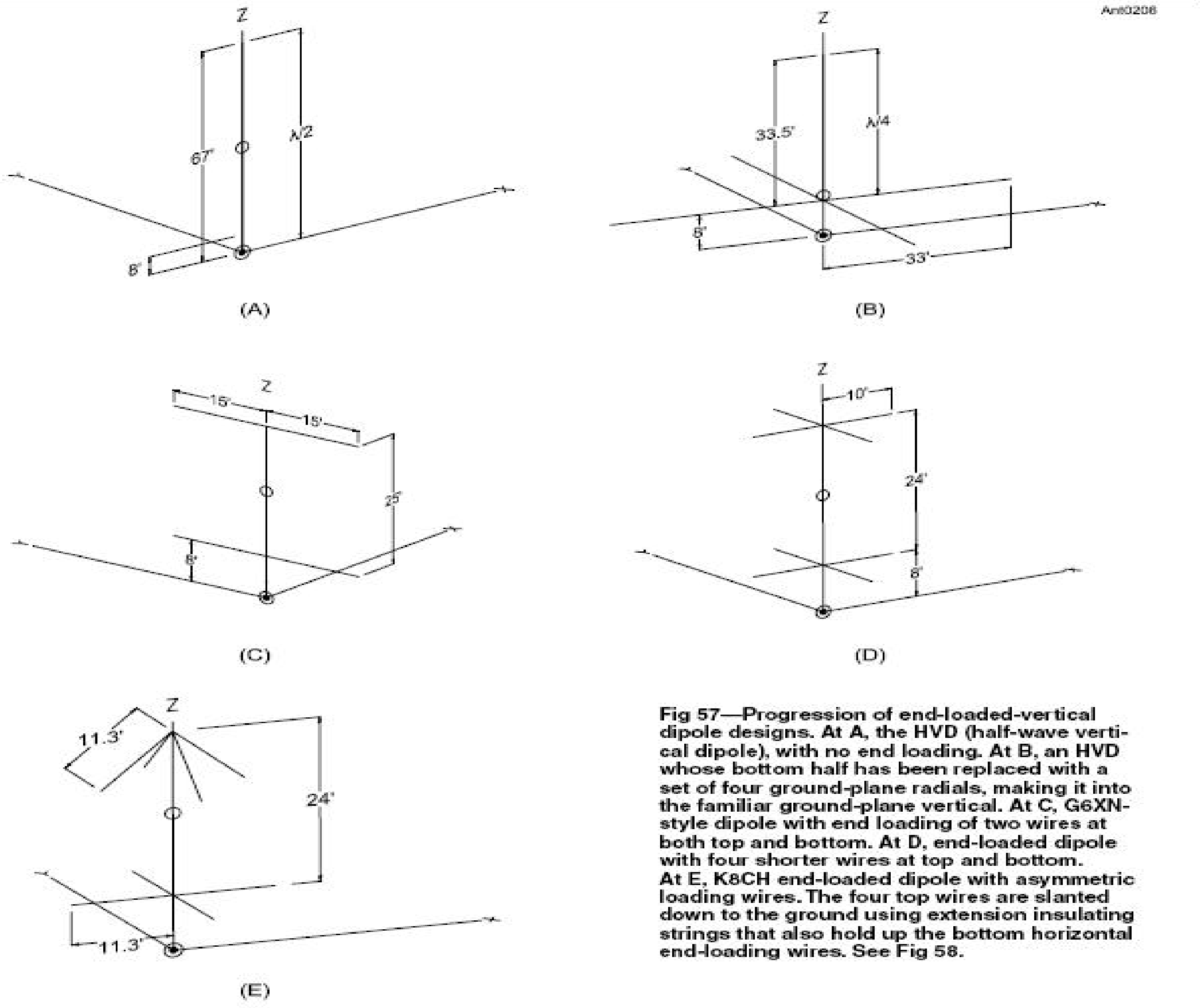


Fig 57—Progression of end-loaded-vertical dipole designs. At A, the HVD (half-wave vertical dipole), with no end loading. At B, an HVD whose bottom half has been replaced with a set of four ground-plane radials, making it into the familiar ground-plane vertical. At C, G6XN-style dipole with end loading of two wires at both top and bottom. At D, end-loaded dipole with four shorter wires at top and bottom.
At E, K8CH end-loaded dipole with asymmetric loading wires. The four top wires are slanted down to the ground using extension insulating strings that also hold up the bottom horizontal end-loading wires. See Fig 58.

Chap 6, Low-Frequency Antennas

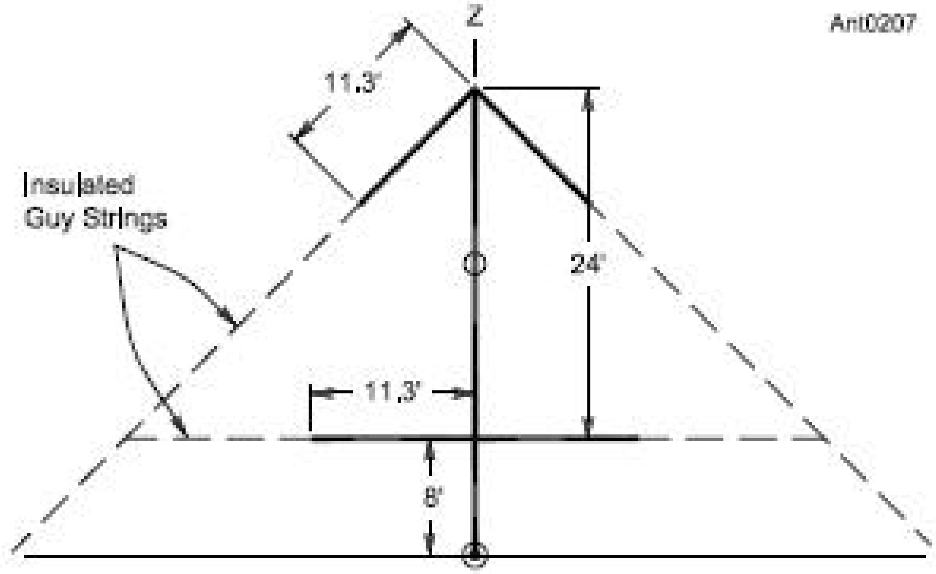


Fig 58—Layout of CVD made using #14 wire suspended from a tree branch.

A 40-meter CVD – Compact Vertical Dipole.

Chap 6, Low-Frequency Antennas

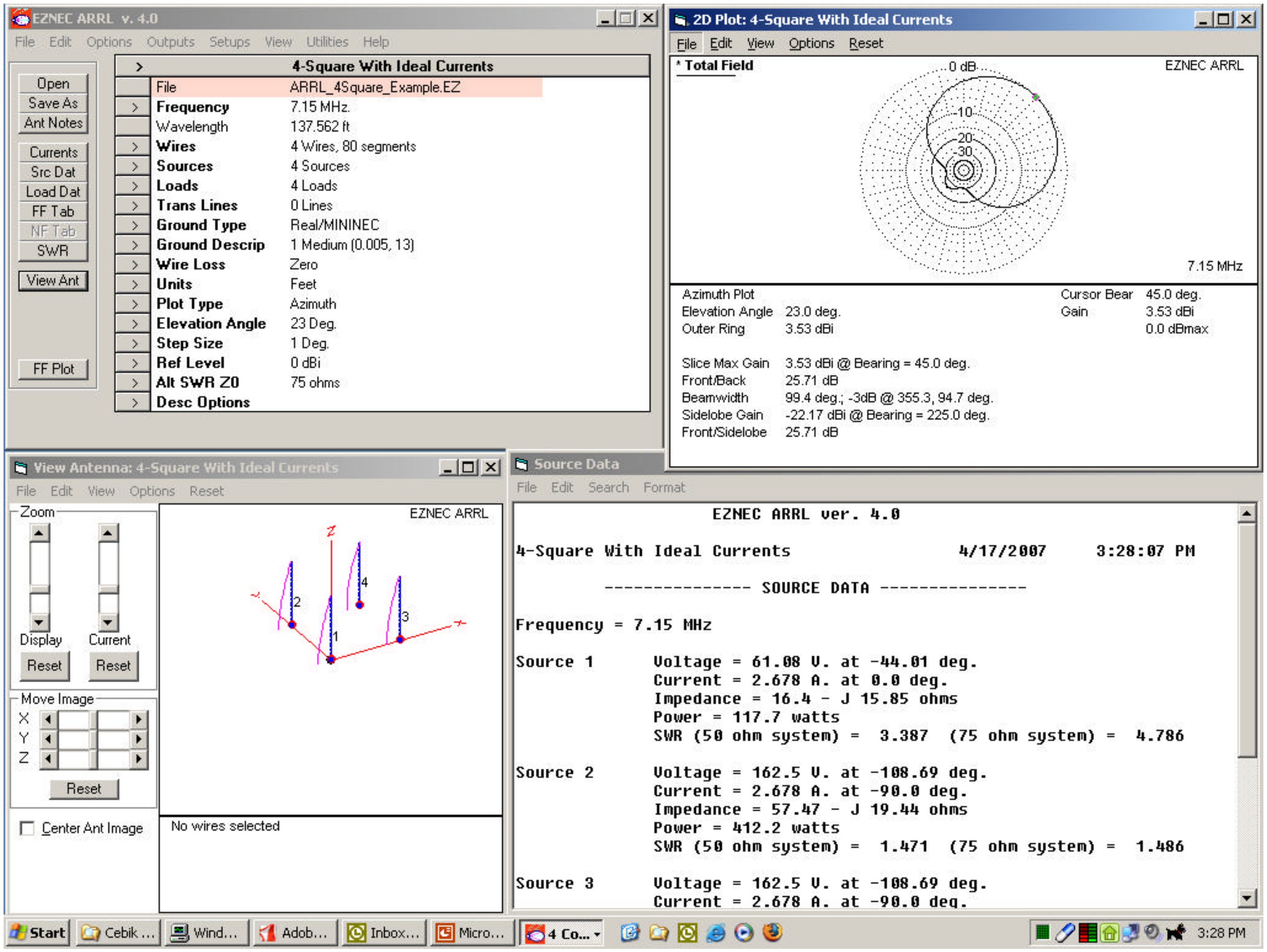
Table 9
Variations on a Vertical Center-Fed Dipole

Name	*Style Fig 57*	*Vertical Length feet*	*Spoke Length feet*	*Min. Ht feet*	*Max. Gain dBi*	*2:1 SWR kHz*	*Hairpin Coil µH*	*Center Load µH*
20 Meters								
GP	B	17.53	16.53	8	0.29	400	—	—
CVD 1	C	13	7.57	8	0.12	625	—	—
CVD 2	D	12	5.1	8	0.00	550	0.68	0.68
CVD 3	E	12.15	5.6	8	–0.01	450	0.5	0.5
30 Meters								
GP	B	24.54	23.14	8	0.04	400	—	—
CVD 1	E	24	5.33	8	–0.2	500	—	—
CVD 2	E	17	7.60	8	–0.36	400	0.82	0.82
40 Meters								
HVD	A	66	—	8	0.13	450	—	—
GP 1	B	35	33	8	–0.12	325	—	—
GP 2	B	34.5	33	2	–0.37	400	—	—
CVD 1	C	25	15	8	–0.42	450	—	—
CVD 2	C	24	15	2	–1.09	400	—	—
CVD 3	D	24	10	8	–0.55	425	—	0.25
CVD 4	D	24	5	8	–0.85	225	—	8.7
CVD 5	D	16	8	8	–1.18	175	0.94	6.8
CVD 6	E	24	11.3	8	–0.59	250	—	—
80 Meters								
HVD	A	135	—	8	0.19	225	—	—
GP	B	65.5	61	8	0.11	200	—	—
CVD 1	C	48.3	30	8	–0.27	200	—	—
CVD 2	E	46.5	21.9	8	–0.50	150	—	—

The CVD – Compact Vertical Dipole.

Some examples from Chapter 8, **Multielement Arrays** with special *EZNEC-ARRL* and *ArrayFeed1* software by Roy Lewallen, W7EL

Chap 8, Multielement Arrays



EZNEC-ARRL updated by Roy Lewallen, W7EL

Chap 8, Multielement Arrays

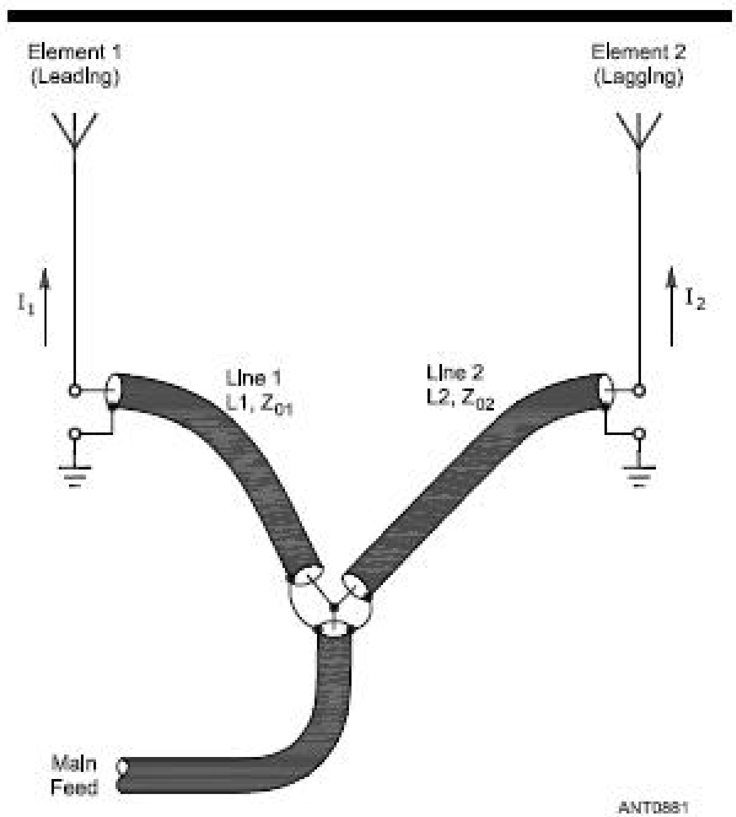
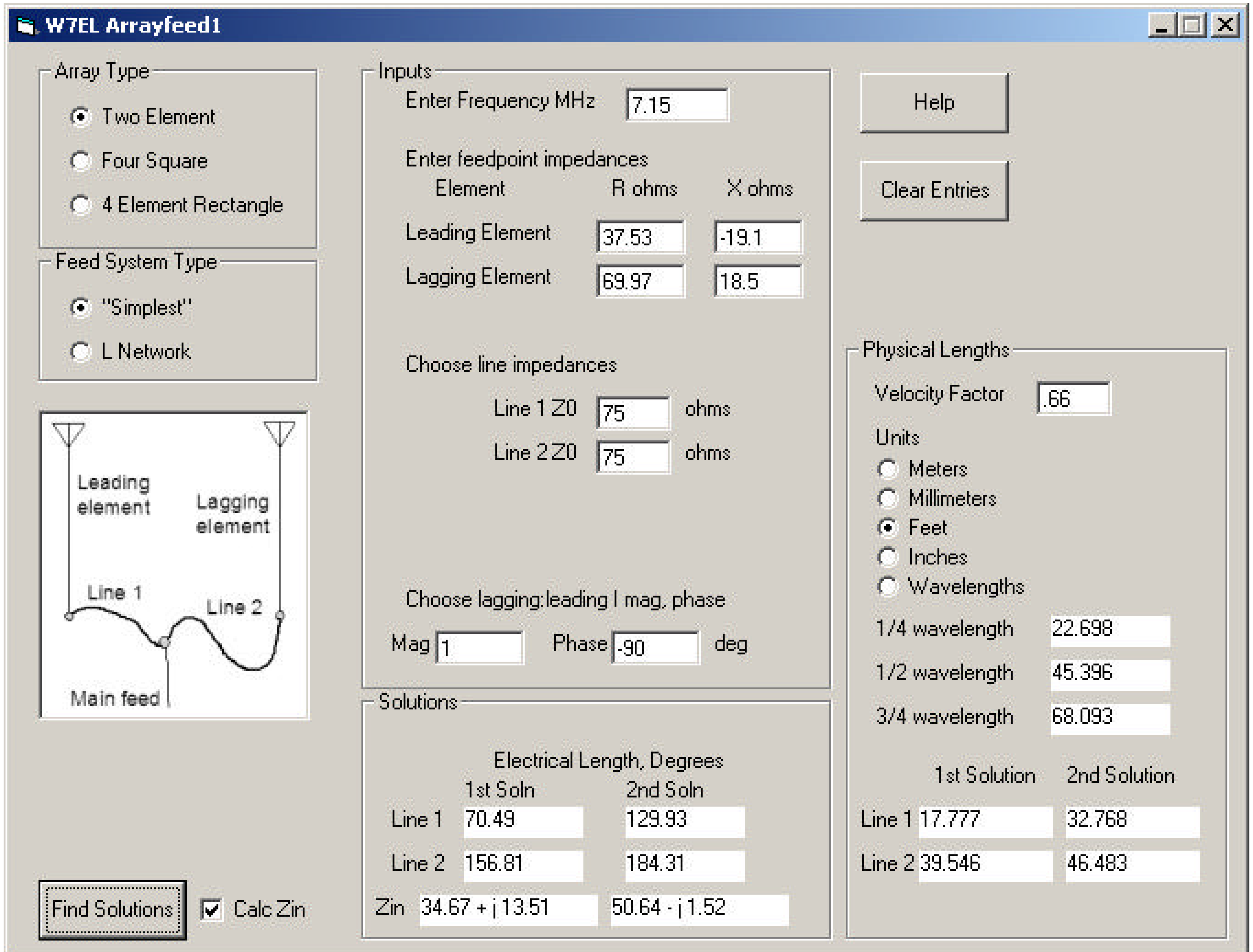


Fig 16—"Simplest" feed system for 2-element array. No matching or phasing network is used here, only transmission lines.

"Simplest" feed system, 2-element phased array.

Chap 8, Multielement Arrays



Arrayfeed1 and "simplest" feed system

Chap 8, Multielement Arrays

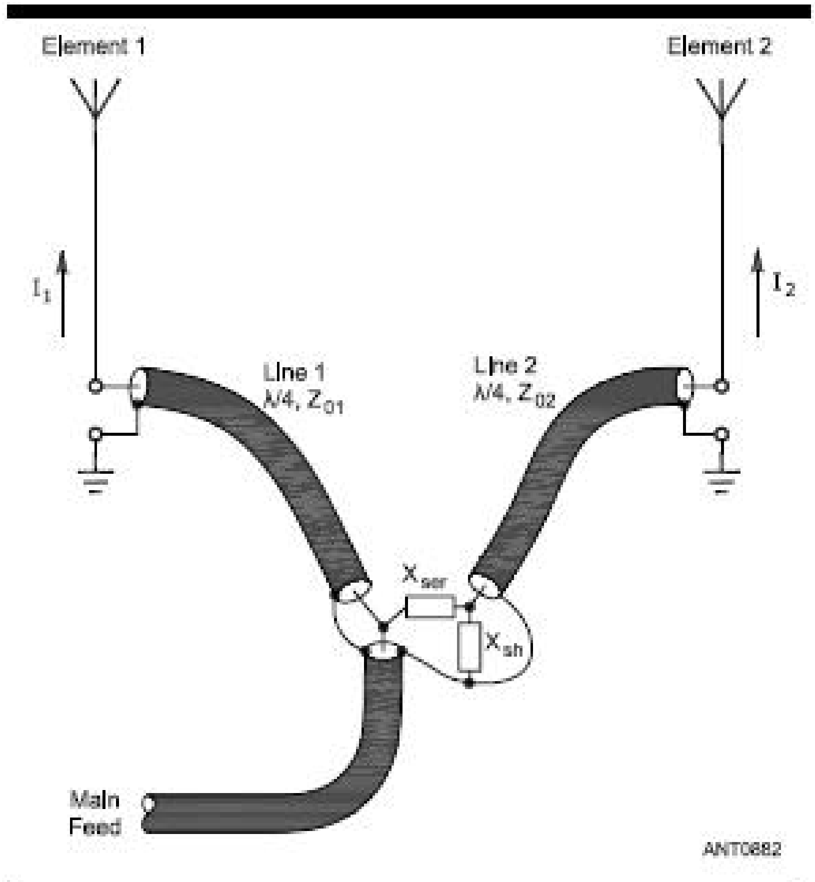
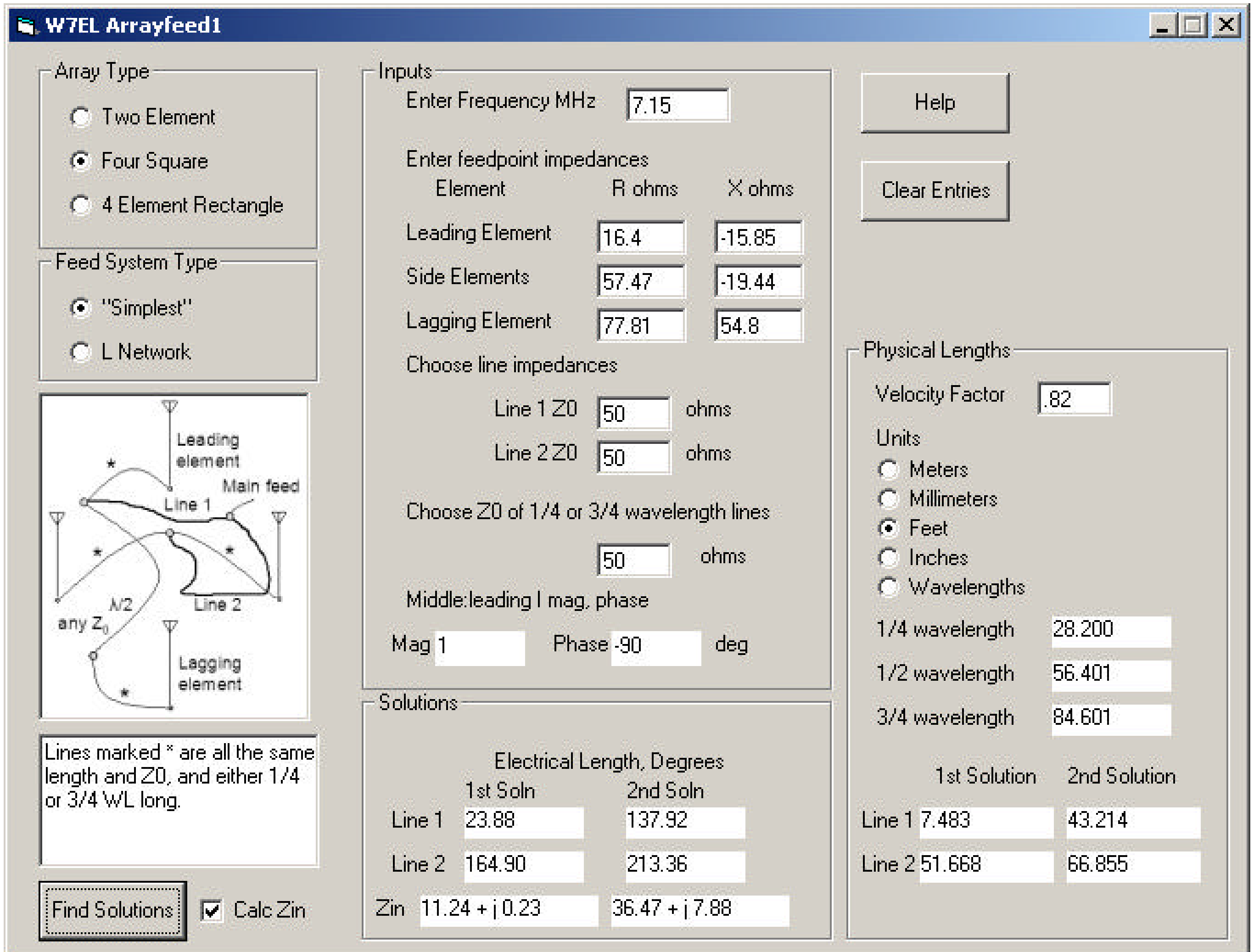


Fig 17— The addition of a simple L-network to Fig 16 allows you to easily adjust feeding of element pairs at other relative phase angles and/or magnitude ratios.

L-Network feed system for 2-element phased array

Chap 8, Multielement Arrays



Arrayfeed1 and “simplest” feed system for Four Square

Chapter 14,
Direction-Finding Antennas

Chap 14, Direction-Finding Antennas

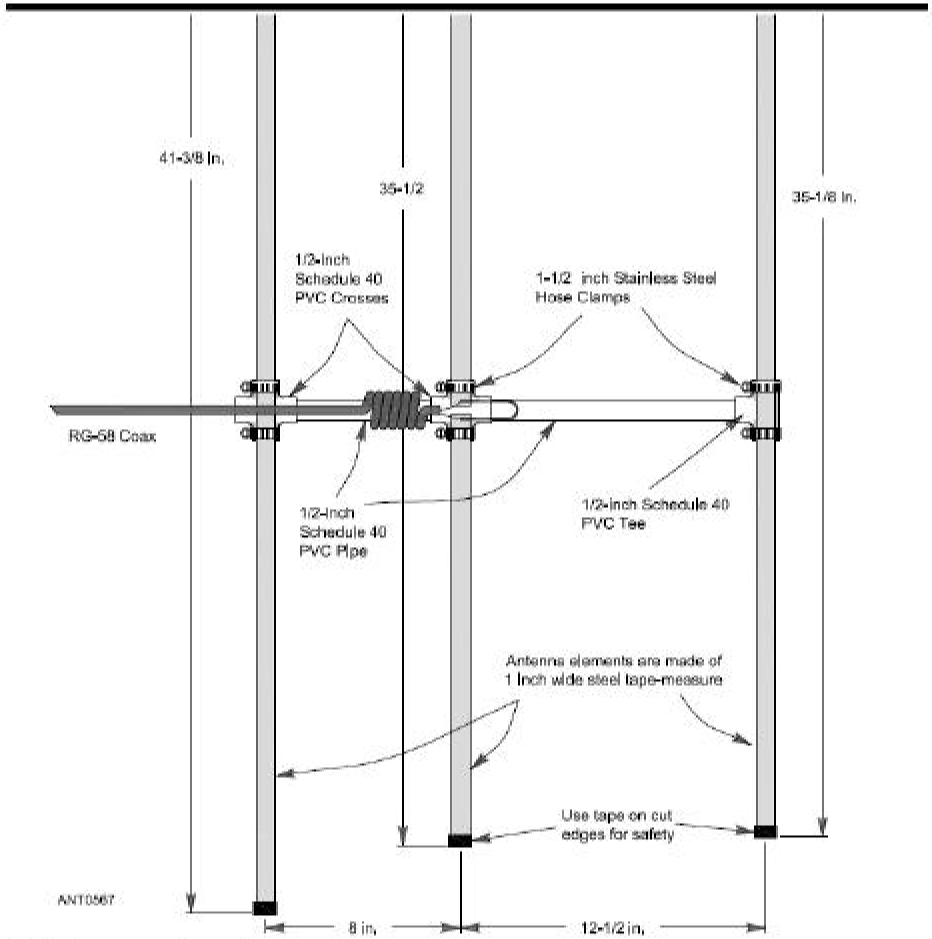


Fig 44—Tape-measure beam dimensions.

A Tape-Measure Beam for RDFing

Chapter 16,

Mobile and Maritime Antennas

Chap 16, Mobile Antennas

Fig 23—The completed Screwdriver antenna mounted on KO4TV's truck rear bumper. (*Photo courtesy of Gary Pearce, KN4AQ.*)

The “Screwdriver” mobile antenna

Chapter 23,

Radio Wave Propagation

Chap 23, Radio Wave Propagation

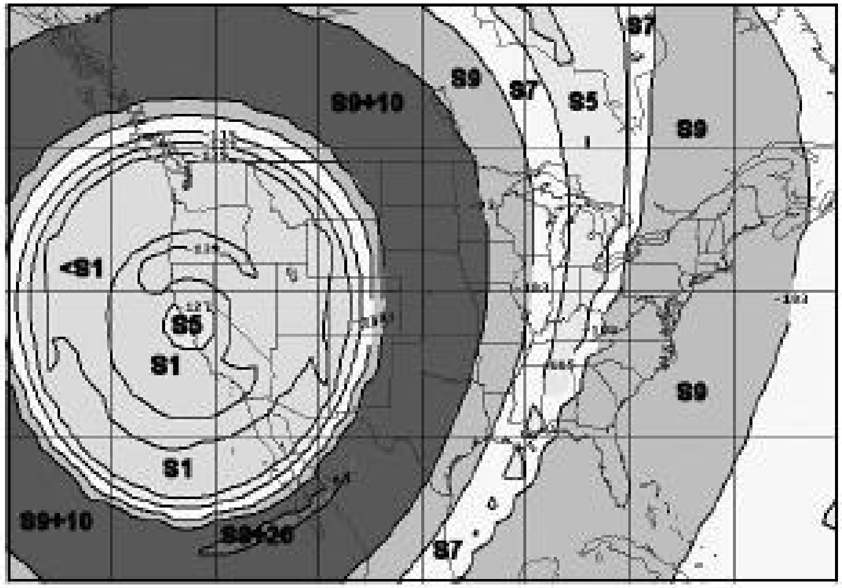


Fig 26—Modified *VOAAREA* plot for 21.2 MHz from San Francisco to the rest of the US, annotated with signal levels in S units, as well as signal contours in dBW (dB below a watt). Antennas are assumed to be 3-element Yagis at 55 feet above flat ground; the transmitter power is 1500 W; the month is November with SSN = 50, a moderate level of solar activity, at 22 UTC. The most obvious feature is the large "skip zone" centered on the transmitter in San Francisco, extending almost a 1/3 of the distance across the US.

Details on the concept of a "Skip Zone"

Chapter 27,
Antennas & Transmission Line Measurements

New coverage on Vector Network Analyzers (VNAs) by Rudy Severns, N6LF

Software Included with the 21st Edition of *The ARRL Antenna Book*

Windows Software:

TLW – Transmission Line for Windows

YW – Yagis for Windows

HFTA – HF Terrain Assessment

MicroDEM (by Peter Guth, US Naval Academy)

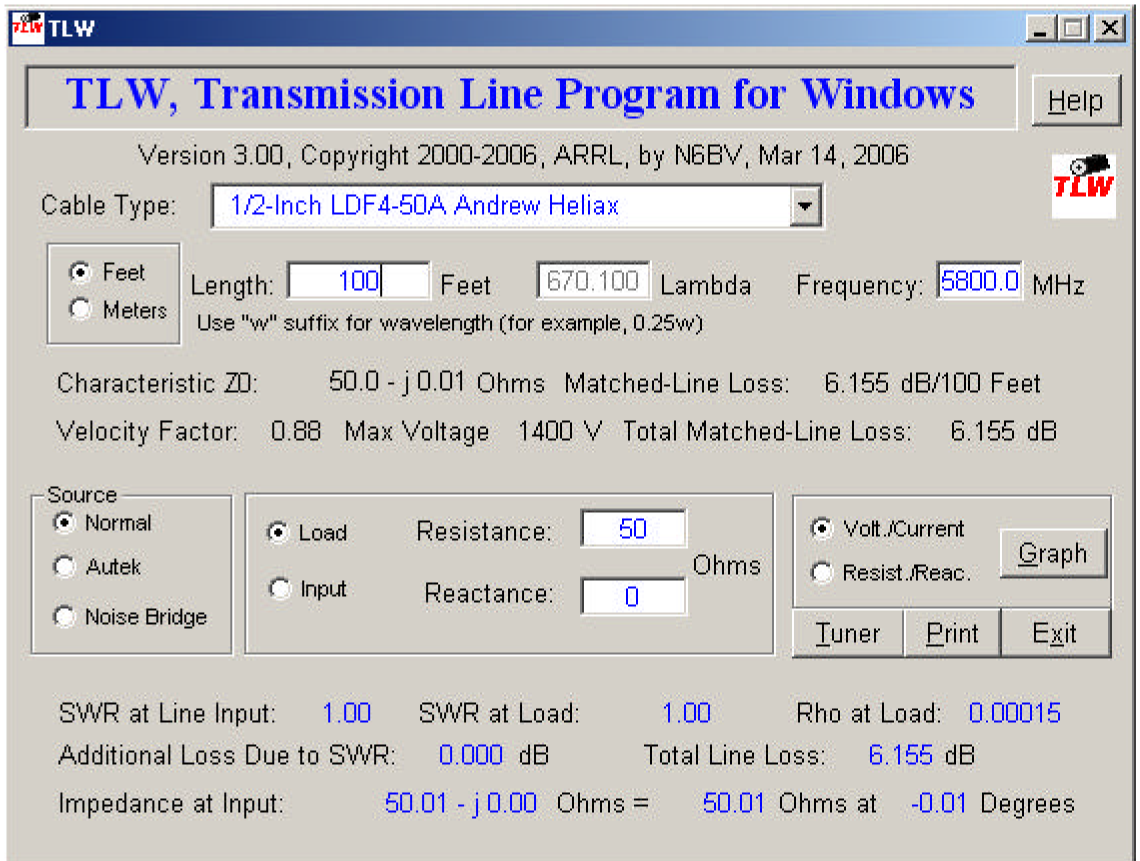
Geo Alert Wizard—ARRL (by Jim Tabor, KU5S)

Range-Bearing

ArrayFeed1 (by Roy Lewallen, W7EL)

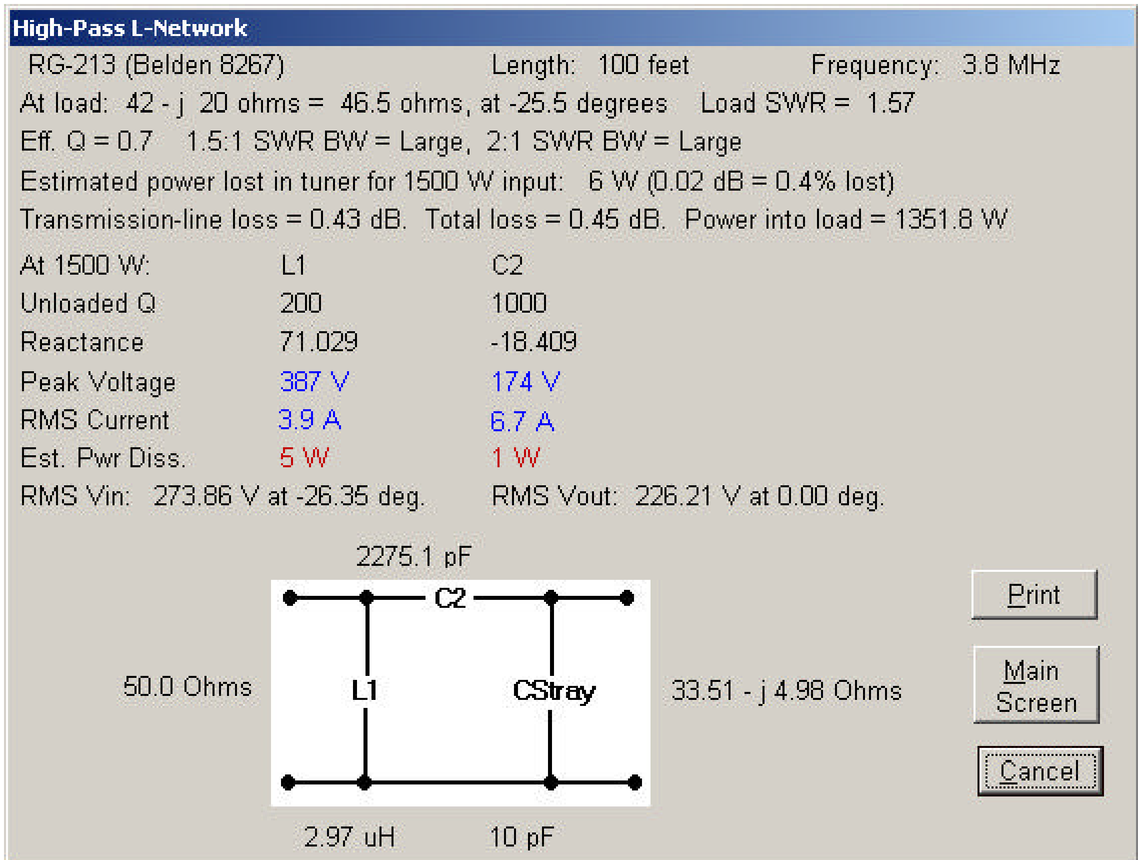
EZNEC-ARRL v. 4 (by Roy Lewallen, W7EL)

Software Included with the 21st Edition of *The ARRL Antenna Book*



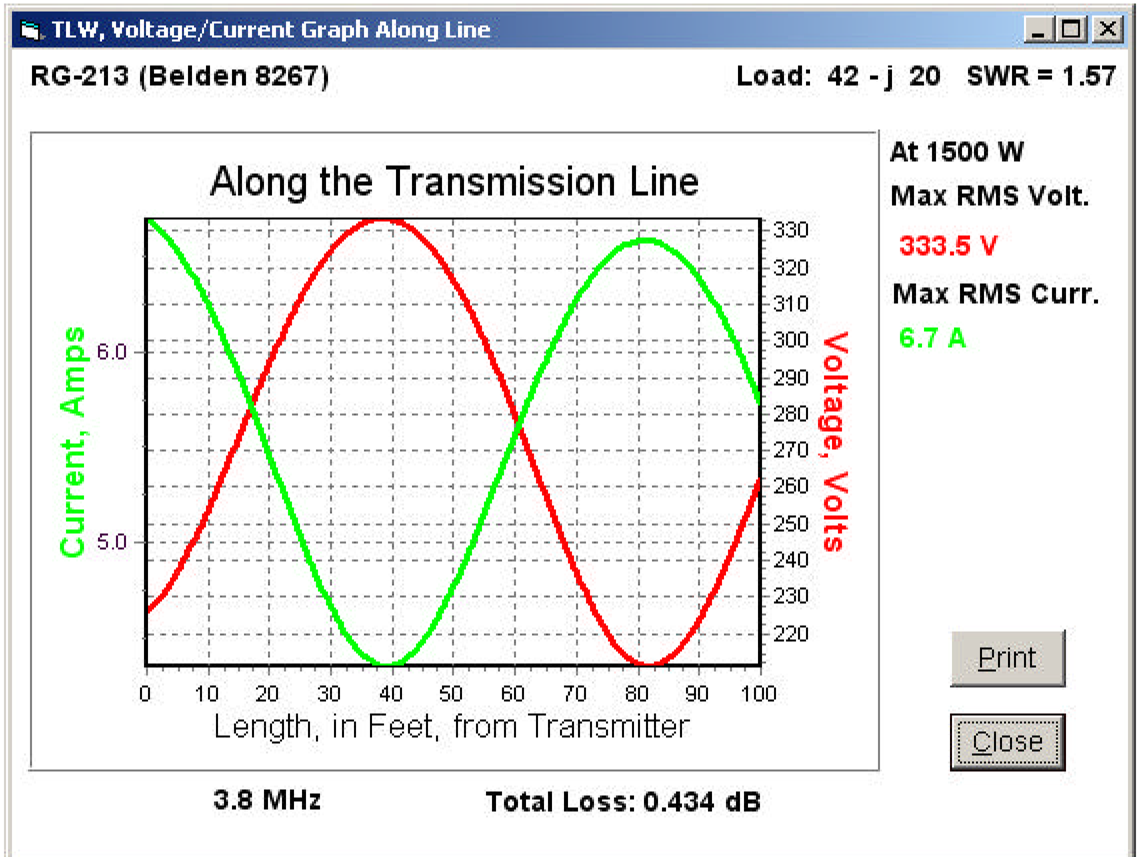
Now covers up to 6 GHz

Software Included with the 21st Edition of *The ARRL Antenna Book*



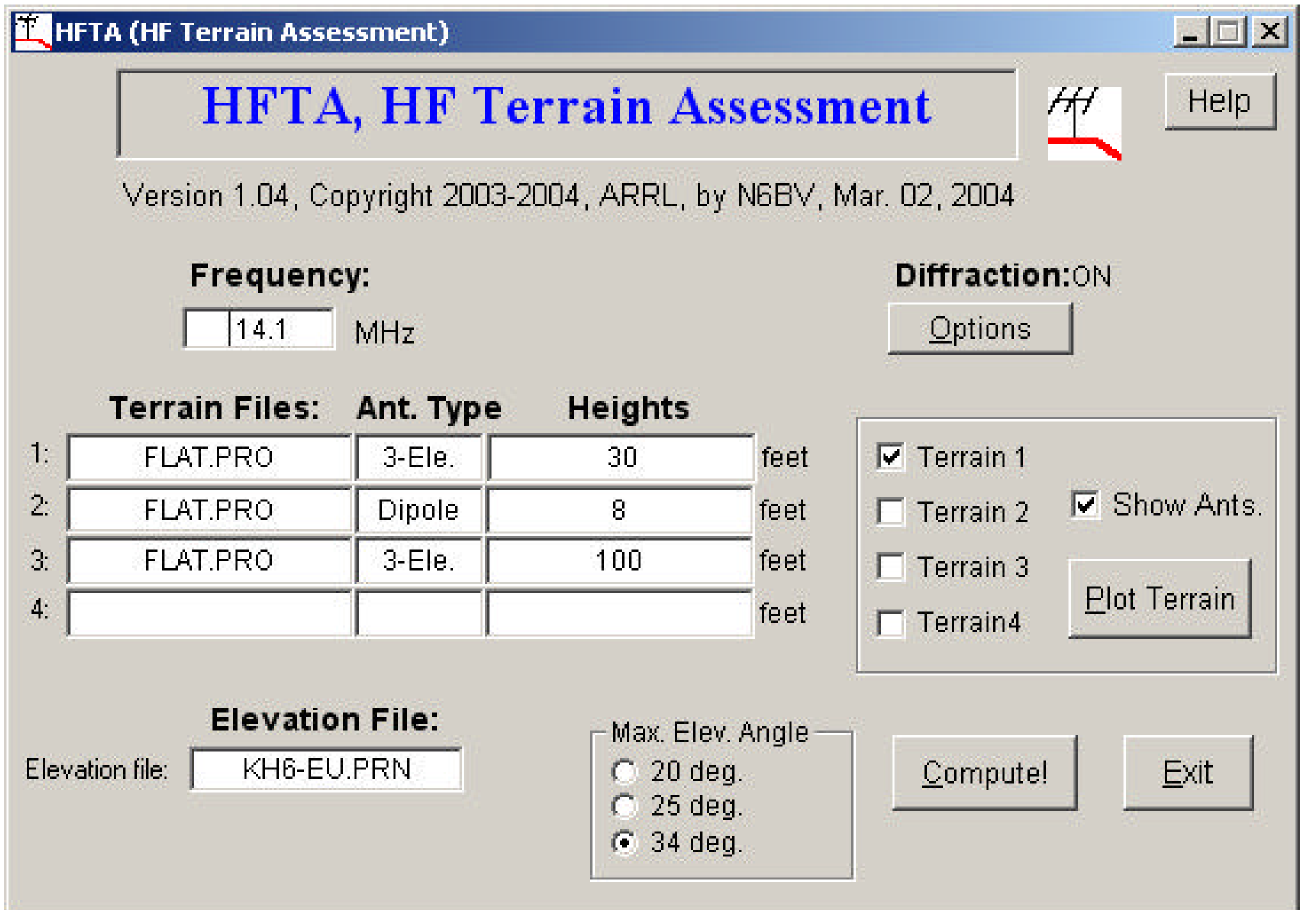
Tuner calculations in *TLW*

Software Included with the 21st Edition of *The ARRL Antenna Book*



Voltage/Current along the line in *TLW*

Software Included with the 21st Edition of *The ARRL Antenna Book*



HFTA for Terrain Assessment

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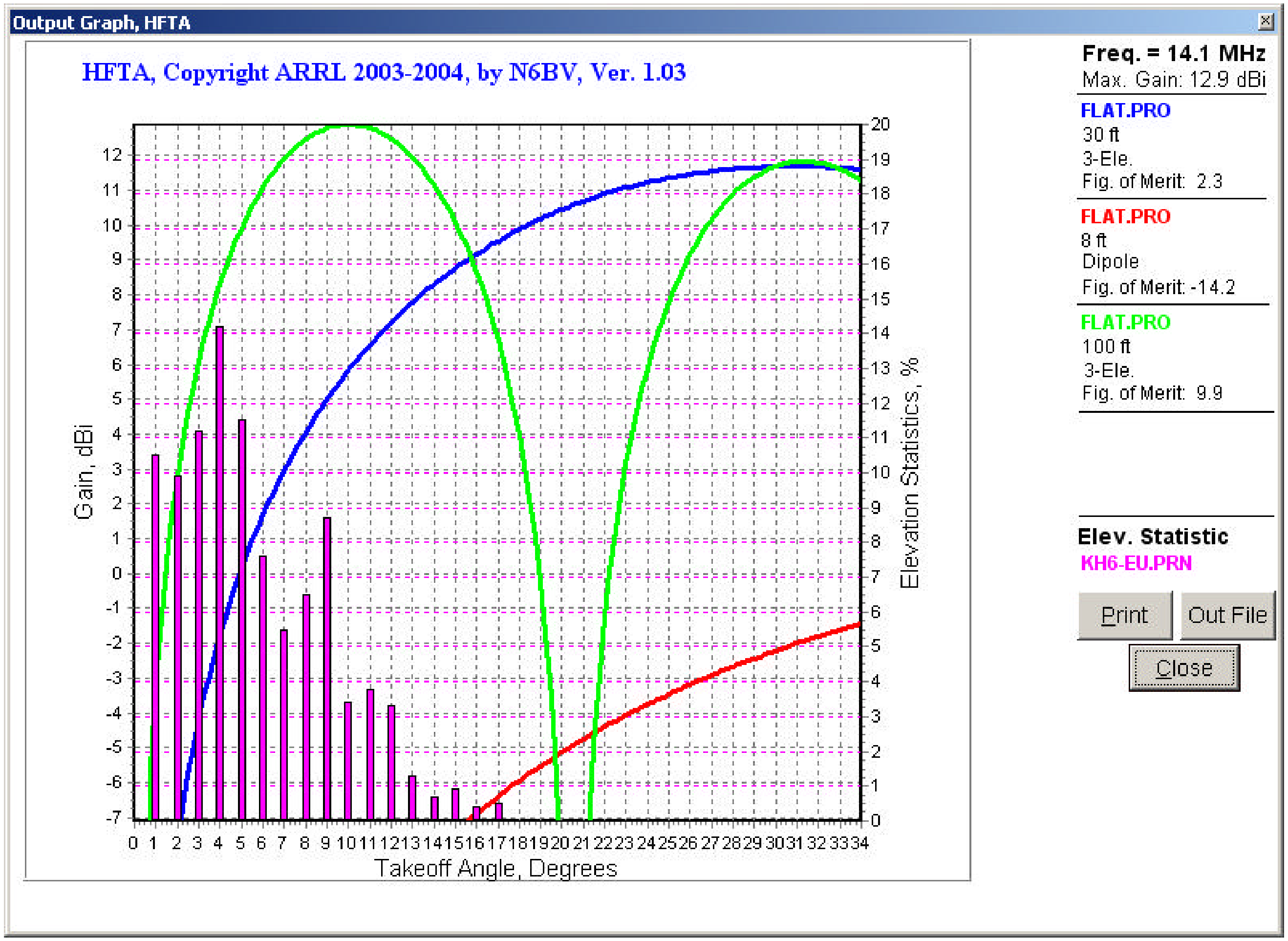

HFTA for Terrain Assessment

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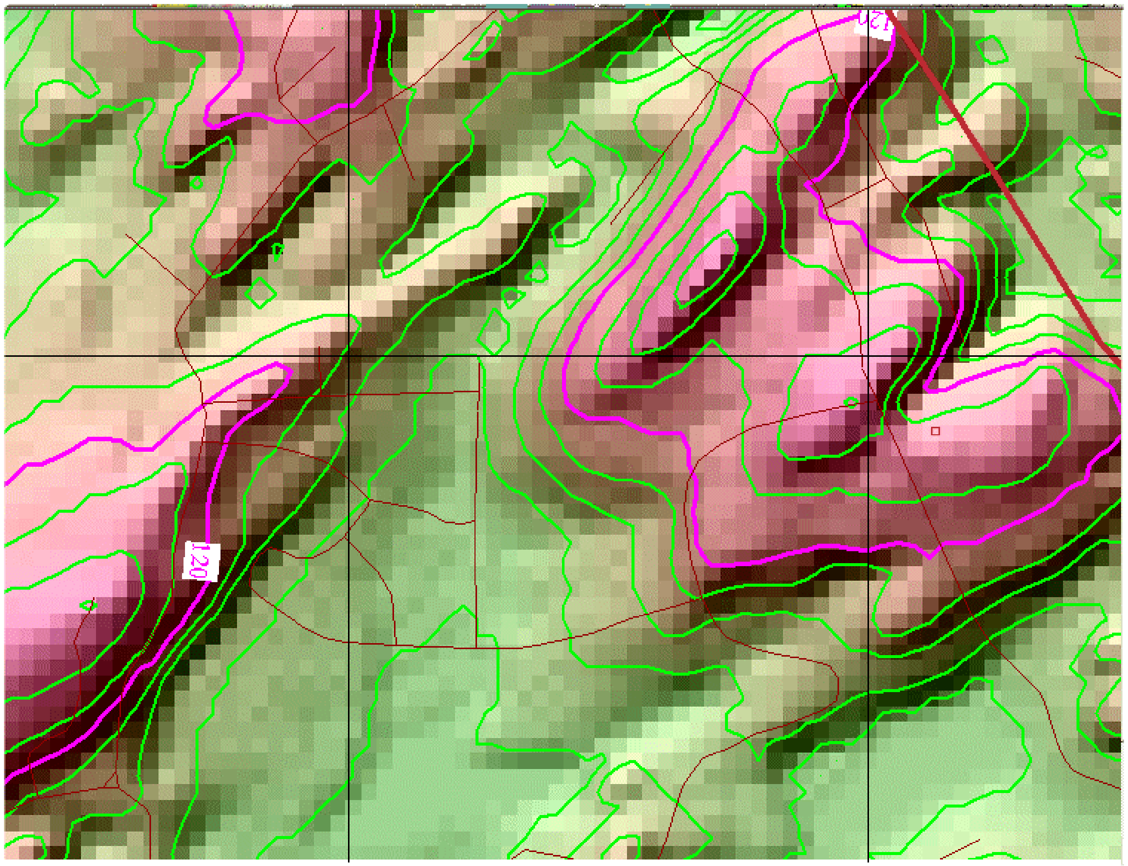

MicroDEM, showing N6BV/1 in New Hampshire

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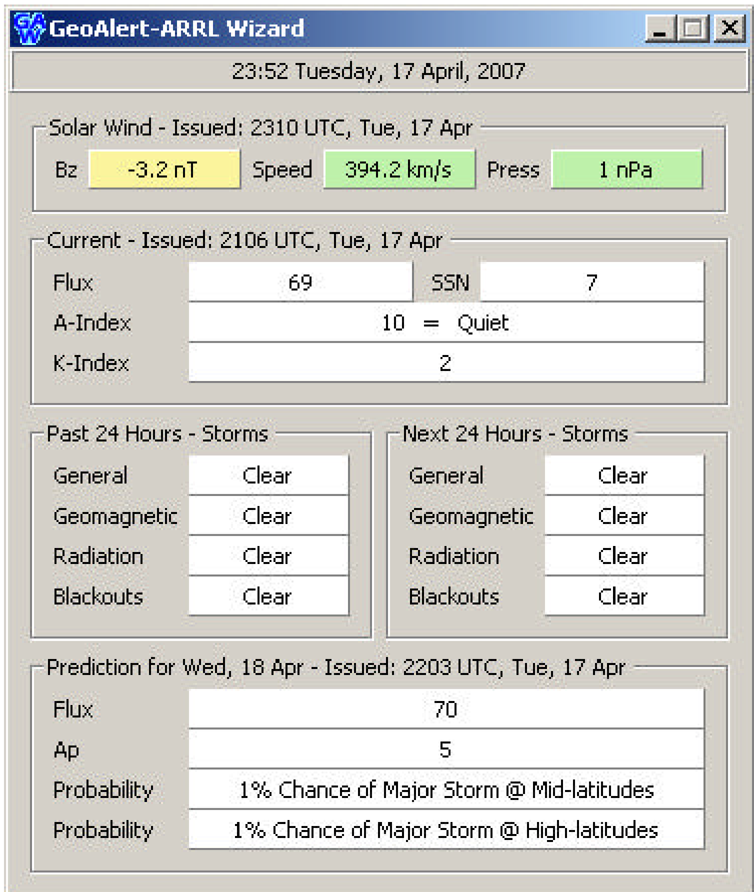
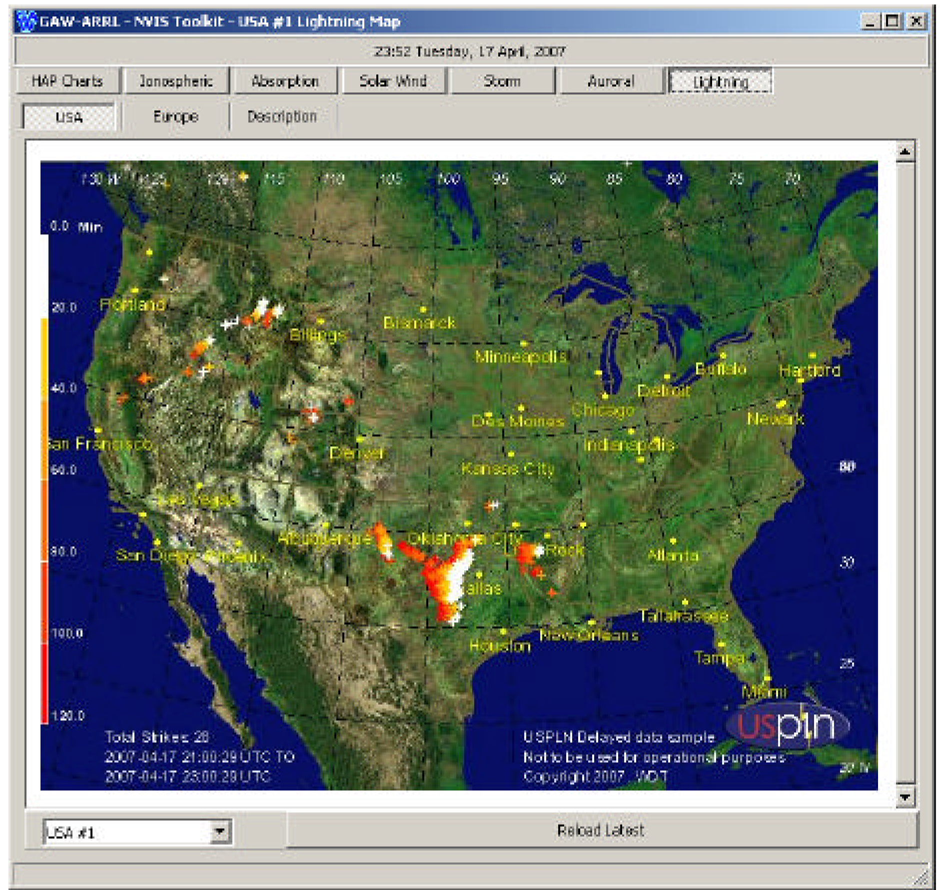
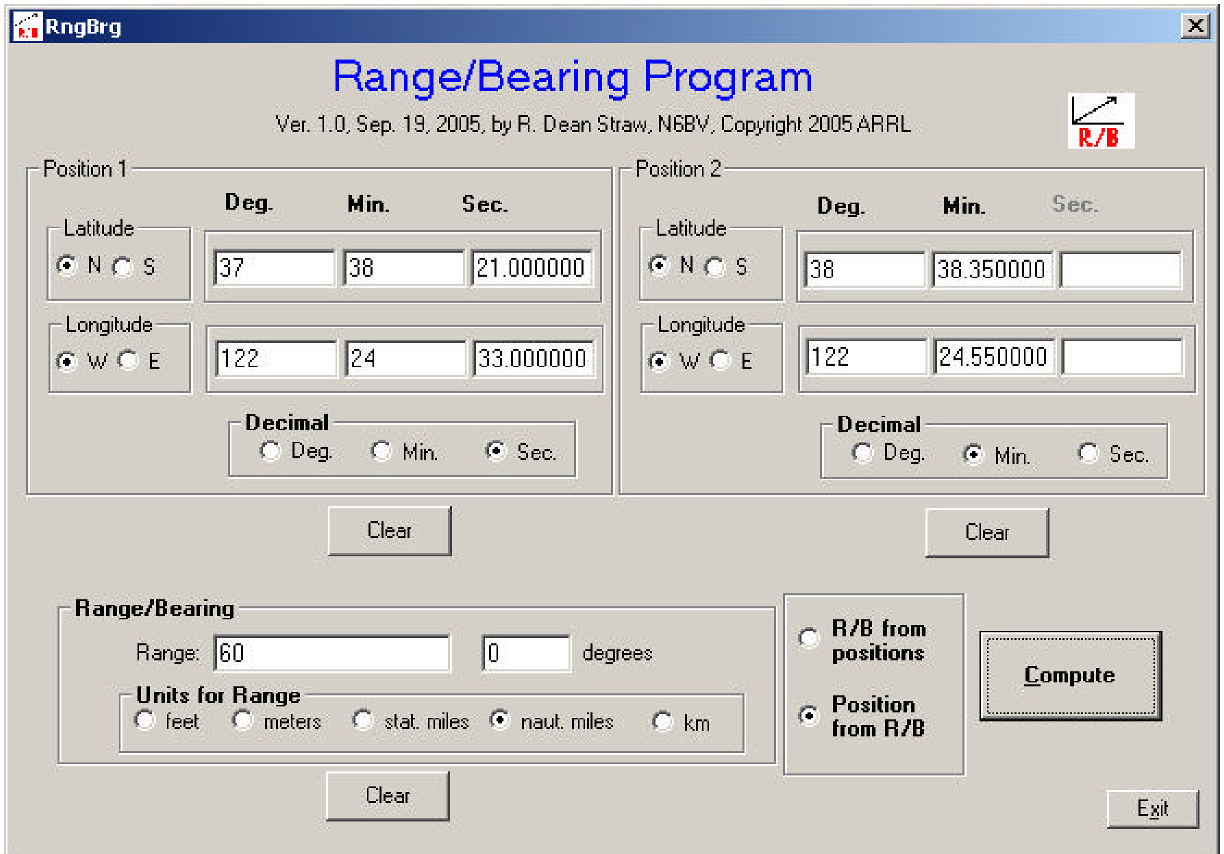




Geo Alert Wizard—ARRL queries the Internet for geophysical data

Software Included with the 21st Edition of *The ARRL Antenna Book*



Range-Bearing – great for converting DMS to D, or DM, or latitude/longitude positions to Range/Bearings for *HFTA*

Software Included with the 21st Edition of *The ARRL Antenna Book*

DOS Software:

SCALE for scaling Yagis to other frequencies/tapers

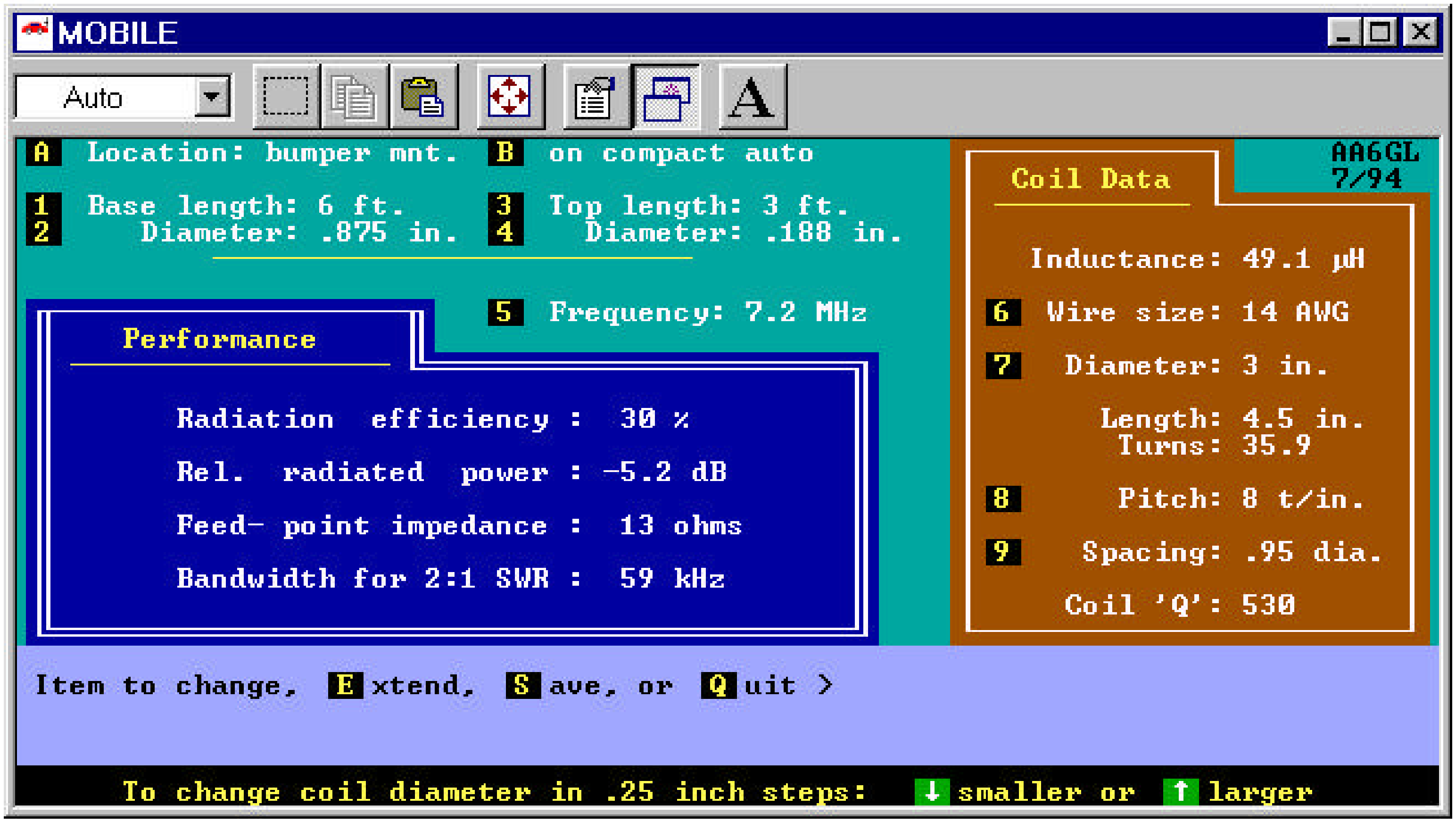
AAT **--** *Analyze Antenna Tuner*

LPDA (by Roger Cox, WB0DGF)

MOBILE (by Leon Braskamp, AA6GL)

GAMMA

Software Included with the 21st Edition of *The ARRL Antenna Book*



Propagation-Prediction Tables

Detailed Propagation Tables

USA

W1B Boston, MA
W2A Albany, NY
W2N Buffalo, NY
W3D Washington, DC
W3P Pittsburg, PA
W4A Montgomery, AL
W4F Miami, FL
W4G Atlanta, GA
W4K Louisville, KY
W4N Raleigh, NC
W4T Memphis, TN
W5A Little Rock, AR
W5H Houston, TX
W5L New Orleans, LA
W5M Jackson, MS
W5N Albuquerque, NM
W5O Oklahoma City, OK
W5T Dallas, TX
W6L Los Angeles, CA
W6S San Francisco, CA
W7A Phoenix, AZ
W7I Boise, ID
W7M Helena, MT
W7N Las Vegas, NV
W7O Portland, OR
W7U Salt Lake City, UT
W7W Seattle, WA
W7Y Cheyenne, WY
W8M Detroit, MI
W8O Cincinnati, OH
W8W Charleston, WV
W9C Chicago, IL
W9I Indianapolis, IN
W9W Milwaukee, WI
WØC Denver, CO
WØD Bismarck, ND
WØI Kansas City, MO
WØK Middle of US, KS
WØM St. Louis, MO
WØN Omaha, NE
WØS Pierre, SD

Other, North America

6Y Kingston, Jamaica
HP Panama City, Panama
J3 Grenada
KL7 Anchorage, Alaska
KP2 Virgin Islands
TI San Jose, Costa Rica
V3 Belmopan, Belize
VE1 Halifax, Nova Scotia
VE2 Montreal, Quebec
VE3 Toronto, Ontario
VE4 Winnipeg, Manitoba
VE5 Regina, Saskatchewan
VE6 Calgary, Alberta
VE7 Vancouver, BC
VE8 Yellowknife, NWT
VO1 St. John's, NFL
VP2 Anguilla
VP5 Turks & Caicos
VP9 Bermuda
XE1 Mexico City, Mexico
ZF Cayman Island

Europe

CT Lisbon, Portugal
DL Bonn, Germany
EA Madrid, Spain
EI Dublin, Ireland
ER Kishinev, Moldava
F Paris, France
G London, England
I Rome, Italy
JW Svalbard
OH Helsinki, Finland
OK Prague, Czech Republic
ON Brussels, Belgium
OZ Copenhagen, Denmark
S5 Slovenia
SP Warsaw, Poland
SV Athens, Greece
TF Reykjavik, Iceland
UA3 Moscow, Russia
UA6 Rostov, Russia
UR Kiev, Ukraine
YO Bucharest, Romania
YU Belgrade, Yugoslavia

South America

8P Barbados
CE Santiago, Chile
CP La Paz, Bolivia
FY Cayenne, French Guiana
HC Quito, Ecuador
HC8 Galapagos Islands
HK Bogota, Columbia
LU Buenos Aires, Argentina
OA Lima, Peru
P4 Aruba
PY1 Rio de Janeiro, Brazil
PY0 Fernando de Noronha
YV Caracas, Venezuela
YV0 Aves Island
ZP Asuncion, Paraguay

Asia

1S Spratly Islands
3W Ho Chi Minh City, Vietnam
4J Baku, Azerbaijan
4S Columbo, Sri Lanka
4X Jerusalem, Israel
9N Katmandu, Nepal
~~AP Karachi, Pakistan~~
BS7 Scarborough Reef
BY1 Beijing, China
BY4 Shanghai, China
BY0 Lhasa, China
HS Bangkok, Thailand
HZ Riyadh, Saudi Arabia
JA1 Tokyo, Japan
JA3 Osaka, Japan
JA8 Sapporo, Japan
JT Ulan Bator, Mongolia
TA Ankara, Turkey
UA9 Perm, Russia
UA0 Khabarovsk, Russia
UN Alma-Ata, Kazakh
VR2 Hong Kong
VU New Delhi, India
VU4 Andaman Islands
~~XZ Rangoon, Myanmar~~

Oceania

3D2 Fiji Islands
3Y Peter I
DU Manila, Philippines
FO Tahiti
H4 Honiara, Solomon Islands
KH0 Saipan, Mariana Islands
KH6 Honolulu, Hawaii
KH7K Kure
KH8 American Samoa
V7 Kwajalein, Marshall Islands
VK2 Sydney, Australia
VK4 Brisbane, Australia
VK6 Perth, Australia
VK8 Darwin, Australia
VK9 Cocos-Keeling Island
YB Jakarta, Indonesia
YJ Vanuatu
ZL1 Aukland, New Zealand
ZL3 Christchurch, New Zealand

Africa

3B7 St Brandon
3B9 Rodrigues
3C Bata, Equatorial Guinea
5N Lagos, Nigeria
5R Antananarivo, Madagascar
5U Niamey, Niger Republic
5Z Nairobi, Kenya

170 QTHs around the world

Propagation-Prediction Tables

6W Dakar, Senegal	9X Kigali, Rwanda	EA8 Canary Islands	T5 Mogadisho, Somalia
7Q Lolongwe, Malawi	C5 The Gambia	FT5X Kerguelen	VQ9 Chagos, Diego Garcia
7X Algiers, Algeria	C9 Maputo, Mozambique	J2 Djibouti	XT Burkina Faso
9J Lusaka, Zambia	CN Casablanca, Morroco	ST Khartoum, Sudan	ZS1 Capetown, So. Africa
9L Freetown, Sierra Leone	D2 Luanda, Angola	SU Cairo, Egypt	ZS6 Johannesburg, So. Africa

170 QTHs around the world

Summary Propagation-Predictions

Nov., Morocco (Casablanca), for SSN = Very High, Sigs in S-Units. By N6BV, ARRL.

	80 Meters							40 Meters							20 Meters							15 Meters							10 Meters							
UTC	EU	FE	SA	AF	AS	OC	NA	EU	FE	SA	AF	AS	OC	NA	EU	FE	SA	AF	AS	OC	NA	EU	FE	SA	AF	AS	OC	NA	EU	FE	SA	AF	AS	OC	NA	UTC
0	9+	-	9	9+	9	-	9+	9+	8	9+	9+	9+	-	9+	9	9+	9+	9+	9+	9+	9+	-	8	9+	9+	3	9+	-	-	4*	9+	9	-	6	-	0
1	9+	-	9	9+	9	-	9+	9+	7	9+	9+	9+	-	9+	9	9+	9+	9+	9+	9	8	-	7	9+	9+	-	9+	-	-	2*	9+	8	-	7	-	1
2	9+	-	8	9+	9	-	9+	9+	-	9+	9+	9+	-	9+	9	9	9+	9+	9+	8	9	-	4	9+	9+	-	8	-	-	1*	9+	8	-	-	-	2
3	9+	-	8	9+	9	-	9+	9+	-	9+	9+	9+	5	9+	8	9	9+	9+	9	9	9+	-	-	9+	9+	-	-	-	-	-	8	5	-	-	-	3
4	9+	-	9	9+	6	-	9+	9+	-	9+	9+	9+	7	9+	5	5	9+	9+	8	9	9+	-	-	9	8	-	-	-	-	-	-	5	-	-	-	4
5	9+	-	9	9+	2	5	9+	9+	-	9+	9+	9	8	9+	6	5	9+	9+	9+	4	9+	-	-	-	6	1	1	-	-	-	-	5	-	-	-	5
6	9+	-	9+	9+	-	5	9+	9+	-	9+	9+	5	9	9+	9+	8	8	9+	9+	4	6	-	8	1*	8	9+	7	-	-	2	-	7	2	6	-	6
7	9+	-	9	9+	-	-	9+	9+	3	9+	9+	3	8	9+	9+	9	9+	9+	9	7	9	9+	9	4	9+	9+	8	-	-	9	-	7	9+	9	-	7
8	9	-	7	9+	-	-	9	9+	2	9+	9+	1	7	9+	9+	9	9+	9+	9	9+	9+	9+	9+	9+	9+	9+	8	-	9	9	8	9+	9+	9	-	8
9	4	-	3	9+	-	-	6	9	-	9	9+	-	-	9	9+	9	9+	9+	9	9+	9	9+	9	9+	9+	9+	9+	4	9+	9	9	9+	9+	9	-	9
10	-	-	-	9+	-	-	1	9	-	5	9+	-	-	8	9+	9	9+	9+	9	9	9+	9+	9	9+	9+	9+	9+	7	9+	9	9	9+	9	9	1	10
11	-	-	-	9+	-	-	-	8	-	1	9+	-	-	5	9+	8	9	9+	8	7	9+	9+	9	9+	9+	9+	9	9	9+	9	9+	9	9+	9	8	11
12	-	-	-	9+	-	-	-	7	-	-	9+	-	-	1	9+	8	8	9	9	8	9	9+	9	9+	9+	9+	9	9+	9+	9	9+	9	9+	9	9	12
13	-	-	-	9+	-	-	-	7	-	-	9+	-	-	-	9+	8	2	9+	9	8	9	9+	9	9	9+	9+	9	9+	9+	9+	9	2	9+	9	9	13
14	-	-	-	9+	-	-	-	8	-	-	9+	4	-	-	9+	9	3	9+	9+	9	9	9+	9+	9	9+	9+	9	9+	9+	9+	9	2	9+	9	9+	14
15	2	-	-	9+	-	-	-	9	-	-	9+	7	-	2	9+	9	5	9+	9+	9	9+	9+	9+	9	9+	9+	9+	9+	9+	9+	9	9+	9+	9	9+	15
16	9	-	-	9+	2	-	-	9+	7	-	9+	9	4	4	9+	9+	8	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	1	9+	8	9+	16
17	9+	-	-	9+	6	-	-	9+	8	-	9+	9+	8	7	9+	9+	9	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	6	9+	9+	6*	8	7	9+	17
18	9+	7	-	9+	8	3	2	9+	9	1	9+	9+	9	8	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	-	9+	9+	1	4*	9	9	18
19	9+	7	-	9+	8	6	6	9+	9	5	9+	9+	9	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9	9+	-	9	9+	9+	2*	4	9	19
20	9+	8	1	9+	9	6	8	9+	9	8	9+	9+	9	9+	9+	9+	9+	9+	9+	9+	9+	4	9+	9+	8	9+	9	9	-	7	9+	4	-	3*	4	20
21	9+	8	6	9+	9	6	9	9+	9	9	9+	9+	9	9+	9+	9+	9+	9+	9+	9+	9+	-	9+	9+	8	9	8	9	-	1	9+	8	-	3*	2*	21
22	9+	7	8	9+	9	1	9+	9+	9	9+	9+	9+	9	9+	9	9+	9+	9+	9+	9+	9+	-	9	9+	9+	6	8	7	-	6	9+	9	-	4*	2*	22
23	9+	8	9	9+	9	-	9+	9+	9	9+	9+	9+	8	9+	9	9+	9+	9+	9+	9+	9+	-	9	9+	9+	5	9	-	-	4	9+	9	-	4*	1*	23
	EU	FE	SA	AF	AS	OC	NA	EU	FE	SA	AF	AS	OC	NA	EU	FE	SA	AF	AS	OC	NA	EU	FE	SA	AF	AS	OC	NA	EU	FE	SA	AF	AS	OC	NA	

Detailed Propagation Predictions

10 Meters: Nov., Morocco (Casablanca), for SSN = Very High, Sigs in S-Units. By N6BV, A

UTC -->

Zone	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
KL7 = 01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	4	-	-	-	-	-
VO2 = 02	-	-	-	-	-	-	-	-	-	-	1	8	1	2	3	3	1	3	4	5	1*	-	-	-
W6 = 03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	9	9	9	4	-	-	-	-
W0 = 04	-	-	-	-	-	-	-	-	-	-	-	-	-	8	9	9+	9+	9+	9	8	1	-	-	-
W3 = 05	-	-	-	-	-	-	-	-	-	-	-	-	9	9	9+	9	9	9	9	8	3*	2*	2*	1*
XE1 = 06	-	-	-	-	-	-	-	-	-	-	-	-	1	9	9	9	9	9	9	9	4	-	-	-
TI = 07	-	-	-	-	-	-	-	-	-	-	-	2	9	9	9	9	9	9	9	9	9	6	1	-
VP2 = 08	-	-	-	-	-	-	-	-	-	-	8	9+	9+	9	9	9	9	9+	9+	9+	8	1	-	-
P4 = 09	-	-	-	-	-	-	-	-	-	-	-	9+	9+	9	9	9	9+	9+	9+	9	9	6	-	-
HC = 10	1	-	-	-	-	-	-	-	-	-	-	7	9	9	9	9	9	9	9	9+	9	9	6	4
PY1 = 11	9+	9	8	8	-	-	-	-	-	9	9	9	9	9	9	9	9	9	9+	9+	9+	9+	9+	9+
CE = 12	9+	9+	9	6	-	-	-	-	8	-	9	9	9	8	8	9	8	9	9	9+	9	9+	9+	9+
LU = 13	9+	9+	9+	8	-	-	-	-	-	2	9	9	9	9	9	9	9	9	9+	9+	9+	9+	9+	9+
G = 14	-	-	-	-	-	-	-	-	7	9+	9+	9+	9+	9+	9+	9+	9+	6	-	-	-	-	-	-
I = 15	-	-	-	-	-	-	-	-	9	9+	9+	9+	5	6	6	9+	5	1	-	-	-	-	-	-
UA3 = 16	-	-	-	-	-	-	-	-	6	9+	9+	9+	9+	9+	9+	6	-	-	-	-	-	-	-	-
UN = 17	-	-	-	-	-	-	-	7	8	9	9	8	8	6	8	-	-	-	-	-	-	-	-	-
UA9 = 18	-	-	-	-	-	-	-	4	9	9	9	9	8	7	1	-	-	-	-	-	-	-	-	-
UA0 = 19	2*	2*	1*	-	-	-	-	-	9	9	5	-	-	-	-	-	-	-	-	-	-	-	-	2*
4X = 20	1	-	-	-	-	-	7	2	9+	9+	9+	2	2	4	9+	9+	2*	1*	-	9	8	7	4	1
HZ = 21	-	-	-	-	-	-	-	9+	9+	9+	9	9+	9+	9+	9+	9+	9+	8	4*	2*	-	-	-	-
VU = 22	-	-	-	-	-	-	2	9	9	9	9	9	9	9+	8	5	-	-	-	-	-	-	-	-
JT = 23	-	-	-	-	-	-	-	5	9	9	9	9	7	-	-	-	-	-	-	-	-	-	-	-
VS6 = 24	-	-	-	-	-	-	-	9	9	9	9	9	9	9	4	-	-	-	-	-	-	-	-	1*
JA1 = 25	4*	2*	1*	-	-	-	-	1	9	8*	4*	3*	1*	1*	-	-	-	-	-	-	-	-	2*	2*
HS = 26	-	-	-	-	-	-	2	9	9	9	9	9	9	9+	9	9+	9+	9+	6	2	-	-	-	-
DU = 27	-	-	-	-	-	-	-	9	9	9	9	9	9	9	9	9	8	2	-	-	-	-	-	1*
YB = 28	-	-	-	-	-	-	2	8	9	9	9	9	9	9	9+	9+	9+	9+	9+	9	7	1	6	4
VK6 = 29	6	7	-	-	-	-	6	7	8	8	7	7	6	1	-	3	4	3	1	-	-	-	-	1
VK3 = 30	5	4	-	-	-	-	3	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2
KH6 = 31	2*	2*	-	-	-	-	-	5*	2*	1*	1*	-	-	-	-	-	-	7	9	3*	3*	3*	1*	1*
KH8 = 32	4*	3*	-	-	-	-	-	1*	-	7	8	6	7	5	1	-	-	7	9	4	1*	2*	4*	4*
CN = 33	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
SU = 34	2	1	-	-	-	-	7	-	9+	9+	9+	4	3	6	9	9+	4	5*	9	9+	9	9	7	4
6W = 35	9	8	6	2	-	-	-	-	9+	1*	2	-	-	-	-	-	-	-	-	5	4	9	9	9
D2 = 36	6	7	8	-	-	-	-	7	5	2	2	1	2	2	2	1	2*	1*	7	6	-	-	1	5
5Z = 37	9	8	2	-	-	-	5	9+	9+	9+	9+	6	6	9+	9+	6	1	6*	1	1	4	8	9	9
ZS6 = 38	9	8	5	-	-	-	1	9	9	9	8	9	9	9	9+	9+	9+	9+	9+	9+	9+	9+	9+	9
FR = 39	8	4	1	-	-	-	5	9	9	8	9	9	9	9	9+	9+	9+	9+	9+	9+	9+	9+	9+	8
FJL = 40	-	-	-	-	-	-	-	-	-	2	8	9	9	9+	9	5	-	-	-	-	-	-	-	-
Zone	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23

UTC -->

Expected signal levels using 1500 W and 4-element Yagis at 60 feet at each station.

ANTENNA BOOK

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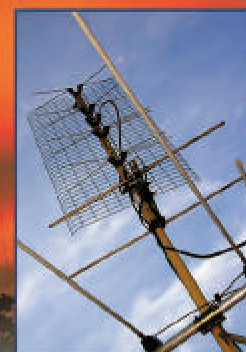

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