630m (472-479kHz)
Amateur Experimentation VK/ZL

Presentation by
Justin Giles-Clark VK7TW
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Some MF History

- 405-535 kHz with 500 kHz int marine calling & distress frequency, 512 kHz sec calling & distress & 410 kHz DF frequency.
- Keys dates 1906, 1912/13 and 1932
- World Radiocommunication Conference 2012 allocated 427-479kHz to the amateur service
- Secondary basis - 1 watt effective isotropic radiated power (EIRP)
- Don’t forget we also have 137kHz (2200m)
Some VK/ZL LF & MF Experimenters

- Robert Milne AX2TAR/VK7ZAL SK – 171.5kHz experimenter – 30/8/97 – Two way with ZL3FJ 1941km extended to 2444km with ZL1WB
- ZL2CA, ZL3PN and ZL4MD RX John Adcock AX3T35(VK3ACA) – 13/09/92
- Bob ZL2CA & Andrew ZL2BBJ - First ZL's 2-way QSO – 19/06/91
- Drew Diamond VK3XU – Published Transmitters – Vol 4 Radio Projects 137 & 500kHz + AR Mag
- Dimitris VK1SV, Dale VK1DSH, Nick VK2DX, Murray ZL1BPU to name but a few
AX2TAR/VK7ZAL - LF Experimenter

- 350W – 171.5kHz
- 1 kilowatt – 171.5kHz
<table>
<thead>
<tr>
<th>QRB km</th>
<th>DATE</th>
<th>Call RX</th>
<th>QTH-loc</th>
<th>Equipment</th>
<th>Call TX</th>
<th>Mode</th>
<th>QTH-loc</th>
<th>Equipment</th>
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</thead>
<tbody>
<tr>
<td>19187.2</td>
<td>11-Apr-05</td>
<td>ZL4OL</td>
<td>RE54GG</td>
<td>Active whip 10m, IC-R75, Argo</td>
<td>G3AQC</td>
<td>DFCW180</td>
<td>IO90NT</td>
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<td>17933.7</td>
<td>26-Mar-05</td>
<td>ZL2CA</td>
<td>RE78IR</td>
<td>Active whip 10m, TS850, Argo</td>
<td>YU7AR</td>
<td>120</td>
<td>KN05BW</td>
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<td>16833</td>
<td>1-Nov-13</td>
<td>Edgar J Twining (VK7-EJTSWL)</td>
<td>QE37WK</td>
<td>1m Active whip &amp;9m, IDC-136II receiver, SL</td>
<td>DK7FC</td>
<td>DFCW180</td>
<td>JN49IK00WD</td>
<td>Inv-L, H eff=25m, 470pF / 3 mH</td>
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<td>1-2W ERP</td>
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<td>Active whip 1m, IC-R75, SL</td>
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<td>DFCW180</td>
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<td>QF55HF</td>
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<td>RE78JS</td>
<td>Active Loop (1.6m square), Home Brew RX, Argo</td>
<td>RU6LA</td>
<td>120</td>
<td>KN97LN09IG</td>
<td>15-20W ERP</td>
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<td>15-20W ERP</td>
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<td>ZL2BBJ</td>
<td>RE78JS</td>
<td>Active Loop (1.6m square), Home Brew RX, Argo</td>
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<td>DFCW120</td>
<td>KN95LC27AU</td>
<td>40W ERP</td>
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<td>RE78IR</td>
<td>Active whip 10m, TS850, Argo</td>
<td>RN6BN</td>
<td>60</td>
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<td>40W ERP</td>
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<td>16464</td>
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<td>VK1SV</td>
<td>QF44MT</td>
<td>pa0rdt, TenTex RX331</td>
<td>DK7FC</td>
<td>DFCW180</td>
<td>JN49IK00WD</td>
<td>Inv-L, H eff=25m, 470pF / 3 mH</td>
</tr>
</tbody>
</table>
472-479kHz Operation- The VK Rules

- Advanced Amateurs only
- 2.1 kHz maximum transmit bandwidth - CW, digital & narrow SSB modes
- EIRP of 5 watts (<5% efficient)
- Southern Australia can use - exclusion zones apply in the north and north-west.
- Further details in the amateur section at acma.gov.au
Common Antennas Used

• Receiving antennas:
  – Active antennas - PA0RDT
  – Verticals – Marconi-T
  – Loops
  – Earth dipole – Beveridges – long long wires

• Transmitting antennas:
  – Marconi T
  – Verticals
  – Loops
  – Earth dipole
Active Antennas
Inv L/Verticals/ Marconi-T

Marconi L

Ground

Marconi T

Marconi T with Capacitive Hat
Marconi-T

1/2" PVC Spreader

Use 3 insulators at each end, using only one may fail

Height of poles 47Ft

50 ohm input

2290 pf

Inductor Coil 2 uhy

1600 pf variable or vacuum cap

Static Drain 10k 2 watt

10k 2 watt

Matching Network MOUNTED AT THE BOTTOM OF THE FEED POINT

Feed Point

Twenty 50Ft Radials

105Ft

Pulley rope

42Ft
Marconi-T – Stahan NDB (1)
Marconi-T – Stahan NDB (2)
Loops (2)
Earth Dipoles/ Earth Electrodes

One man's ground is another man's antenna or
How to tune antennas with a sledge hammer!
Antenna Tuning (1)

• Variometer
• Loading coils (VK1DSH):

<table>
<thead>
<tr>
<th>BAND</th>
<th>Approximate Loading Inductance</th>
</tr>
</thead>
<tbody>
<tr>
<td>137kHz</td>
<td>3mH</td>
</tr>
<tr>
<td>472-479kHz</td>
<td>500uH</td>
</tr>
<tr>
<td>1840kHz</td>
<td>9.6uH + 2200pF capacitor</td>
</tr>
</tbody>
</table>

• Matching to transmitter/receiver
• VK1DSH – excellent article on 160, 630, 2200m – AR March 2013
Antenna Tuning (2)
Antenna Tuning (4)
Propagation (1)

- Think AM broadcasting stations – day/night
- Ground wave propagation can be >2000 km
- Not greatly affected by D layer absorption during day like HF (80, 40, 20m)
- Sky wave propagation – refraction + multihop

<table>
<thead>
<tr>
<th>Layer (Height km)</th>
<th>Day Distance (km)</th>
<th>Night Distance (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D (~50km)</td>
<td>~1000km</td>
<td></td>
</tr>
<tr>
<td>E (~100km)</td>
<td></td>
<td>~2000km</td>
</tr>
</tbody>
</table>
Propagation (2)

\[ r = \text{Radius of Earth} = 6328\text{km} \]
\[ h = \text{Height of reflection} \]

Typical layer heights:
- D-layer \( h = 50 \text{ - } 90\text{km} \)
- E-layer \( h = 90 \text{ - } 150\text{km} \)

Simple Equations:
\[ d = r \cdot a \] (\( a \) in radians)
\[ \cos(a) = \frac{r}{r + h} \]
\[ s = r \cdot \tan(a) \]

Calculation of Extreme Single-hop Range.
VK Grabbers Abound

• Matt, VK2DAG - http://vk2dag.com/grabber
• David, VK2DDI. Berry Mountain Grabber - http://goo.gl/Dnjmk
• Bob VK7ZL - http://www.users.on.net/~bobw/vlf/
Transmitters (1)

- Many different designs available
- Drew Diamond – 100W CW 472kHz – AR 4/14
- GW3UEP – 100W Class D
- W1FR/N1FBZ – 100W Class D
- 100W HF Linear modules with suitable LPF
- Hafler (& other) Audio Amplifiers modified
- Ex-NDB Transmitters – currently shutting them down
Philips NDB
Transmitters (3)

VK1SV 6AG7/807 transmitter for 472 kHz (630 m)
Receivers

- HPSDR
- SDRs – softrock, Genesis, SDR-IQ, Perseus, Elecraft K3
- Many modern HF rigs have general coverage receivers these days – transvert for other rigs
- Rohde & Schwarz ESH3 9Khz~30MHZ Test Receiver!
- Telco level meters – eg. Wandel & Goltermann SPM-19 Selective Level Meter (50Hz to 25MHz)
- Many other options
- Where receivers don’t tune low enough – transvert up to an freq the rx can receive on – VK3YE
Transverters (1)

• VK3XDK Transverter Kit – 10 or 30m <> 630m
Transverters (2)

• VK1DSH Transverter design – 472-479kHz to 10.472-10.479MHz
Transverters (3)

- G3XBM Transverter design – 80m <> 630m
630m
Software used on 630m

- Spectrum Lab – Sophisticated Audio Analyser
- Spectran – More basic Audio Analyser
- Argo – Spectrum and modes in one
- Fldigi – Multi mode
- WSPR/WSJT – K1JT Weak Signal
- HDSDR/HPSDR – Open Source Software
  Defined Radio – PowerSDR/VAC/Com2Com
- AADE & VK1OD – Filter Design
WSPR on 630m
Modes

- CW
- QRSS – (extremely slow CW)
- DFCW (Dual Frequency CW)
- WSPR – K1JT
  - [http://physics.princeton.edu/pulsar/K1JT/wspr.html](http://physics.princeton.edu/pulsar/K1JT/wspr.html)
- WSQ - Con ZL2AFP and Murray ZL1BPU
- Narrow SSB <2.1kHz
- Plus more
630m Activities

- Nightly contacts - WSPR, CW, QRSS, WSQ, etc
- Essential membership – VK 600m Yahoo Grp - https://groups.yahoo.com/neo/groups/600m/info
- Activity weekends – distance and km/watt
- VK3FI Beacon – Mildura – Thanks Noel
- Aiming for Regular AR articles
- Learning and experimenting!
Net Resources

- **VK1SV**:  

- **VK1DSH**:  
  - https://groups.yahoo.com/neo/groups/600m/files/VK1DSH/

- **VK1DDI**:  
  - https://groups.yahoo.com/neo/groups/600m/files/VK2DDI/

- **ZL1BPU/ZL1EE**:  
  - https://groups.yahoo.com/neo/groups/600m/files/ZL1EE/  
    - http://www.qsl.net/zl1bpu/

- [http://www.500kc.com/](http://www.500kc.com/)  
- [http://www.w1vd.com/](http://www.w1vd.com/)  
- [http://630m.net/dev/](http://630m.net/dev/)  
Thanks for listening

- 73, Justin, VK7TW