



# Strategies Using Propagation Predictions for DXing and Contesting

A Presentation to  
Dayton Hamvention

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Dayton, OH

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# Why Predict Propagation?

- Planning ahead to get that all-time “new one”



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# Why Predict Propagation?

- Planning ahead to get that all-time “new one.”
- Planning to move a station to other bands where you need him.
- Planning to be a new one yourself — going on a DXpedition.





# Using Propagation Predictions

- Let's say you need VU4 for an all-time new one (like lots of folks did before December 2004).



# Using Propagation Predictions

- Let's say you need VU4 for an all-time new one (like lots of folks did before December 2004).
- What would be the best time to try to snag her/him in December, with low sunspot conditions? Let's try native *VOACAP*, considered the “gold standard” propagation program.



# Snagging that VU4: Using VOACAP Tabular Results

```
Scrollw:C:\ITSHFBC\RUN\VOACAPx.out 49134 bytes
File Edit
■ CCIR Coefficients ~METHOD 30 UOACAP 04.1012W PAGE 1

Dec 2004 SSN = 35. Minimum Angle= 1.000 degrees
SAN FRANCISCO Andaman AZIMUTHS N. MI. KM
37.78 N 122.42 W - 11.75 N 92.70 E 319.16 31.87 7236.9 13401.6
XMTR 2-30 2-D P-to-P[hamcap\3Yagi55.N14 ] Az=319.2 OFFaz=360.0 1.500kW
RCUR 2-30 2-D P-to-P[hamcap\3Yagi55.N14 ] Az= 31.9 OFFaz=360.0
3 MHz NOISE = -150.0 dBW REQ. REL = 50% REQ. SNR = 43.0 dB
MULTIPATH POWER TOLERANCE = 3.0 dB MULTIPATH DELAY TOLERANCE = 0.100 ms

1.0 21.7 3.6 7.2 14.1 21.2 28.4 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 FREQ
F2F2 E E F2F2 F2F2 F2F2 F2F2 - - - - - - - - MODE
4.3 1.5 3.7 8.0 5.7 3.6 - - - - - - - - TANGLE
12.6 1.5 3.7 14.0 13.4 3.6 - - - - - - - - RANGLE
47.9 45.2 46.1 46.3 48.0 47.0 - - - - - - - - DELAY
461 98 234 219 456 339 - - - - - - - - U HITE
0.50 1.00 1.00 1.00 0.61 0.00 - - - - - - - - MUFday
150 333 207 159 146 273 - - - - - - - - LOSS
5 -165 -44 -8 8 -112 - - - - - - - - DBU
-118 -300 -169 -127 -15 -241 - - - - - - - - S DBW
-174 -148 -156 -167 -173 -177 - - - - - - - - N DBW
56 -152 -13 39 59 -64 - - - - - - - - SNR
13 195 56 4 -16 107 - - - - - - - - RPWRG
0.73 0.00 0.00 0.26 0.77 0.00 - - - - - - - - REL
0.00 0.00 0.00 0.00 0.00 0.00 - - - - - - - - MPROB
0.98 0.00 0.00 0.24 0.99 0.00 - - - - - - - - S PRB
25.0 9.8 9.8 9.9 25.0 25.0 - - - - - - - - SIG LW
25.0 5.8 5.8 5.8 21.1 25.0 - - - - - - - - SIG UP
26.8 13.1 12.7 13.4 26.8 26.8 - - - - - - - - SNR LW
25.6 9.0 8.1 7.5 21.8 25.6 - - - - - - - - SNR UP
6.7-17.0 -3.7 8.2 8.3 6.9 - - - - - - - - TGAIN
11.3-17.0 -3.7 11.1 11.1 6.9 - - - - - - - - RGAIN
56 -152 -13 39 59 -64 - - - - - - - - SNRxx
```

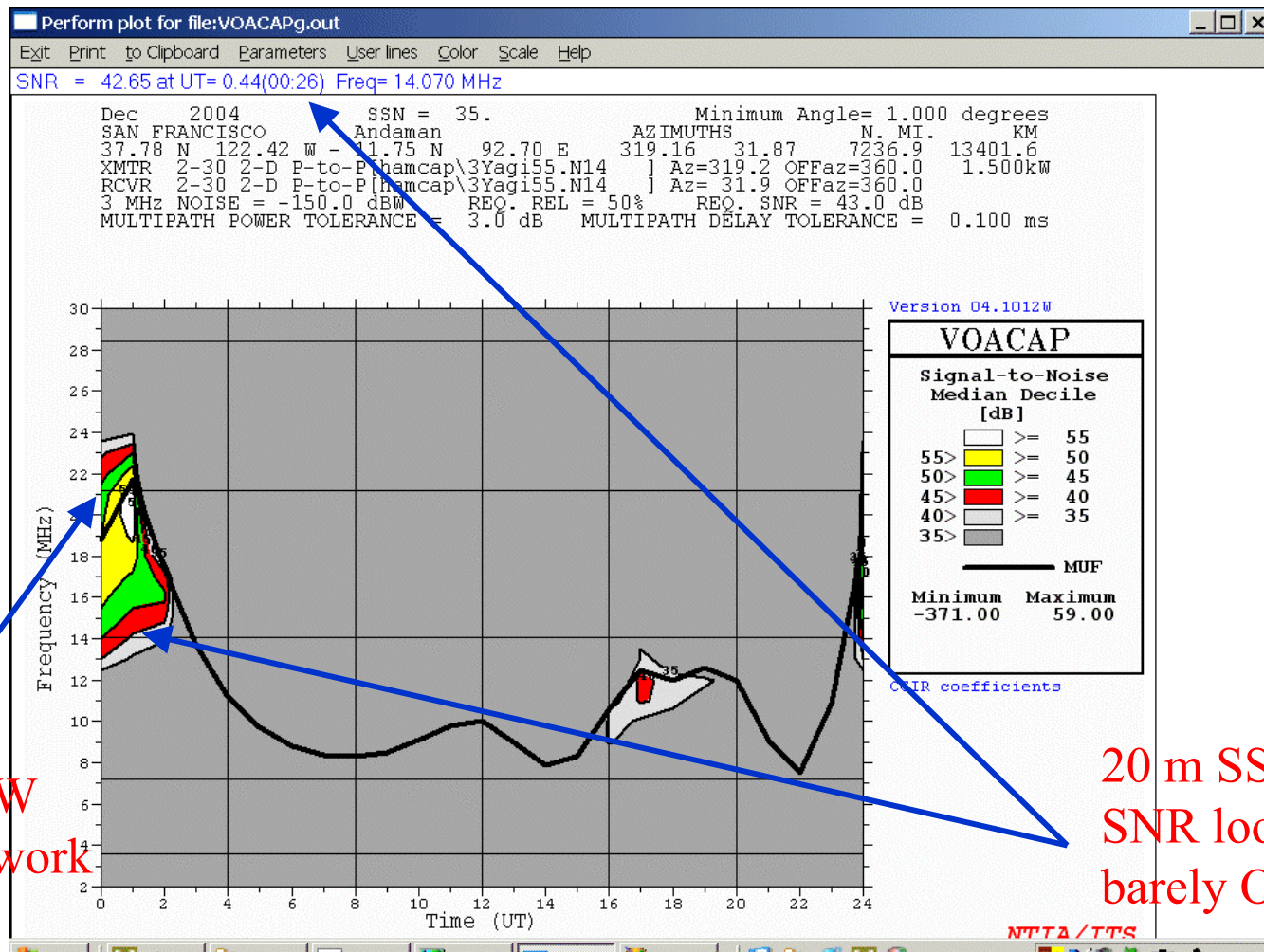
39 dB SNR in 1-Hz BW is 12 dB SNR in 500-Hz BW. Enough for a solid CW QSO.

-127 dBW; that's easy to understand, isn't it? !

And there are 23 more pages like this! It's really difficult to get a handle around all this raw "data."



# How About a *VOACAP* Graph?



15 m CW  
should work

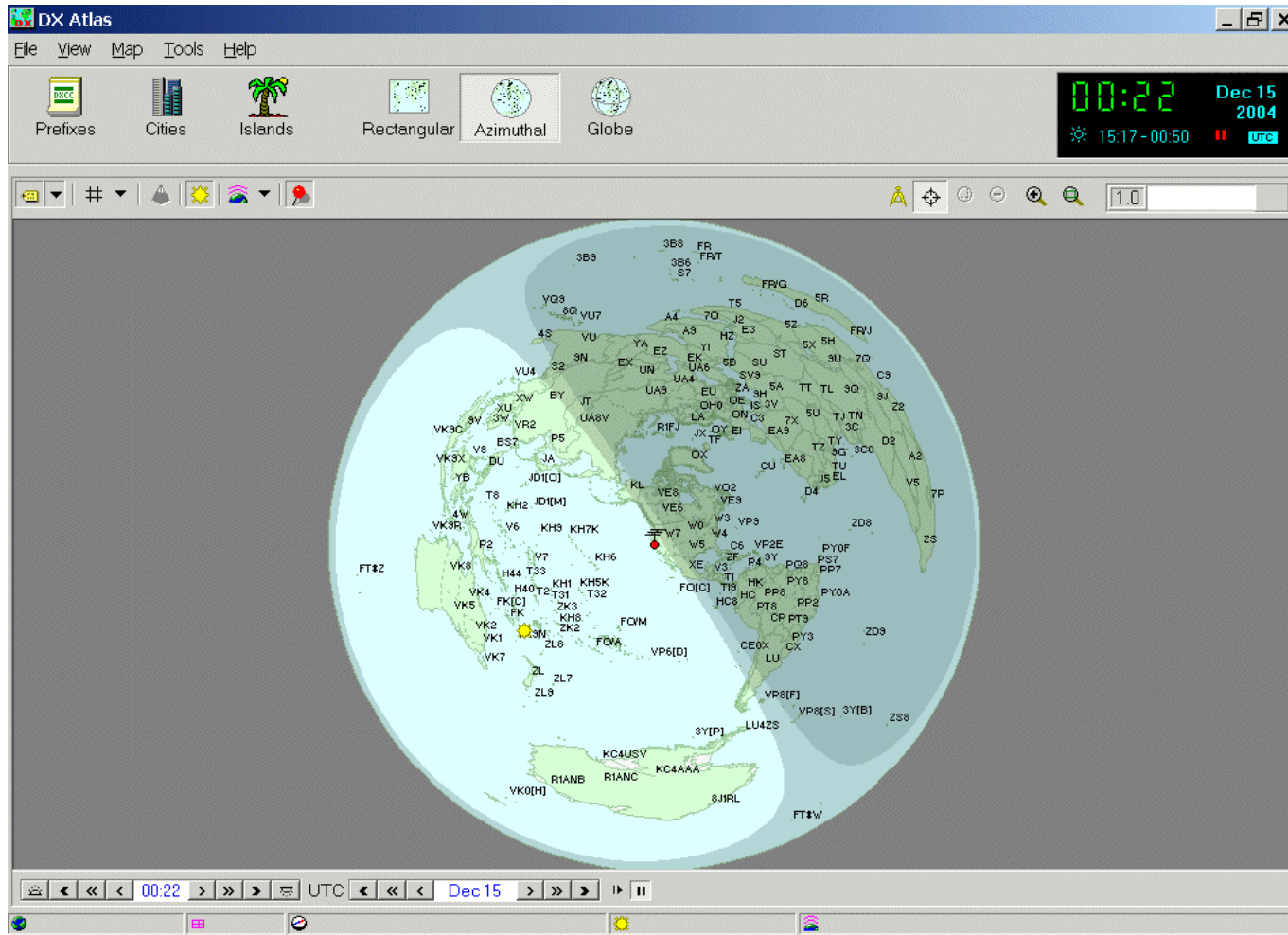
20 m SSB  
SNR looks  
barely OK

The graph is pretty. It's easier to understand, but it is still difficult to interpret and apply.





# Azimuthal Geographic View



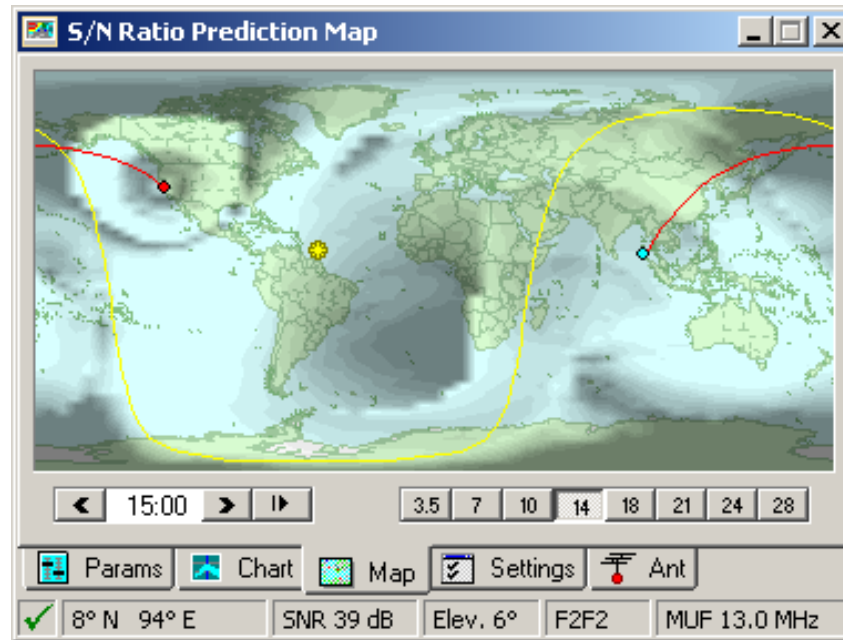
SP: 320°,  
8,396 mi

LP: 140°,  
16,461 mi

*DX Atlas* is a fine program that shows exactly what we'd expect from experience — the best chance on 20 m is at W6 sunset, morning in VU4.



# Another Way to Show the Data



*HamCAP* shows SNR on a small rectangular map for current solar conditions. This is elegant and more intuitive. But it is still a “snapshot” for only one band/one UTC. And hams still aren’t really comfortable with SNR in a 1-Hz bandwidth.



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- Native *VOACAP* is a bear to use, even though it is regarded as being accurate.



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- Geographic programs are great for grayline analyses -- but aren't really optimal for propagation prediction.



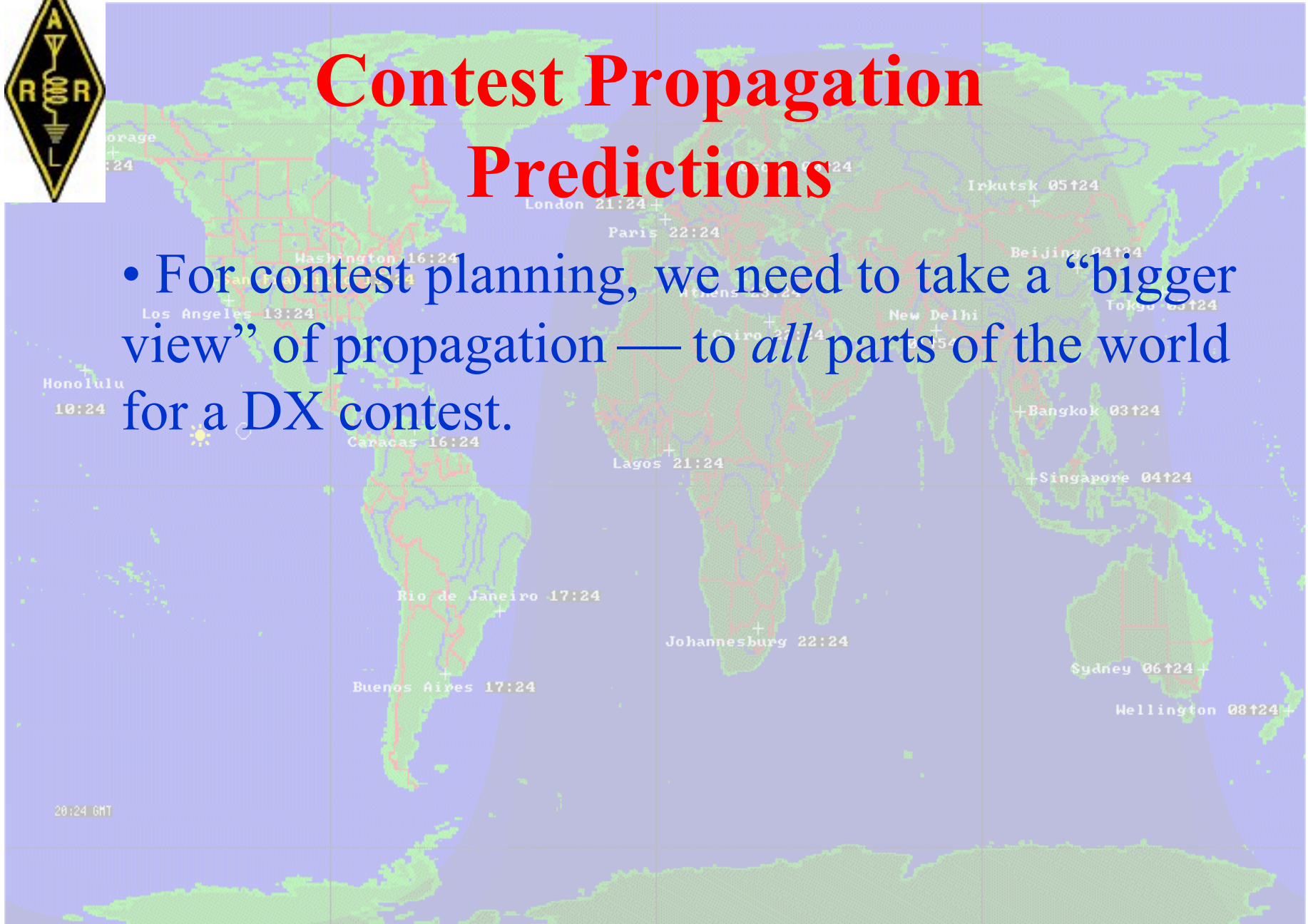
# Is There a Better Way?

- Native *VOACAP* is a bear to use, even though it is regarded as being accurate.
- Geographic programs are great for grayline analyses -- but aren't really optimal for propagation prediction.
- We'd like to see the “bigger picture” -- not just more data, but data made into *information!*



# Contest Propagation Predictions

- For contest planning, we need to take a “bigger view” of propagation — to *all* parts of the world for a DX contest.





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- On the CD bundled with the 20th Edition of *The ARRL Antenna Book* there are “Summary” and “Detailed” propagation tables for more than 150 QTHs around the world.



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- They cover 80 to 10 meters for a particular month, a particular level of solar activity and one transmitting QTH.





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- Cover 7 general target areas of interest:

EU (Europe), FE (Far East), SA (South America), AF (Africa), AS (south Asia), OC (Oceania), NA (North America).



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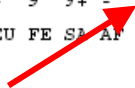
- They cover 80 to 10 meters for a particular month, a particular level of solar activity and one transmitting QTH.
- Cover 7 general target areas of interest:  
EU (Europe), FE (Far East), SA (South America), AF (Africa), AS (south Asia), OC (Oceania), NA (North America).
- Signals are calibrated in “S units,” which hams know and understand (not in SNR in a 1-Hz bandwidth, or in dBW).



# A Summary Prediction from W6

Dec., CA (San Francisco), for SSN = Low, Sigs in S-Units. By N6BV, ARRL.

UTC	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	
0	8	-	5	8	4	-	9+	9	5	9+	9	9	6	9+	4	9+	9+	9	9	9+	9+	-	9+	9+	2	1	9+	9+	-	2	-	-	-	7	6	0
1	8	-	9	9	6	2	9+	9	5	9+	9+	9	8	9+	3	9+	9+	9	9+	9+	9+	-	9	7	-	6	9	7	-	-	-	-	4	6	1	
2	9	-	9	9	5	5	9+	9+	6	9+	9+	8	9+	9+	4	9+	9+	7	9+	9+	9+	-	1	4	-	-	8	7	-	-	-	-	-	6	2	
3	9	-	9+	9	6	8	9+	9	7	9+	9+	8	9+	9+	1	6	9+	3	4	9+	9+	-	-	-	-	-	5	7	-	-	-	-	-	6	3	
4	9	2	9+	9	-	9	9+	9+	8	9+	9+	9	9+	9+	-	1	9	-	-	9	9+	-	-	-	-	-	-	7	-	-	-	-	-	6	4	
5	9	5	9+	9	-	9+	9+	9	8	9+	9+	8	9+	9+	-	-	9	-	-	8	9+	-	-	-	-	-	-	6	-	-	-	-	-	6	5	
6	9	7	9+	9	-	9+	9+	9	8	9+	9+	8	9+	9+	-	-	9	-	-	7	9	-	-	-	-	-	-	6	-	-	-	-	-	6	6	
7	9	8	9+	9	1	9+	9+	9	9	9+	9+	8	9+	9+	2	-	9	-	-	6	9	-	-	-	-	-	-	6	-	-	-	-	-	6	7	
8	8	9	9+	8	8	9+	9+	9	9	9+	9	9	9+	9+	1	-	9	3	-	5	9+	-	-	-	-	-	-	6	-	-	-	-	-	6	8	
9	8	9	9+	6	9	9+	9+	9	9+	9+	8	9	9+	9+	3	-	9+	8	-	2	9+	-	-	1	-	-	-	6	-	-	-	-	-	6	9	
10	1	9	9+	-	9	9+	9+	9	9	9+	7	9+	9+	9+	1	-	9	4	-	1	9+	-	-	-	-	-	-	7	-	-	-	-	-	6	10	
11	6	9	9+	-	9	9+	9+	8	9+	9+	6	9+	9+	9+	-	-	7	-	-	5	9	-	-	-	-	-	-	6	-	-	-	-	-	6	11	
12	7	9	9+	-	9	9+	9+	9	9+	9	4	9	9+	9+	-	1	3	-	-	9	6	-	-	-	-	-	-	6	-	-	-	-	-	6	12	
13	8	9	8	-	9	9+	9+	8	9+	9+	6	9+	9+	9+	-	-	6	1	-	5	9	-	-	-	-	-	-	6	-	-	-	-	-	6	13	
14	7	9	4	-	9	9+	9+	9	9	9	6	9	9+	9+	-	1*	9+	8	-	1	9+	-	-	4	-	-	-	6	-	-	-	-	-	6	14	
15	6	9	-	-	9	9+	9+	9	9+	6	7	9+	9+	9+	9	-	9+	9	5*	3	9+	-	1*	9+	7	-	1*	9+	-	-	1	-	-	6	15	
16	5	9	-	-	8	9	9+	8	9	1	6	9	9+	9+	9+	1	9+	9+	8	9+	9+	4	1*	9+	9	1*	-	9+	-	-	8	2	-	-	9	16
17	-	7	-	-	7	6	9+	8	9	-	6	9	9	9+	9	9+	9	9*	7	9+	9+	-	1	9+	9+	-	8	9+	-	-	9	7	-	1	9+	17
18	-	5	-	-	-	-	9+	8	8	-	2	8	8	9+	9	9	8	7	6	9+	9+	-	-	9+	9+	-	9	9+	-	-	9	8	-	2	9+	18
19	-	1	-	-	-	-	9+	7	8	-	2	8	5	9+	-	7	9	9	7	9+	9+	-	-	9+	9	-	9+	9+	-	-	9	9	-	8	9+	19
20	-	-	-	-	-	-	9+	7	6	1	4	7	1	9+	-	4	9	9	7	9+	9+	-	-	9+	4*	-	9+	9+	-	-	9	9	-	6	9+	20
21	-	-	-	-	-	-	9+	7	4	2	6	6	1	9+	-	9	9+	9+	5	9	9+	-	1	9+	1*	-	9+	9+	-	-	9	8	-	9	9+	21
22	-	-	-	-	-	-	9+	8	3	6	8	7	1	9+	4	9	9+	9+	6	9+	9+	-	9	9+	-	1	9	9+	-	-	9	3	-	9	9	22
23	7	-	2	7	-	-	9+	9	4	9	8	8	3	9+	1	9+	9+	9	9	9+	9+	-	9	9+	-	2	9+	9+	-	-	7	1	-	1	7	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	



Situation to south Asia is grim on 15 meters, for example



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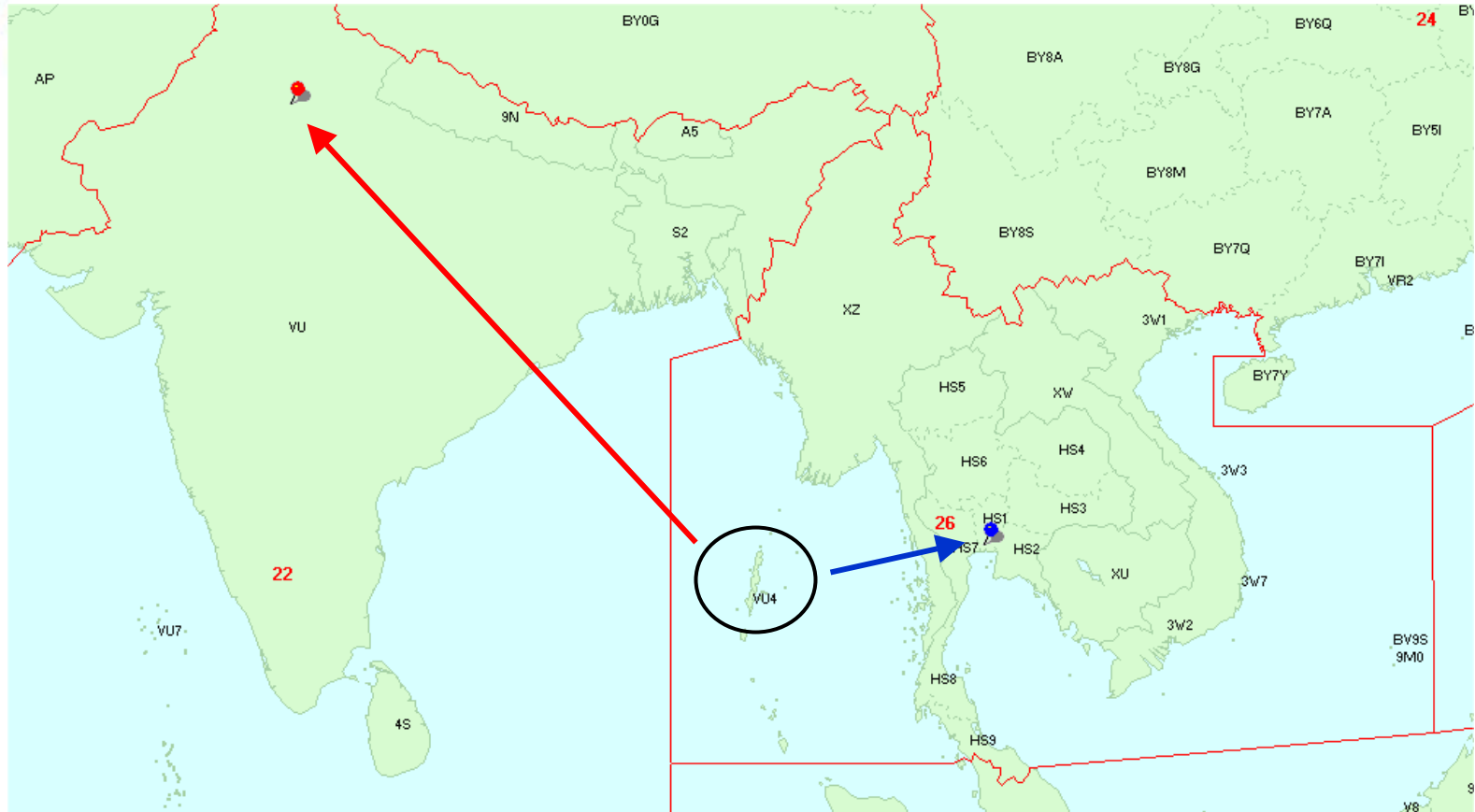


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- Predictions can be extrapolated for other bands for DXpeditions (30, 17, 12 meters).



# Choosing the Target Zone



Andamans are closer to Zone 26 target (Bangkok, Thailand) than to Zone 22 target (New Delhi, India).





# Detailed 20-m Prediction

20 Meters: Dec., CA (San Francisco), for SSN = Low, Sigs in S-Units. By N6BV, ARRL.

Zone	UTC -->																							
	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	9+	6	9+	8	1	2	2	2	2	2	1	1	1	1	1	1	6	9+	9	9+	9+	9+	9+	9+
VO2 = 02	9	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9+	9+	9+	9+	9+	9+	9+	1
W6 = 03	3	4	4	4	4	3	3	3	3	4	4	4	3	3	3	3	3	3	3	3	3	3	3	3
W9 = 04	9+	9+	9	5	1	1	1	3	8	8	8	2	-	-	9	9+	9+	9+	9+	9+	9+	9+	9+	9+
W3 = 05	9+	4	6	3	1	1	1	4	7	7	6	2	1	6	3	9+	9+	9+	9+	9+	9+	9+	9+	9+
XE1 = 06	9+	9+	9+	9+	9+	9+	9	9	9+	9+	9+	9	6	9	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+
TI = 07	9+	7	9	5	3	2	1	1	6	9	5	-	-	4	1	9+	9+	9	7	9	9	9+	9+	9+
VP2 = 08	9	8	6	1	-	-	-	-	6	8	4	-	-	5	9+	9+	9	8	8	9	9	9+	9+	9+
P4 = 09	9	9+	7	2	1	-	-	1	7	8	4	-	-	5	9+	9+	9	8	8	8	8	9	9+	9+
HC = 10	9+	9	9	7	6	5	4	6	6	5	-	-	-	6	9+	9+	9	6	6	7	8	9	9+	9+
PY1 = 11	9+	9+	9+	9	9	9	9	9	8	9	8	4	3	5	5	1	1	1	1	4	6	8	9	9+
CE = 12	9+	9+	9+	9+	9	9	9	9	9	9	9	7	-	4	9	8	6	3	2	2	4	6	8	9+
LU = 13	9+	9+	9+	9	9	9	9	9	9	9	9	5	-	6	7	4	1	1	1	1	5	6	8	9
G = 14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	9+	9	9	-	-	-	-	-
I = 15	2	2	4	1	-	-	-	-	1	3	1	-	-	-	-	9	9+	9	2	-	-	-	-	-
UA3 = 16	4	3	1	-	-	-	-	2	-	-	-	-	-	-	6	-	-	-	-	-	-	-	4	1
UN = 17	-	3	7	4	-	-	-	-	-	-	-	-	-	-	-	1*	1	3	6	7	7	4	1	-
UA9 = 18	-	4	8	4	-	-	-	-	-	-	-	-	-	-	-	-	1	3	4	1	1	-	-	-
UA0 = 19	9+	9+	9+	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	9	9	9+
4X = 20	7	8	5	-	-	-	-	-	-	-	-	-	-	-	-	6	9	5	-	-	2	2	4	7
HZ = 21	9	7	2	1	-	-	-	-	-	-	-	-	-	-	-	5*	8	7	4	4	4	5	6	9
VU = 22	6	9	9	3	-	-	-	-	-	-	-	-	-	-	-	2*	2	3	4	4	5	5	5	5
JT = 23	9	9+	9+	4	-	-	-	-	-	-	-	-	-	-	-	-	-	2	5	1	1	-	-	6
VS6 = 24	9	9	8	5	1	-	-	-	-	-	-	-	-	-	1*	-	-	-	4	-	-	-	1	9
JA1 = 25	9	9	9	6	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	9	9	9
HS = 26	9	9	8	4	-	-	-	-	-	-	-	-	-	-	1*	-	-	1	3	1	-	-	-	6
DU = 27	8	7	8	7	2	-	-	-	-	-	-	-	2	-	-	-	-	8	5	-	-	-	-	8
YB = 28	9	7	4	4	-	-	-	-	-	-	-	-	1	-	-	-	1	9+	9	7	1*	1*	8	8
VK6 = 29	1*	-	-	-	-	-	-	-	-	-	-	-	4	1	-	-	9	9+	9	8	7	5	2	1
VK3 = 30	1*	-	1	5	7	5	5	2	2	1	1	5	9	4	-	-	9+	9	9	7	5	2	1	-
KH6 = 31	9+	9+	9+	9+	5	8	7	6	5	2	1	5	7	5	1	3	-	9+	9+	9+	9+	9	9+	9+
KH8 = 32	6	8	9	9	9	7	6	6	4	1	1	5	6	2	-	1	4	9+	9+	8	6	7	6	6
CN = 33	1	-	-	1	-	-	-	-	3	4	1	-	-	-	3	9	9+	9	9	9	2	-	3	-
SU = 34	8	8	7	1	-	-	-	-	-	-	-	-	-	-	-	7	9+	6	1	1	-	2	5	7
6W = 35	9	9	7	3	-	-	-	-	3	8	4	-	-	-	1	8	8	7	9	8	9	9	9+	9
D2 = 36	9+	9+	5	1	-	-	-	-	2	-	-	-	-	-	1	5	8	8	8	8	9	9	9+	9+
SZ = 37	9+	9	1	-	-	-	-	-	-	-	-	-	-	-	-	9	9	9	9	9	9	9	9+	9+
ZS6 = 38	9+	9+	7	2	-	-	-	-	-	-	-	-	-	-	2	8	7	9*	7	8	8	9	9	9+
FR = 39	9+	7	7	1*	-	-	-	-	-	-	-	-	-	-	-	5*	9	9+	9+	9	9	9	9	9+
FJL = 40	8	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	1	9	9	8	7	8
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 -->																								

\* = Longpath  
 Expected signal levels using 1500 W and 3-element Yagis at 100 feet at each station.

Use Zone 26 (Bangkok, Thailand) for Andaman (VU4)



# Scaling Propagation Predictions

- The antennas and powers assumed in the *VOACAP* computations are representative of “big-gun” stations at both ends of the path -- so that all reasonable possibilities can be seen.

80/40 m: 100' high dipoles

20 m: 3-ele. Yagi at 100'

15/10 m: 4-ele. Yagis at 60'



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- What happens if the antennas are not large and high, and the power isn't a full gallon?



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Scaling signal levels for transmitting station:

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- Subtract 1 S unit for a dipole at 50' rather than dipole at 100' on 80/40 m



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- Subtract 1 S unit for a dipole at 50' rather than dipole at 100' on 80/40 m
- Subtract 3 S units for 100 W rather than 1500 W (or subtract 6 S units for 5 W QRP)



# Scaling Propagation Predictions

Scaling signal levels for transmitting station:

- Subtract 2 S units for a dipole instead of a Yagi
- Subtract 3 S units for a dipole at 50' instead of a Yagi at 100' on 20 m (or 60' on 10/15 m)
- Subtract 1 S unit for a dipole at 50' rather than dipole at 100' on 80/40 m
- Subtract 3 S units for 100 W rather than 1500 W (or subtract 6 S units for 5 W QRP)
- Subtract 3 S units if *receiving* station uses a dipole at 50' instead of a Yagi





# A Numerical Example

**W6 to Zone 26, VU4, Dec 2004**

On 20 meters, assume VU4 uses 100 W to a 50' high dipole, instead of defaults used in predictions.

- At 00 UTC, the base prediction is for an S9 signal.  
Actual signal = S9 – 3 (50' dipole) – 3 (100 W) = S3

(The analysis here assumes 3-ele. Yagi at 100' for the receiving station, over flat ground.)



# Scaling Propagation Predictions

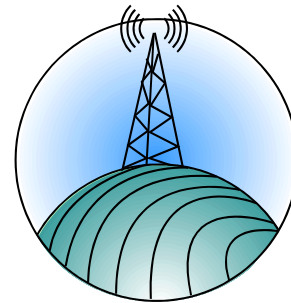
What about the effects of the local terrain?  
In other words, what if the ground isn't flat?



# Scaling Propagation Predictions

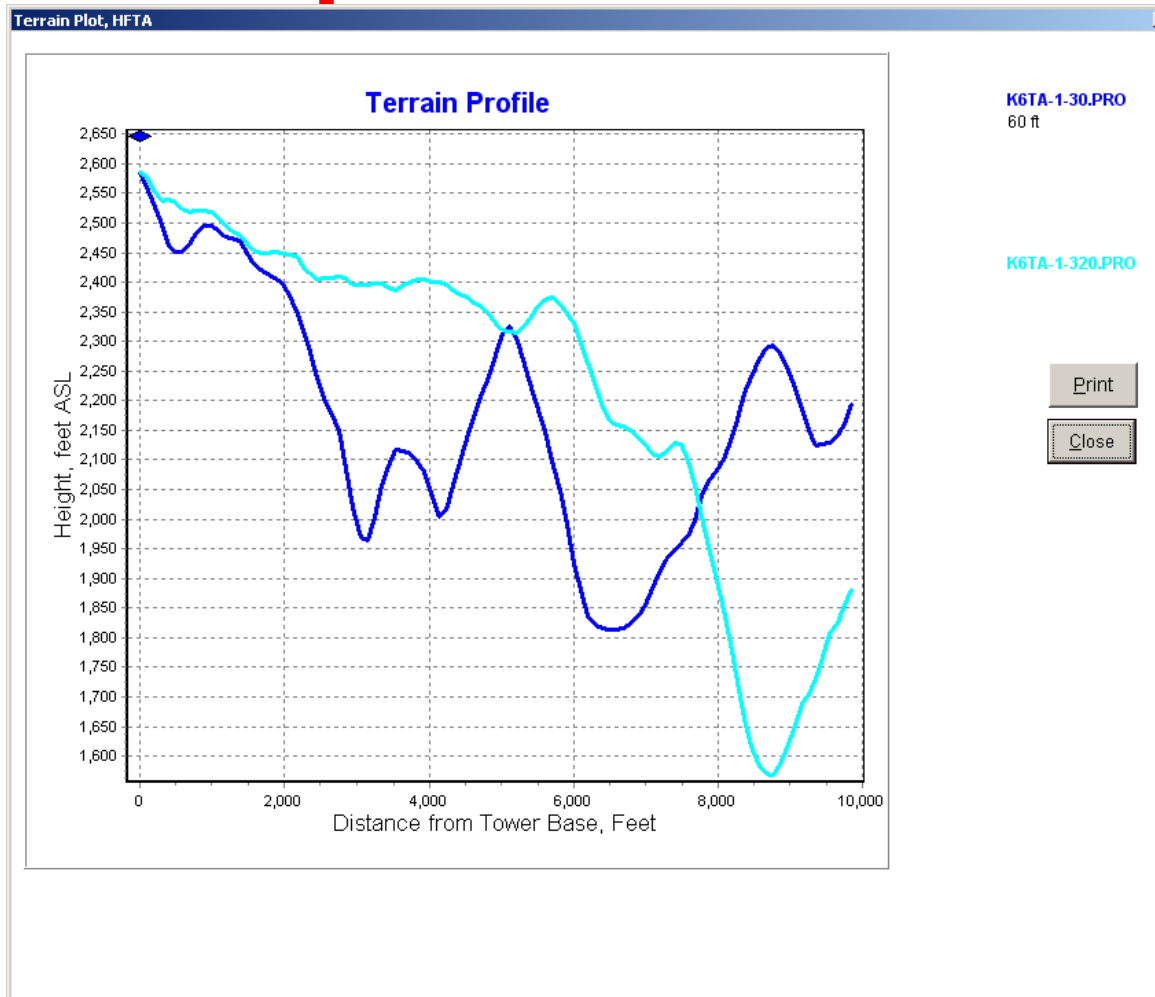
What about the effects of the local terrain?  
In other words, what if the ground isn't flat?

- I'm glad you asked! Local terrain can have a *profound* effect on the launch of HF signals into the ionosphere.





# Hilltop Location vs Flat Land

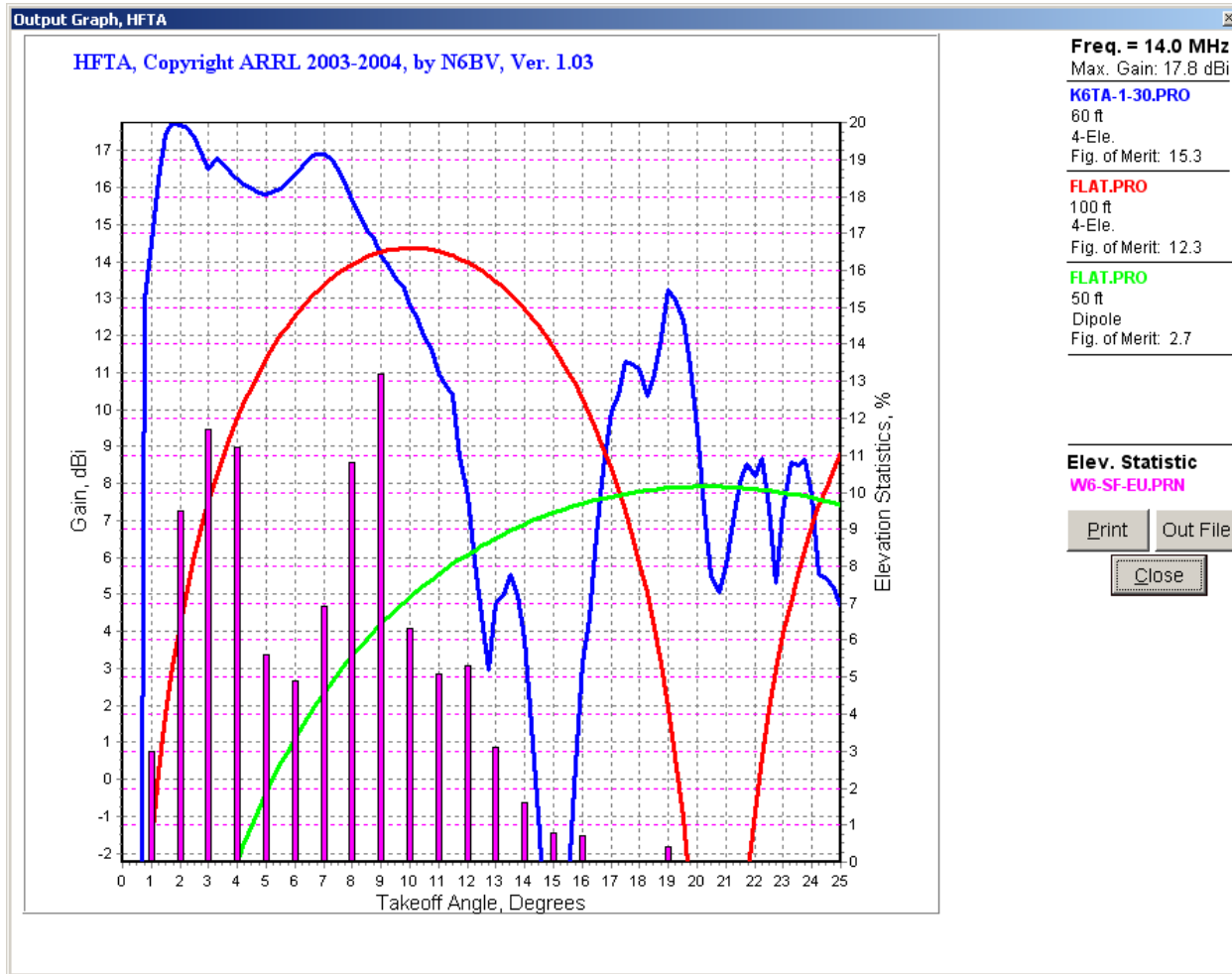


Great drop off  
to Europe:  
600' in 3000'.  
The shot to  
VU4 isn't too  
shabby either:  
200' in 3000'.

My dear friends Ken, K6TA, and Kay, K6KO, have a magnificent location in the foothills of the Sierra Nevada.



# Hilltop Location vs Flat Land



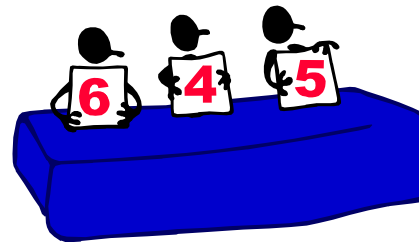
*HFTA*  
analysis to  
Europe

At 3°, K6TA's hill gives him **20 dB** over a dipole at 50' on flat ground! At 9° the advantage narrows to 10 dB.



# Case Study: Analyzing W6 to VU4

What kind of signal does your competition (from all over the world) put into the VU4's receiver?





# W6 Evening Opening to VU4

20 Meters: Dec., Thailand (Bangkok), for SSN = Low, Sigs in S-Units. By N6BV, ARRL.

Zone	UTC -->	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	9+	9	9	8	5	-	-	-	-	-	-	-	1	2	1	-	-	-	-	5	-	-	5	
VO2 = 02	2	4	2	1	1	-	-	-	-	-	-	4	9	9+	8	8	7	1	4	7	6	3	-	2
W6 = 03	9	8	8	2	-	-	-	-	-	-	-	-	1	-	-	-	1	5	7	6	1	-	7	
W9 = 04	9+	8	2	-	-	-	-	-	1	3	1	3	5	8	8	2	-	1	3	3	-	-	6	
W3 = 05	8	7	5	3	-	-	-	2	1	1	-	-	8	9+	8	6	1	-	-	2	5	-	4	
XE1 = 06	9	8	3	-	-	-	2	4	6	7	6	4	5	8	6	1	1	-	-	-	-	-	3	
TI = 07	9+	9	7	5	-	-	5	8	9	8	8	9	9	6	3	-	-	-	-	1	-	-	-	
VP2 = 08	5	2	-	-	-	-	-	1	-	8	9	9	8	8	2	-	1	1	3	7	3	-	1	
P4 = 09	8	6	1	-	-	1	1	4	2	7	9	9	8	7	1	-	-	1	2	6	3	-	1*	
HC = 10	9+	7	7	5	1	1	1	5	5	6	7	9	9+	5	1*	-	-	-	-	2	-	-	2	
PY1 = 11	9	9+	9	9	1	-	-	1	2	9	7*	2*	-	-	-	1	5	8	9	9+	9+	9	8	
CE = 12	9	8	7	2*	-	-	-	2	9	8	8	5	5	-	-	1	-	1	7	7	8	7	9	
LU = 13	9+	9	8	6	1	-	-	1	2	9	5*	5*	-	-	1	1	1	5	8	7	9	9	9	
G = 14	1	-	-	-	-	6	8	9	9	9+	9+	9+	9+	9+	9+	8	1	-	-	-	-	-	1	1
I = 15	4	4	-	-	2	8	8	7	7	9	9	9+	9+	9+	9	8	4	2	2	8	4	1	1	
UA3 = 16	2	-	-	8	8	9	9	9	9+	9+	9+	9+	9	8	1	-	-	2	-	5	1	-	-	
UN = 17	-	9+	9+	9+	9+	9	9	9	9+	9+	9+	9+	9+	8	5	8	7	5	6	1	-	-	-	
UA9 = 18	5	3	9+	9+	9+	9	9	9+	9+	9+	4	7	9	4	-	-	-	-	-	1	-	-	-	
UA0 = 19	9+	9+	9+	9	9	9	9	9+	9+	5	6	9	5	-	-	-	-	-	-	-	-	-	-	
4X = 20	-	-	-	7	9+	9	9	6	6	8	9	9+	9+	9+	9	7	7	3	-	-	-	2	1	
HZ = 21	-	-	9+	9+	9	8	8	8	8	9	9+	9+	9+	9+	9+	9+	9+	9+	9	8	9	8	1	
VU = 22	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9	8	
JT = 23	7	9+	9+	9+	9+	9	9	9+	9+	9+	9+	9+	4	9	8	7	4	4	7	5	-	-	-	
VS6 = 24	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9	9	5	-	-	-	4	
JA1 = 25	9+	9+	9+	9	9	9	9	9+	9+	9+	9+	5	9	9	3	-	-	-	-	-	-	-	8	
HS = 26	2	2	5	5	2	1	1	2	3	5	5	3	5	3	2	2	2	3	3	3	3	3	2	
DU = 27	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	7	-	1	9+
YB = 28	4	9	9+	9+	9+	9+	9+	9+	9	9+	9+	9+	9+	9+	9+	8	9+	9+	9+	9+	9+	9	9+	
VK6 = 29	9+	9+	9+	8	7	3	7	8	9	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9	8	8	9+
VK3 = 30	9	8	7	6	4	4	5	8	9	9+	9+	9+	9+	9+	9+	9+	9	9	8	6	6	6	9	
KH6 = 31	5	4	4	5	5	6	8	9	9	9	9	9	9	8	5	-	-	9	8	1	-	3	7	
KH8 = 32	2	1	2	1	2	4	7	9	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	8	2	1	5	4
CN = 33	5	9	7	1	-	-	8	6	6	9	7	7	8	9	9+	9+	9+	9+	9+	9+	8	5	2	
SU = 34	-	-	-	2	9+	9	8	6	7	8	8	9	9+	9+	9+	9	7	5	2	2	3	2	2	
6W = 35	8	9	9+	7	-	-	5	3	9	4*	3	4	5	8	9	9	9+	9+	9+	9+	9+	8	8	
D2 = 36	5	9+	9	4	9	6	4	3	4	4	4	5	8	9	9	9+	9+	9+	9+	9+	9+	9	7	
SZ = 37	-	4	6	9	8	7	5	4	4	4	5	8	9+	9+	9+	9+	9+	9+	9+	9+	9	6	1	
ZS6 = 38	9+	9	9	9	8	7	5	3	4	4	5	7	9	9	9+	9+	9+	9+	9+	9+	9+	9	9	
FR = 39	9	9	9+	9	8	4	2	2	4	5	8	9	9+	9+	9+	9+	9+	9+	9+	9	9	8	8	
FJL = 40	-	-	-	6	9	9	9	9	9	9+	9+	9	1	1	-	-	-	-	1	2	2	-	-	
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

\* = Longpath  
 Expected signal levels using 1500 W and 3-element Yagis at 100 feet at each station.

At 00 UTC W6 is S9, but JAs would be louder at S9+. Europe is weak but South America is strong. Not many SA though.



# W6 Morning Opening to VU4

20 Meters: Dec., Thailand (Bangkok), for SSN = Low, Sigs in S-Units. By N6BV, ARRL.

Zone	UTC -->																		
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18
KL7 = 01	9+	9+	9	9	8	5	-	-	-	-	-	-	-	1	2	1	-	-	-
VO2 = 02	2	4	2	1	1	-	-	-	-	-	-	4	9	9+	8	8	7	1	4
W6 = 03	9	8	8	2	-	-	-	-	-	-	-	-	1	-	-	-	1	5	7
W9 = 04	9+	8	2	-	-	-	-	-	-	1	3	1	3	5	8	8	2	-	1
W3 = 05	8	7	5	3	-	-	-	2	1	1	-	-	8	9+	8	6	1	-	-
XE1 = 06	9	8	3	-	-	-	-	2	4	6	7	6	4	5	8	6	1	1	-
TI = 07	9+	9	7	5	-	-	-	5	8	9	8	8	9	9	6	3	-	-	-
VP2 = 08	5	2	-	-	-	-	-	-	1	-	8	9	9	8	8	2	-	1	1
P4 = 09	8	6	1	-	-	-	1	1	4	2	7	9	9	8	7	1	-	-	1
HC = 10	9+	7	7	5	1	1	1	5	5	6	7	9	9+	9	5	1*	-	-	-
PY1 = 11	9	9+	9	9	1	-	-	-	1	2	9	7*	2*	-	-	-	1	5	8
CE = 12	9	8	7	2*	-	-	-	-	2	9	8	8	5	5	-	-	1	-	1
LU = 13	9+	9	8	6	1	-	-	-	1	2	9	5*	5*	-	-	1	1	1	5
G = 14	1	-	-	-	-	-	6	8	9	9	9+	9+	9+	9+	9+	9+	8	1	-
I = 15	4	4	-	-	2	8	8	7	7	7	9	9	9+	9+	9+	9	8	8	4
UA3 = 16	2	-	-	8	8	9	9	9	9+	9+	9+	9+	9+	9	8	1	-	-	2
UN = 17	-	9+	9+	9+	9+	9	9	9	9+	9+	9+	9+	9+	9+	8	5	8	7	5
UA9 = 18	5	3	9+	9+	9+	9	9	9+	9+	9+	4	7	9	4	-	-	-	-	-
UA0 = 19	9+	9+	9+	9	9	9	9	9+	9+	5	6	9	5	-	-	-	-	-	-
4X = 20	-	-	-	7	9+	9	9	6	6	8	9	9+	9+	9+	9+	9	7	7	3
HZ = 21	-	-	9+	9+	9	9	8	8	8	9	9	9+	9+	9+	9+	9+	9+	9+	9+
VU = 22	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+
JT = 23	7	9+	9+	9+	9+	9	9	9+	9+	9+	9+	9+	9	4	9	8	7	4	4
VS6 = 24	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9
JA1 = 25	9+	9+	9+	9	9	9	9	9+	9+	9+	9+	5	9	9	3	-	-	-	-
HS = 26	2	2	5	5	2	1	1	2	3	5	5	3	5	3	2	2	2	3	3
DU = 27	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+
YB = 28	4	9	9+	9+	9+	9+	9+	9+	9	9+	9+	9+	9+	9+	9+	8	9+	9+	9+
VK6 = 29	9+	9+	9+	8	7	3	7	8	9	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+
VK3 = 30	9	8	7	6	4	4	5	8	9	9+	9+	9+	9+	9+	9+	9+	9	9	9
KH6 = 31	5	4	4	5	5	6	8	9	9	9	9	9	9	8	5	-	-	9	8
KH8 = 32	2	1	2	1	2	4	7	9	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+
CN = 33	5	9	7	1	-	-	8	6	6	9	7	7	8	9	9+	9+	9+	9+	9+
SU = 34	-	-	-	2	9+	9	8	6	7	8	8	9	9+	9+	9+	9	9	7	5
6W = 35	8	9	9+	7	-	-	-	5	3	9	4*	3	4	5	8	9	9	9+	9+
D2 = 36	5	9+	9	4	9	6	4	3	4	4	4	5	8	9	9	9+	9+	9+	9+
SZ = 37	-	4	6	9	8	7	5	4	4	4	5	8	9+	9+	9+	9+	9+	9+	9+
ZS6 = 38	9+	9	9	9	8	7	5	3	4	4	5	7	9	9	9+	9+	9+	9+	9+
FR = 39	9	9	9+	9	8	4	2	2	4	5	8	9	9+	9+	9+	9+	9+	9+	9+
FJL = 40	-	-	-	6	9	9	9	9	9	9+	9+	9	1	1	-	-	-	-	1
Zone	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18

\* = Longpath  
 Expected signal levels using 1500 W and 3-element Yagis at 100 feet at each station.

At 18 UTC, the JAs and Europeans would be weak, but S. Asia and Africa would be strong. Not many of them again.





# How Did the VU4 Predictions Do?

The VU4 signals were predicted to be weak on all bands that were open in Dec 2004 -- mainly because at the start of the operation they were using 100 W power and inverted-V dipoles.



# How Did the VU4 Predictions Do?

The VU4 signals were predicted to be weak on all bands that were open in Dec 2004 -- mainly because at the start of the operation they were using 100 W power and inverted-V dipoles.

Later, they put up some Yagis and their signals improved a lot!





# West Coast VU4 Spots, Dec 2004

## Methodology of validation analysis:

- Use *DXSummit* spot history for VU4 and the HF bands.



# West Coast VU4 Spots, Dec 2004

## Methodology of validation analysis:

- Use *DXSummit* spot history for VU4 and the HF bands.
- Compare spots for each hour with predicted signal strengths.



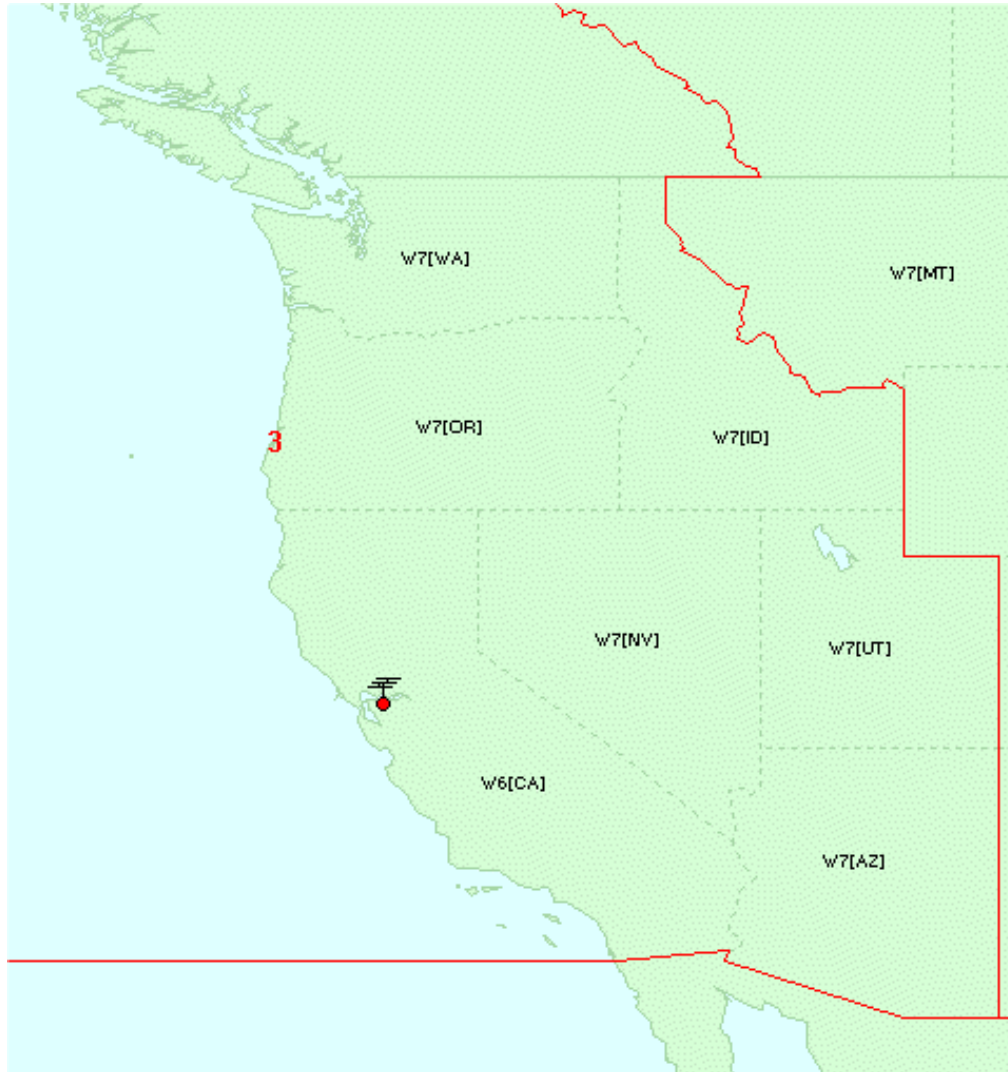
# West Coast VU4 Spots, Dec 2004

## Methodology of validation analysis:

- Use *DXSummit* spot history for VU4 and the HF bands.
- Compare spots for each hour with predicted signal strengths.
- The predicted signal strengths will be at the maximum levels (not the 100-W and inverted-V-dipole levels), just to see the possibilities.



# West Coast VU4 Spots, Dec 2004



CQ Zone 3



# West Coast VU4 Spots, Dec 2004

## 30 meters:

W6UC	3800.0	VU4RBI	gud time for u too!!!!!!	1438	25	Dec	2004
W6UC	3800.0	VU4NRO	grey line gud to usa now!!!!!!	1148	26	Dec	2004

## 40 meters

W6TA	7006.0	VU4RBI	CALL CORR. LAST UP 3.6	1323	04	Dec	2004
N7RT	7006.0	VU4NRO	QSX 7011	1332	04	Dec	2004
NJ6D	7006.0	VU4RBI	qsx 7012.5 hdg 330 in AZ	1356	04	Dec	2004
W6VX	7006.0	VU4RBI	QSX 7010.96 Last country!	1407	04	Dec	2004
WV6E-@	7075.0	VU4	lp so weak	0114	10	Dec	2004
K6JAJ	7075.0	VU4	Hay!! their trying!!!!!!	0119	10	Dec	2004
K6JAJ	7075.1	VU4	QSX 7210.01 they are don't you	0137	10	Dec	2004
W6XK	7004.2	VU4NRO	wrkd 7007.97 lp 135d	0037	25	Dec	2004
AA6NP	7004.0	VU4NRO	calling for EU...up	1806	25	Dec	2004
AA6NP	7004.1	VU4NRO	now peaking 58 LP in OR..up	0029	26	Dec	2004
K6CTA	7004.2	VU4NRO	gud cpy N. Cal	0034	26	Dec	2004

Possible anomalies (or were these mainly commentaries?)

80 was *really* tough, and 40 wasn't really productive, even from the West Coast.



# 40 Meter West Coast VU4 Spots, Dec 2004 Summary Table

Best time, at night

40 meters	Predicted Signal Strengths to VU4																							
UTC	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
West Coast sigs	1									6	8	9	9	9	9	9	9	8	5					
East Coast sigs											5	6	7	6	2									
European sigs	9+	9+	9	7	2				1	2	8	9		9+	9+	9+	9+	9+	9+	9+	9+	9+	9	
JA sigs	8	5	1						3	6	9	9+	9+	9+	9+	9+	9	9+	9+	9+	6	8	6	9+
December	West Coast Spots																							
4														3	1									
10		3																						
17																								
25	1																		1					
26	1																							

*signals*

*Calendar*

Look at competition from Europe and Japan!

Three possibly anomalous West Coast spots on Dec 10, 01 UTC. It's not clear whether QSOs were actually made.





# West Coast VU4 Spots

## 15 meters

N6FF	21285.0	VU4NRO	Looking for USA	0048	06	Dec	2004
N7RT	21240.0	VU4RBI	QSX 285 Vy weak hr 2X2, no cha	0053	06	Dec	2004
KG6I	21285.0	VU4NRO	at the noise N. CA	0056	06	Dec	2004
N6ZS-@	21285.0	VU4NRO	QSX 21298.5	0102	06	Dec	2004
NI6T	21284.9	VU4NRO	QSX 21315.01	0110	06	Dec	2004
K7WT	21241.0	VU4RBI		0111	07	Dec	2004
K7ZV	21240.9	VU4RBI	USA	0033	13	Dec	2004
W6TA	21241.0	VU4RBI	SIMPLEX GUD CPY IN CA.	0049	13	Dec	2004
VE6JY	21241.0	VU4RBI	just copyable, building now,	30137	13	Dec	2004
KG6I	21241.0	VU4RBI	Peaking nw N. CA	0050	16	Dec	2004

## 10 meters

Nada, nil, zilch, zero!

Not much action on 15, and that occurred around 00 to 01 UTC, as predicted. 10 meters is useless at this stage of Cycle 23, unfortunately.



# 15 Meter West Coast VU4 Spots, Dec 2004 Summary Table

15 meters	Predicted Signal Strengths to VU4																							
UTC	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
West Coast sigs	9	8														1*	1*							
East Coast sigs													2*	3*	1*									
European sigs						5	8	9	9	9	9+	9+	9+	9+	7	3								
JA sigs	9	2	5	4	9	9+	9+	9+	9+	6	8	1												
December	West Coast Spots																							
6	3	4																						
7		1																						
13	2																							
16	1																							

There were only 11 spots on 4 days on 15 meters to the West Coast. What was spotted did occur when the predictions said they would be available, around 00-01 UTC.



# 20 Meter West Coast VU4 Spots

## 20 meters

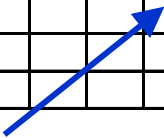
K7NK-@	14191.0	VU4RBI	qsx 14.187	1741	16	Dec	2004
W7GO	14191.0	VU4RBI		1816	16	Dec	2004
VE7WJ	14191.0	VU4RBI		1821	16	Dec	2004
VA7DJ	14191.0	VU4RBI	U.S.A. Z0000000	1855	16	Dec	2004
VE7BV	14191.0	VU4RBI	needs wider split!!	1911	16	Dec	2004
K7YU	14191.0	VU4RBI	THANK	1916	16	Dec	2004
WS7W	14191.0	VU4RBI	5-5 in Wyoming	0047	17	Dec	2004
VE6BMX	14190.0	VU4RBI	try split. too much QRM	0059	17	Dec	2004
N6ZN	14191.1	VU4RBI	not good need to split qsx 5	0100	17	Dec	2004
N7RT	14191.0	VU4RBI	Send an opr, not ur job	0102	17	Dec	2004
N7KH	14190.0	VU4	excuse me... it is lp!!!	0108	17	Dec	2004
KG6I-@	14191.0	VU4RBI	LP Weak into N. CA Up 5	0114	17	Dec	2004
W0OX-@	14191.0	VU4RBI	ugly in Oregon	0115	17	Dec	2004
W6ED	14191.0	VU4RBI	Peaking LP qsx 191-200	0132	17	Dec	2004
KF7E	14191.0	VU4	53 SP 41 LP in AZ	0136	17	Dec	2004
K7ABV	14191.0	VU4RBI	gud conditions for MT finally	0149	17	Dec	2004
W6KK	14191.0	VU4NRO	QSX 14196.00 LP S2 in SOCAL	0235	17	Dec	2004
W6ED	14191.0	VU4RBI	Abt s4 short path	1609	17	Dec	2004
KR6C	14025.1	VU4NRO	QSX 14027.29 slow and gud sig	1715	17	Dec	2004

No West Coast spots on 20 m before Dec 16 -- before Yagis were put up at VU4, I believe.



# 20 Meter West Coast VU4 Spots, Dec 2004 Summary Table

20 meters	Predicted Signal Strengths to VU4																							
UTC	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
West Coast sigs	9	9	8	5											1*		3	2	3	4				
East Coast sigs	8	7	5	3				2	1	1			8	9+	8	6	1			2	5			4
European sigs	4	4		8	8	9	9	9	9+	9+	9+	9+	9+	9+	9+	9	8	4	2	5	8	4	1	
JA sigs	9+	9+	9+	9	9	9	9	9+	9+	9+	9+	5	9	9	3									8
December	West Coast Spots																							
16																		1	3	2				
17	2	9	1														1	1						
18	1	5	1														3	6	6	3				
19	4	1															1	4						
20	1	4																2						
21		3			1												3	1	3	1				
22		1	2	1													4	4						
23		3												1				2	3					
24													1				2	8	2	2				
25	1															1	1	4	1					
26																								
		Blue = LAX			Green = Seattle																			



Anomalies probably involved stations with high antennas or very favorable terrain (like W6YX). Overall, however, the predictions match the spots. Again, a spot don't necessarily mean someone actually worked them from the West Coast!



# Contest Band-Planning Strategies

Single-Operator, All-Band, SO2R

- Multipliers are very important.



# Contest Band-Planning Strategies

## Single-Operator, All-Band, SO2R

- Multipliers are very important.
- Making lots of QSOs (rate) is also very important.



# Contest Band-Planning Strategies

## Single-Operator, All-Band, SO2R

- Multipliers are very important.
- Making lots of QSOs (rate) is also very important.
- Predicted signals  $>$  S8 or S9 should allow you to run rate.



# Band-Planning Strategies

## Single-Operator, All-Band, SO2R

Nov., CA (San Francisco), for SSN = Low, Sigs in S-Units. By N6BV, ARRL.

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

Short JA opening Oceania

SA open during daylight

Africa opening. Be there!

Oceania

Start on the highest band, since openings are shortest there. 56





# Band-Planning Strategies

## Single-Operator, All-Band, SO2R

Nov., CA (San Francisco), for SSN = Low, Sigs in S-Units. By N6BV, ARRL.

UTC	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		
0	7	-	4	7	1	-	9+	8	3	9	8	7	5	9+	5	9+	9+	9	9	9+	9+	-	9	9+	7	8	9+	9+	-	6	7	-	-	7	6	0					
1	8	-	8	8	2	1	9+	9	3	9+	9	7	8	9+	7	9+	9+	8	9+	9+	9+	-	9	9	1	9	9+	9+	-	1	-	-	-	9	6	1					
2	8	-	9	8	3	5	9+	9	3	9+	9	8	9	9+	6	9	9+	9	9+	9+	9+	-	8	7	-	3	9	7	-	-	-	-	-	4	6	2					
3	9	-	9+	9	-	8	9+	9	5	9+	9	7	9+	9+	5	9	9+	7	9	9+	9+	-	4	3	-	-	7	7	-	-	-	-	-	-	6	3					
4	9	-	9+	9	-	9	9+	9+	7	9+	9+	7	9+	9+	2	8	9+	5	4	9+	9+	-	1	1	-	-	3	6	-	-	-	-	-	-	6	4					
5	9	2	9+	9	-	9+	9+	9	8	9+	9+	8	9+	9+	-	6	9+	5	-	9	9+	-	-	-	-	-	-	6	-	-	-	-	-	-	6	5					
6	9	5	9	9	-	9+	9+	9	9	9+	9+	8	9+	9+	-	2	9+	5	-	9	9+	-	-	-	-	-	-	6	-	-	-	-	-	-	6	6					
7	8	8	9	8	-	9+	9+	9	9	9+	9	8	9+	9+	1	-	9+	2	-	8	9+	-	-	-	-	-	-	6	-	-	-	-	-	-	6	7					
8	8	8	9+	7	1	9+	9+	9	9	9+	9	9	9+	9+	3	-	9+	8	-	8	9+	-	-	2	-	-	-	6	-	-	-	-	-	-	6	8					
9	7	9	9	-	8	9+	9+	9	9+	9+	8	9	9+	9+	7	-	9	7	-	6	9+	-	-	2	-	-	-	6	-	-	-	-	-	-	6	9					
10	1	9	9+	-	8	9+	9+	8	9	9+	7	9	9+	9+	-	1	9	-	1	6	9+	-	-	-	-	-	-	6	-	-	-	-	-	-	6	10					
11	1	9	9	-	9	9+	9+	8	9+	9+	5	9+	9+	9+	-	-	9	9	-	5	9	9	-	-	-	-	-	-	6	-	-	-	-	-	-	6	11				
12	-	9	9+	-	9	9+	9+	8	9+	9+	2	8	9+	9+	-	4	5	-	2	9	9	-	-	-	-	-	-	6	-	-	-	-	-	-	6	12					
13	5	9	8	-	9	9+	9+	8	9+	9+	-	9	9+	9+	-	1	9	5	3	8	9+	-	-	2	-	-	-	6	-	-	-	-	-	-	6	13					
14	4	9	2	-	9	9+	9+	8	9	8	4	9	9+	9+	6	9+	8	-	4	9+	-	-	9	3	-	-	9	-	-	1	-	-	-	6	14						
15	4	9	-	-	8	9+	9+	7	9	5	4	9	9+	9+	9	1	9	9	8	9	9+	1	2*	9+	9	1*	2*	9+	-	-	9	1	-	-	9	15					
16	-	7	-	-	7	8	9+	7	9	1	4	9	9+	9+	9	9+	9+	8	8	9+	9+	6	1*	9+	9	4*	8	9+	-	-	9	7	-	-	9+	16					
17	-	5	-	-	1	4	9	8	9	9	9	9	9+	9+	9	9	7	9+	9+	5	5	9+	9	1*	8	9+	-	-	9	8	-	1	9	17							
18	-	1	-	-	-	-	9+	7	8	-	1	8	7	9+	8	8	9	7	9+	9+	1	4	9	9	-	9+	9+	-	-	9	9	-	6	9+	18						
19	-	-	-	-	-	-	9+	5	5	-	9	8	8	9	9+	9+	8	8	9	3	9+	9+	-	-	9	9	-	9+	9+	-	-	9	8	-	8	9+	19				
20	-	-	-	-	-	-	9+	5	3	-	1	5	1	9+	4	9	9	5	9	9+	1	9+	8	-	9+	9+	-	-	9	8	-	6	9+	20							
21	-	-	-	-	-	-	9+	5	1	1	1	5	1	9+	2	9	9+	9	5	9	9+	-	8	9+	5	1	9+	9+	-	-	9	7	-	2	9+	21					
22	-	-	-	-	-	-	9+	7	1	5	6	5	-	9+	5	9	9+	9+	6	9+	9+	-	9	9+	5	1	9+	9+	-	3	9+	4	-	2	9+	22					
23	1	-	1	-	-	-	9+	8	1	8	8	7	1	9+	2	9	9+	9+	9	9+	9+	-	9	9+	1	1	9+	9+	-	5	9	1	-	6	9	23					

Short, weak EU opening.

Be there, or be hoised!

Even when signals start weak at 20Z

they rapidly get stronger on 15 meters to JA

Now, add 15-meter openings. Concentrate on multipliers. 57



# Band-Planning Strategies

## Single-Operator, All-Band, SO2R

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UTC	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		
0	7	-	4	7	1	-	9+	8	3	9	8	7	5	9+	5	9+	9+	9	9	9+	9+	-	9	9+	7	8	9+	9+	-	6	7	-	-	7	6	0					
1	8	-	8	8	2	1	9+	9	3	9+	9	7	8	9+	7	9+	9+	8	9+	9+	9+	-	9	9	1	9	9+	9+	-	1	-	-	-	9	6	1					
2	8	-	9	8	3	5	9+	9	3	9+	9	8	9	9+	6	9	9+	9	9+	9+	9+	-	8	7	-	3	9	7	-	-	-	-	4	6	2						
3	9	-	9+	9	-	8	9+	9	5	9+	9	7	9+	9+	5	9	9+	7	9	9+	9+	-	4	3	-	-	7	7	-	-	-	-	-	6	3						
4	9	-	9+	9	-	9	9+	9+	7	9+	9+	7	9+	9+	2	8	9+	5	4	9+	9+	-	1	1	-	-	3	6	-	-	-	-	-	6	4						
5	9	2	9+	9	-	9+	9+	9	8	9+	9+	8	9+	9+	-	6	9+	5	-	9	9+	-	-	-	-	-	-	6	-	-	-	-	-	6	5						
6	9	5	9	9	-	9+	9+	9	9	9+	9+	8	9+	9+	-	2	9+	5	-	9	9+	-	-	-	-	-	-	6	-	-	-	-	-	6	6						
7	8	8	9	8	-	9+	9+	9	9	9+	9	8	9+	9+	1	-	9+	2	-	8	9+	-	-	-	-	-	-	6	-	-	-	-	-	6	7						
8	8	8	9+	7	1	9+	9+	9	9	9+	9	9	9+	9+	3	-	9+	8	-	8	9+	-	-	2	-	-	-	6	-	-	-	-	-	6	8						
9	7	9	9	-	8	9+	9+	9	9+	9+	8	9	9+	9+	2	-	9+	7	-	6	9+	-	-	2	-	-	-	6	-	-	-	-	-	6	9						
10	1	9	9+	-	8	9+	9+	8	9	9+	7	9	9+	9+	-	1	9	-	1	6	9+	-	-	-	-	-	-	6	-	-	-	-	-	6	10						
11	1	9	9	-	9	9+	9+	8	9+	9+	5	9+	9+	9+	-	3	8	-	5	9	9	-	-	-	-	-	-	6	-	-	-	-	-	6	11						
12	-	9	9+	-	9	9+	9+	8	9+	9+	2	9	9+	9+	-	4	5	-	2	9	9	-	-	-	-	-	-	6	-	-	-	-	-	6	12						
13	5	9	8	-	9	9+	9+	8	9+	9+	-	9+	9+	9+	-	1	9	5	3	8	9+	-	-	2	-	-	-	6	-	-	-	-	-	6	13						
14	4	9	2	-	9	9+	9+	8	9	8	4	9	9+	9+	6	1*	9+	8	-	4	9+	-	-	9	3	-	-	9	-	-	1	-	-	6	14						
15	4	9	-	-	8	9+	9+	7	9	5	4	9+	9+	9+	9	1	9+	9	8	8	9+	1	2*	9+	9	1*	2*	9+	-	-	9	1	-	-	9	15					
16	-	7	-	-	7	8	9+	7	9	1	4	9	9+	9+	9	9+	9+	8	8	9+	9+	6	1*	9+	9	4*	8	9+	-	-	9	7	-	-	9+	16					
17	-	5	-	-	1	4	9+	7	8	-	4	8	9	9+	9	9+	9	9+	7	9+	9+	5	5	9+	9	1*	8	9+	-	-	9	8	-	1	9	17					
18	-	1	-	-	-	-	9+	7	8	-	1	8	7	9+	8	9	8	9	7	9+	9+	1	4	9	9	-	9+	9+	-	-	9	9	-	6	9+	18					
19	-	-	-	-	-	-	9+	5	5	-	1	6	3	9+	8	8	8	9	3	9+	9+	-	-	9	9	-	9+	9+	-	-	9	8	-	8	9+	19					
20	-	-	-	-	-	-	9+	5	3	-	1	5	1	9+	4	9	9	9	5	9	9+	-	1	9+	8	-	9+	9+	-	-	9	8	-	6	9+	20					
21	-	-	-	-	-	-	9+	5	1	2	4	5	-	9+	2	9	9+	9	5	9	9+	-	8	9+	5	1	9+	9+	-	-	9	7	-	2	9+	21					
22	-	-	-	-	-	-	9+	7	1	5	6	5	-	9+	5	9	9+	9+	6	9+	9+	-	9	9+	5	1	9+	9+	-	3	9+	4	-	2	9+	22					
23	1	-	1	-	-	-	9+	8	1	8	8	7	1	9+	2	9	9+	9+	9	9+	9+	-	9	9+	1	1	9+	9+	-	5	9	1	-	6	9	23					

Adding the other bands. Complicated, isn't it?



# Band-Planning Strategies

## Single-Operator, All-Band, SO2R

Nov., CA (San Francisco), for SSN = Low, Sigs in S-Units. By N6BV, ARRL.

UTC	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		
0	7	-	4	7	1	-	9+		8	3	9	8	7	5	9+		5	9+	9+	9	9	9+	9+		-	9	9+	7	8	9+	9+		-	6	7	-	-	7	6	0	
1	8	-	8	8	2	1	9+		9	3	9+	9	7	8	9+		7	9+	9+	8	9+	9+	9+		-	9	9	1	9	9+	9+		-	1	-	-	-	9	6	1	
2	8	-	9	8	3	5	9+		9	3	9+	9	8	9	9+		6	9	9+	9	9+	9+	9+		-	8	7	-	3	9	7		-	-	-	-	4	6	2		
3	9	-	9+	9	-	8	9+		9	5	9+	9	7	9+	9+		5	9	9+	7	9	9+	9+		-	4	3	-	-	7	7		-	-	-	-	-	6	3		
4	9	-	9+	9	-	9	9+		9+	7	9+	9+	7	9+	9+		2	8	9+	5	4	9+	9+		-	1	1	-	-	3	6		-	-	-	-	-	6	4		
5	9	2	9+	9	-	9+	9+		9	8	9+	9+	8	9+	9+		-	6	9+	5	-	9	9+		-	-	-	-	-	6		-	-	-	-	-	-	6	5		
6	9	5	9	9	-	9+	9+		9	9	9+	9+	8	9+	9+		-	2	9+	5	-	9	9+		-	-	-	-	-	6		-	-	-	-	-	-	6	6		
7	8	8	9	8	-	9+	9+		9	9	9+	9	8	9+	9+		1	-	9+	2	-	8	9+		-	-	-	-	-	6		-	-	-	-	-	-	6	7		
8	8	8	9+	7	1	9+	9+		9	9	9+	9	9	9+	9+		3	-	9+	8	-	8	9+		-	-	2	-	-	6		-	-	-	-	-	-	6	8		
9	7	9	9	-	8	9+	9+		9	9+	9+	8	9	9+	9+		2	-	9+	7	-	6	9+		-	-	2	-	-	6		-	-	-	-	-	-	6	9		
10	1	9	9+	-	8	9+	9+		8	9	9+	7	9	9+	9+		-	1	9	-	1	6	9+		-	-	-	-	-	6		-	-	-	-	-	-	6	10		
11	1	9	9	-	9	9+	9+		8	9+	9+	5	9+	9+	9+		-	3	8	-	5	9	9		-	-	-	-	-	6		-	-	-	-	-	-	6	11		
12	-	9	9+	-	9	9+	9+		8	9+	9+	2	9	9+	9+		-	4	5	-	2	9	9		-	-	9	3	-	-	9		-	-	-	-	-	6	12		
13	5	9	8	-	9	9+	9+		8	9+	9+	-	9+	9+	9+		-	1	9	5	3	8	9+		-	-	9	3	8	9+		-	-	-	-	-	-	6	13		
14	4	9	2	-	9	9+	9+		8	9	8	4	9	9+	9+		6	1*	9+	8	-	4	9+		-	-	9	3	-	-	9		-	-	1	-	-	-	6	14	
15	4	9	-	-	8	9+	9+		7	9	5	4	9+	9+	9+		9	1	9+	9	8	8	9+		1	2*	9+	9	1*	2*	9+		-	-	9	1	-	-	9	15	
16	-	7	-	-	7	8	9+		7	9	1	4	9	9+	9+		9	9+	9+	8	8	9+	9+		6	1*	9+	9	4*	8	9+		-	-	9	7	-	-	9+	16	
17	-	5	-	-	1	4	9+		7	8	-	4	8	9	9+		9	9+	9	9+	7	9+	9+		5	5	9+	9	1*	8	9+		-	-	9	8	-	1	9	17	
18	-	1	-	-	-	-	9+		7	8	-	1	8	7	9+		8	9	8	9	7	9+	9+		1	4	9	9	-	9+	9+		-	-	9	9	-	6	9+	18	
19	-	-	-	-	-	-	9+		5	5	-	1	6	3	9+		8	8	8	9	3	9+	9+		-	-	9	9	-	9+	9+		-	-	9	8	-	8	9+	19	
20	-	-	-	-	-	-	9+		5	3	-	1	5	1	9+		4	9	9	9	5	9	9+		-	1	9+	8	-	9+	9+		-	-	9	8	-	6	9+	20	
21	-	-	-	-	-	-	9+		5	1	2	4	5	-	9+		2	9	9+	9	5	9	9+		-	8	9+	5	1	9+	9+		-	-	9	7	-	2	9+	21	
22	-	-	-	-	-	-	9+		7	1	5	6	5	-	9+		5	9	9+	9+	6	9+	9+		-	9	9+	5	1	9+	9+		-	3	9+	4	-	2	9+	22	
23	1	-	1	-	-	-	9+		8	1	8	8	7	1	9+		2	9	9+	9+	9	9+	9+		-	9	9+	1	1	9+	9+		-	5	9	1	-	6	9	23	

Sleep?

Sleep? Contesters don't need no stinkin' sleep !



# Band-Planning Strategies

## Single-Operator, All-Band, SO2R

- Reducing all this data to a plan

W6 BAND PLAN, LOW SSN, NOVEMBER							
UTC	160	80	40	20	15	10	Comments
0			SA	JA,AF,OC,SA	JA, OC	JA, OC	Run JA, tune Radio 2 on 10/20m
1			EU, SA	EU,JA,SA,OC	JA, OC	OC	Run JA, tune Radio 2 on 20m
2	SA		EU, SA	EU,JA,SA,OC	JA		Run EU, tune Radio 2 on 15m
3	SA	EU, SA, AF	EU, SA	SA			Run EU, tune Radio 2 on 20/80m
4	SA	EU, SA, AF	EU, SA	SA			Run EU, tune Radio 2 on 160/80/20m
5	SA, OC	EU, SA, AF	EU, SA	SA			Run EU, tune Radio 2 on 160/80/20m
6	SA, OC	EU, SA, AF	EU, JA, SA	SA			Run EU, tune Radio 2 on 160/80/20m
7	SA, OC	JA, SA	EU, JA, SA	SA, OC			Run EU, tune Radio 2 on 160/80/20m
8	SA, OC	JA, SA	JA, EU, SA	SA, OC			Run JA, tune Radio 2 on 160/80/20m
9	SA, OC	JA, SA	JA, EU, SA	SA			Run JA, tune Radio 2 on 160/80/20m
10	SA, OC	JA, SA	JA	SA			Run JA, tune Radio 2 on 160/80/20m
11	SA, OC	JA, SA	JA	SA, OC			Run JA, tune Radio 2 on 160/80/20m
12	SA, OC	JA	JA	OC			Run JA, tune Radio 2 on 160/80/20m
13	SA, OC	JA	JA	SA, OC			Run JA, tune Radio 2 on 160/80/20m
14	JA	JA	JA	SA, AF			Run JA, tune Radio 2 on 160/80/20m
15	JA	JA	JA	EU,AF,AS,OC	EU, OC	SA	Run EU, tune Radio 2 on 40/15/80m
16				EU,AF,AS,OC	EU, OC	SA, AF	Run EU, tune Radio 2 on 15/10m
17				Everybody	OC	SA, AF	Run EU, tune Radio 2 on 15/10m
18				Everybody	OC	SA, AF	Run EU, tune Radio 2 on 15/10m
19				Everybody	OC	OC, SA, AF	Run EU, tune Radio 2 on 15/10m
20				JA,SA,AF,OC	JA, OC	SA, AF, OC	Run JA, tune Radio 2 on 20/10m
21				JA,SA,AF,OC	JA, OC	SA, AF	Run JA, tune Radio 2 on 20/10m
22				JA,SA,AF,OC	JA, OC	SA	Run JA, tune Radio 2 on 20/10m
23				JA,SA,AF,OC	JA, OC	JA, SA	Run JA, tune Radio 2 on 20/10m
Yellow Highlighting = May be Possible to Run Rate!							



# Refining Planning Strategies



A refined plan is important



# Refining Planning Strategies

20 Meters, W6 San Francisco, Nov, Low SSN

Zone	UTC -->	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	9+	9+	9	9+	8	5	1	-	-	-	1	5	1	-	-	-	5	9+	9	9+	9+	9+	9+	9+	9+
VO2 = 02	8	7	-	-	-	-	-	-	-	-	-	-	-	-	-	9	2	9+	9+	9+	9+	9+	9+	9+	2
W6 = 03	3	3	4	4	4	3	3	3	3	4	3	3	3	3	3	3	3	3	2	2	2	2	2	3	3
W9 = 04	9+	9+	9+	9	7	7	6	8	9	9	7	1	-	8	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+
W3 = 05	9+	8	7	6	5	5	6	7	8	8	5	1	2	8	9+	9+	9+	9+	9	9+	9+	9+	9+	9+	9+
XE1 = 06	9+	9	9+	9+	9+	9+	9+	9+	9+	9+	9+	9	9	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+
TI = 07	9+	3	9	9	6	6	5	8	9	9	2	-	-	9	9+	9+	9+	9	8	8	9	9	9+	9+	9+
VP2 = 08	9	9	8	6	2	2	3	6	8	5	1	-	-	9	9+	9	9	8	8	8	9	9+	9+	9+	9+
P4 = 09	9	9+	9	8	5	5	5	8	9	7	1	-	-	9	9+	9	9	8	7	7	8	9	9+	9+	9+
HC = 10	9+	9+	9	9	8	8	7	6	6	3	-	-	1	9	9+	9	9	7	5	6	7	9	9+	9+	9+
PY1 = 11	9+	9+	9+	9+	9	9	9	9+	9+	9+	9	4	5	8	4	1	1	1	1	4	6	8	9	9+	9+
CE = 12	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9	8	4	7	9	8	6	3	2	2	4	6	8	9+	9+
LU = 13	9+	9+	9+	9+	9+	9	9+	9+	9+	9+	9	7	2	9	7	3	1	1	1	1	3	6	8	9	9
G = 14	1	3	1	2	-	-	-	-	-	-	1	-	-	-	-	4	9	9	9	8	8	4	-	-	-
I = 15	5	6	6	5	1	-	-	1	3	2	-	-	-	-	-	6	9	9	9	7	5	1	-	1	2
UA3 = 16	5	7	5	5	2	-	-	-	-	-	1	-	-	-	-	-	8	8	4	-	-	1	2	5	2
UN = 17	-	6	9	7	-	-	-	-	-	-	-	-	-	-	-	-	2	1	6	5	3	3	1	-	-
UA9 = 18	6	9	9+	8	1	-	-	-	-	-	1	4	1	-	-	-	-	-	-	-	-	-	-	-	1
UA0 = 19	9+	9+	9	9	5	2	1	-	-	-	1	1	1	-	-	-	-	-	-	-	2	9	9	9	9
4X = 20	8	8	4	1	-	-	-	-	-	-	-	-	-	-	-	2	9	9	8	4	1	3	4	6	7
HZ = 21	7	6	7	4	-	-	-	-	-	-	-	-	-	-	-	8	8	7	7	3	4	5	6	7	7
VU = 22	9	9	9	6	-	-	-	-	-	-	-	-	-	-	-	-	2*	4	6	5	3	5	4	1	4
JT = 23	9	9+	9	9	4	-	-	-	-	-	1	5	2	3	-	-	-	4	2	1	-	-	1	5	9
VS6 = 24	8	9	8	8	7	4	1	-	-	-	1	3	4	-	1*	-	4	8	6	3	-	1	8	8	8
JA1 = 25	9	9	9	9	8	6	2	-	-	-	-	-	1	-	-	-	-	3	1	-	4	9	9	8	9
HS = 26	8	8	7	7	3	1	-	-	-	-	-	-	-	-	-	-	-	8	8	7	5	-	-	-	8
DU = 27	9	6	7	7	8	5	2	-	-	-	-	4	6	2	-	1	9	9	9	2	-	8	8	9	9
YB = 28	9	6	3	2	3	1	1	-	-	-	-	2	4	1	1*	1	9+	9+	9	8	1	1	7	9	9
VK6 = 29	2*	-	-	-	-	1	2	3	5	2	2	8	9	5	-	7	9+	9+	8	8	6	1	2	1	1
VK3 = 30	2*	1	2	5	7	8	8	8	8	4	4	9	9	5	1	8	9	9	8	7	5	2	1	1*	1*
KH6 = 31	9+	9+	9+	9+	9	3	9	8	8	6	6	8	9	8	4	8	9	9+	9+	9+	9	9	9+	9+	9+
KH8 = 32	6	8	9	9+	9+	9	8	8	8	5	5	8	8	4	1	4	8	9+	9	8	8	6	4	4	4
CN = 33	3	2	4	4	-	1	-	-	2	3	-	-	-	-	1	8	8	9	9	9	9	9	6	7	2
SU = 34	8	8	6	1	-	-	-	-	-	-	-	-	-	-	-	3	9	9	9	2	3	2	4	6	7
6W = 35	9	8	7	7	5	4	5	1	8	7	-	-	-	-	5	6	6	6	9+	8	8	9	9+	9+	9+
D2 = 36	9+	9+	9	6	2	2	3	2	3	-	-	-	-	-	-	2	5	9	8	8	8	8	9	9	9+
5Z = 37	9+	9+	2	2*	-	-	-	-	-	-	-	-	-	-	-	4	8	9	9	9	8	8	8	9	9
ZS6 = 38	9+	9+	8	6	4	5	1	2	-	-	-	-	-	-	-	1	8	8	8	6	7	8	8	9	9+
FR = 39	9+	9+	9	3	-	-	-	-	-	-	-	-	-	-	-	-	7	9+	9+	9	8	8	9	9	9+
FJL = 40	8	8	6	1	-	-	-	-	-	-	-	-	-	-	-	-	1	8	2	8	7	7	7	8	8
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	

Highlight strong signals for multipliers on 20 meters.



# Refining Planning Strategies

15 Meters, W6 San Francisco, Nov, Low SSN

Zone	UTC	-->	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	9	9+	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	9+	9	8	9	9	9	
VO2 = 02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	7	5	-	-	6	8	-	
W6 = 03	6	6	7	7	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
W9 = 04	9+	7	-	-	-	-	-	-	-	-	-	-	-	-	-	1	9+	9+	9+	9	9	9+	9+	9+	9+	
W3 = 05	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	5	3	9	9+	9+	9+	9+	9+	9+	9+	
XE1 = 06	9+	9	6	1	-	-	-	-	-	-	-	-	-	-	-	9	9	8	9+	7	8	9	9	9	9	
TI = 07	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	5	9+	9+	9	5	5	9	4	5	
VP2 = 08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	9	9	9	9	9	9+	9+	8	4	
P4 = 09	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	9+	9+	9	9	9	9+	9+	8	9	
HC = 10	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	9+	9+	9	9	9	9	9+	9+	9+	
PY1 = 11	9+	6	3	-	-	-	-	-	-	2	2	-	-	-	2	9	9	8	8	8	8	8	9	9	9+	
CE = 12	9+	9	7	3	1	-	-	-	-	-	-	-	-	-	-	8	9	9	8	8	8	8	9	9+	9+	
LU = 13	9+	8	6	2	1	-	-	-	-	-	-	-	-	-	1	9	9	8	8	8	8	8	9	9+	9+	
G = 14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	5	1	-	-	-	-	-	
I = 15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	6	5	-	-	-	-	-	-	
UA3 = 16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
UN = 17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
UA9 = 18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
UA0 = 19	9	8	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	8	9	
4X = 20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	5*	1*	-	-	-	-	-	
HZ = 21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4*	-	-	-	-	1	1	1	
VU = 22	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1*	-	1*	-	-	-	-	-	-	
JT = 23	8	9	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	
VS6 = 24	9	9	4	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	9	
JA1 = 25	9	9	6	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	8	9	0	
HS = 26	9	9	4	-	-	-	-	-	-	-	-	-	-	-	-	2*	1*	1*	-	-	-	-	-	-	1	
DU = 27	9	9	7	1	-	-	-	-	-	-	-	-	-	-	-	2*	-	-	-	-	-	-	-	9	9	
YB = 28	9	9	8	4	1	-	-	-	-	-	-	-	-	-	-	-	-	-	5	4	-	-	-	2	0	
VK6 = 29	8	8	8	2	-	-	-	-	-	-	-	-	-	-	-	-	1	8	6	-	-	-	-	6	8	
VK3 = 30	7	8	8	7	3	-	-	-	-	-	-	-	-	-	-	-	8	6	-	1	8	8	8	8	8	
KH6 = 31	9+	9+	5	-	2	-	-	-	-	-	-	-	-	-	-	-	4	5	9+	9+	9+	9+	9+	9+	9+	
KH8 = 32	9	9	9	6	2	-	-	-	-	-	-	-	-	-	-	-	-	-	8	9+	0	9+	8	8	8	
CN = 33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	9	9	9	3	-	-	-	-	
SU = 34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	5*	1*	-	-	-	-	-	-	
6W = 35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	9	9	9	9	9	8	5	5	1	
D2 = 36	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	9	9	9	9	9	9+	9+	9+	9+	
5Z = 37	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	9	9	9	9	9	9	9	9	
ZS6 = 38	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	8	9	9	9	9	9	9	9+	8	
FR = 39	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	9	9+	9	9+	8	7	
FJL = 40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

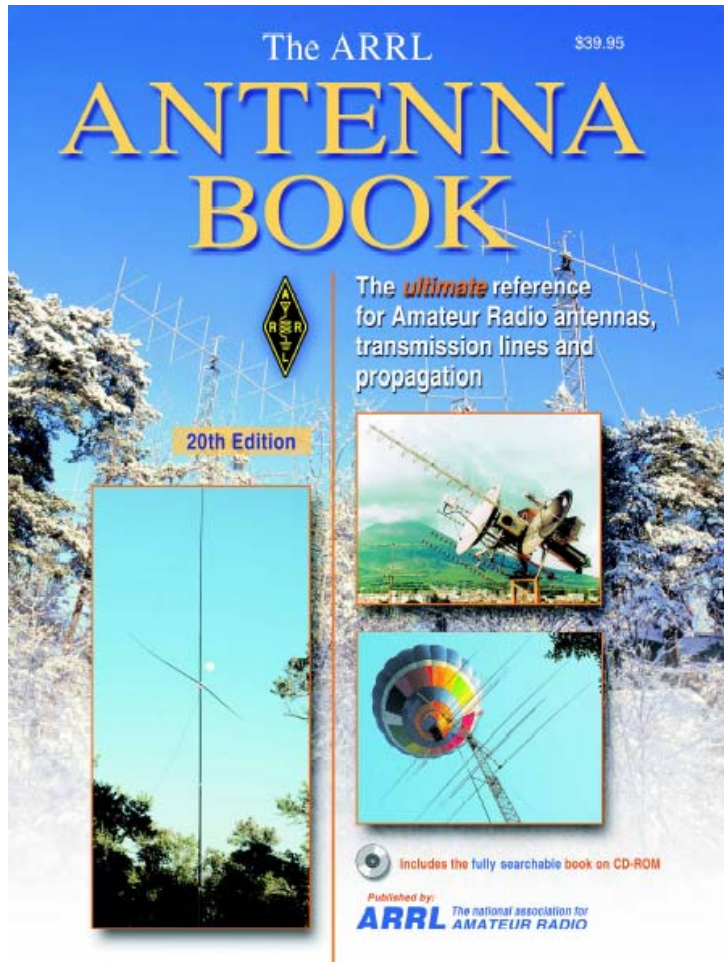


LP to  
Zone 20 &  
Zone 34

Looking at the details for multipliers on 15 meters.



# 20th Edition of *The ARRL Antenna Book*



And now, my usual blatant pitch for the *Antenna Book*... After all, I am the Editor!

At \$39.95, it's a real bargain, with lots of great software too (but that's a subject for another lecture).