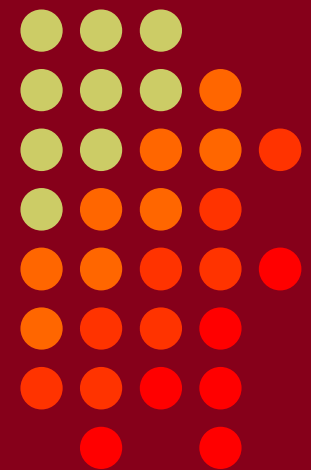


CW Skimmers, DX Cluster, and the Reverse Beacon Network

Presented by N6TV

n6tv@arri.net



• CTU •
CONTEST
UNIVERSITY

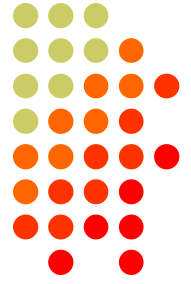
ICOM

Overview

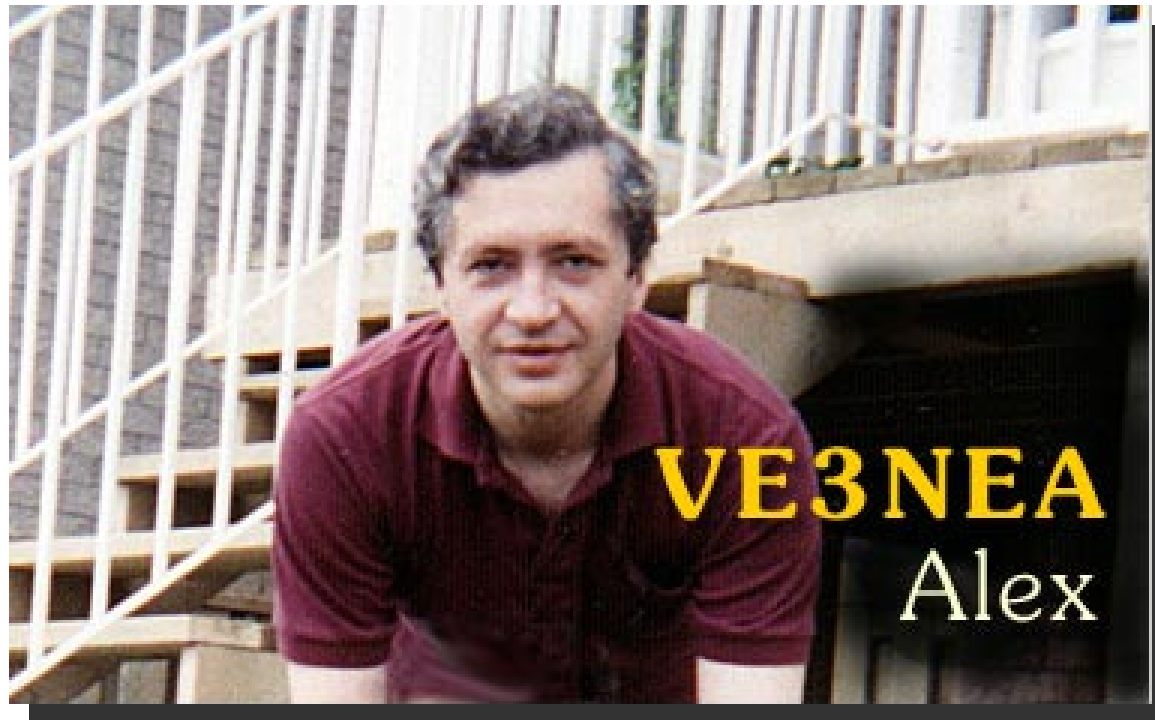


- **What is CW Skimmer?**
- **What is the Reverse Beacon Network?**
- **How does it work?**
- **What can the RBN do for *me*?**
- **How can I help?**
- **What's new?**

It all starts with one developer



- Alex Shovkopylas, **VE3NEA**
(b. 1965, ex-UR5EMI, in Canada since 1998)



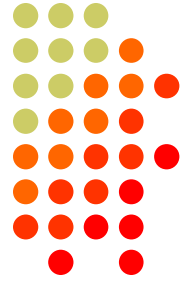


What is CW Skimmer?

1. Hardware: PC + Software Defined Radio (SDR)



SDR Antenna



2. Wideband RX Antenna, 1.8-30 MHz

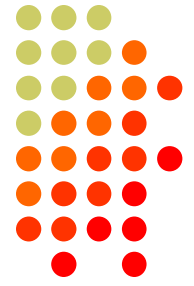
Pixel Tech.
Loop
RF Pro-1B:



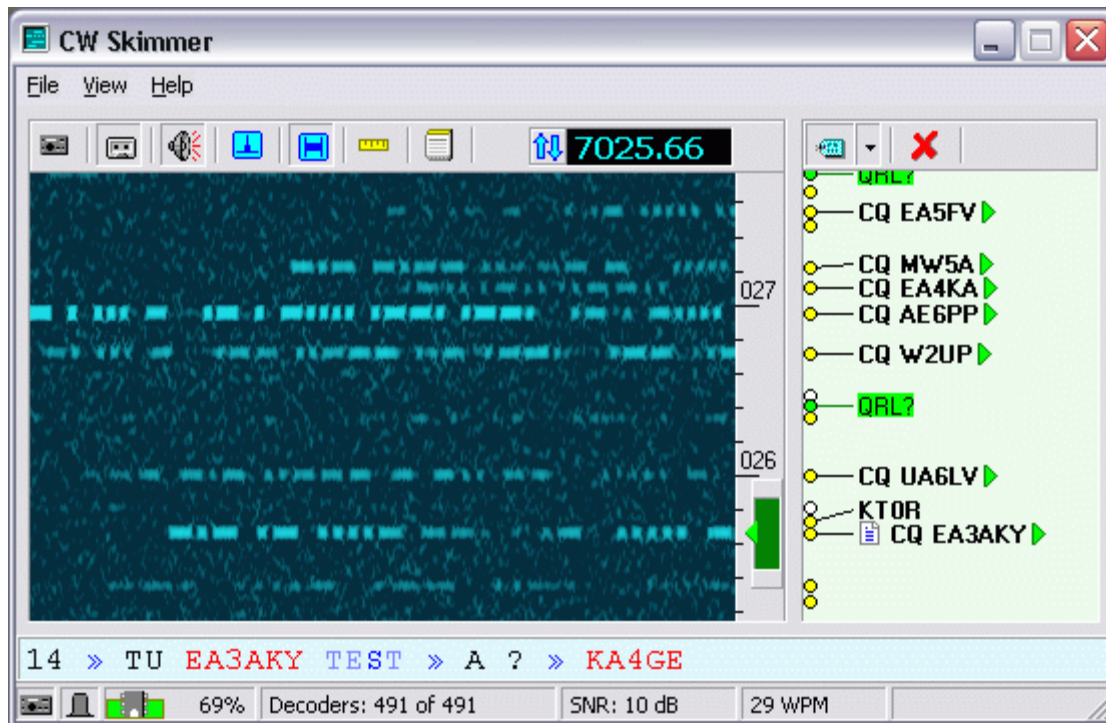
DX Engineering
Active Horizontal
ARAH3-1PE:



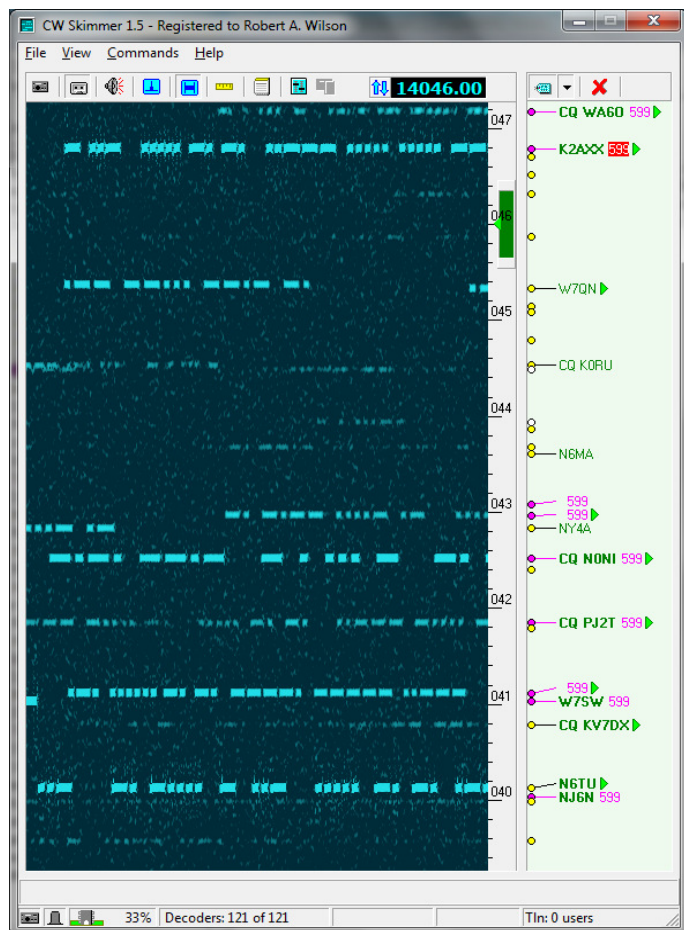
Software



3. CW Skimmer or Skimmer Server

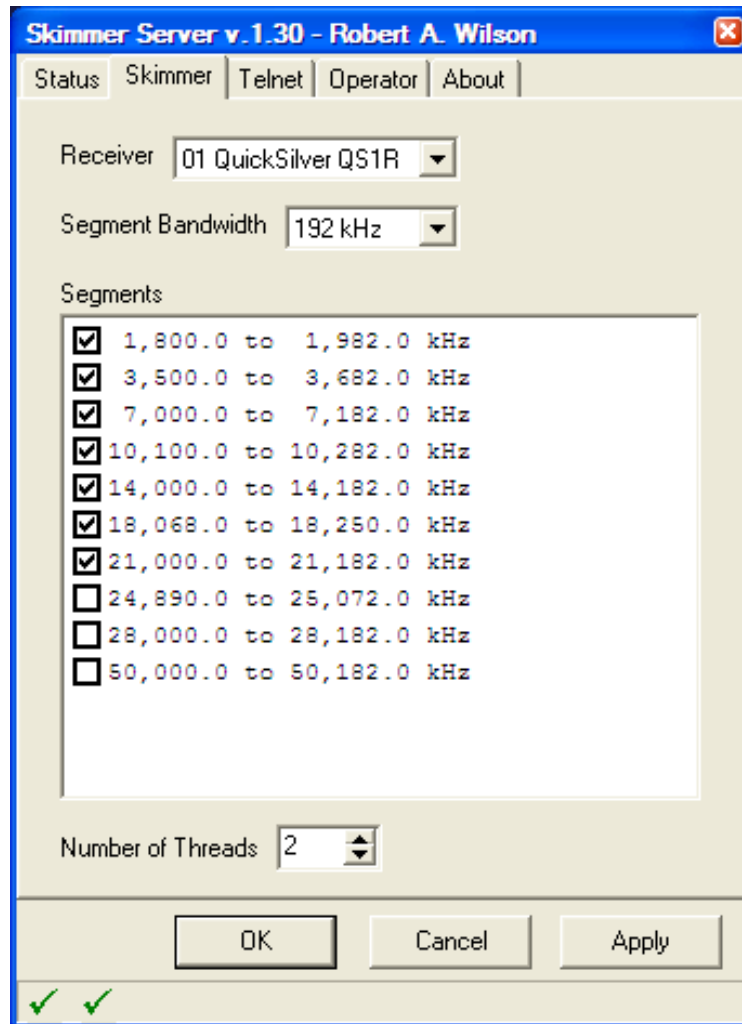
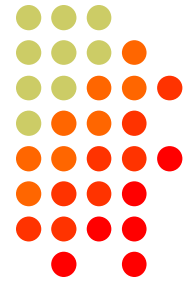


CW Skimmer by VE3NEA



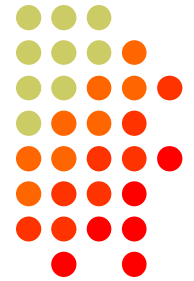
- Works with many SDRs
- Decodes *multiple* CW signals in real time
- Can monitor *entire* CW band
- Waterfall Display
- Uses MASTER.DTA
- Telnet Server (emulates a DX Cluster)

Skimmer Server by VE3NEA



- Only supports QS1R SDR
- Decodes multiple CW signals in real time
- Monitors *multiple bands* with single SDR
- No Waterfall Display
- No MASTER.DTA
- Telnet Server

Telnet server (localhost port 7300)



- Emulates a DX Cluster Node

```

DX de N6TU-#: 14058.7 WR7HE 24 dB 31 WPM CQ 2350
DX de N6TU-#: 14029.6 NM7D 29 dB 25 WPM CQ 2350
DX de N6TU-#: 14059.5 YW4D 35 dB 31 WPM CQ 2350
DX de N6TU-#: 14022.6 J39BS 11 dB 25 WPM CQ 2350
DX de N6TU-#: 14066.8 NF6A 38 dB 30 WPM CQ 2350
DX de N6TU-#: 14054.4 N5UM 26 dB 28 WPM CQ 2350
DX de N6TU-#: 14021.2 NN5J 35 dB 31 WPM CQ 2350
DX de N6TU-#: 14061.4 WX5S 12 dB 28 WPM CQ 2350
DX de N6TU-#: 14064.2 WQ5L 15 dB 28 WPM CQ 2350
DX de N6TU-#: 14032.2 UE7XF 18 dB 27 WPM 2350
DX de N6TU-#: 14042.9 NT5C 45 dB 31 WPM 2350
DX de N6TU-#: 14032.2 UE7XF 18 dB 27 WPM CQ 2350
DX de N6TU-#: 14039.2 EA3FP 15 dB 31 WPM CQ 2350
DX de N6TU-#: 14052.5 W0YR 20 dB 28 WPM CQ 2350
DX de N6TU-#: 14022.9 AB7E 32 dB 25 WPM CQ 2350
DX de N6TU-#: 14028.4 WH6R 7 dB 29 WPM 2350
DX de N6TU-#: 14065.6 KH7B 25 dB 29 WPM CQ 2350
To ALL de SKIMMER <0952Z> : Clicked on "UE7XF" at 14032.2
DX de N6TU-#: 14069.6 KF6T 13 dB 28 WPM CQ 2350
DX de N6TU-#: 14069.1 NK0M 25 dB 28 WPM CQ 2350
To ALL de SKIMMER <0952Z> : Clicked on "" at 14031.4
DX de N6TU-#: 14035.5 KF8GE 12 dB 26 WPM 2350
DX de N6TU-#: 14028.4 WH6R 7 dB 29 WPM CQ 2350
DX de N6TU-#: 14036.1 NZ1U 16 dB 28 WPM CQ 2350
DX de N6TU-#: 14062.7 N4QS 11 dB 29 WPM CQ 2350
DX de N6TU-#: 14045.1 YU1FM 20 dB 32 WPM CQ 2350
DX de N6TU-#: 14059.6 YW4D 35 dB 31 WPM 2350
    
```

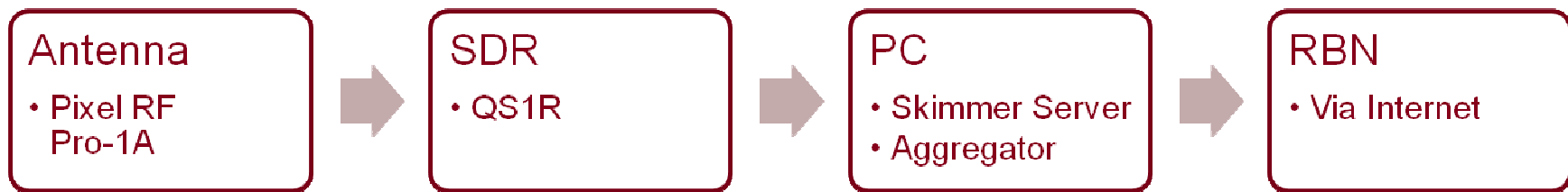
Reports Signal to Noise ratio, CW Speed, CQers

What is the Reverse Beacon Network (RBN)?



- Uses *any* CW signal as a beacon
- Multiple CW Skimmers world-wide record signal strength (S/N ratio in dB) and CW speed (WPM)
- A free “Aggregator” program forwards CW Skimmer spots to a central server
- Central server distributes spots via web page and public telnet servers
- You don’t need to have an SDR to use it

How do spots get to the RBN server?



Acknowledgements

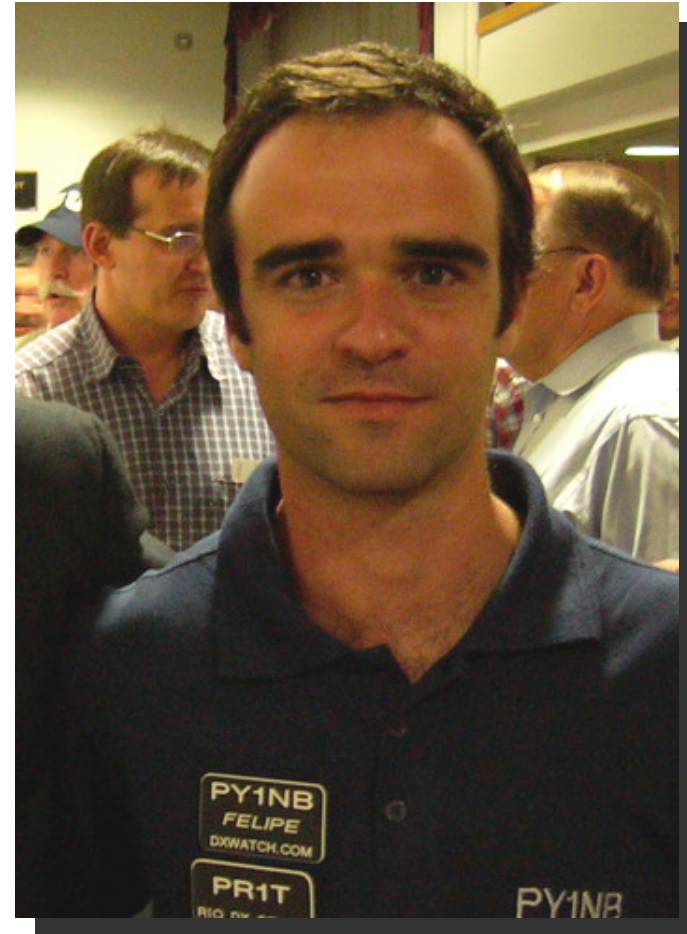


- RBN web site and first aggregator originated by PY1NB (similar to his other web site, www.dxwatch.com). Felipe pays all the bills.
- Lots of code by W3OA (aggregator), F5VIH (Spots analysis tool)
- CW Skimmer evangelized and tested by N4ZR (also publishes [RBN blog](#)) – “RBN Chief Propagandist”
- Telnet server support by K5TR, W2QO, KM3T

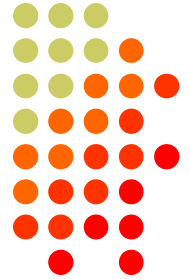
Felipe Ceglia, PY1NB



- Created and maintains the Reverse Beacon Network
- Hosts dxwatch.com and reversebeacon.net



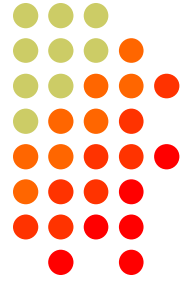
Dick Williams, W3OA



- Created the newest RBN Aggregator software



Nick Sinanis, F5VIH

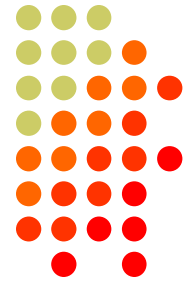


- Wrote the RBN Spots Analysis Tool

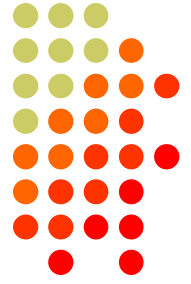


Pete Smith, N4ZR

- RBN Chief Evangelist
- Skimmertalk Reflector:
<http://dayton.contesting.com/mailman/listinfo/skimmertalk>

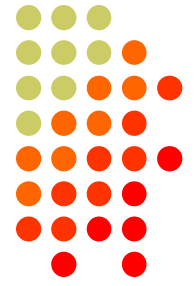


What can the RBN do for *me*?



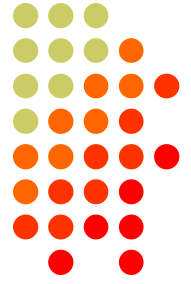
- It can improve your score
 - Fills spots in band map (SOA, Multi-op)
 - Spots *you* very often, if you CQ “properly”
- Entering a contest?
 - Before: Check antenna F/B, signal strength
 - During: See where you are being heard
 - After: Compare signal strength with the competition

How can I use RBN to improve my score?



- Make sure the Skimmers find *you*
- When permitted, use RBN as **DX Cluster** for CW and RTTY contests
 - Far more spots, with smaller pileups than human-posted Cluster spots
 - Quickly fills up your logging software **band map**
 - Helps you find **clear spots** (between stations you can't hear)
 - Shows where *you* are being heard
 - E.g. at K3LR on 15m: "**Spotted by S50ARX-#**"
(First EU answered our 15m CQs 25 minutes later)

How do I CQ “properly”?

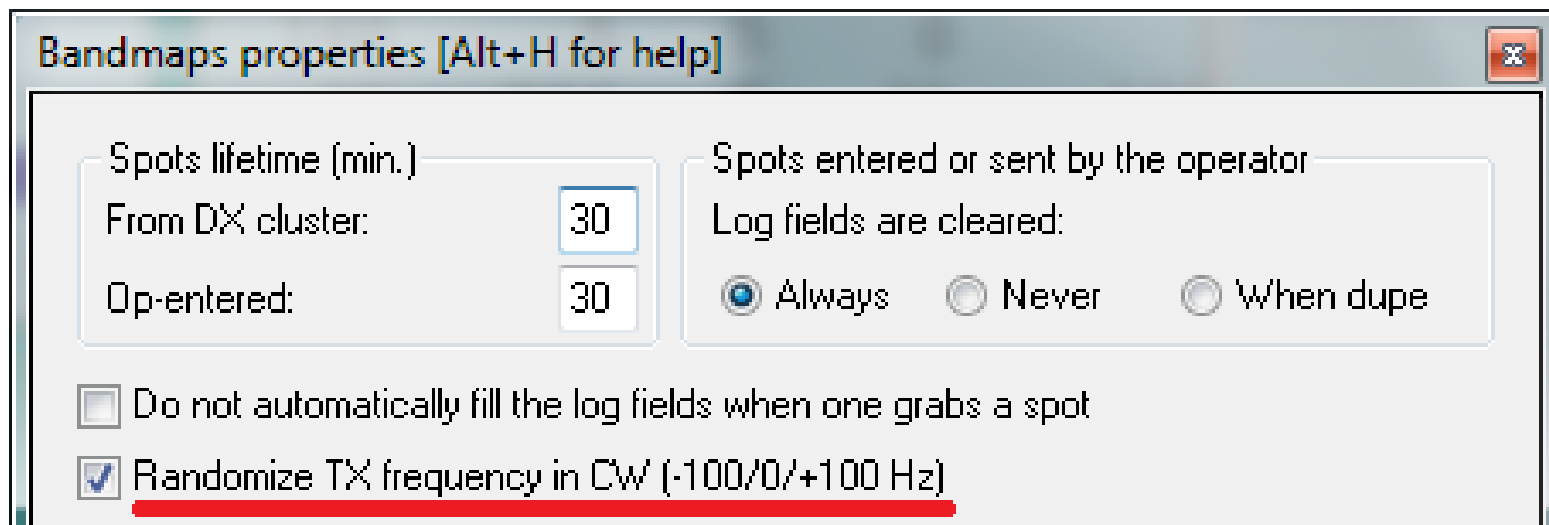


- Send *everything* at the *same consistent speed*
 - Never use >/< or +++/--- to change speed in messages
- Call CQ or TEST and send your call twice
 - CQ N6TV N6TV
 - TEST N6TV N6TV
 - CQ N6TV N6TV TEST
- Use proper spacing (let computer send)
 - Don't send with paddles and rusheverythingtogether
- Change your freq. *slightly* to get spotted again

How to improve your chances in a Skimmer-generated pileup



- Use XIT or the “randomize TX” feature of your logging program to **call a bit off frequency**.



How do I use the RBN to Check My Antennas?



- To test performance, just call CQ on CW, check RBN web site (turn beam, repeat)
- Use RBN web site's "Spots Analysis Tool" to compare your signal to the competition
- Download raw data files for deeper analysis
 - Every RBN spot posted since February, 2009 is archived on the site

Accessing the RBN (SOA, Multi)



1. telnet.reversebeacon.net port 7000
(DX Spider software)
2. arcluster.reversebeacon.net port 7000
(V6 AR-Cluster software)
3. dxc.ve7cc.net port 23
(CC Cluster software – removes bad spots!)
4. Some clusters combine RBN *and* human spots (VE7CC, W9ZRX, N7TR)
5. <http://www.reversebeacon.net>

Filtering Spots (old way)



- telnet.reversebeacon.net port 7000
 - accept/spots by_zone 1,3,4,6,7,31 and not by WZ7I or call N6TV
 - http://www.dxcluster.org/main/filtering_en.html#toc1
- arcluster.reversebeacon.net port 7000
 - set dx filter call=N6TV or (**unique**>1 and (spotterstate=CA or spotterstate=NV or spotterstate=UT))
 - <http://www.ab5k.net/ArcDocsVer6/UserManual/ArcDx.htm>

Filtering Spots (new way)



- Use **CC User** software by VE7CC to log in to dxc.ve7cc.net and program filters with a full-feature Graphical User Interface
- CC Cluster nodes *automatically* reject “unique” (busted) spots
- Tutorial:
 - <http://reversebeacon.blogspot.com/2010/11/using-rbn-telnet-server-brief-tutorial.html>
- Reference:
 - <http://www.bcdxc.org/ve7cc/default.htm#download>

CC User Filter Dialogs



Settings | **Country** | State | Bands | Locals = 11 | DX | WWV = 4 | Login Msg | Ann = 5 | Wx | Mail

filter7 reject not by_dxcc @VE7CC-1

<input type="checkbox"/> 4U1U	<input type="checkbox"/> FO/c	<input type="checkbox"/> J8	<input type="checkbox"/> TG	<input type="checkbox"/> VP5
<input type="checkbox"/> 6Y	<input type="checkbox"/> FP	<input checked="" type="checkbox"/> K	<input type="checkbox"/> T1	<input type="checkbox"/> VP9
<input type="checkbox"/> 8P	<input type="checkbox"/> HH	<input type="checkbox"/> KG4	<input type="checkbox"/> T19	<input type="checkbox"/> XE
<input type="checkbox"/> C6	<input type="checkbox"/> HI	<input type="checkbox"/> KL	<input type="checkbox"/> V2	<input type="checkbox"/> XF4
<input type="checkbox"/> CM	<input type="checkbox"/> HK0/a	<input type="checkbox"/> KP1	<input type="checkbox"/> V3	<input type="checkbox"/> YN
<input type="checkbox"/> CY0	<input type="checkbox"/> HP	<input type="checkbox"/> KP2	<input type="checkbox"/> V4	<input type="checkbox"/> YS
<input type="checkbox"/> CY9	<input type="checkbox"/> HR	<input type="checkbox"/> KP4	<input checked="" type="checkbox"/> VE	<input type="checkbox"/> YV0
<input type="checkbox"/> FG	<input type="checkbox"/> J3	<input type="checkbox"/> KP5	<input type="checkbox"/> VP2E	<input type="checkbox"/> ZF
<input type="checkbox"/> FJ	<input type="checkbox"/> J6	<input type="checkbox"/> OX	<input type="checkbox"/> VP2M	
<input type="checkbox"/> FM	<input type="checkbox"/> J7	<input type="checkbox"/> PJ7	<input type="checkbox"/> VP2V	

NA 2
 EU
 AF
 AS
 SA
 OC

Filter Type
 DX Origination
 Announce
 DX Country

Pass Reject

Settings | Country | **State** | Bands | Locals = 40 | DX = 9 | WWV | L

States and Provinces

<input type="checkbox"/> W1	<input type="checkbox"/> W2	<input type="checkbox"/> W3	<input type="checkbox"/> W4	<input type="checkbox"/> W5	<input type="checkbox"/> W6	<input type="checkbox"/> W7	<input type="checkbox"/> W8	<input type="checkbox"/> W9	<input type="checkbox"/> W0	<input type="checkbox"/> VE	
<input type="checkbox"/> CT	<input type="checkbox"/> NJ	<input type="checkbox"/> DC	<input type="checkbox"/> AL	<input type="checkbox"/> AR	<input type="checkbox"/> CA	<input checked="" type="checkbox"/> AZ	<input type="checkbox"/> MI	<input type="checkbox"/> IN	<input type="checkbox"/> CO	<input type="checkbox"/> NB	<input checked="" type="checkbox"/> SK
<input type="checkbox"/> MA	<input type="checkbox"/> NY	<input type="checkbox"/> DE	<input type="checkbox"/> GA	<input type="checkbox"/> LA		<input checked="" type="checkbox"/> ID	<input type="checkbox"/> OH	<input type="checkbox"/> IL	<input type="checkbox"/> IA	<input type="checkbox"/> NS	<input checked="" type="checkbox"/> AB
<input type="checkbox"/> ME		<input type="checkbox"/> MD	<input type="checkbox"/> KY	<input type="checkbox"/> MS		<input checked="" type="checkbox"/> MT	<input type="checkbox"/> WV	<input type="checkbox"/> WI	<input type="checkbox"/> KS	<input type="checkbox"/> PE	<input checked="" type="checkbox"/> BC
<input type="checkbox"/> NH	<input type="checkbox"/> PA	<input type="checkbox"/> NC	<input type="checkbox"/> NM			<input checked="" type="checkbox"/> NV			<input type="checkbox"/> MN	<input type="checkbox"/> NL	<input type="checkbox"/> NT
<input type="checkbox"/> RI		<input type="checkbox"/> FL	<input type="checkbox"/> OK			<input checked="" type="checkbox"/> OR			<input type="checkbox"/> MO	<input type="checkbox"/> QC	<input type="checkbox"/> NU
<input type="checkbox"/> VT		<input type="checkbox"/> SC	<input type="checkbox"/> TX			<input checked="" type="checkbox"/> WA			<input type="checkbox"/> NE	<input type="checkbox"/> ON	<input type="checkbox"/> YT
		<input type="checkbox"/> TN				<input checked="" type="checkbox"/> WY			<input type="checkbox"/> ND	<input type="checkbox"/> MB	
		<input type="checkbox"/> VA				<input checked="" type="checkbox"/> UT			<input type="checkbox"/> SD		

Some nodes combine RBN and “legacy” (human) spots



- dxc.ve7cc.net port 23 (CC Cluster, many filtering options, use CC User to set them)
- dxc.w9zrx.net port 7373 (AR Cluster)
- dxc.n7tr.com port 7373 (AR Cluster, but pre-filters to show only spots from Zones 3 and 4)

Using www.reversebeacon.net



- Great for post-contest analysis
- Plot signal strengths
- Raw data files can be downloaded / analyzed
 - Millions of spots archived

www.reversebeacon.net



REVERSE BEACON NETWORK callsign lookup:

welcome **main** dx spots skimmers downloads about contact us

Welcome to the reverse beacon network!

The Reverse Beacon Network is a revolutionary new idea. Instead of beacons actively transmitting signals, the RBN is a network of stations listening to the bands and reporting what stations they hear, when and how well.

If you already know all this, skip directly to the [main page](#).

So why should you care? Well, to begin with, you can see band openings in near-real time on an animated map. You can call a quick CQ, and see which reverse beacons hear you, and how strong you are. [Try It!](#)

But the real breakthrough is in the database of past "spots". You can instantly find out what stations, from a given country or zone, have been heard, at what times and on what frequencies. You can see when you've been spotted, who spotted you, and how loud you were. [Try It!](#)

Check out our blog!

[Aggregator 2.1 - new insight for Skimmer ops](#)

The newest Aggregator, Version 2.1, is now available, after extensive beta testing. This post explains the new features of this release, tab by tab. First of all, there is an entirely new tab titled "Skimmer Traffic." Here's what it looks like...

statistics:

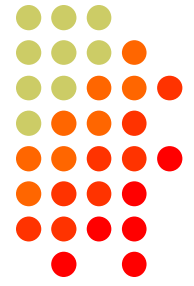
we have 70 skimmers online

we have 115 visitors online

skimmers online:

9V1RM - 20m,15m,17m
AB1HL -
10m,20m,30m,80m,40m,17m
DJ9IE - 40m
DK8NE - 6m
DK9IP - 30m,80m,40m
DL0LBS -
DL2CC - 20m,30m,80m,40m
DL3KR -
DR1A - 20m 30m 80m 40m

www.reversebeacon.net main



← → ↻ ⤴ www.reversebeacon.net/main.php

REVERSE BEACON NETWORK callsign

welcome main dx spots skimmers downloads about contact us

[show/hide my last filters](#)

no filter selected, showing all spots rows to show: 50

[search spot by callsign](#)

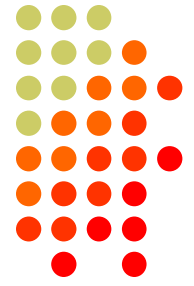
de	dx	freq	cq/dx	snr	speed	time
W4AX	HB9TPT	10115.5	CQ	6 dB	19 wpm	0945z 02 Apr
EA4TX	HB9TPT	10115.5	CQ	8 dB	19 wpm	0945z 02 Apr
IK3STG	HB9TPT	10115.5	CQ	17 dB	20 wpm	0945z 02 Apr
K8ND	VE1ZZ	1823.5	CQ	28 dB	19 wpm	0945z 02 Apr
W3OA	VE1ZZ	1823.5	CQ	21 dB	19 wpm	0945z 02 Apr
K1TTT	VE1ZZ	1823.5	CQ	35 dB	19 wpm	0945z 02 Apr
WZ7I	VE1ZZ	1823.5	CQ	36 dB	20 wpm	0945z 02 Apr
KB9AMG	VE1ZZ	1823.5	CQ	14 dB	19 wpm	0945z 02 Apr
RZ3DVP	MS5RAI	10117.5	CQ	12 dB	28 wpm	0945z 02 Apr
KH6LC	LU9DO	14012.0	CQ [LoTW]	28 dB	14 wpm	0945z 02 Apr

options:
[show/hide](#)

news
[RBN blog: stay tuned!](#)
we have 67 skimmers online
we have 147 visitors online

skimmers online:
9V1RM - 10m,17m,12m,15m
AB1HL - 20m,30m,40m,17m
DJ9IE - 40m
DK1MAX -
DK8NE - 6m
DK9IP -
20m,30m,40m,17m,12m,15m
DL0LBS -
DL2CC - 20m,30m,40m,17m,15m

Where was I heard?



← → ↻ 🏠 www.reversebeacon.net/dxsd1/dxsd1.php?f=0&c=N6TV&t=dx

REVERSE BEACON NETWORK

welcome main **dx spots** skimmers downloads about contact us

[show/hide my last filters](#)

showing spots for DX call: N6TV rows to show: 50

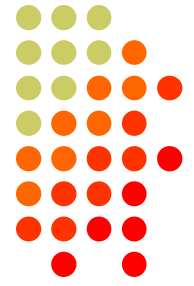
search spot by callsign

search callsign: DX DE

wildcard * allowed

de	dx	freq	cq/dx	snr	speed	time
WZ7I	N6TV	28019.0	CQ [LoTW]	19 dB	25 wpm	2021z 01 Apr
K1TTT	N6TV	28019.1	CQ [LoTW]	18 dB	24 wpm	2017z 01 Apr
S50ARX	N6TV	28019.0	CQ [LoTW]	12 dB	25 wpm	2017z 01 Apr

Plot spots on a map



REVERSE BEACON NETWORK callsign

welcome | main | dx spots | skimmers | downloads | about | contact us

[show/hide my last filters](#)

no filter selected, showing all spots rows to show: 50

search spot by callsign

de	dx	freq	cq/dx	snr	speed	time
W4AX	HB9TPT	10115.5	CQ	6 dB	19 wpm	0945z 02 Apr
EA4TX	HB9TPT	10115.5	CQ	8 dB	19 wpm	0945z 02 Apr
IK3STG	HB9TPT	10115.5	CQ	17 dB	20 wpm	0945z 02 Apr
K8ND	VE1ZZ	1823.5	CQ	28 dB	19 wpm	0945z 02 Apr
W3OA	VE1ZZ	1823.5	CQ	21 dB	19 wpm	0945z 02 Apr
K1TTT	VE1ZZ	1823.5	CQ	35 dB	19 wpm	0945z 02 Apr
WZ7I	VE1ZZ	1823.5	CQ	36 dB	20 wpm	0945z 02 Apr
KB9AMG	VE1ZZ	1823.5	CQ	14 dB	19 wpm	0945z 02 Apr
RZ3DVP	MS5RAI	10117.5	CQ	12 dB	28 wpm	0945z 02 Apr
KH6LC	LU9DO	14012.0	CQ [LoTW]	28 dB	14 wpm	0945z 02 Apr

options:

[show/hide](#)

news

[RBN blog: stay tuned!](#)

we have 67 skimmers online

we have 147 visitors online

skimmers online:

9V1RM - 10m,17m,12m,15m
AB1HL - 20m,30m,40m,17m
DJ9IE - 40m
DK1MAX -
DK8NE - 6m
DK9IP -
20m,30m,40m,17m,12m,15m
DL0LBS -
DL2CC - 20m,30m,40m,17m,15m

Which bands are open at *my* QTH?



REVERSE BEACON NETWORK callsign

welcome | main | dx spots | skimmers | downloads | about | contact us

Map | Satellite | Hybrid

POWERED BY Google

/ 160m / 80m / 40m / 30m / 20m / 17m / 15m / 12m / 10m / 6m / 2m
world wide / zoom to US / zoom to Europe / zoom to North Atlantic

show/hide my last filters

showing spots for spotter call: N6TV rows to show: 50
search spot by callsign

de	dx	freq	cq/dx	snr	speed	time
----	----	------	-------	-----	-------	------

options: [show/hide](#)

language: english

spots format: dxwatch

tracking mode on
 show flags
 show lotw users

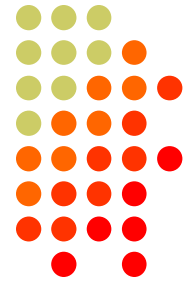
tag new spots: since last update

map (beta version):
 show with grayline
 show
 hide

spots lifetime: 10 minutes

watch list: no watchlist

Spots analysis tool



The screenshot shows the website header with the title "REVERSE BEACON NETWORK" in a green bar. Below it is a navigation menu with items: "welcome", "main", "dx spots", "skimmers", "downloads", "about", and "contact us". The "dx spots" item is circled in red. A dropdown menu is open under "dx spots", with "spots analysis tool" also circled in red. Other items in the dropdown include "download raw data", "spot search", "create your filter!", "HF >", "VHF+ >", "HF", "VHF+", and "HF/CW". A tooltip "analyze and compare spots" is visible over the "spot search" item. The main content area includes a "Welcome to" message, a description of the RBN as a network, and a "Check out our blog!" section with a link to "Aggregator 2.1 - new insight for Skimmer ops".

Pick a Date, a Skimmer, add callsigns to compare



1. Select a comparison date i
 MM/DD/YY

2. Select a Reverse Beacon
▶ Europe
▼ North America

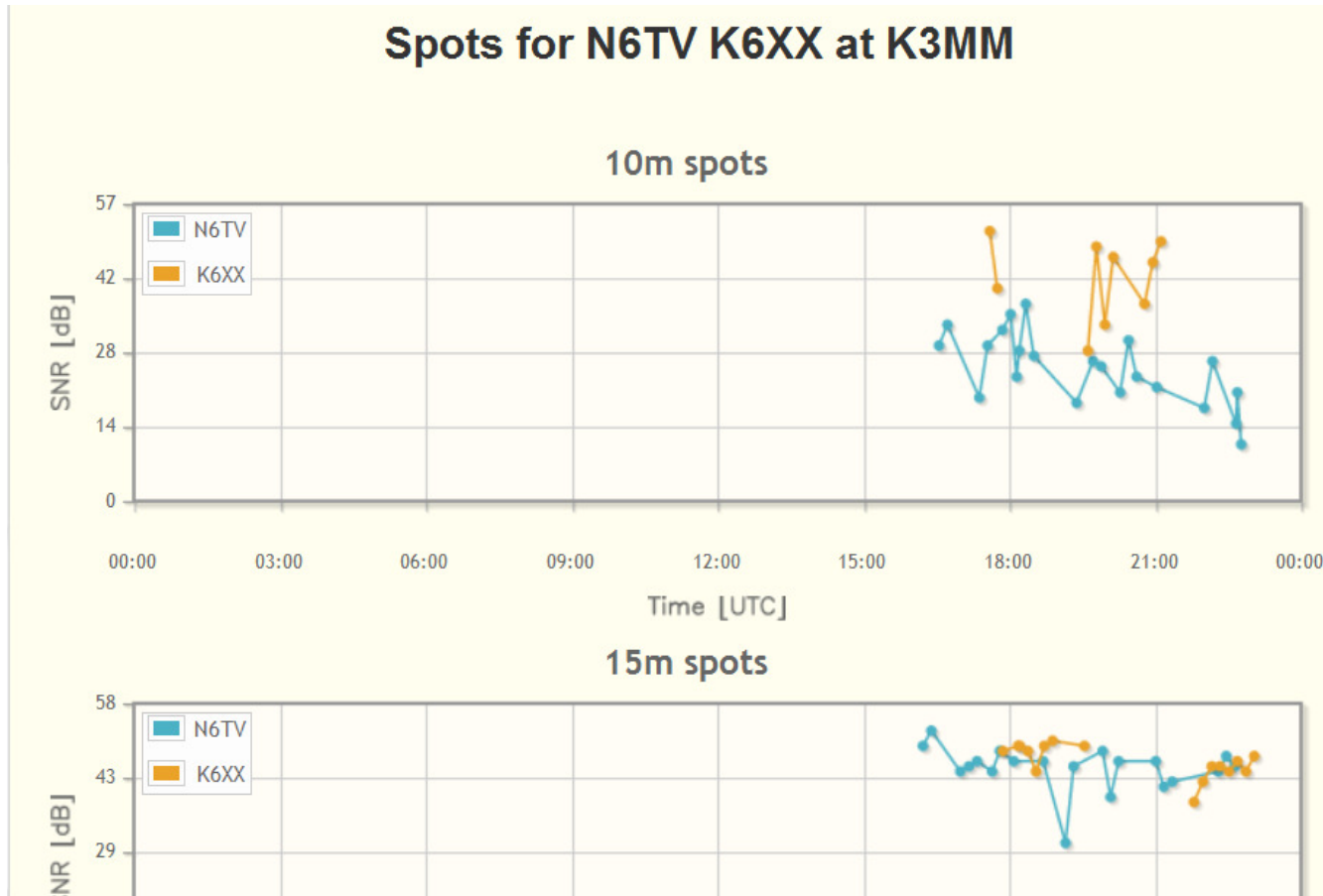
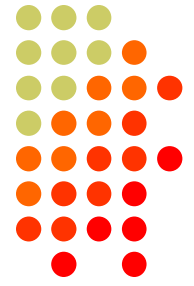
- AA4VV 354 spots
- K1TTT 5318 spots
- K3MM 6926 spots
- K6ND 3751 spots
- KA9SWE 657 spots
- KB9AMG 181 spots
- KC0VKN 877 spots

▶ Africa
▶ Oceania

3. Enter callsigns to compare ↻

<input checked="" type="checkbox"/>	<input type="checkbox"/>	N6TV	58 spots
<input checked="" type="checkbox"/>	<input type="checkbox"/>	K6XX	29 spots

And the winner is ... K6XX!





Raw data downloads

REVERSE BEACON NETWORK

welcome main dx spots skimmers downloads about contact us

download raw data

Raw data downloads

spots analysis tool

spot search

create your filter!

HF >

VHF+ >

HF

VHF+

HF/CW

HF/SSB

VHF+/CW

VHF+/SSB

1.8/3.5/7MHz

14/21/28MHz

10/18/24MHz

1089KBytes

20120201.zip

20120202.zip

20120203.zip

Dayton 2013

The data files then amount of data will the RBN produced full daily data set, c

The only thing that with the RBN com publication. Please

Click on the year, a

collapse all month

2012

January

February

01 Wedne

02 Thurs

03 Friday

1089KBytes

Dayton 2013

Raw data is text file, Comma Separated Values



```
callsign,de_pfx,de_cont,freq,band,dx,dx_pfx,dx_cont,mode,db,date
VK6IA,VK,OC,28028.4,10m,W6YI,K,NA,CQ,14,2011-11-26 00:00:00
ON5KQ,ON,EU,7005.5,40m,K2QMF,K,NA,CQ,40,2011-11-26 00:00:00
ON5KQ,ON,EU,7005.5,40m,K2QMF,K,NA,CQ,40,2011-11-26 00:00:00
N4ZR,K,NA,7011.7,40m,OM5NS,OM,EU,CQ,22,2011-11-26 00:00:00
N4ZR,K,NA,7020.6,40m,S50R,S5,EU,CQ,40,2011-11-26 00:00:00
N4ZR,K,NA,7023,40m,NQ4I,K,NA,CQ,56,2011-11-26 00:00:00
WA7LNW,K,NA,7051.5,40m,YR1C,YO,EU,CQ,15,2011-11-26 00:00:00
```

Total World-Wide RBN spots, 2012 CQ WW CW:

3,163,126 (18.3 spots per second)

2013 ARRL DX CW:

3,937,108 by all Skimmers (82,023 spots per hour)

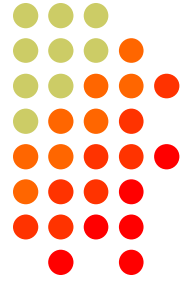
2,013,282 by DX Skimmers outside USA

How can I help?



- Set up an SDR, feed Skimmer Spots to the RBN, using the Aggregator program
 - More skimmers needed in Asia/Africa/South America
- Call a bit off frequency

What's New?



- DL4RCK **RCKSkimmer** automatically adds RTTY spots into RBN network (but doesn't use wideband SDR)
- VE3NEA is attempting:
 - RTTY/PSK Skimmer
 - SSTV Skimmer
 - But he says "Not close to completion"
- Not attempted:
 - SSB Skimmer



For more information

- <http://www.reversebeacon.net>
- <http://www.bcdxc.org/ve7cc/default.htm#download>
- <http://www.dxatlas.com/CwSkimmer>
- <http://www.dxatlas.com/SkimServer>
- <http://www.srl-llc.com/> (QS1R)
- <http://microtelecom.it/perseus/>
- <http://www.pixelsatradio.com/product/shortwave-magnetic-loop-antenna/> (RF Pro-1B loop antenna)
- <http://www.dxengineering.com/parts/dxe-arah3-1pe>
(ARAH3-1PE horizontal antenna)

For more information



- <http://www.pvrc.org/n4zr/rbn.pdf>
- <http://reversebeacon.blogspot.com>
- <http://www.ve7cc.net/>
- <http://www.qrz.com/db/n6tv>

Questions?

