

Contesting Technical College

AREG Adelaide 2017

Outline

- * Setup a modern contest station for SO2R
- * Real life appraisal of a contest location
- * Discuss examples of how to use the most popular software and the lessons learned from it.
- * Multi Operator Stations
- * Filtering; Bandpass and Coax Stub
- * Antenna selection Software usage
- * N1MM with examples of SSB RTTY and CW.

What won't be covered

- * VHF/UHF Techniques
- * Distance vs Grid Square Scoring
 - * –you can not change the laws of physics
- * Microwave Activities
- * Drugs to stay awake – find your own
- * Things you can research easily

Google is your friend

A rectangular search input field with a thin blue border. On the right side of the field is a small, colorful microphone icon, indicating voice search functionality.

Google Search

I'm Feeling Lucky

What are the basics?

- * Antenna
- * Coax
- * Radio
- * Power
- * That is enough to join in to a radio contest

What is ideal?

- * Lots of Antennae
- * Lots of radios
- * Really good radios (sometimes amps)
- * Great Locations
- * PC Logging
- * Internet
- * Comfortable shack
- * Ability to stay in the chair for the entire time

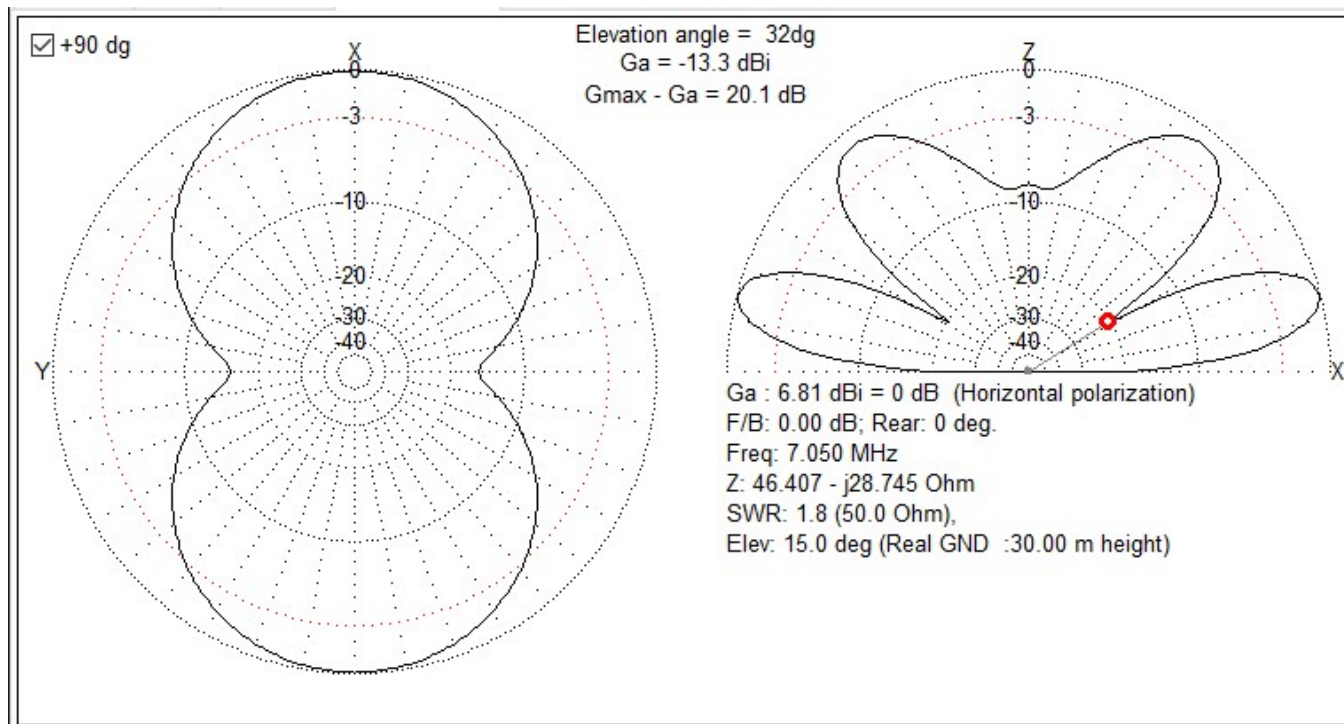
It is all about dB

- * Reference 10watt
- * 100 watt is 10db stronger
- * 400 watts is 16db stronger
- * 1000 watts is 20db stronger
- * ***How can a 10 watt station compete?***

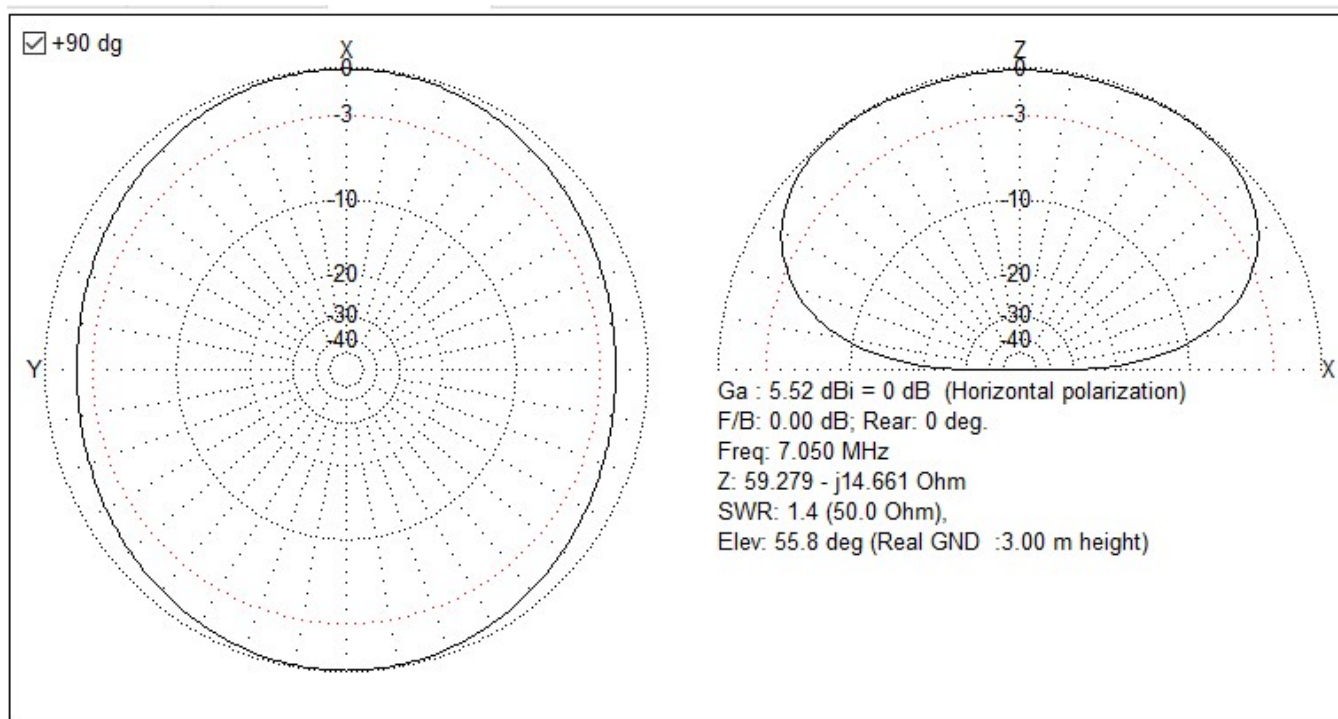
The Great Power Debate

- * They are running excess power
- * I am using full 100 watts and they are using 10 watts
- * We are both using dipoles
- * Signal report is the same
- * The DB difference is 10db –must be cheating

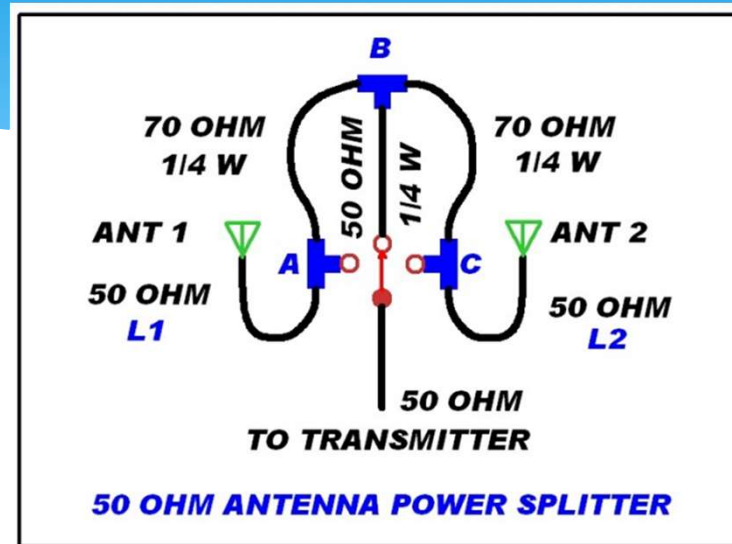
Antenna Envy



Newbie Antenna



Simple Combiner – W9XT



- * Two special cases are at work here. A $\frac{1}{4} \lambda$ feed line will convert an open circuit on one end to a short circuit at the other. The inverse is true, and a short circuit on one end will appear as an open circuit at the other end. The other special case is that a $\frac{1}{4} \lambda$ 70 Ω coax will transform 50 Ω on one end to 100 Ω on the other.
- * Looking at the diagram, the switch is in the centre position. In this position, both antennas will be connected. Antenna 1 will present a 50 Ω load at Tee connector A. The 70 Ω coax between connectors A and B will transform the 50 Ω to 100 Ω at connector B. Similarly, the impedance from Antenna 2 will also appear as 100 Ω at connector B. The two 100 Ω impedances in parallel form 50 Ω which is preserved through the 50 Ω coax back to the switch and to the transmitter.

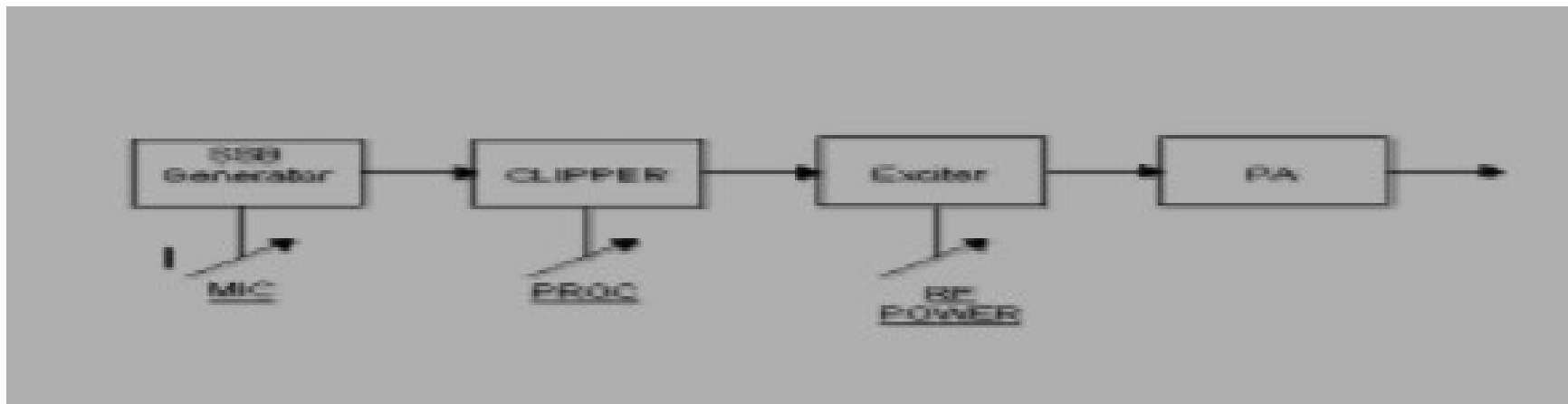
http://www.w9xt.com/page_antennas_coax_matching_network.html

How can a 10 watt station compete?

- * SSB = use the processor
- * Easy to get 10db gain; the same as 100w
- * Set it up properly
- * Use gain antennas
- * Learn CW
- * Use the right antenna for the job
- * You can never have enough antennae

No More Splatter

- * <http://www.ifwtech.co.uk/g3sek/cleansig/no-splat.htm>
- * SSB Transmitter Block Diagram





Step 1	Connect the transmitter to a dummy load.	Please don't do this on the air - you are going to make some foul noises before everything is adjusted correctly.
Step 2	Identify the MIC GAIN control.	This is before the clipper stage (see above). It controls the level of the SSB signal going into the clipper.
Step 3	Identify the processor ON/OFF button, and the PROCESSING level control. Help	The PROCESSING level control is inside the clipper stage (see above). It controls the level at which clipping is applied (higher-level peaks are removed).
Step 4	Identify the RF POWER control (often called PWR).	This comes after the clipper stage. It controls the level of the clipped signal, and the drive to the follow-on PA if you're using one, but it does not alter the degree of clipping.
Step 5	Set your transceiver to full-power CW, and adjust the PA as normal.	
Step 6	Set your transceiver to SSB, and the processor button to OFF. Adjust the MIC level control according to the handbook.	If possible, set the MIC control so that the ALC meter just below the point where the ALC meter indicates on speech peaks.

Step 7	Turn the PROCESSING control fully clockwise, and the processor button to ON. Give a long, loud "Haaaaaaaalo" into the microphone, and adjust the RF POWER level for maximum output from the PA.	This will sound terrible - do not do this into the antenna! Don't use a whistle - it's too high-pitched to give full output. At this stage you'll probably be generating horrendous splatter!
Step 8	Back off the RF POWER control until the output from the PA drops by about 10%. Note the setting of the RF POWER control, and then don't touch it again!	This is the step that will give you a clean signal! With most transmitters, reducing the peak power by about 10% from the maximum possible (saturated) level makes a huge improvement in IMD levels. Reduce your drive power to the level where the RF output starts to drop off quickly - about 10% usually does it.
Step 9	Listen to your signal on another receiver. Turn the PROCESSING level control fully counter-clockwise, then advance it slowly until your voice sounds loud and crisp, but not distorted.	If the background noise in your shack is very noticeable, you'll have to back off the PROCESSING control. Important: during this step, do not touch the RF POWER control!
Step 10	Ask a local station for an SSB quality report , with and without processing. If your signal is broader with the processor on, turn down the RF POWER control until it is narrower than before.	Your signal should be narrower with the processor on than without it - because the processor should be preventing those peaks of overdrive.
Step 11	Check the effectiveness of the processor with DX stations. Adjust the PROCESSING control as necessary, to get the best balance between audio quality and "punch".	Any improvement in "talk power" will be most noticeable when your signal is weak, so ask DX stations about that. Ask local stations about your audio quality and the width of your signal .
Step 12	Congratulate yourself!	- and grateful thanks from all your neighbors on the air!

Preconceptions

- * You don't need to **announce** your callsign when running a frequency
- * It is a level playing field
- * If you can hear them you can work them

One of the best ZF2MM (K9PG)
430 QSOs in one hour



MMANA

MMANA-GAL basic C:\MMANA-GAL_Basic\ANT\HF beams\3EL20.MAA

File Edit Tools Setup Help MMANA-GALpro

Geometry View Calculate Far field plots

Rele 20m (30mm/25mm/20mm Pipe)

Freq 14.15 MHz

Ground

☐ Free space

☐ Perfect

☒ Real Ground setup

Add height 20.00 m

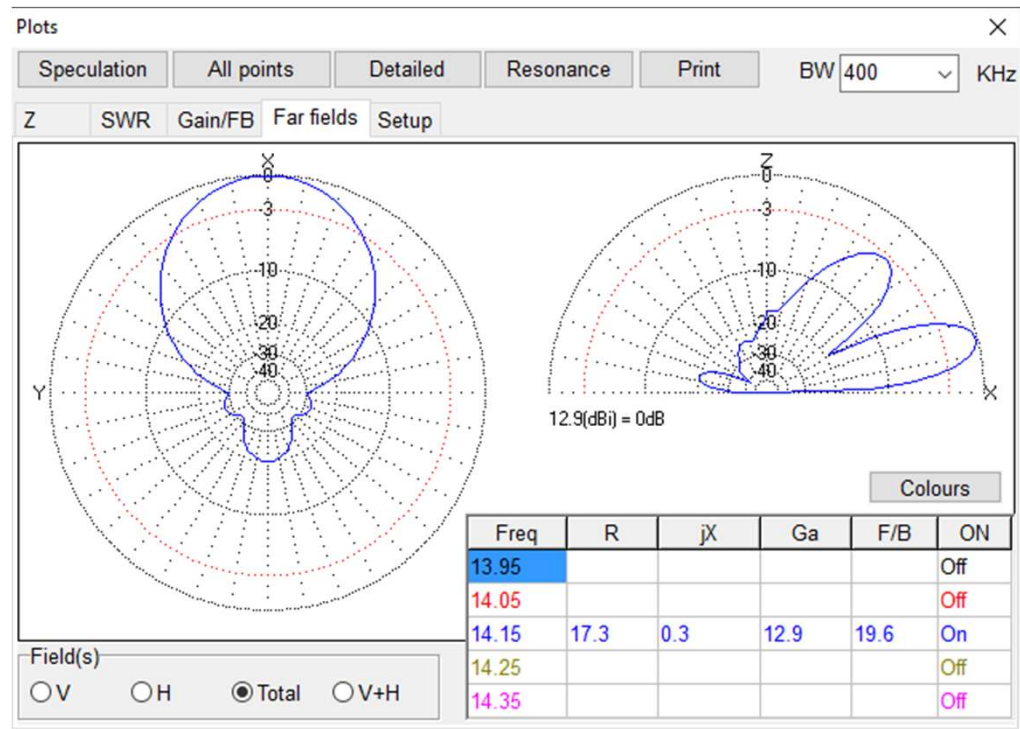
Material Al pipe

WAVE LENGTH = 21.187 (m)
TOTAL PULSE = 85
THE LOWEST POINT OF ANTENNA = 20.000 M
FILL MATRIX...
FACTOR MATRIX...
PULSE U (V) I (mA) Z (Ohm) SWR
w1c 1.00+j0.00 57.82-j0.94 17.29+j0.28 2.89
CURRENT DATA...
FAR FIELD ...
NO FATAL ERROR(S)
0.17 sec

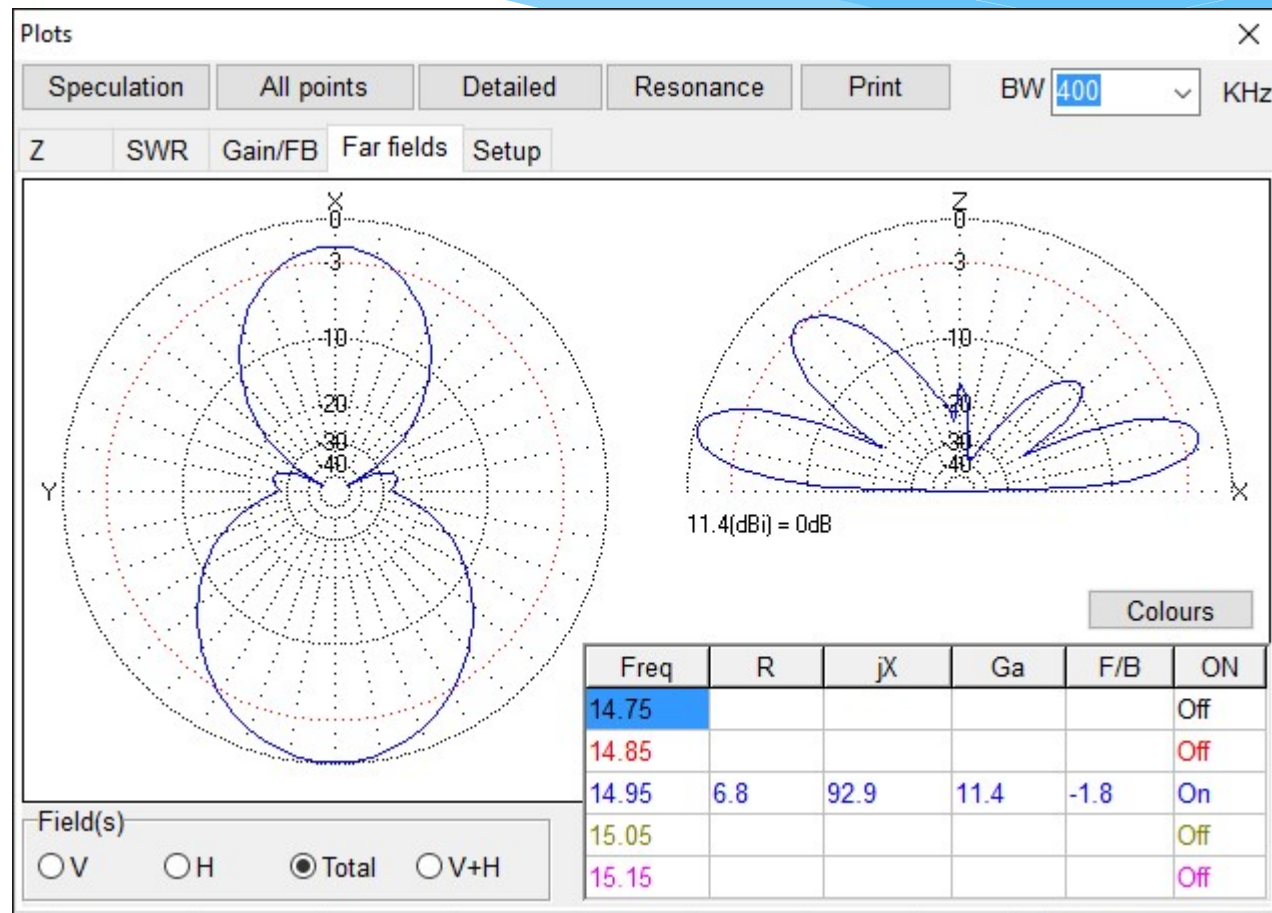
No.	F (MHz)	R (Ohm)	jX (Ohm)	SWR 50	Gh dBd	Ga dBi	F/B dB	Elev.	Ground	Add H.	Polar.
2	14.15	17.29	0.2801	2.89	---	12.92	19.59	14.4	Real	20.0	hori.
1	14.15	17.05	0.1946	2.93	---	13.0	19.52	14.4	Real	20.0	hori.

Start Optimization Optimization log Plots Wire edit Element edit

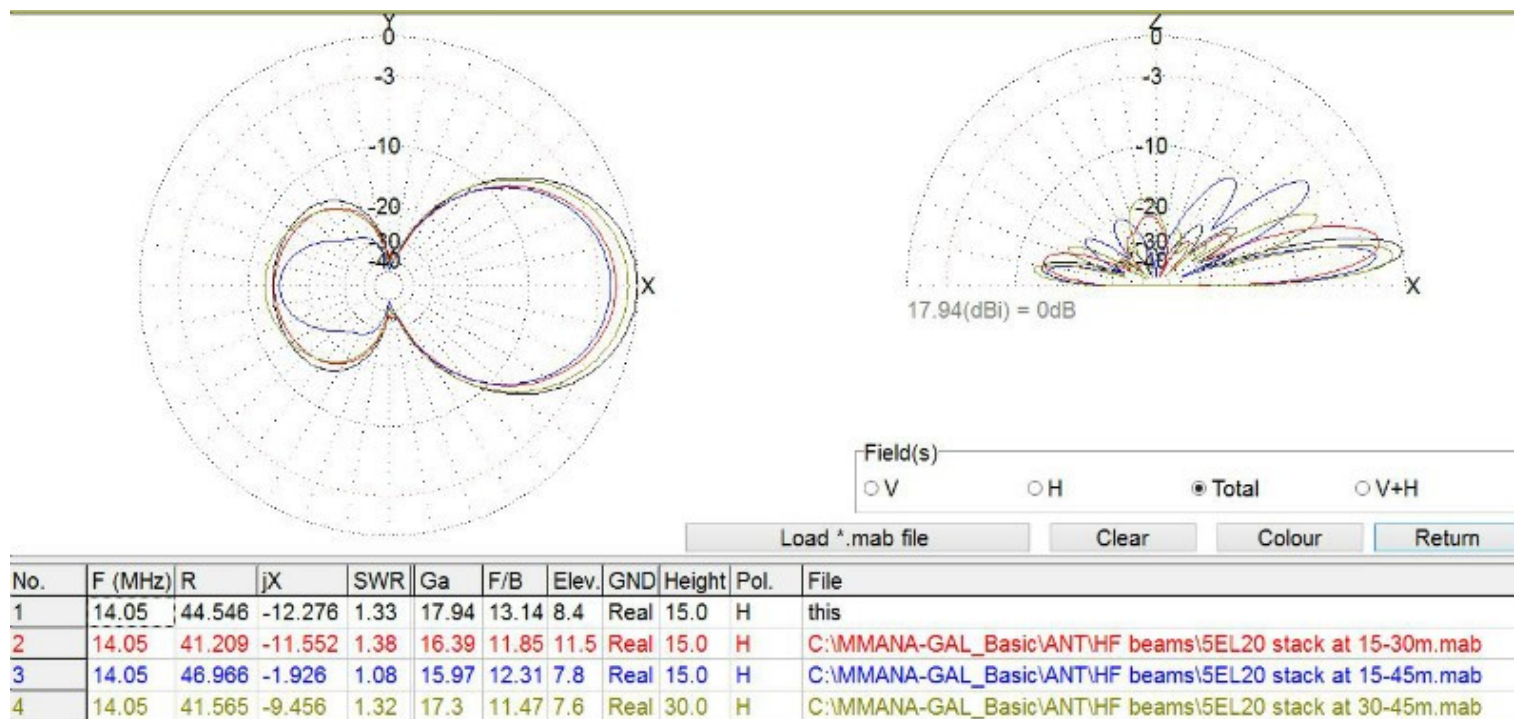
MMANA Plots



What you tune with a matcher



Stack matching



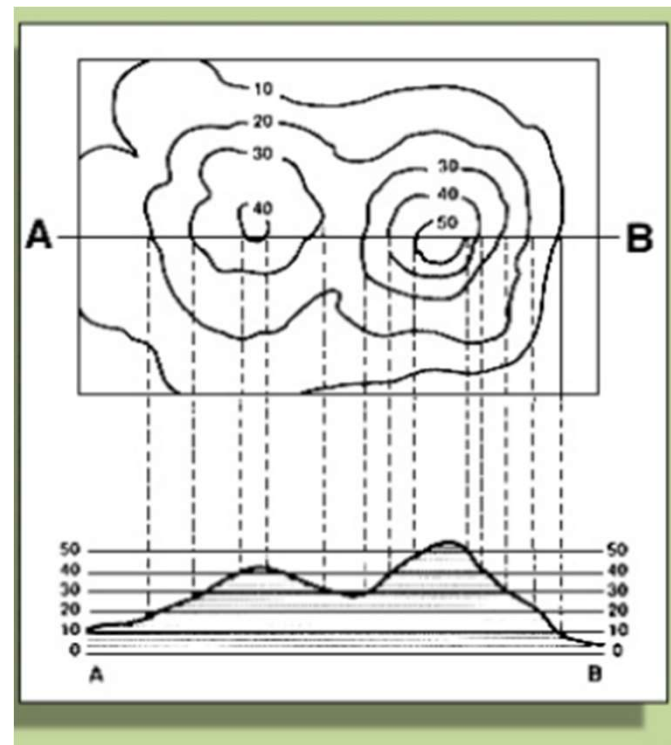
HFTA

High Frequency Terrain Analysis

- * Developed by Dean Straw
- * Packaged with ARRL Handbook
- * Compares antenna location and propagation

Plots the old way

- * Used Contour map
- * Plotted individually in multiple directions
- * Very time consuming
- * Errors happen easily
- * Radius 20,000 feet



Where do you get the plots?

The screenshot shows a web browser window with the URL `k6tu.net/?q=node/254091`. The page header features the K6TU Propagation logo and the tagline "Propagation for Contest & DX Strategy". A green notification bar at the top states: "Terrain Profile Request queued. You will receive an email when the Prediction results are available".

The main content area displays the call sign **VK5GN -34.589025, 138.692353**. Below this, the following details are listed:

- File name root:
- AZ:
- Latitude: -34.589025 degrees
- Longitude: 138.692353 degrees
- Status: [Queued](#)

The page includes three sidebars:

- Main menu:** Home, Shopping Cart, !! Subscribe !!, HF Terrain Analysis, Tutorials, User Profile, Logout.
- Who's new:** KK7L, AC7AV, K1ZK, AB9NN, N3HE, KM6DOV, ON5KQ, WH7W.
- Navigation:** Prediction Wizard, Show, New.

Done for every direction of interest

AZI-21.00 - Notepad

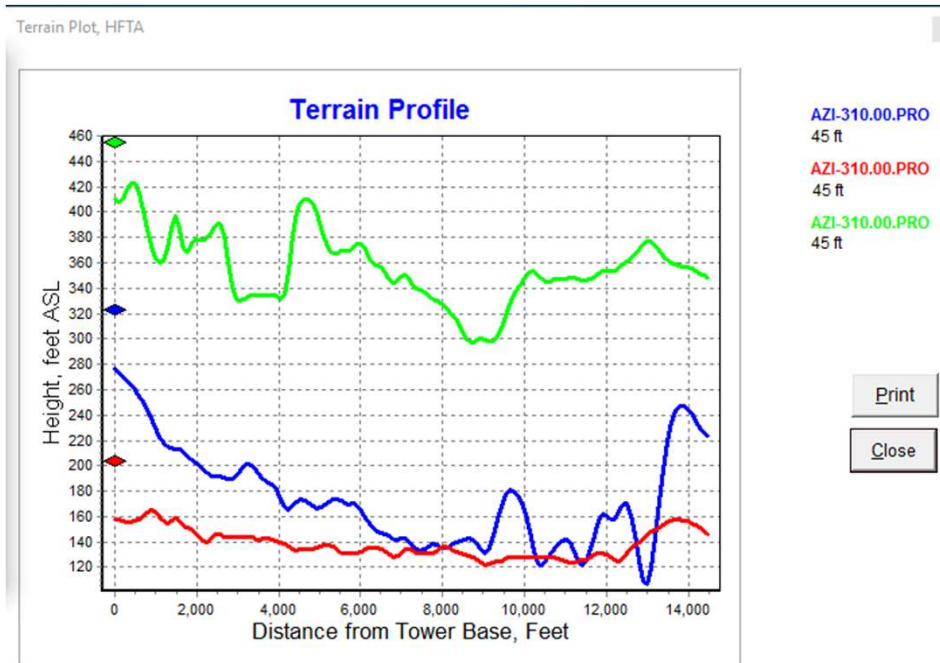
File	Edit	Format	View	Help
meters				
0	3.6			
30	4.0			
60	4.3			
90	4.3			
120	3.8			
150	3.2			
180	2.6			
210	2.2			
240	2.1			
270	2.0			
300	2.0			
330	2.0			
360	2.0			
390	1.8			
420	1.8			
450	2.3			
480	3.5			
510	4.7			
540	5.5			
570	5.9			
600	6.0			
630	6.0			
660	5.8			
690	5.6			
720	5.7			
750	6.1			
780	6.4			
810	6.3			
840	6.0			
870	5.9			
900	6.0			
930	5.9			
960	5.6			
990	5.2			
1020	5.0			

Propagation Statistics to EU VK2

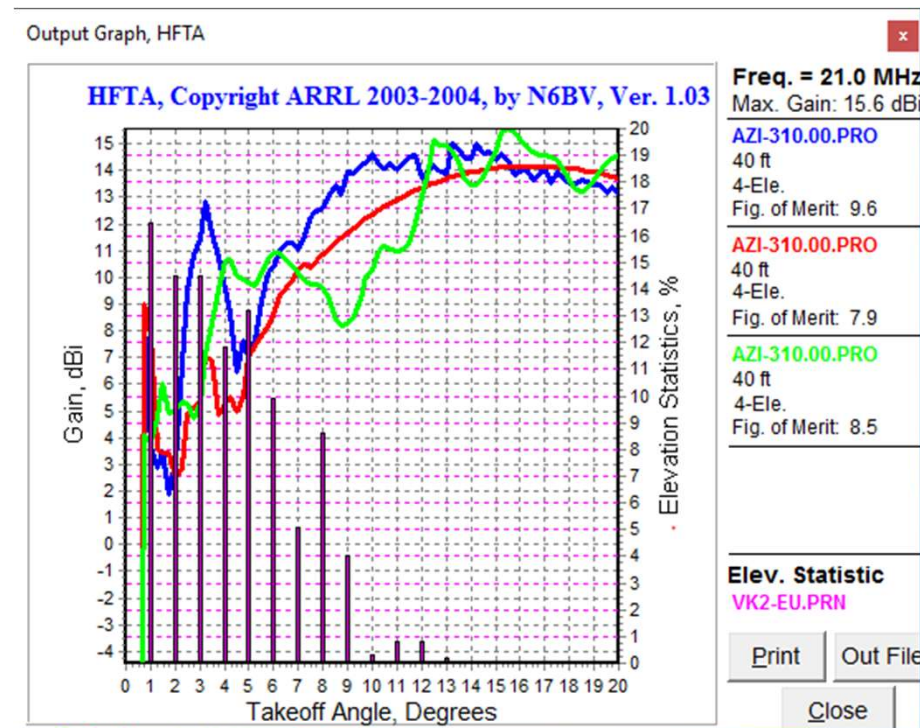
Elevations are averaged over all months, all days, all hours, over a complete 11 year sunspot cycle.

VK2-EU - Notepad								
File Edit Format View Help								
Sydney, Australia to Europe								
Elev	80m	40m	30m	20m	17m	15m	12m	10m
1	0.0	29.7	24.5	16.4	20.1	16.5	15.7	15.1
2	0.0	23.0	17.7	13.9	14.1	14.5	14.0	14.7
3	0.0	26.3	17.3	19.1	13.4	14.5	13.1	19.3
4	0.0	19.6	14.3	14.9	17.0	11.8	15.0	10.6
5	0.0	1.4	15.7	9.3	13.8	13.2	10.5	14.7
6	0.0	0.0	7.0	10.6	6.4	9.9	9.3	6.0
7	0.0	0.0	1.6	8.6	8.8	5.1	9.3	9.6
8	0.0	0.0	1.6	4.0	4.0	8.6	3.3	4.1
9	0.0	0.0	0.2	1.8	0.9	4.0	5.2	4.1
10	0.0	0.0	0.0	1.1	1.1	0.3	3.3	1.4
11	0.0	0.0	0.0	0.3	0.5	0.8	1.4	0.5
12	0.0	0.0	0.0	0.1	0.0	0.8	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

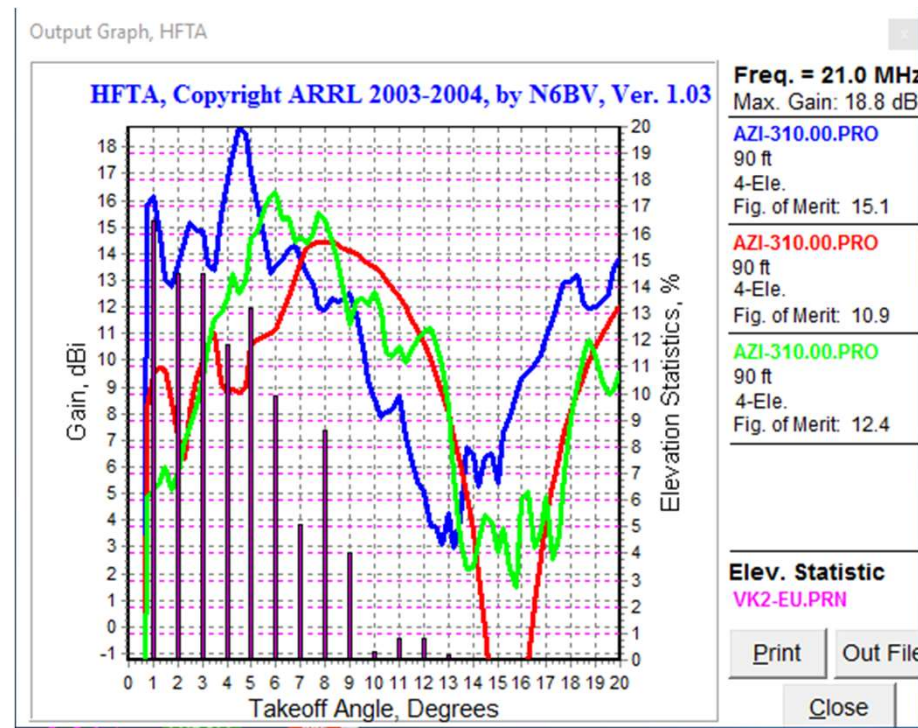
Putting it together



VK5GN VK5CRS VK5GR EU 40ft

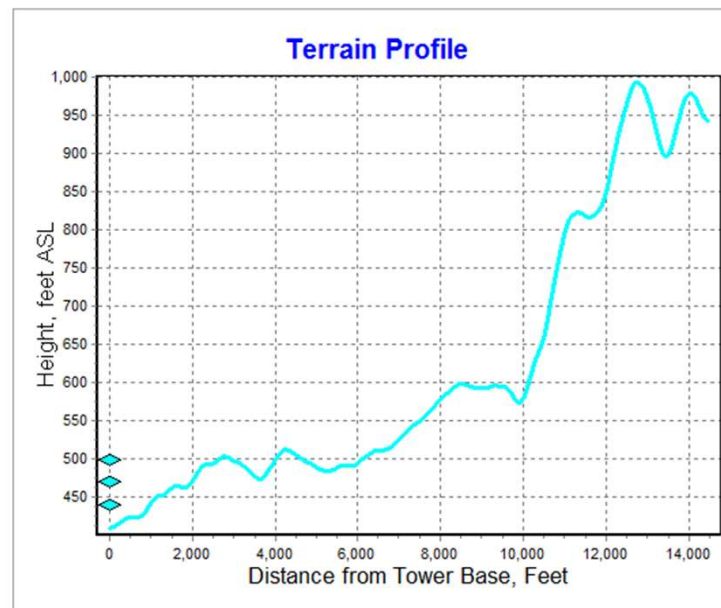


VK5GN VK5CRS VK5GR EU 90ft



VK5GR aiming USA

Terrain Plot, HFTA



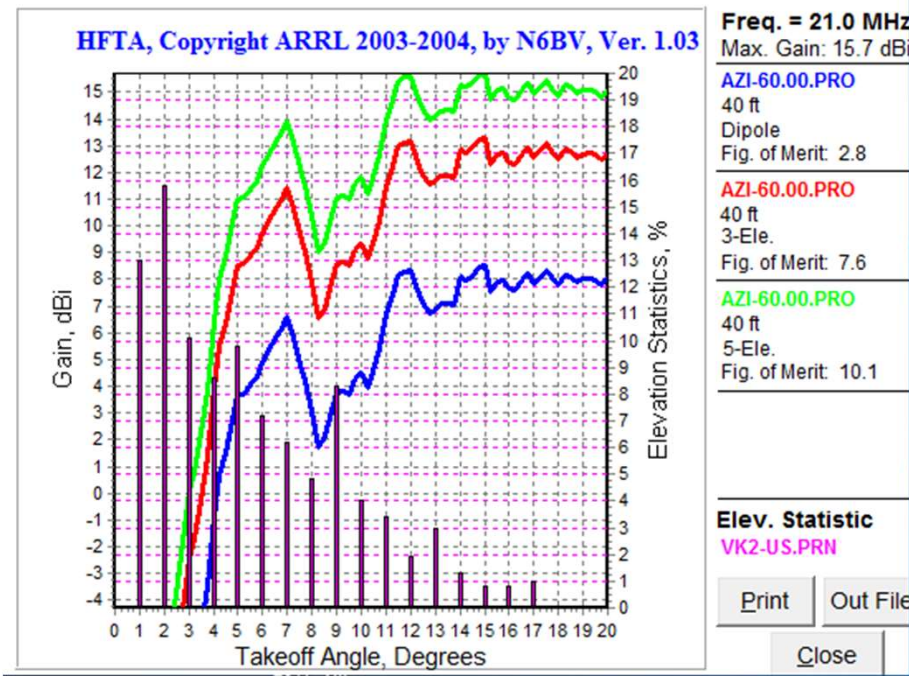
AZI-60.00.PRO
90 ft
AZI-60.00.PRO
90 ft
AZI-60.00.PRO
90 ft
AZI-60.00.PRO
30/60/90 ft

Print

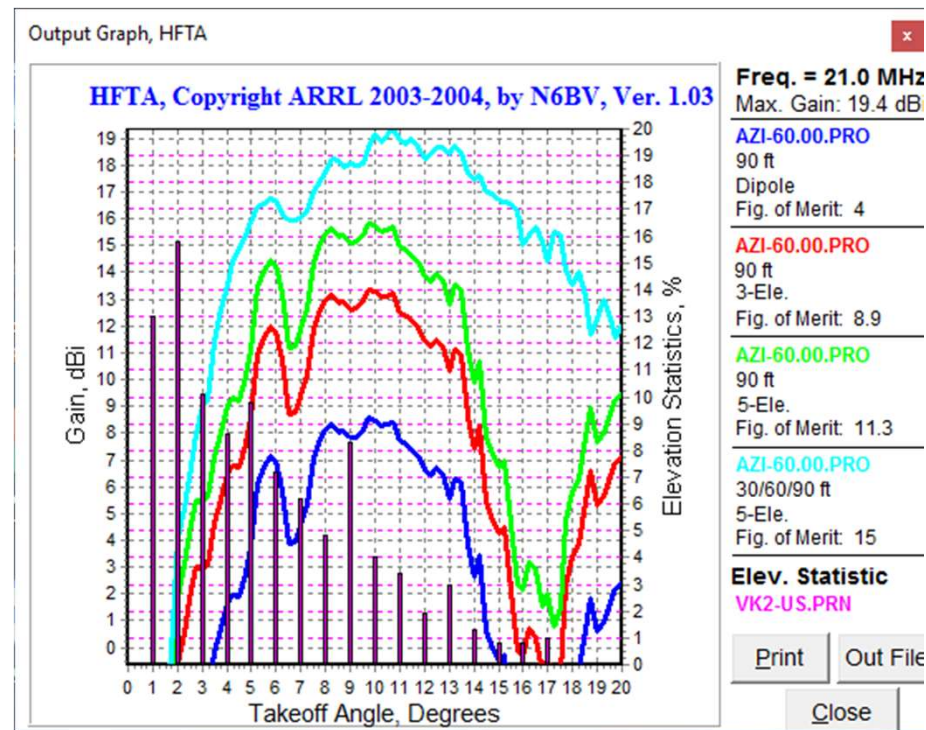
Close

VK5GR USA @40 feet

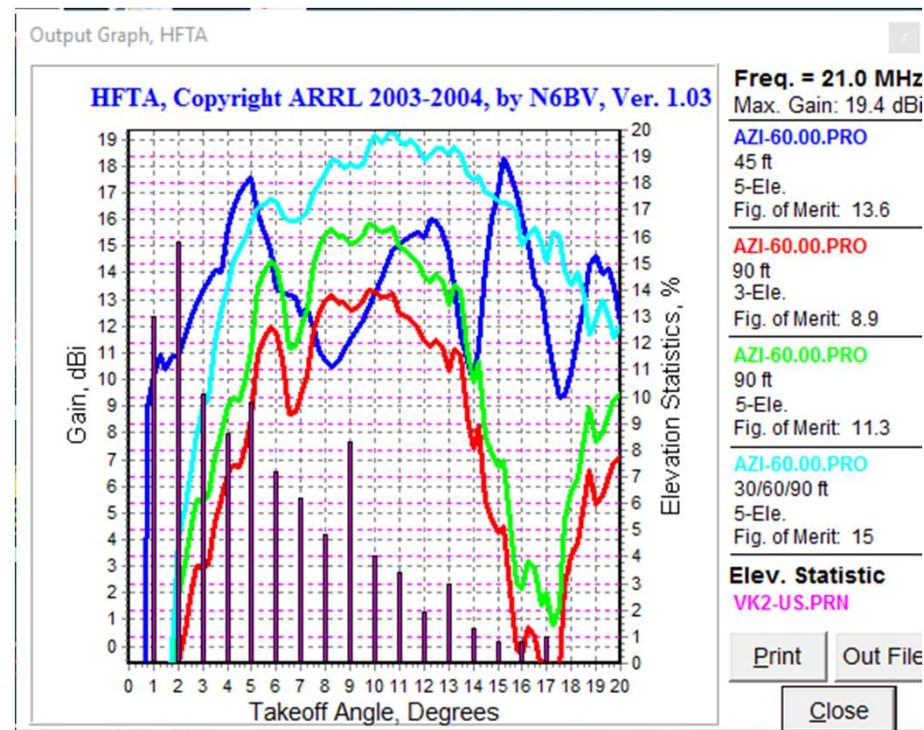
Output Graph, HFTA



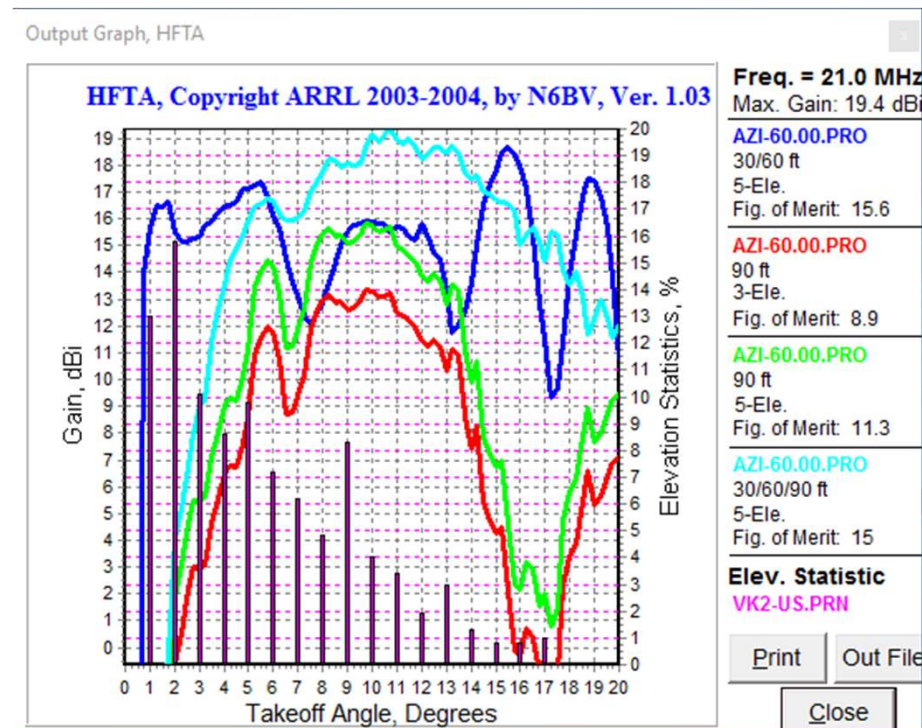
VK5GR USA @90 feet



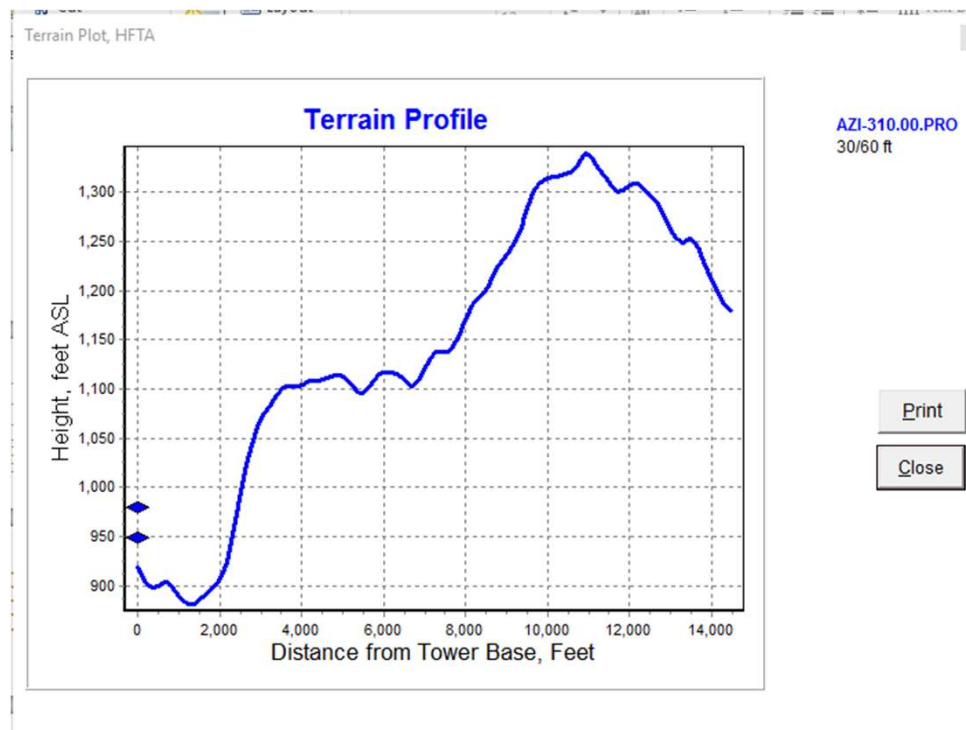
How good is location X?



Stack on a hill to USA

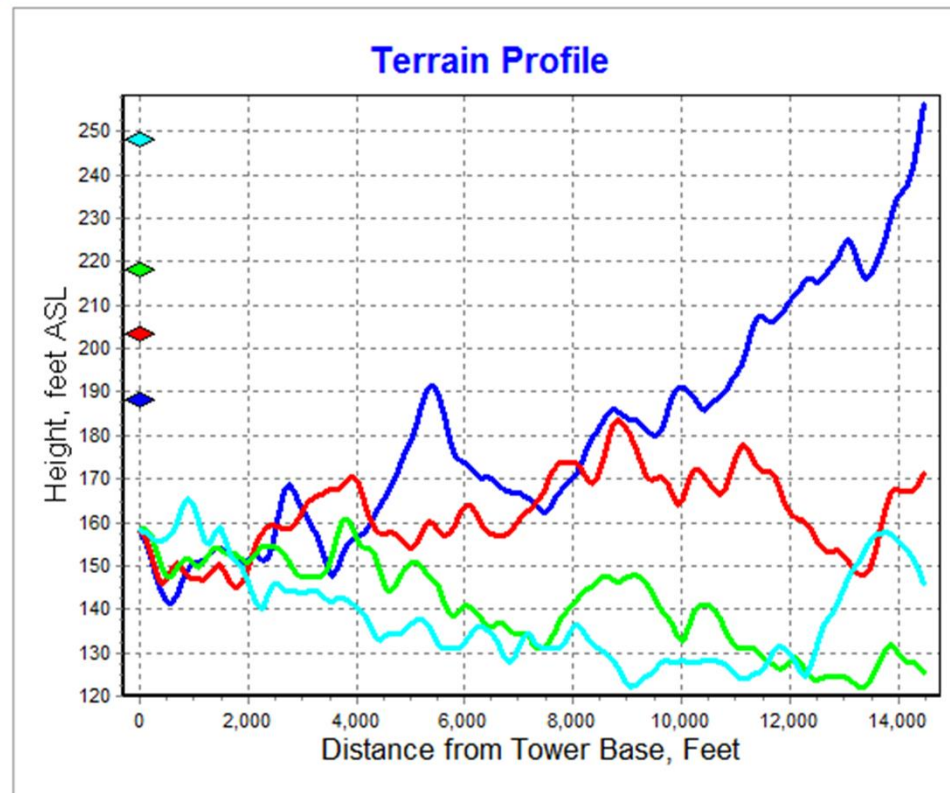


Problems to EU



VK5GN Common directions

Terrain Plot, HFTA



AZI-60.00.PRO
30 ft
AZI-135.00.PRO
45 ft
AZI-240.00.PRO
60 ft
AZI-310.00.PRO
90 ft

Print

Close

Martin VK5GN



VK5GN Gawler



VK5GN

Two Icom 765 radios and an impressive antenna farm consisting of :

- * beverages,
- * 80ft vertical for 160m,
- * quarter wave vertical for 80m,
- * sloping dipoles with reflector wires on 40m,
- * 9 el log periodic at 60ft for 20m to 10m,
- * 4 el yagi at 70ft for 15m
- * 6 el yagi at 70ft for 10m.

VK5GN CQWPX SSB

Rank	Call	Year	Category	Score	QSOs
1	VK5GN	2000	SO HP ALL	7,799,293	2,898
2	VK2WU	1984	SO HP ALL	5,928,934	3,134
3	VK5GN	2002	SO HP ALL	5,547,783	2,243
4	VK4CT	2012	SO HP ALL	5,147,126	1,882
5	VK8AA	2003	SO HP ALL	4,841,184	2,150
6	VK3TZ	2000	SO HP ALL (T)	4,554,869	2,038
7	VK2KL	1988	SO HP ALL	4,300,160	2,145
8	VK4UC	2000	SO HP ALL	4,257,870	1,890
9	VK4UC	2002	SO HP ALL	4,232,865	1,942
10	VK5GN	1993	SO HP ALL	4,130,580	2,201

VK5GN CQWW SSB

Rank	Call	Year	Category	Score	QSOs	Zn	Cty
1	VK5GN	1999	SO HP ALL	3,709,900	2,928	127	333
2	VK5GN	2002	SO HP ALL	3,612,654	2,876	118	331
3	VK5GN	2000	SO HP ALL	3,494,205	2,868	123	306
4	VK4VU	1982	SO HP ALL	3,462,200	3,341	107	243
5	VK4CT	2012	SO HP ALL	3,269,234	2,783	123	299
6	VK6HD	1971	SO HP ALL	2,911,224	2,442	117	287
7	VK5GN	2001	SO HP ALL	2,907,368	2,418	122	302
8	VK4VU	1981	SO HP ALL	2,697,562	3,028	101	200
9	VK8AA	2002	SO HP ALL	2,447,474	2,406	112	270
10	VK2IM	2012	SO HP ALL	2,282,660	2,224	116	264

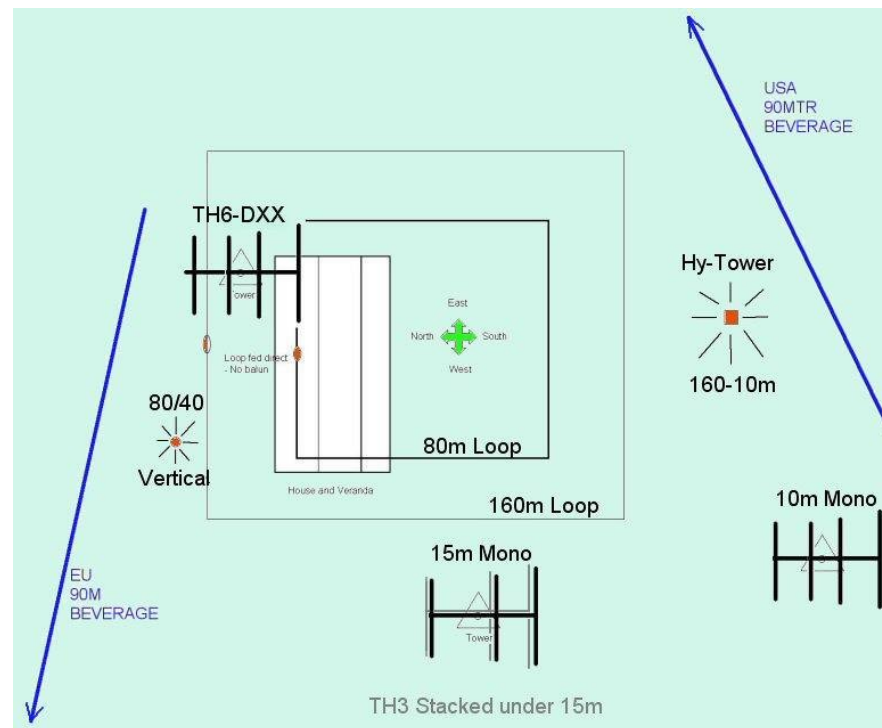
VK4SN



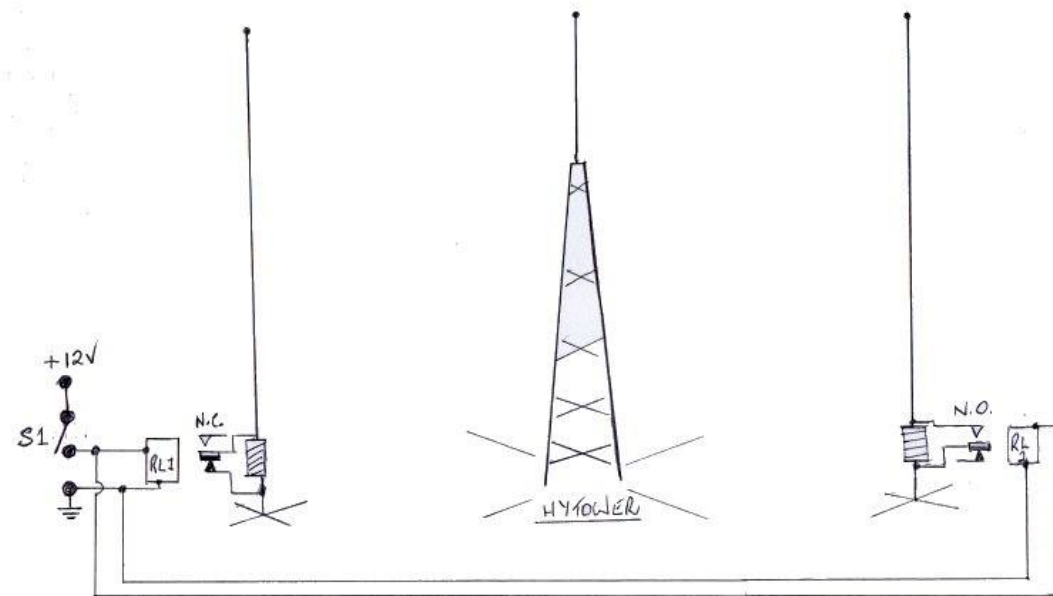
Easy operating



VK4SN Station Layout

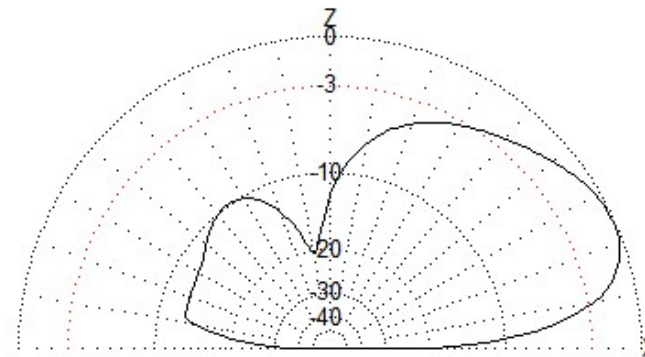
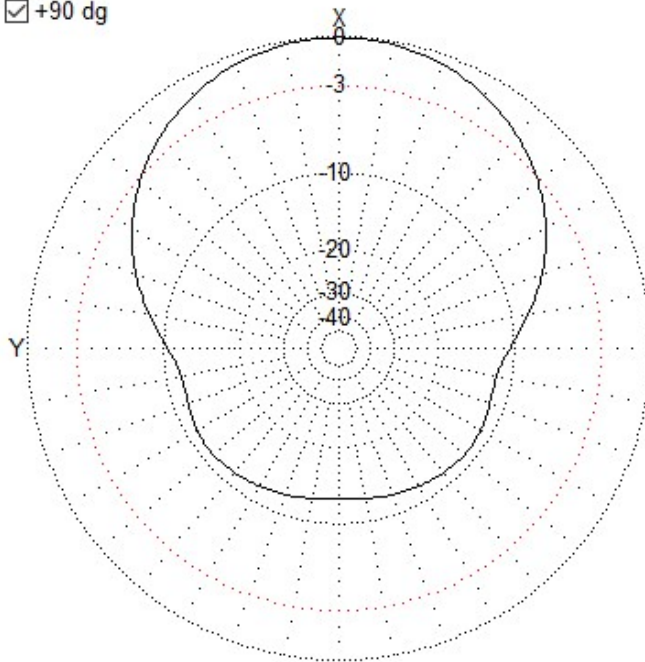


VK4SN 40M Vertical Beam



Radiation Pattern VK4SN

☒ +90 dg



Ga : 5.8 dBi = 0 dB (Vertical polarization)
F/B: 9.79 dB; Rear: Azim. 120 deg, Elev. 60 deg
Freq: 7.010 MHz
Z: 26.728 + j1.880 Ohm
SWR: 1.9 (50.0 Ohm),
Elev: 23.9 deg (Real GND :3.00 m height)

Setting up the Station – the Rig

- * What features are nice ?
- * PC Interface
- * Processor for SSB
- * Filters for receive
- * additional antenna sockets
- * Receive only antenna socket
- * Easy interface SSB Digital (RTTY PSK) CW

FT950 Yaesu



Features

- TX Frequency Coverage: 160 - 6 meters
- RX Frequency Coverage: 30 kHz - 56 MHz
- Operating Modes: USB, LSB, CW, AM, FM
- Digital Noise Reduction
- Power Output: 5 to 100 watts 160 - 6 meters
- Speech Processing
- Built-in Electronic Keyer
- Built In Antenna Tuner

ICOM 756 pro



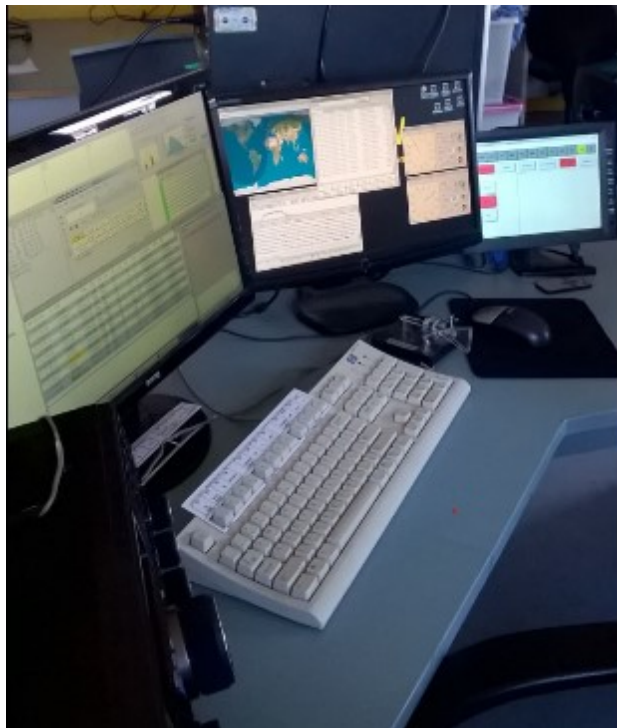
Features

- Voice Keyer
- 101 Memories
- RIT/XIT
- Noise Blanker
- Multiple Display Formats
- Realtime Spectrum Display
- Twin Digital PBT
- Voice Recorder
- 100 Watt Output
- Built-in Auto Antenna Tuner
- TCXO Built In
- 100% Duty Cycle
- Built in RTTY Demod
- DSP Notch
- 1 Hz Readout
- Memory Keyer
- RF Attenuator 6/12/18 dB
- Automatic Notch

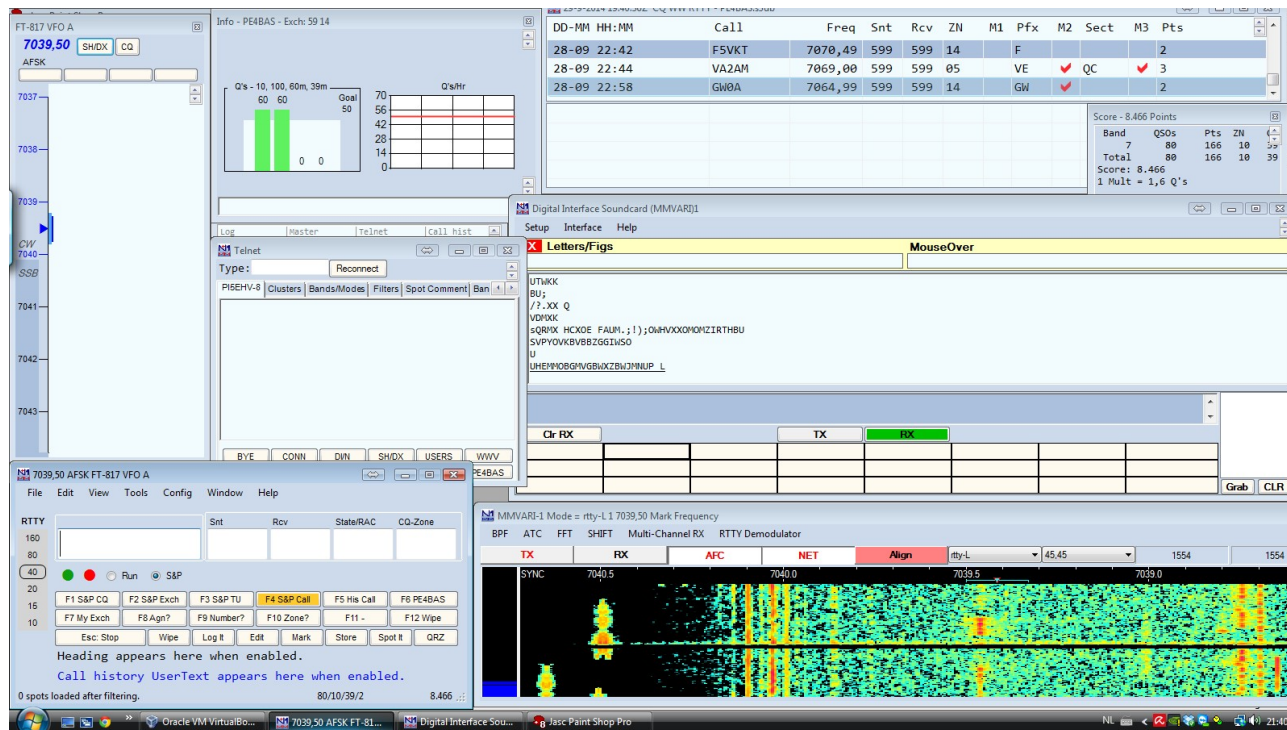
Shack PC - Software

- * N1MM+ Free – all contest modes
- * VKCL Free Specialist VK Software
- * Writelog Charge – Good RTTY PSK
- * TR4W Free – all contest modes
- * Wintest Charge – all modes
- * Logging Software e.g. Logger 32 These usually don't warn of duplicate contacts

Multiple Screens are handy



N1MM+



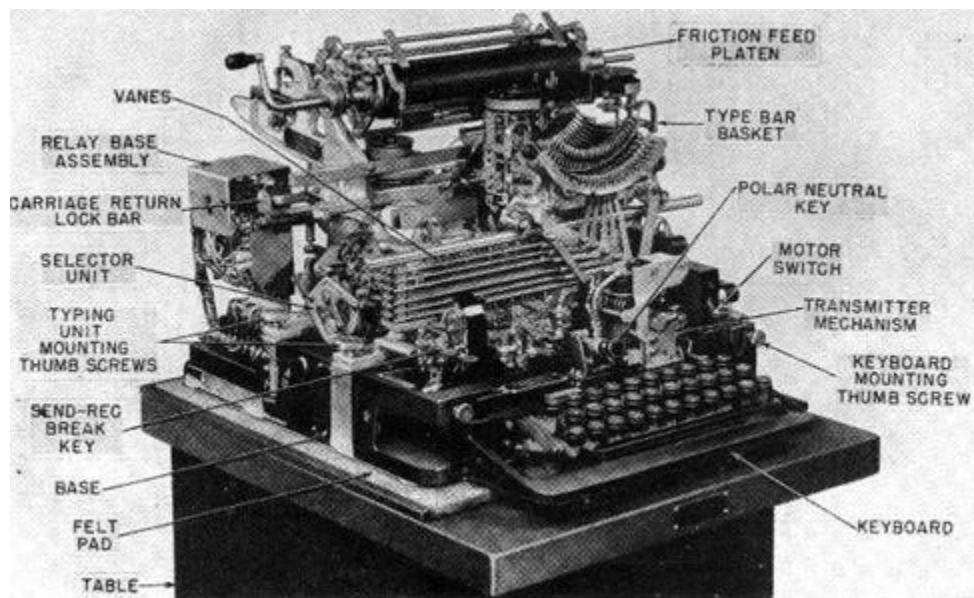
Google is your friend

A rectangular search input field with a thin blue border. On the right side of the field is a small, colorful microphone icon.

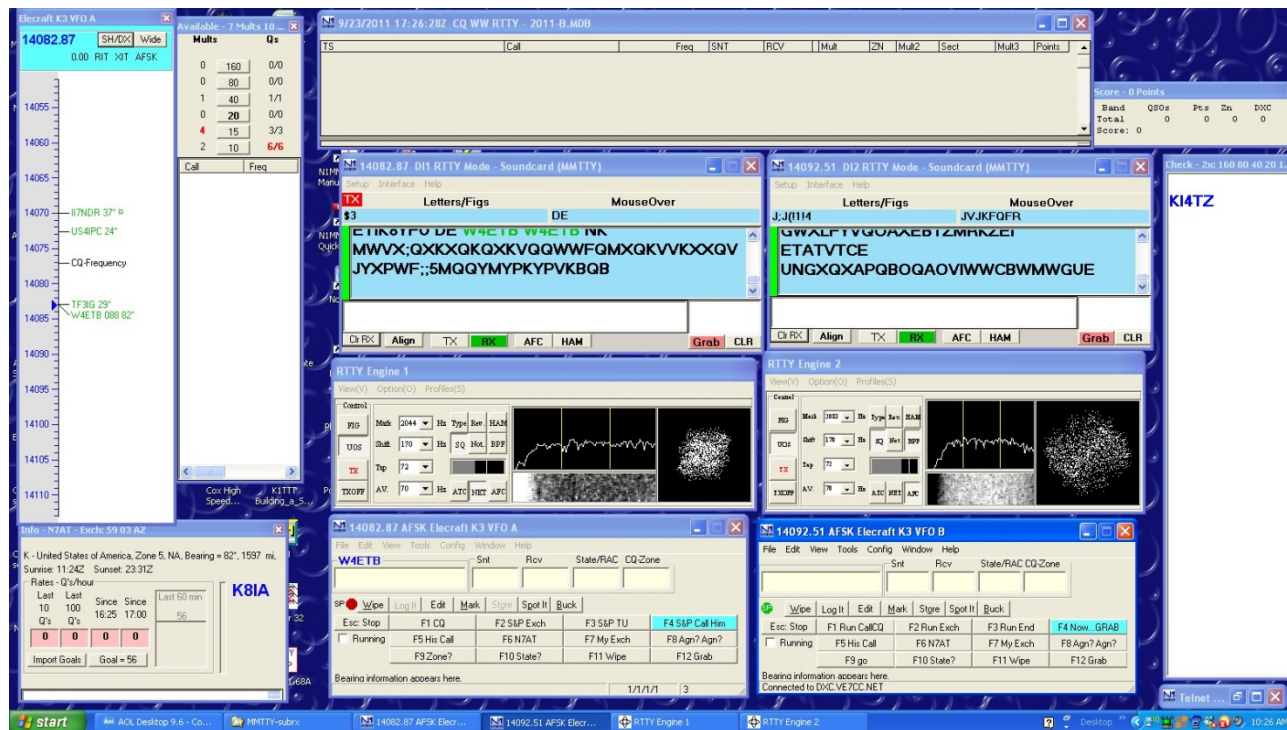
Google Search

I'm Feeling Lucky

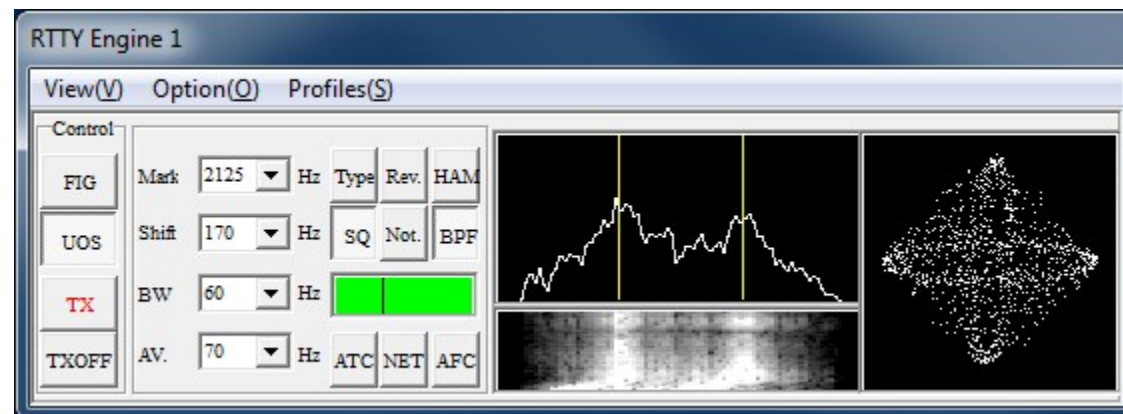
RTTY has moved on a bit



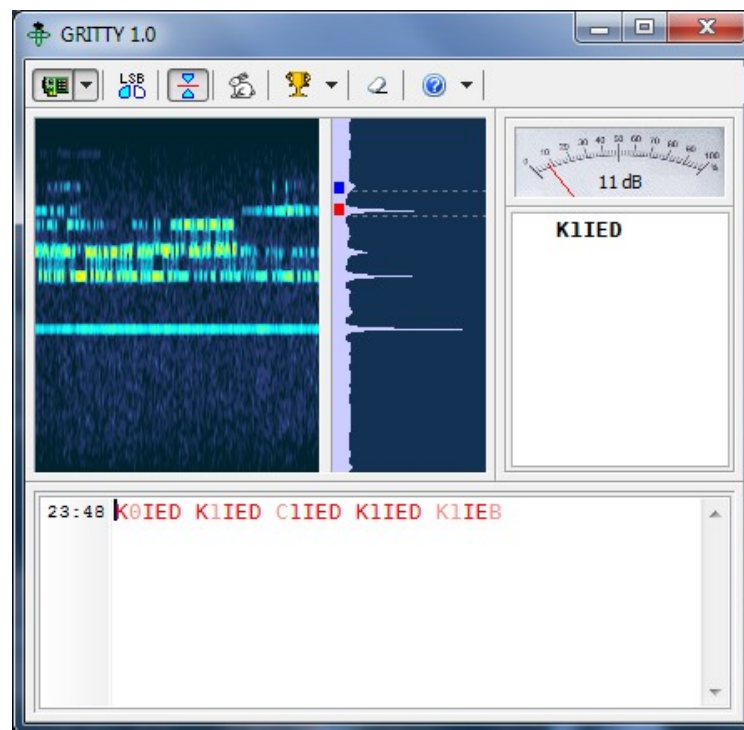
N1MM RTTY



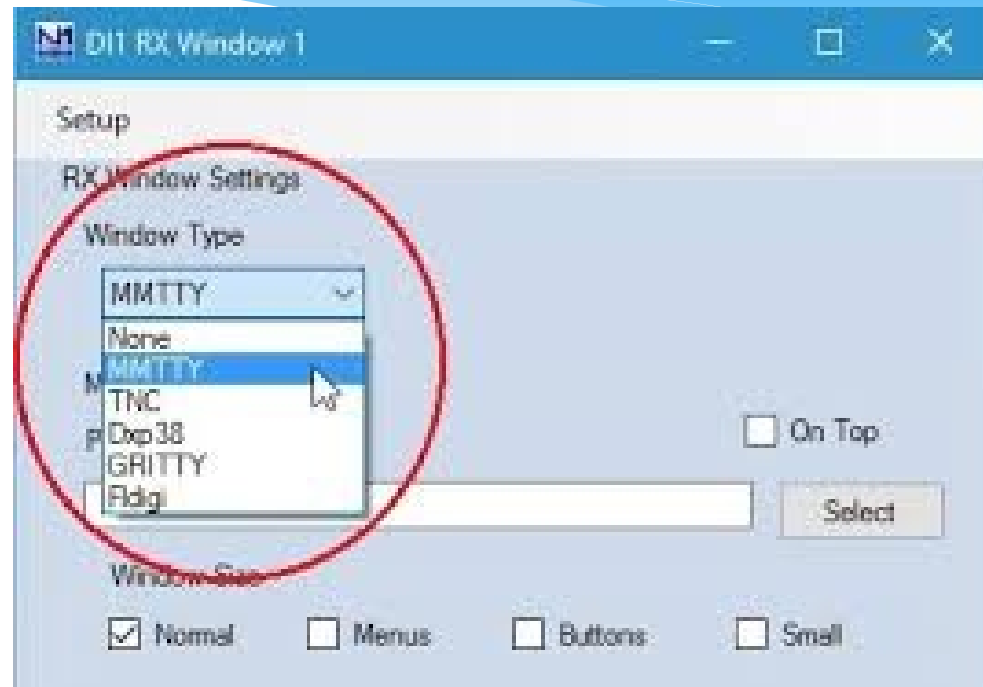
MMTTY Engine



GRITTY



Add it all together



Best RTTY Setup?

- * Use Multiple decoders
- * MMTTY with different filters (2 Instances)
- * Two Tone
- * GRiTTy
- * **MUST USE FSK** – Much better than AFSK
- * Easy to do two radios (SO2R)

SO₂R, Multi Single, Multi 2

- * Basically setup is identical
- * Filtering is needed
- * Separation of antenna
- * Not as critical as imagined
- * Start simple and work upwards

SO2R

- * Single operator – two radios
- * Latest variation is 2BSIQ - Two Bands Synchronized Interleaved QSOs
- * Software driven
- * Need to experiment – every station is different

Roll your own SO2R



2 radio RTTY CW and SSB controller for Writelog



Jaycar Microphone preamp to boost Heil headset and help match to Sound card



SO2R out of box solutions

- * All modes catered for – no rewiring of station
- * Best of the best



YCCC SO2R



- works with major contest logging software including N1MM Logger, Win-Test, and WriteLog.
- Comes in Kit form

DX Doubler

- * Simple hook-up
- * Much cheaper than MicroHam
- * Good for SSB or CW



Filters that work

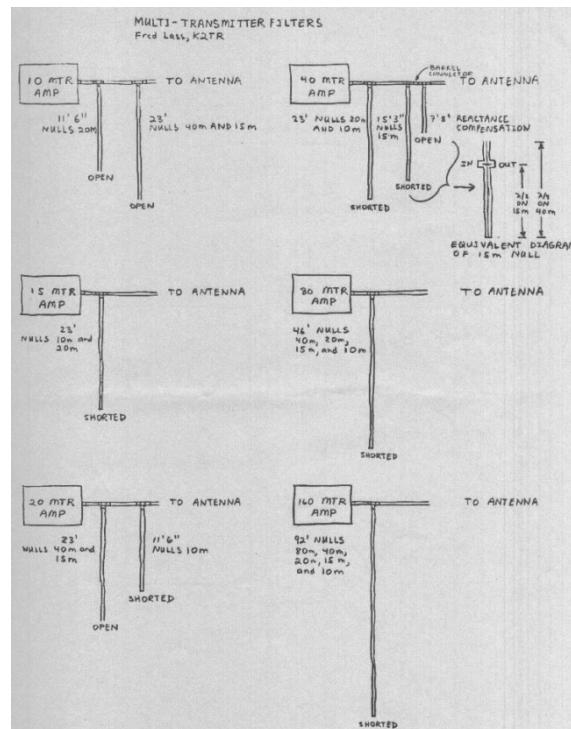
- * Coaxial Stubs
- * W3NQN
- * Dunestar
- * ICE
- * High Power versions of W3NQN several suppliers eg 4O3A and others

STUBS

- * Stubs – simple to make – tune on analyser
- * Cheap – bigger coax is better
- * RG58 to RG8 Approx. 10~15db better
- * Standards K2TR and K9YC
- * Can add two stubs to get bigger nulls (K9YC)

<u>Frequency</u>	<u>$\lambda/4$ Open</u>	<u>$\lambda/2$ Shorted, 2nd Harm</u>
160M	18-21 dB	
80M	20-23 dB	23-27 dB
40M	23-26 dB	25-27 dB
20M	26-29 dB	26-29 dB
10M	28-30 dB	

K2TR



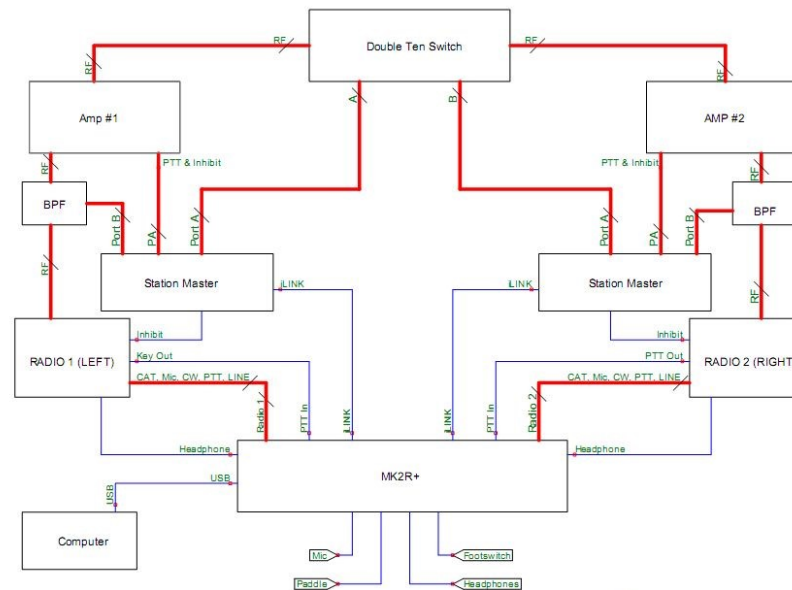
More Stubs



Bandpass FILTERS

- * Anything goes
- * W3NQN is the gold Standard
- * Usually handle rig output
- * Modern versions can handle 2kw plus
- * Typically over 45db suppression on adjacent bands
- * Again Google is your friend

Typical SO2R



Note: PTT/Key Out must be connected from each transceiver to MK2R+ (or in the absence of MK2R+ to PTT In of Station Master). For Yaesu transceivers PTT Out and Inhibit are available via the "Band Data" jack. For the K3, Inhibit and Key Out are available on the ACC connector. Most TenTec transceivers have PTT Out and Inhibit connections available on RA jacks. Icom transceivers require the use of the "Send" RCA jack or a two stage transistor circuit from the HSEND line of the ACC jack. Kenwood transceivers require connection to the amplifier relay (Remote, pin 4) or an NPN transistor driver connected to +12T (Remote, pin 7).

Title		
MK2R+/Station Master Connection		
Author		
W4TV		
File	Document	
C:\mikeham\Projects\BASIC_SO2R.dcn		
Revision	Date	Sheets
1.0	9 Jan 2009	1 of 1

CR300

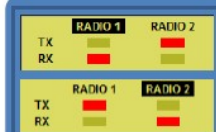
Two Bands

2BSIQ requires the capability to RUN with no interstation interference, in an alternate way, on two bands, interleaving transmitting signals one at a time



SO2R set-up

- Two radios; No inter-station interference
- No interference to be able to RUN on any two bands



Alternate running on two bands

- If radio1 on band 1 is TX, radio2 on band 2 must be RX
- If radio1 on band 1 is RX, radio 2 can be TX



Only one signal on the air

- To comply with SOAB only one signal on the air
- To comply with SOAB each TX signal to different band

CR300 2BSIQ

- * CR300 operating 2BSIQ (Two Bands Synchronized Interleaved QSOs) during CQWW CW 2016

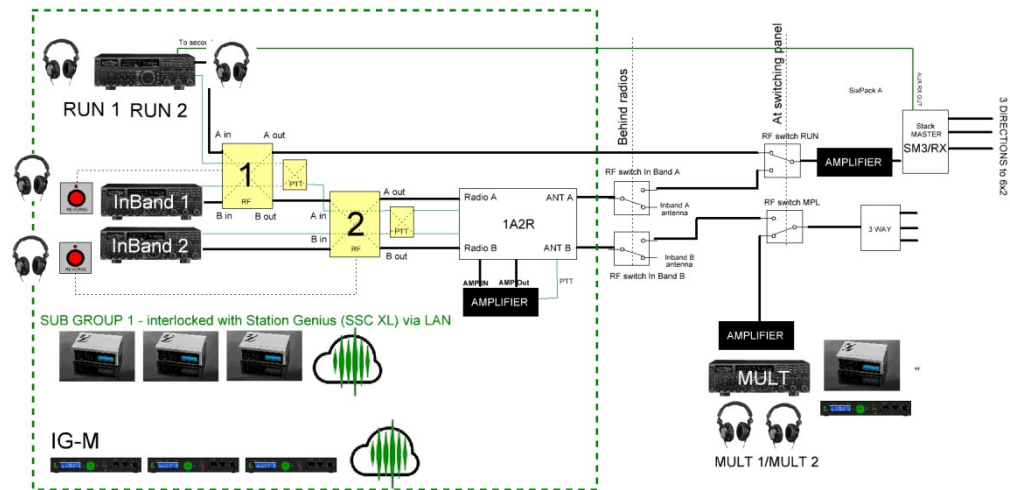


- * <https://www.youtube.com/watch?v=42TCOtmJuE>

Multi Single

- * Multiple operators – One Transmitter
- * Some contests (CQWW) allow one Transmitter and a second one that can only work Multipliers
- * Read the rules- they are all different
- * Take on modern contesting; Transmitter refers to one transmitted signal at any given time

Multi Single



Rotator Genius controlled via LAN/WAN

SO2R/Multi Single setup with 4 radios-6 OPs
Basic diagram
403A Signature

CN2AA



CN2AA – a bit of wiring



Description of CN2AA – why they are so very good

- * There is a four radios with four operators running the station (RUN).
- * Two of those operators listening to the same frequency, this allows you to hear two different directions by two different operators and picking up two different call signs at the same time.
- * Two other stations (S&P) are picking up what is left on the band (in-band) around your main transmitter's frequency.
- * Switching and interlocking the stations is so sophisticated, that every operator can choose any antenna for the band to transmit and receive by "stealing" any antenna from the multiplier station and vice-versa.
- * You can transmit and receive into three different directions, if you want, and by clicking just one button choose which one you are using.
- * S&P station is stealing not only your antenna (giving you his own at the moment, so you didn't left deaf), but also locking you on transmitting anything
- * This time we also had a four multiplier stations.
- * While two guys, running in low band multipliers with both stations interlocked - other two guys looking for the multipliers on the high bands and putting stations they could hear quicker with the thinner pile ups etc. to the band map
- * when two of us on MULT station see, that there is no more "easy" workable multipliers left- we just tell the other two guys start working their band. It is still one signal at the time on one band, but four people getting ready to call the multipliers... later in the contest, when there is not much multipliers left to work - only two guys are hunting them. But for the last five hours all radios at CN2AA was taken.

Antennae CN2AA

- * **Hill (70m ASL) home for 4 towers:**

- * Tower 1 (12m): 5el Yagi 10m rotary
- Tower 2 (24m): 2el Quad 10m & 15m & 20m rotary (RQ-23)
- Tower 3 (36m): 2el Quad 80m fixed NA & Half wave dipole sloping to NA 160m
- Tower 4 (24m): 4el Quad 10m, 15m and 3el 20m (RQ-43) 3el Quad 40m fixed NA @ 15m
- Between towers: 3el Quad 40m fixed EU @ 21m & 1/4 Vertical 80m

- * **Cliff 30m ASL home for 3 towers:**

- Tower 1 (24m): 5el Yagi 20m rotary 2el Quad 40m fixed to South
- Tower 2 (24m): 6 over 6el Yagi 15m fixed to NA 6 over 6el Yagi 10m fixed to NA
- Tower 3 (24m): 5 over 5 over 5el Yagi 10m fixed to EU (top rotary) 5 over 5el Yagi 15m fixed to EU (top rotary)
- * Hotel rooftop (15m ASL) home for 1 tower
- Tower 1 (15m): 5el Yagi 20m rotary

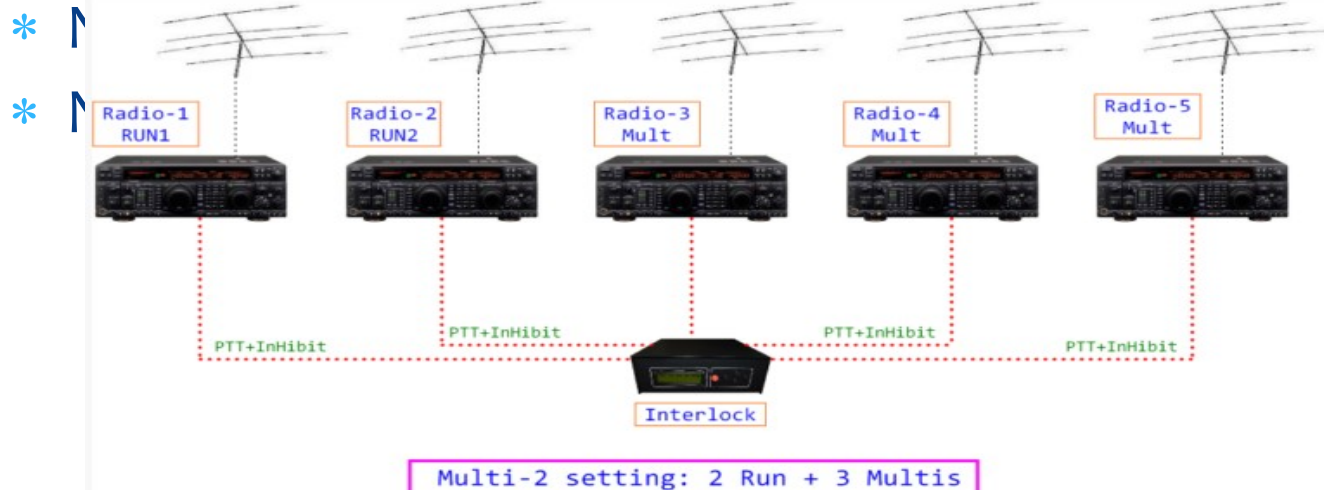
- * **On the beach**

- 4 SQ 80m
- 4 SQ 40m
- * beverage EU 350m preamp 15db
- beverage NA 230m preamp 15db
- beverage 220* 250m preamp 15db
- beverage 90* 200m preamp 15db
- beverage 180* 250m preamp 15db

The Super Remembrance Day Station

- * What do the rules allow ?
 - * The rules are actually flexible; we all need to read them and see what loopholes there are....
- * SSB,RTTY and CW on the one band ? At the same time?
- * What ideas can we steal from CN2AA?
- * How the hell do they transmit on the same band and not blow up the other receivers ?
 - * Think about it; again Google is your friend

VK Super Club



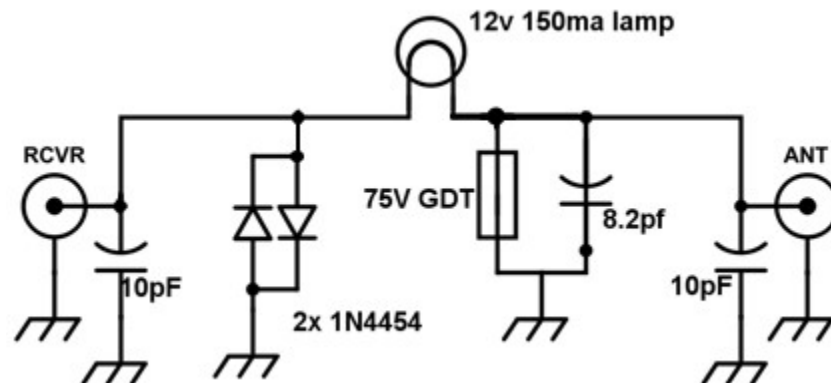
* <http://ea4tx.com/en/ea4tx-interlock/>

How do we protect the RX?

* Simple



* Roll your own



Simple Circuits

- * Back to back diodes 1N4148
- * GDT – Gas Discharge Tubes
- * Cap isolation
- * Clamp over $S_{9+50\text{db}}$
- * Parts are all ex Jaycar
- * Transformer matching I/O * Specialised item

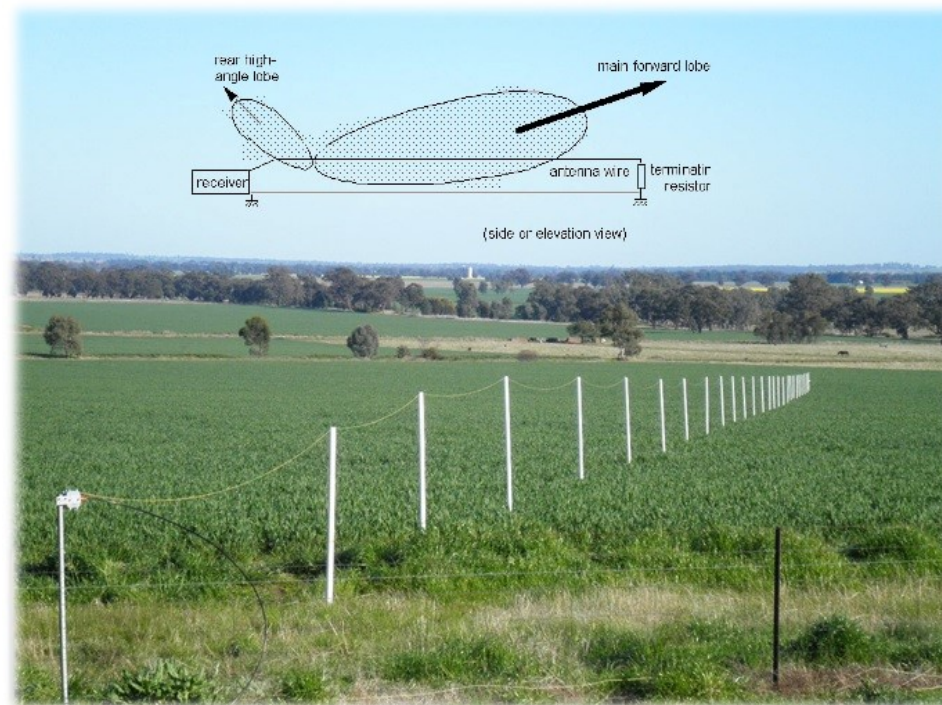
LF Receiving

- * 160 80 40M need specialised techniques
- * Beverages are best if you have room
- * K9AY and associated Loops are very good
- * Vertical arrays can solve issues
- * A lot of googling is needed for best results

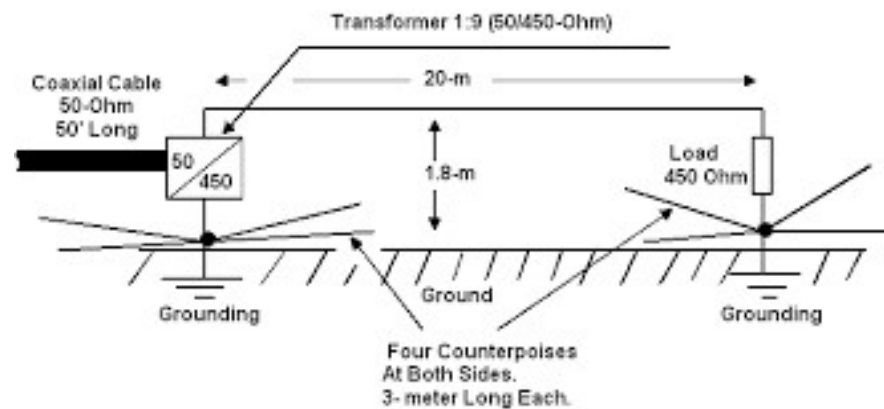
Beverage

- * The **Beverage antenna** or "wave antenna" is a long-wire receiving **antenna** mainly used in the low frequency and medium frequency radio bands, invented by Harold H. **Beverage** in 1921. It is used by amateur radio, shortwave listening, and longwave radio DXers and military applications

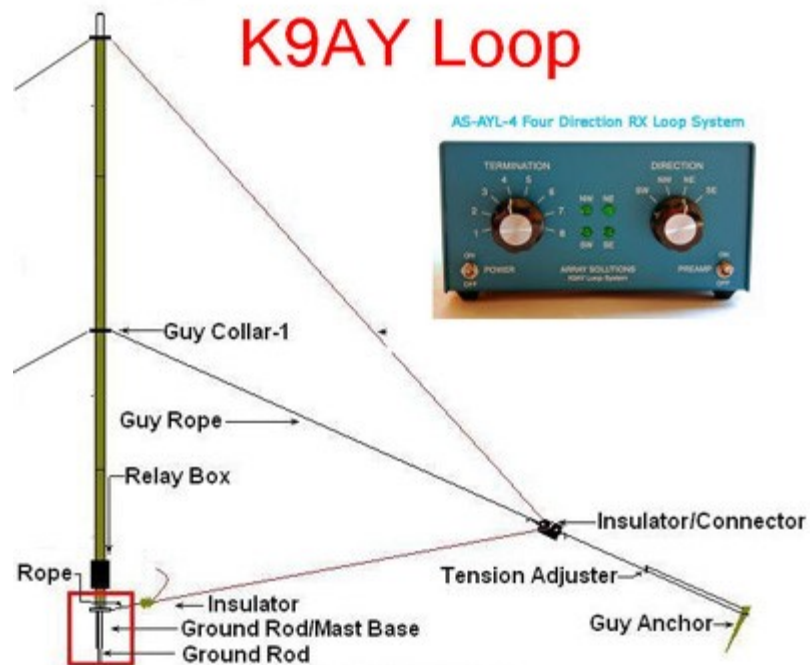
Beverage Antenna



More Beverage



K9AY Loop



GM3SEK “Clean up your shack”

Take the time to find YouTube RSGB Presentation by GM3SEK called “Clean up your shack”

*Basically filter your mains and your antennae and you will get rid of 90% of noise



Thank you

- * 73
- * TU VK4TS
- * VK5? Again? Again?
- * QRP?
- * Buy a linear
- * QRZ ? De VK4TS