Rx antennas at IV3PRK: Signal/Noise Tests

Using an improved 1.843 Test Oscillator and the SDR-IQ receiver

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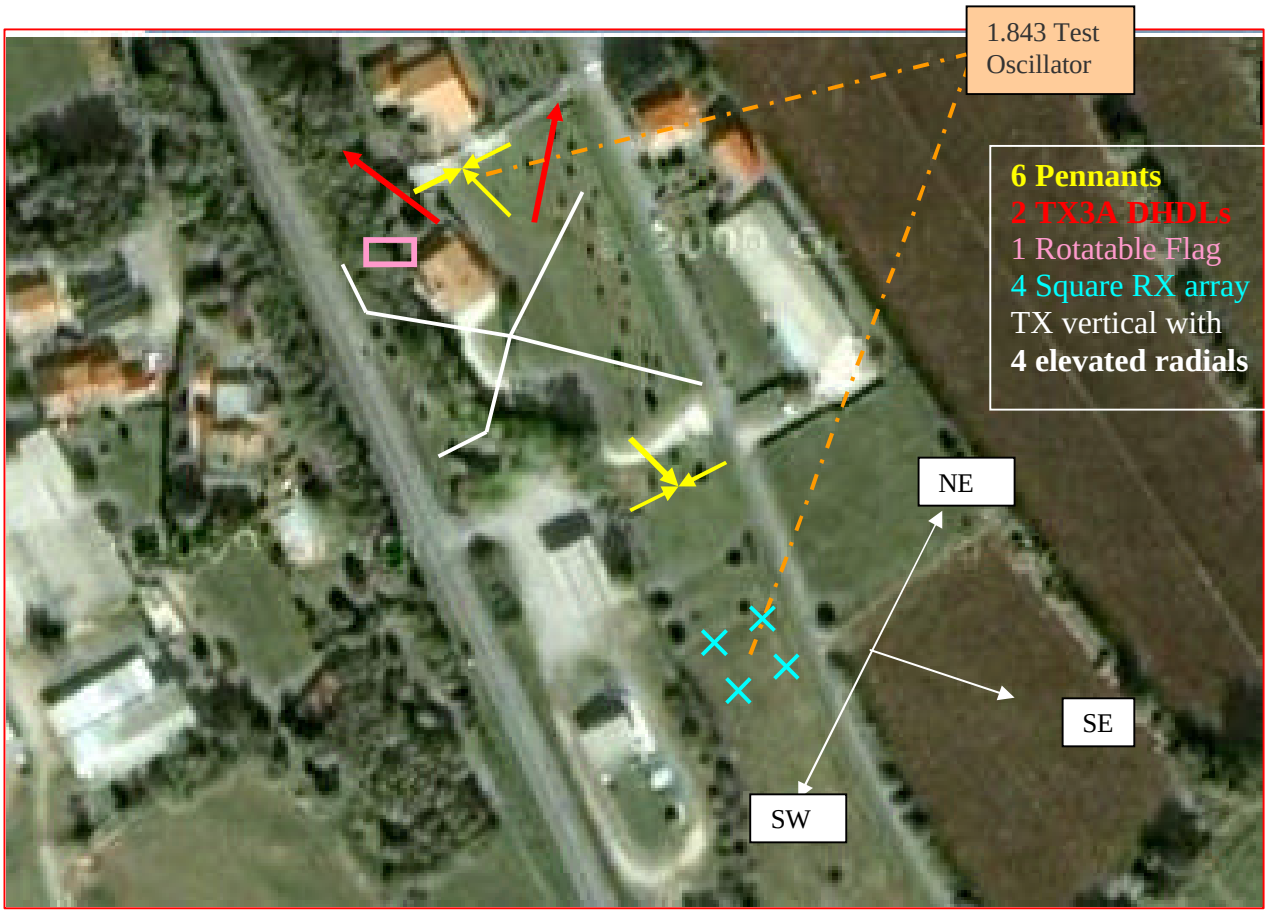
Finally, with the small SDR-IQ receiver and a stable reference signal from the 1.843 oscillator, I have been able to perform some definite tests on several RX antennas.

Its first use has been in the field to fine tune the 4-square vertical array. Connected directly to the phasing/switching box, it has been easy to carefully adjust the two attenuators on the delayed lines to get the minimum signal from the back of the array. All the details can be found on the PDF document "4-square Rx Vertical Array - part 4".

Then I took the readings for all the directions in the shack, at 3 PM local time, under normal operating conditions with the preamplifier set at about 15 dB of gain.

The 8 snapshots of the 4-square are followed by the same graphics taken on most of the other RX antennas; it is very interesting to note not only the 1.8432 signal, but specially the background noise. That explains why, in my particular QTH, the best receiving antennas are still the Pennants.

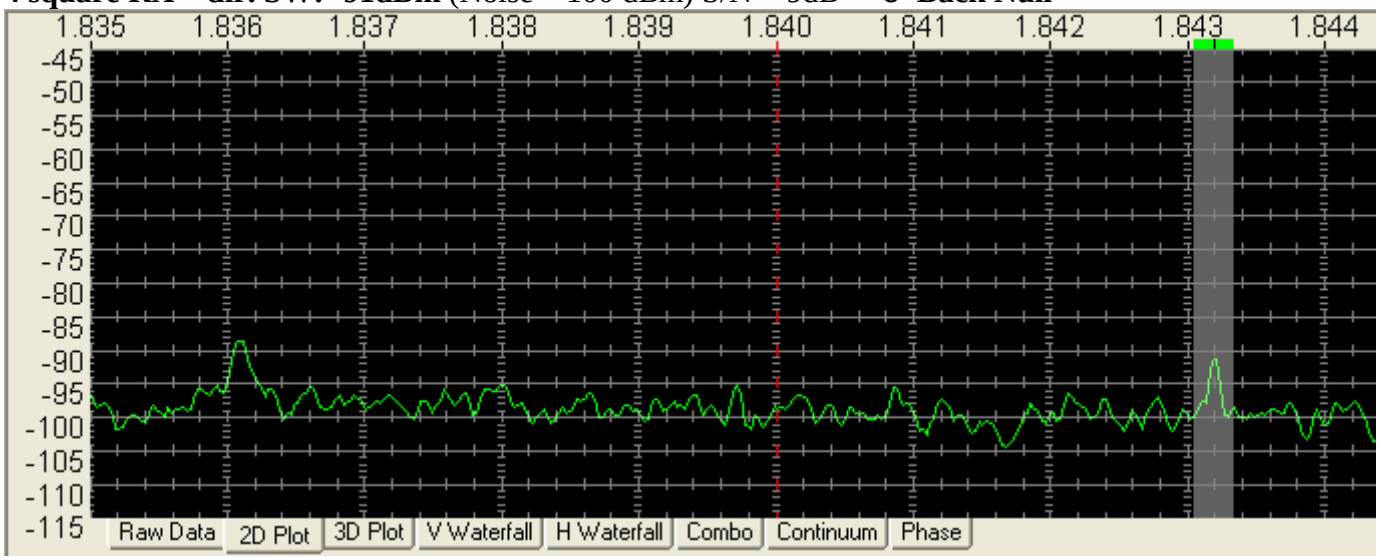
This is a Google map, with all my 160 m. antennas at the present in use, showing the position of the reference test oscillator at about one wavelength from the 4 square Rx array:



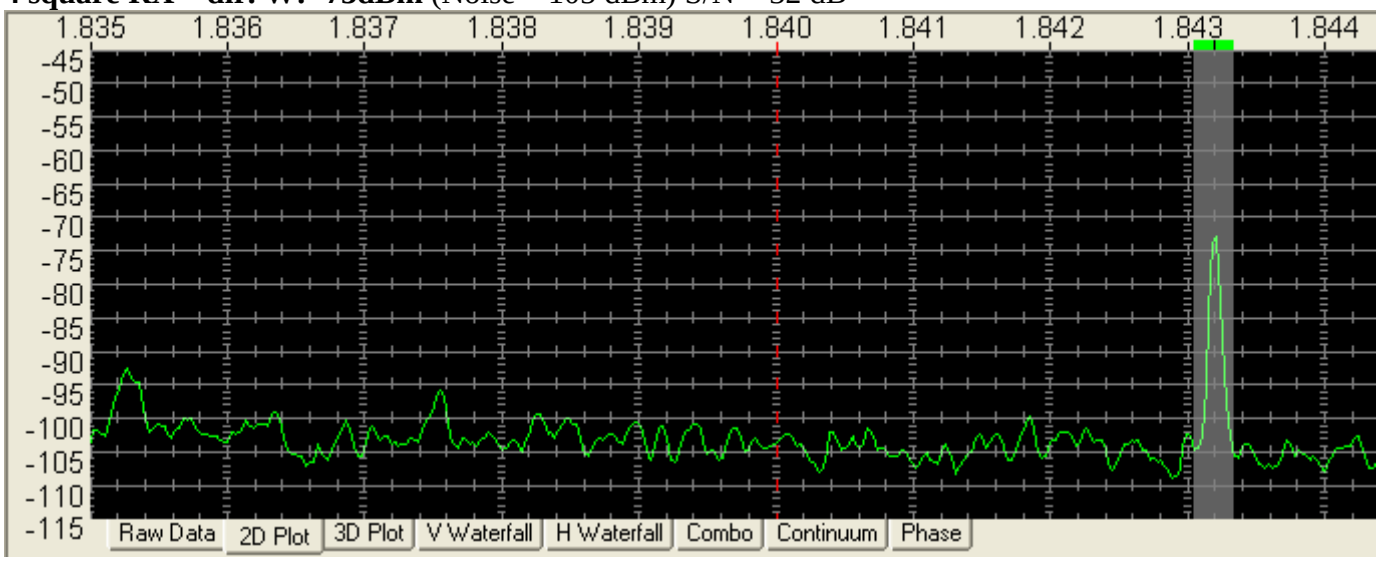
The 4-square RX vertical array

The following are the screen graphics switching directions clockwise from South West (back of the array) to NE (front direction) and down to South, keeping the same reference signal.

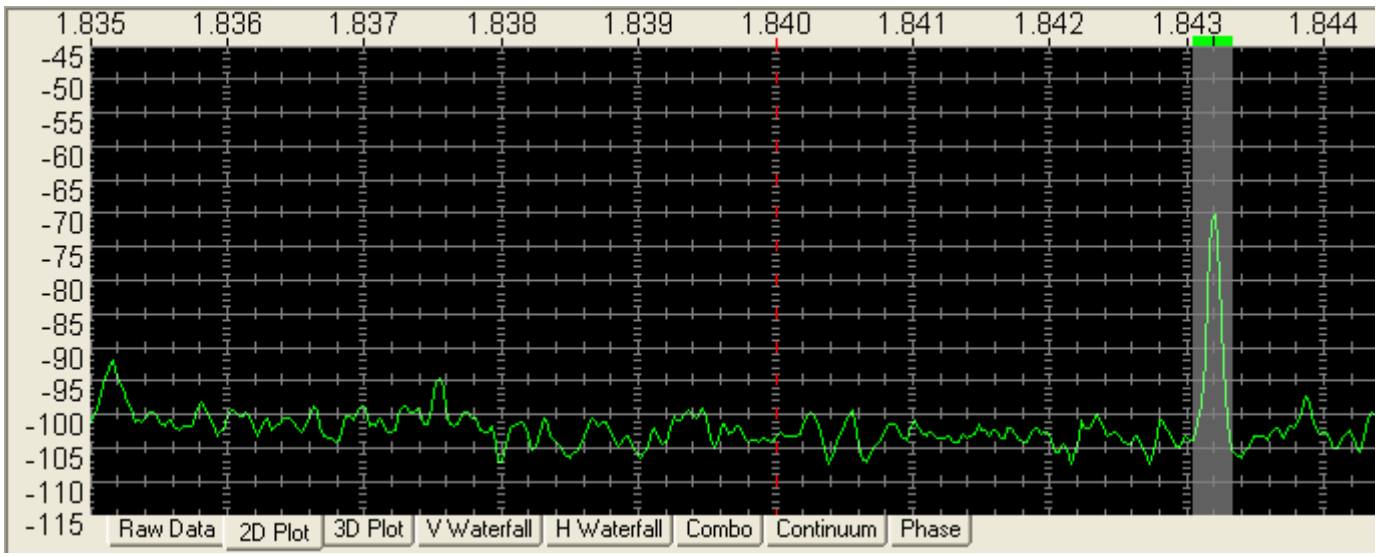
4 square RX – dir. SW: -91dBm (Noise – 100 dBm) S/N = 9dB = è **Back Null**



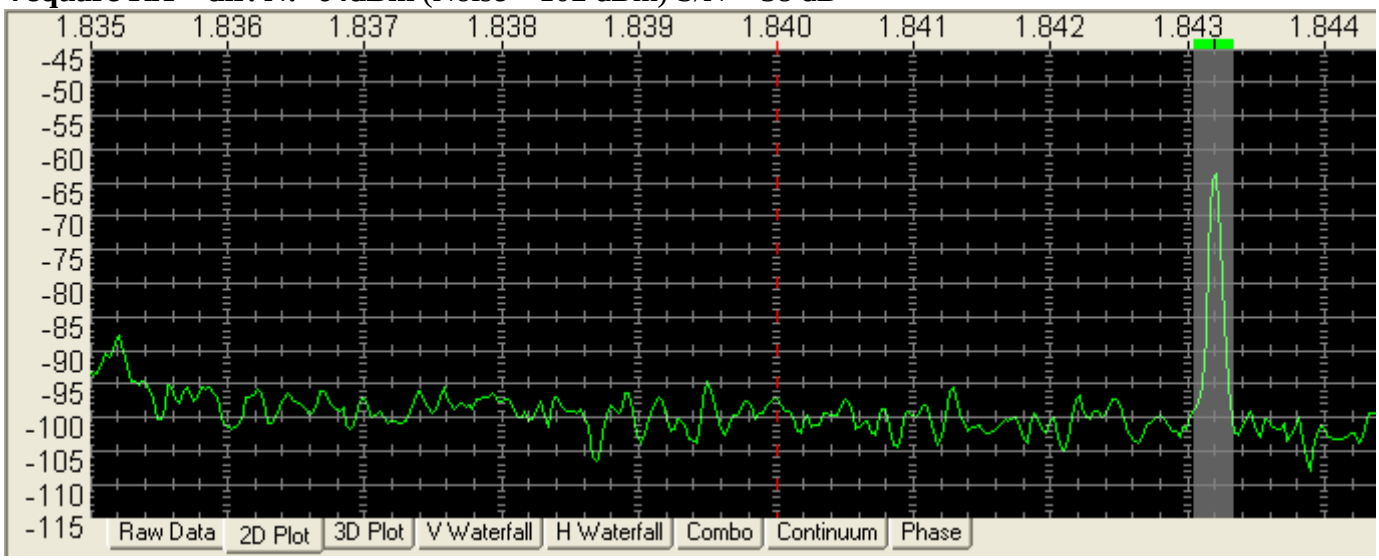
4 square RX – dir. W: -73dBm (Noise – 105 dBm) S/N = 32 dB



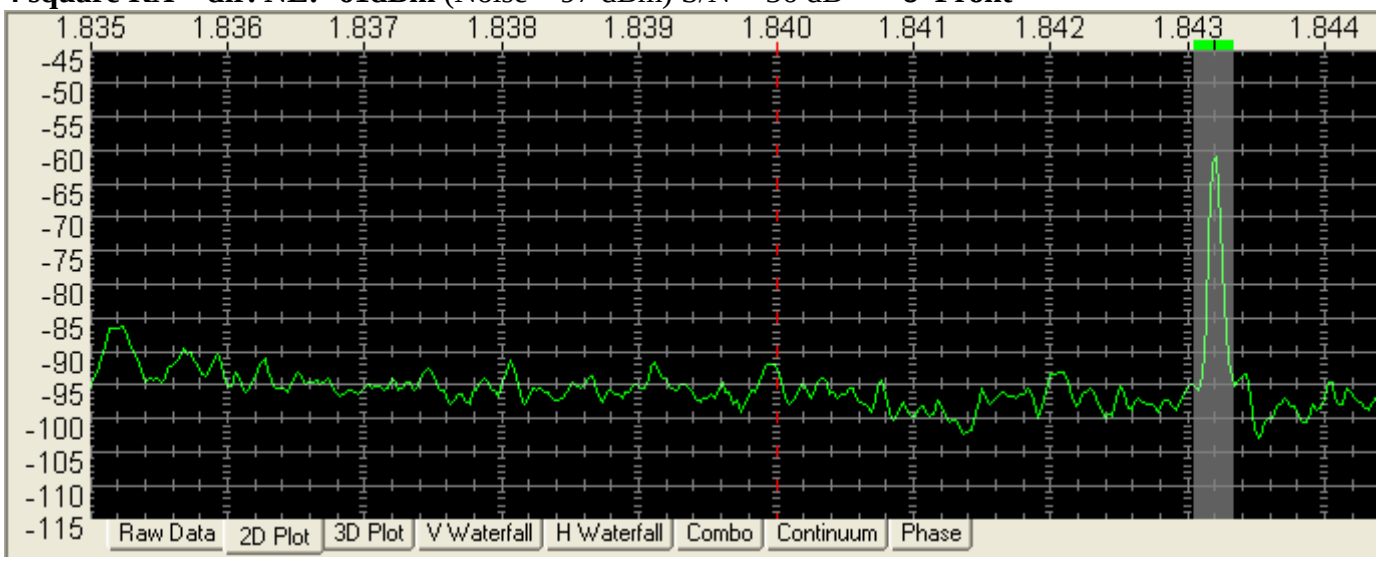
4 square RX – dir. NW: -70dBm (Noise – 105 dBm) S/N = 35 dB



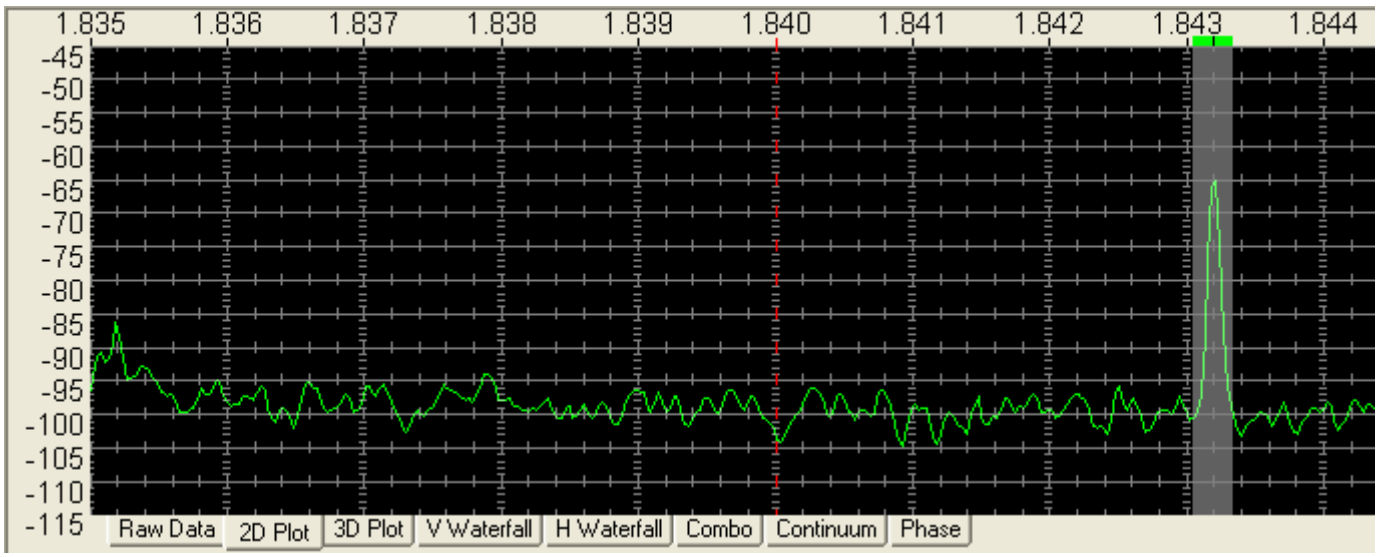
4 square RX – dir. N: -64dBm (Noise – 102 dBm) S/N = 38 dB



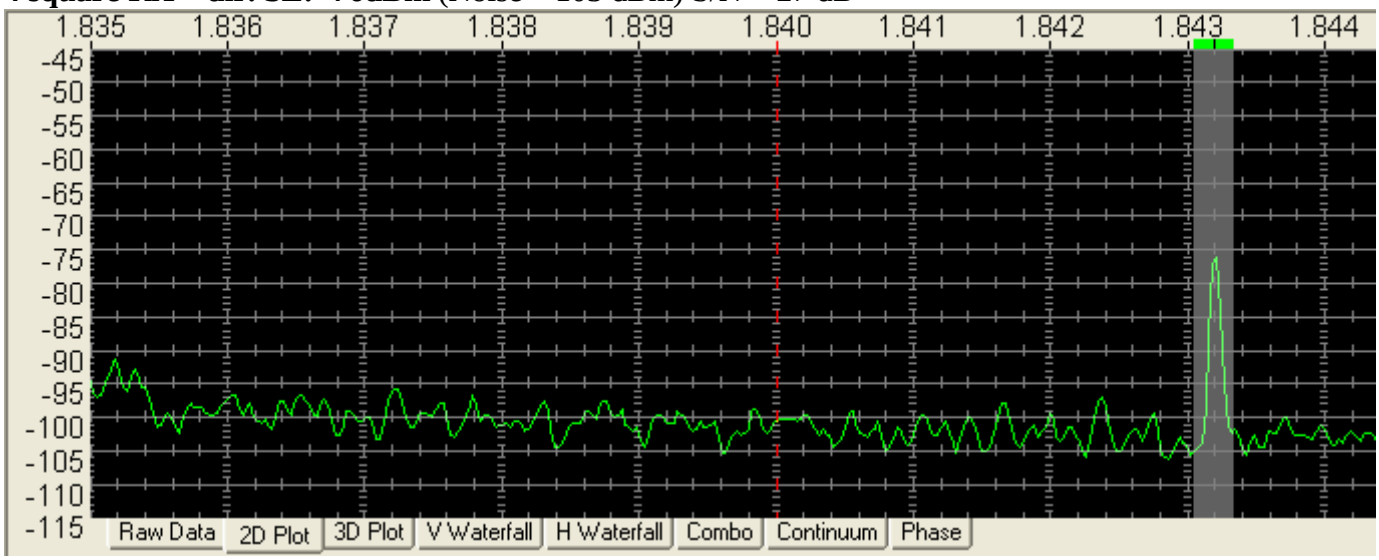
4 square RX – dir. NE: -61dBm (Noise – 97 dBm) S/N = 36 dB = è **Front**



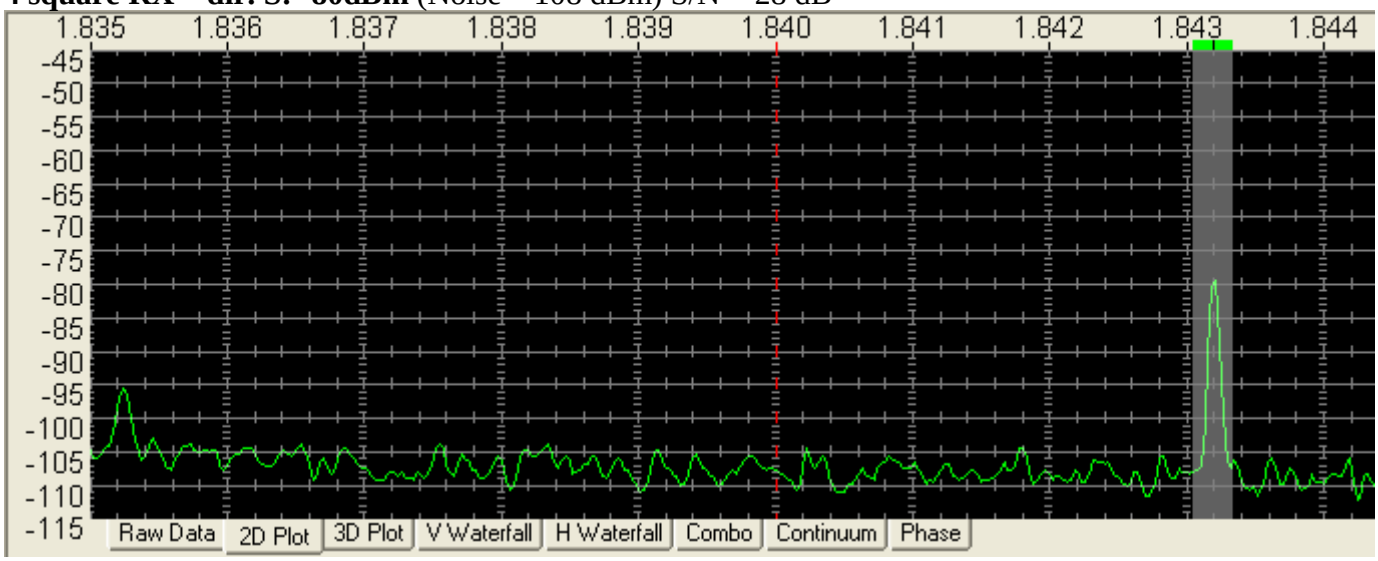
4 square RX – dir. E: -65dBm (Noise – 100 dBm) S/N = 35 dB



4 square RX – dir. SE: -76dBm (Noise – 103 dBm) S/N = 27 dB



4 square RX – dir. S: -80dBm (Noise – 108 dBm) S/N = 28 dB



Thus summarizing:

Dir. SW (diagonal)	– 91 dBm = **- 30 dB Front to Back**	(Noise: -100 dBm; S/N: 9 dB)
Dir. W (side)	– 73 dBm = - 12 dB	(Noise: -105 dBm; S/N: 32 dB)
Dir. NW (diagonal)	– 70 dBm = - 9 dB	(Noise: -105 dBm; S/N: 35 dB)
Dir. N (side)	– 64 dBm = - 3 dB	(Noise: -102 dBm; S/N: 38 dB)
Dir. NE (diagonal)	– 61dBm = Front signal reference	(Noise: - 97 dBm; S/N: 36 dB)
Dir. E (side)	– 65 dBm = - 4 dB	(Noise: -100 dBm; S/N: 35 dB)
Dir. SE (diagonal)	– 76 dBm = - 15 dB	(Noise: -103 dBm; S/N: 27 dB)
Dir. S (side)	– 80 dBm = - 19 dB	(Noise: -108 dBm; S/N: 28 dB)

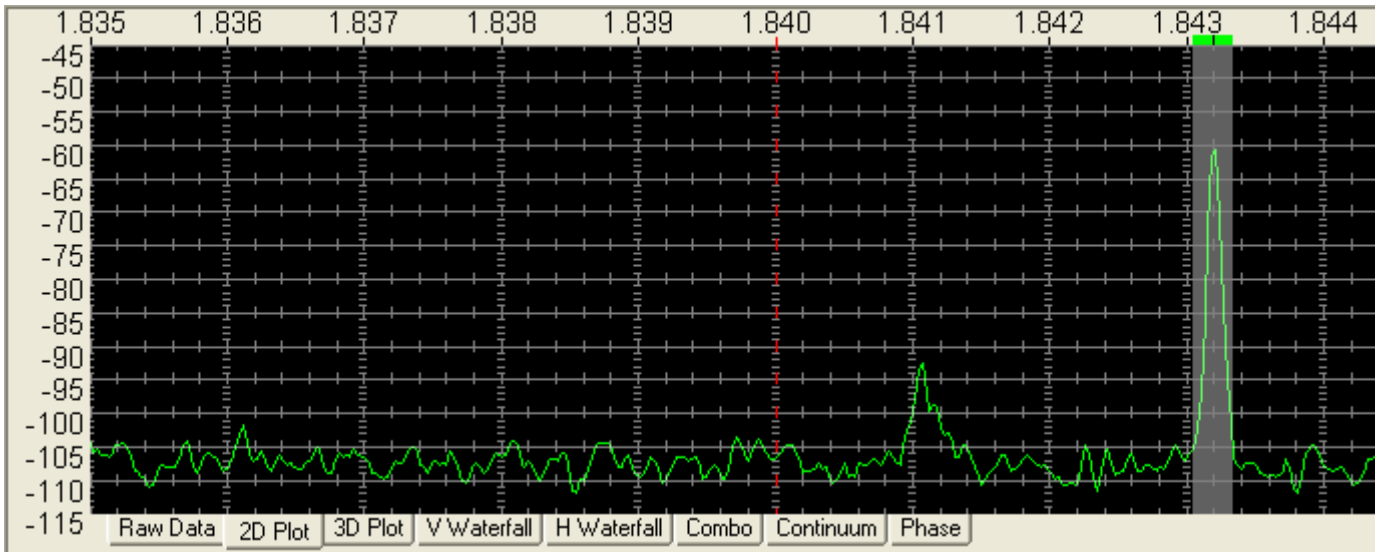
As the gain of the 4-square in the side positions is about 8 dB higher than in the diagonal positions, with a broader lobe, a 8 dB attenuator is automatically switched in to keep the received signal at the same level (All the details in the PDF files "4-square RX vert. array: part 1 and part 2).

So the performance of this 4-square Rx vertical array, with a **F/B ratio of 30 dB,** sounds very good, and if I had not the Pennants system to compare, I could be very satisfied with it!

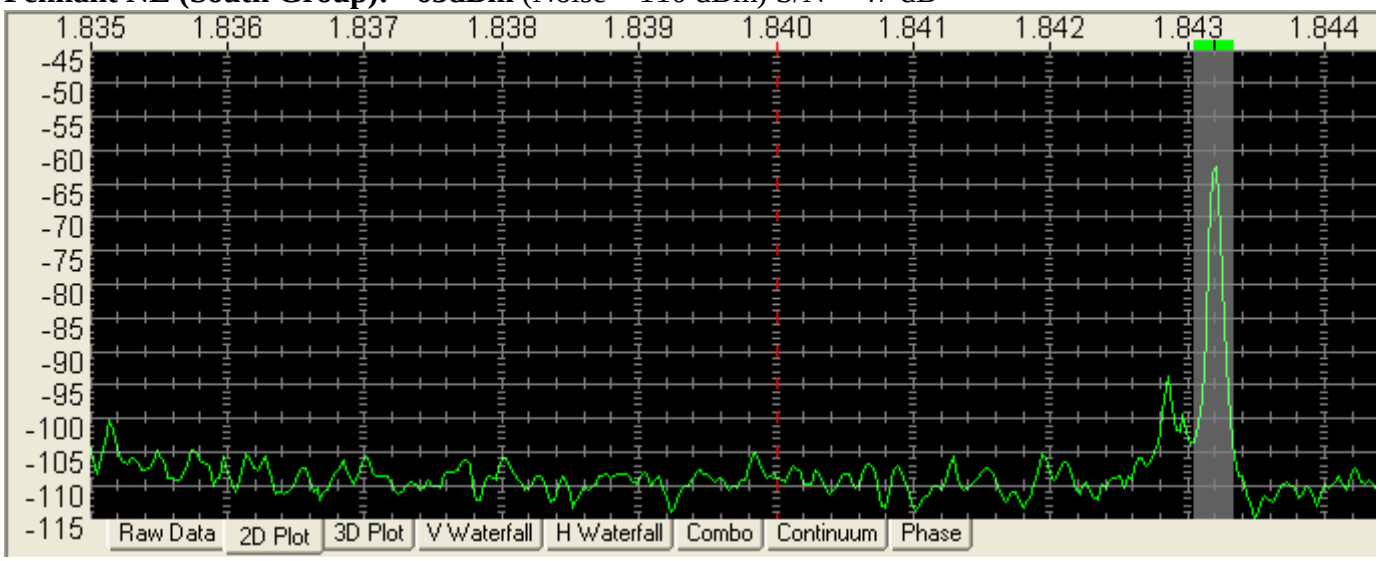
The Pennants

The following are the screen snapshots taken on the several Pennants taken under the same conditions, with an added outside 10 dB preamplifier, which is switched on their buried feedline.

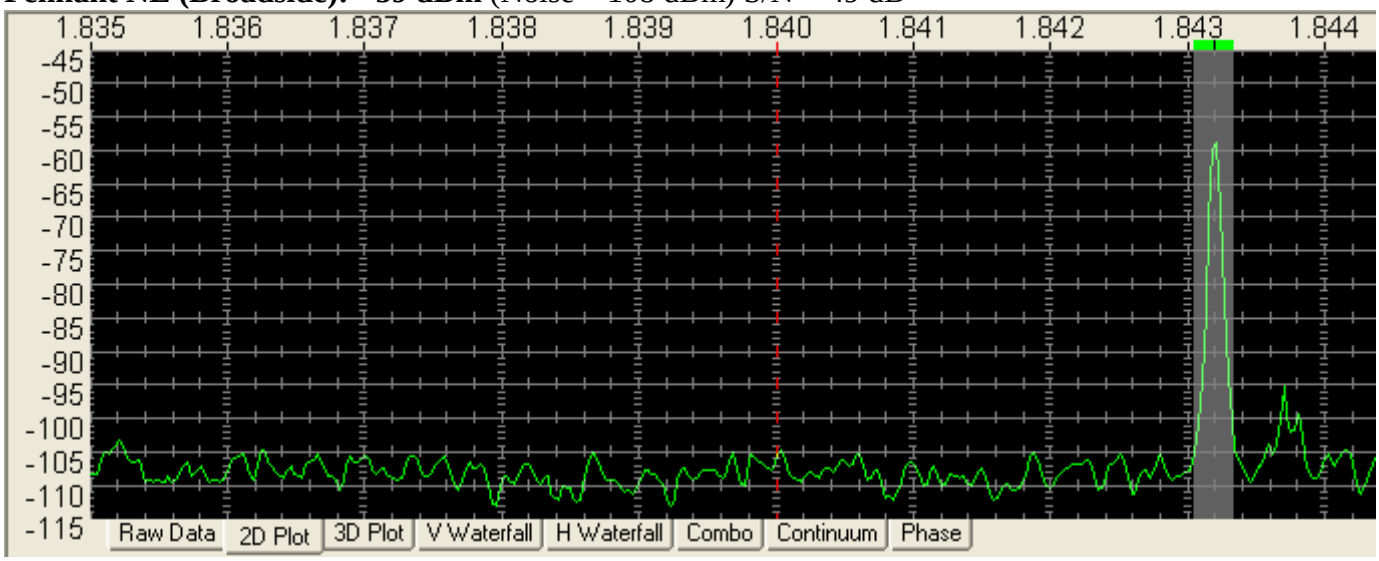
Pennant NE (North Group): - 60dBm (Noise – 107 dBm) S/N = 47 dB



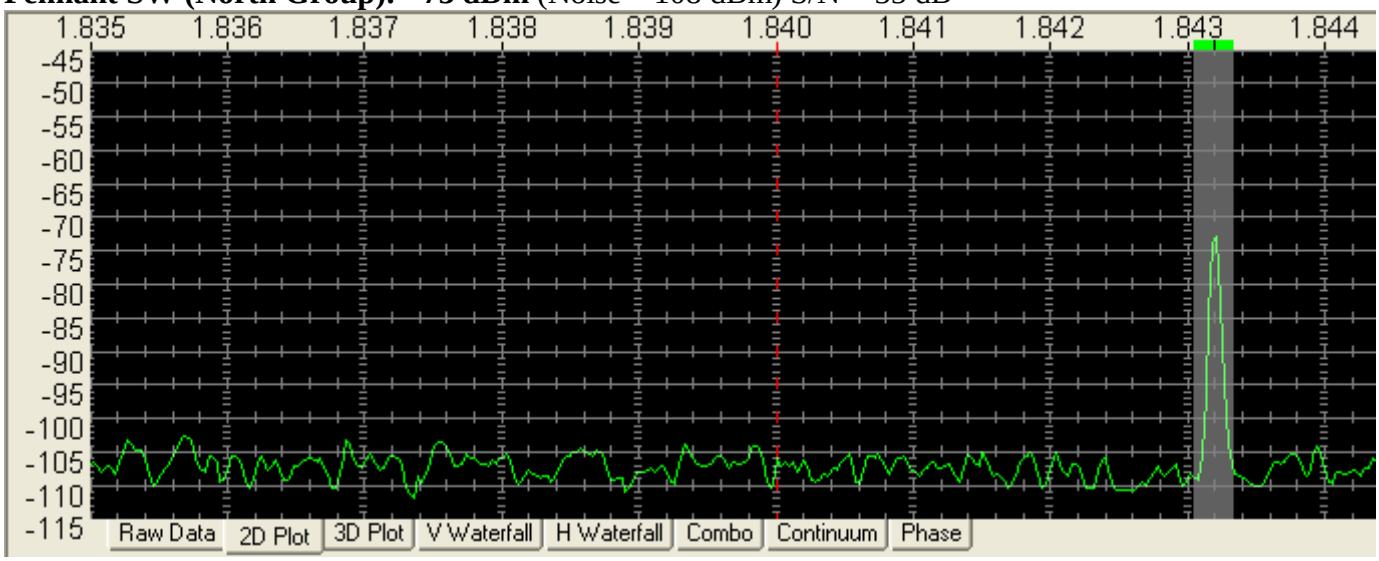
Pennant NE (South Group): - 63dBm (Noise – 110 dBm) S/N = 47 dB



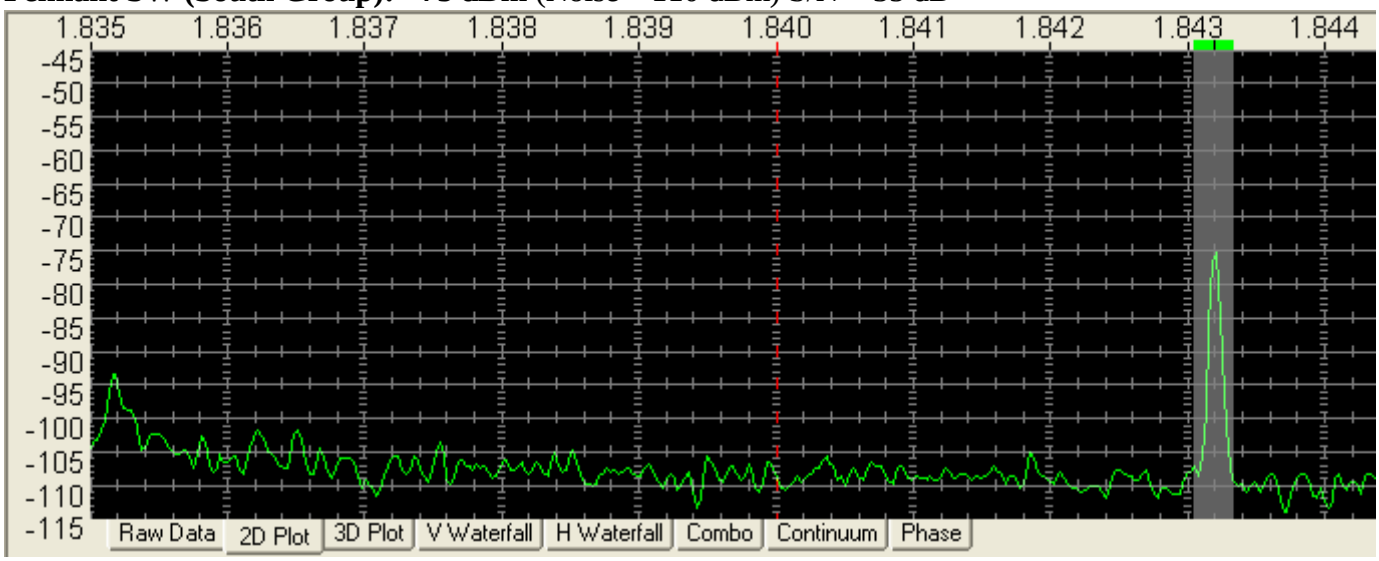
Pennant NE (Broadside): - 59 dBm (Noise – 108 dBm) S/N = 49 dB



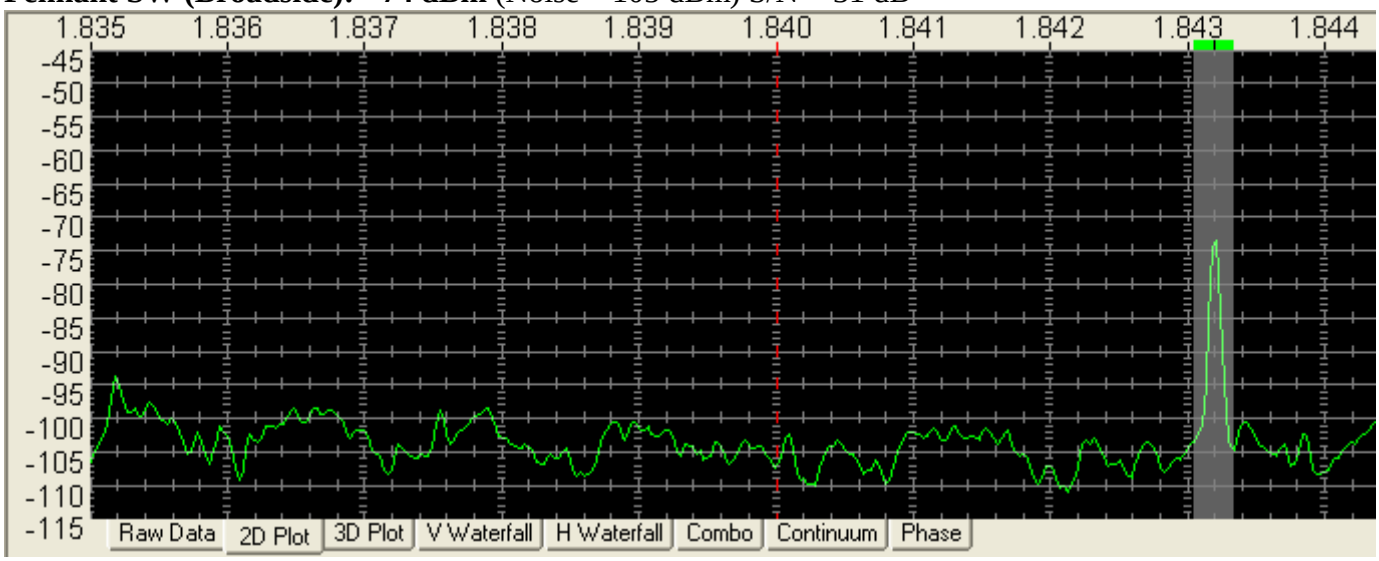
Pennant SW (North Group): - 73 dBm (Noise – 108 dBm) S/N = 35 dB



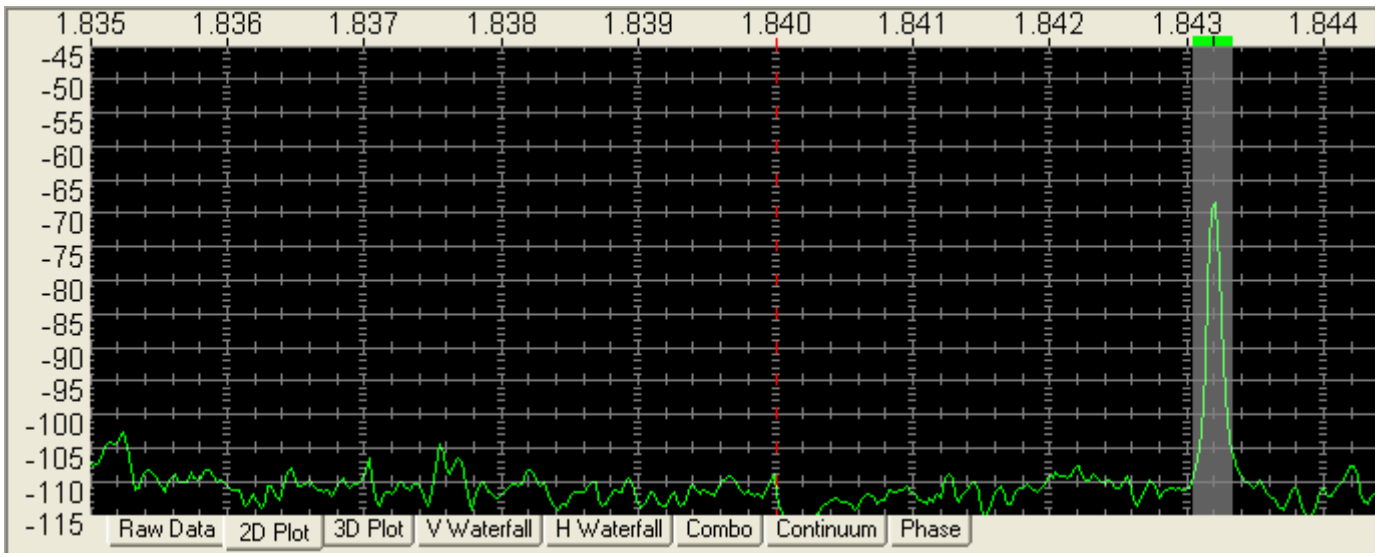
Pennant SW (South Group): - 75 dBm (Noise – 110 dBm) S/N = 35 dB



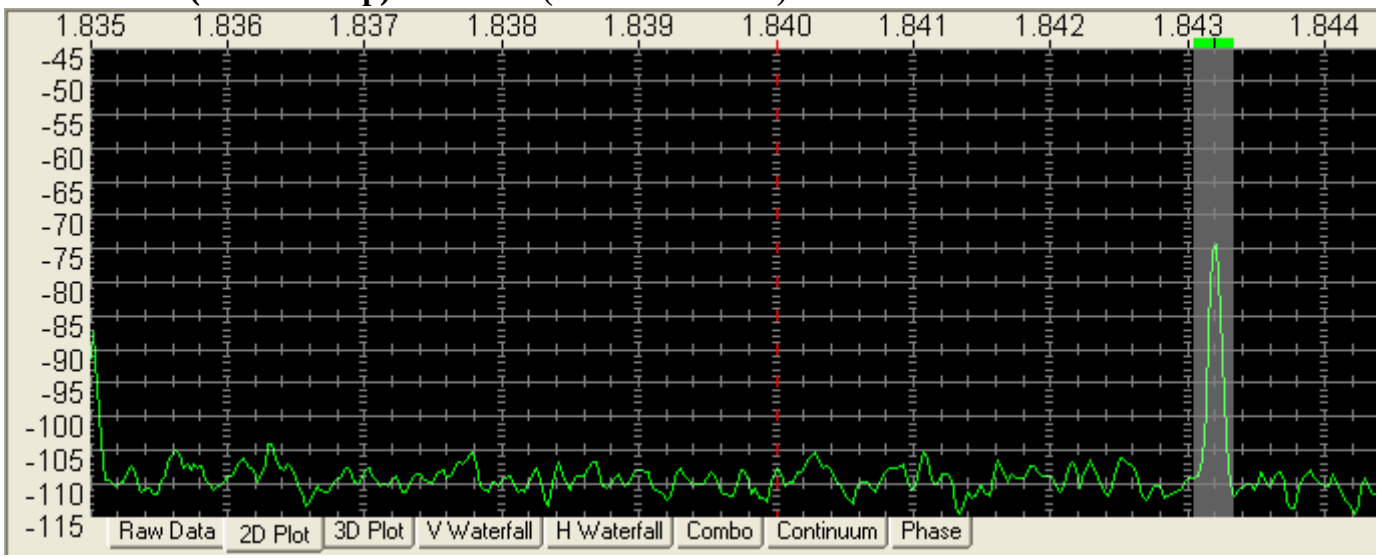
Pennant SW (Broadside): - 74 dBm (Noise – 105 dBm) S/N = 31 dB



Pennant SE (South Group): - 68 dBm (Noise – 110 dBm) S/N = 42 dB



Pennant NW (North Group): - 75 dBm (Noise – 110 dBm) S/N = 35 dB



Of course **t**he 1.843 KHz signal is stronger due to the little shorter distance from the test oscillator, but is very important to note the noise level, which is generally 10 dB lower than on the 4-square, despite the added 10 dB of the outside preamplifier (in total 25 dB of preamp. gain).

Of particular interest is the NE direction, where it can be explained why the Pennants broadside configuration is always my best Rx antenna: under marginal conditions just a couple of dB of improvement in the S/N ratio make the difference (and it is 12 dB better than the 4 square) !

To be more clear, I summarize here the available choices towards NE direction:

- 4 square RX dir.NE (diagonal): Signal - 61dBm Noise: - 97 dBm S/N: 36 dB
- Pennant NE (North Group) : Signal - 60 dBm Noise: - 107 dBm S/N: 47 dB
- Pennant NE (South Group) : Signal - 63 dBm Noise: - 110 dBm S/N: 47 dB
- Pennant NE (Broadside) : Signal - 59 dBm Noise: - 108 dBm S/N: 49 dB

And these are the corresponding back directions:

- 4 square RX dir.SW (diagonal): Signal - 91dBm Noise: - 100 dBm S/N: 9 dB
- Pennant SW (North Group) : Signal - 73 dBm Noise: - 108 dBm S/N: 35 dB
- Pennant SW (South Group) : Signal - 75 dBm Noise: - 110 dBm S/N: 35 dB
- Pennant SW (Broadside) : Signal - 74 dBm Noise: - 105 dBm S/N: 31 dB

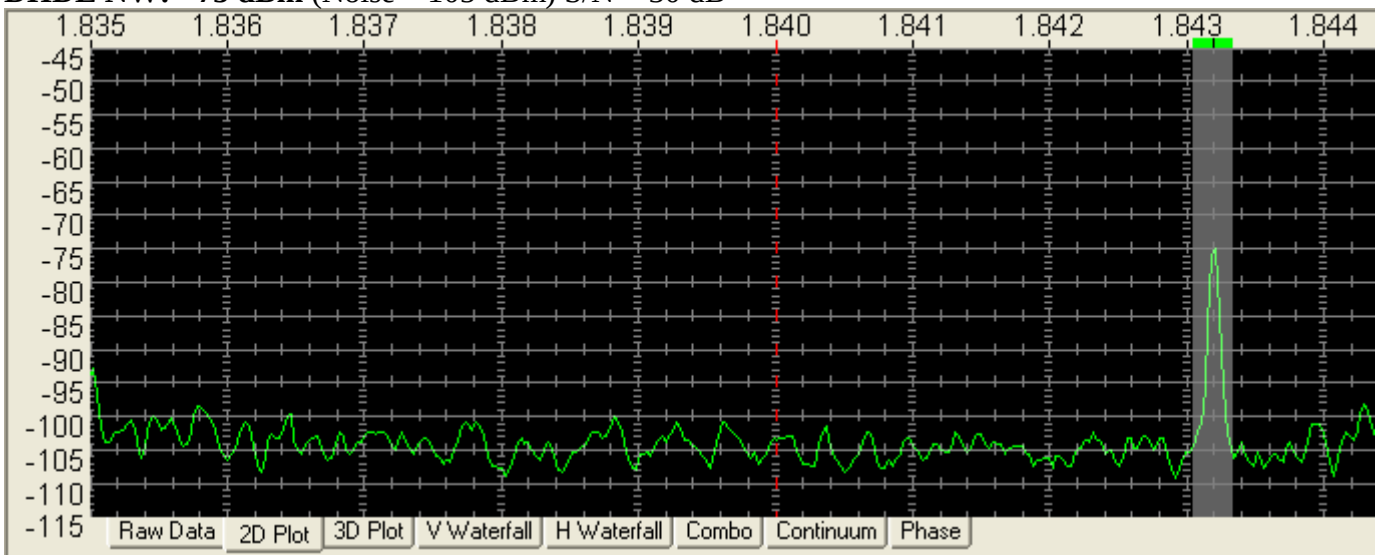
Conclusion:

- the 4-square Rx vertical array works very well, specially in the crossfire (diagonal) positions, with a Front to Back ratio of 30 dB
- the Pennants have a lower F/B, from 12 to 15 dB, but have a much better Signal to Noise ratio, and thus more quiet.

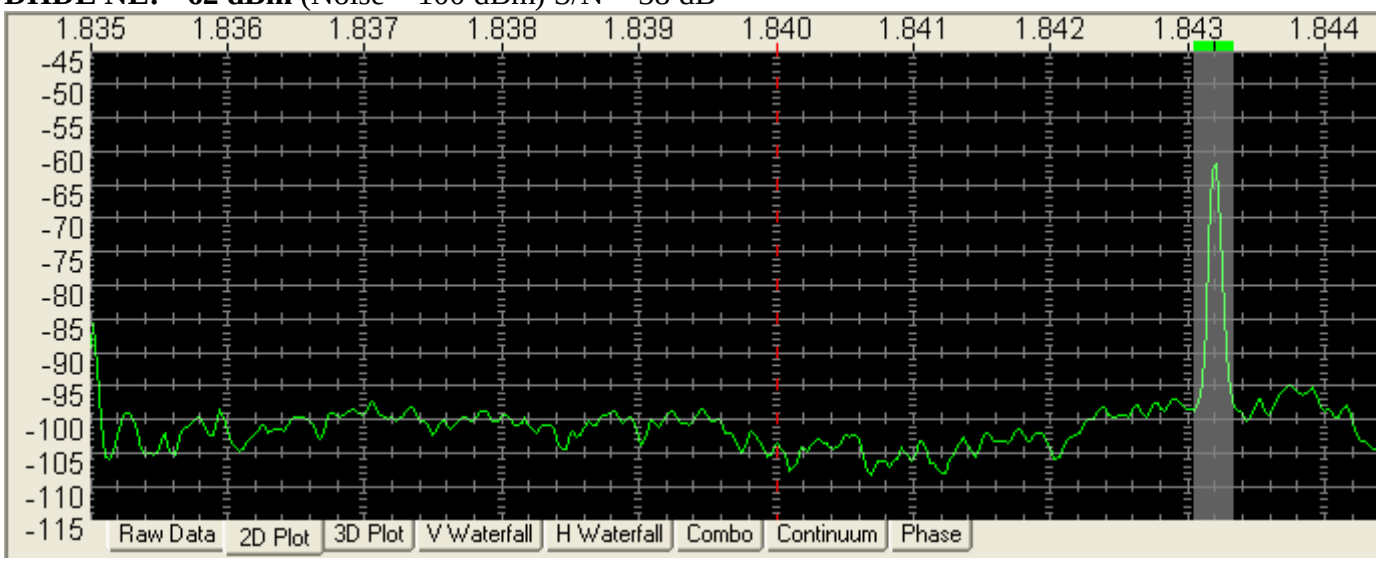
The TX3A Double Half Delta Loop

During the last winter I modelled and built a couple of TX3A DHDL's, at first in end-fire phasing and than as two single antennas. I moved them from one place to another on my lot, I tried a different feed system, but the results seemed far from the excellent Eznec models. All the details on these antennas can be found in the two PDF files under the TX3A DHDL array page.

DHDL NW: - 75 dBm (Noise – 105 dBm) S/N = 30 dB



DHDL NE: - 62 dBm (Noise – 100 dBm) S/N = 38 dB



It is interesting to compare these antennas with the corresponding nearby Pennants, (see the map on top of this document) using the same feedline, switching and preamplifiers:

- TX3A DHDL to NW :	Signal - 75 dBm	Noise: - 105 dBm	S/N: 30 dB
- Pennant NW (North Group) :	Signal - 75 dBm	Noise: - 110 dBm	S/N: 35 dB
- TX3A DHDL to NE :	Signal - 62 dBm	Noise: - 100 dBm	S/N: 38 dB
- Pennant NE (North Group) :	Signal - 60 dBm	Noise: - 107 dBm	S/N: 47 dB

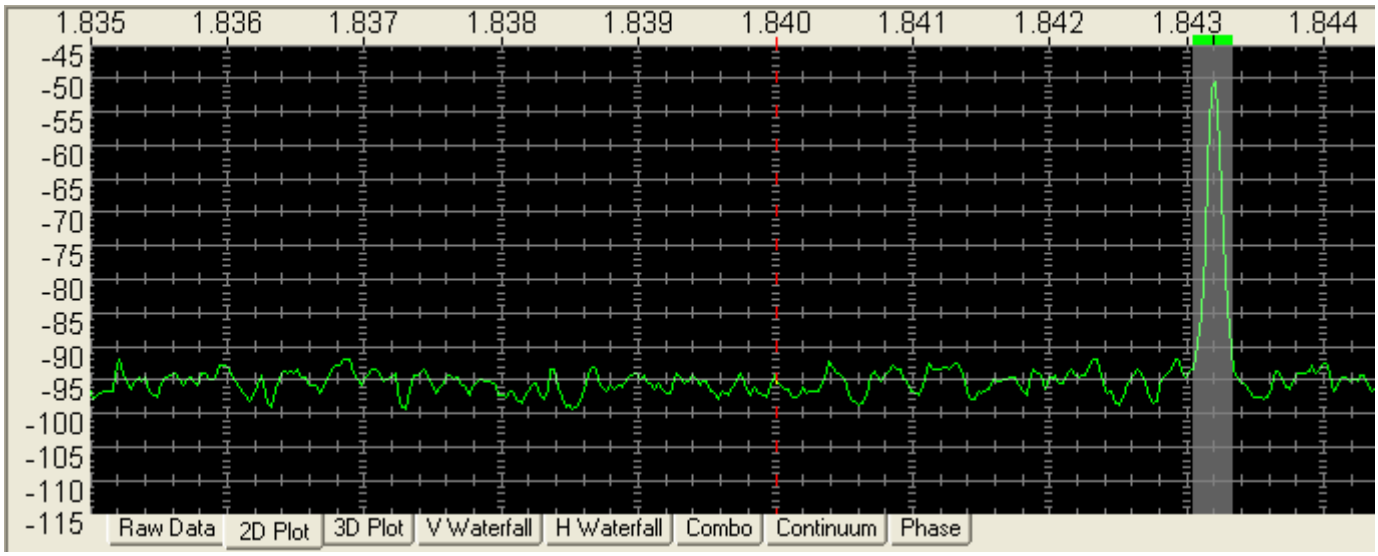
The signal is almost the same on both antenna types, but the noise is at least 5 dB higher on the DHDL, due to the wider area, and that worsens the S/N ratio. My conclusion is that it has been another experience, but not worth all the work.

Anyway both Rys SP5EWY and Neil G0JHC reported great success with these loops, so maybe it's just a matter of location. My personal opinion is that ***each RX antenna behaves differently in a different QTH.***

The TX antenna

At the end of these tests I add also the reading taken on the TX antenna, without any preamplifier of course. To compare the RX antennas with it we must subtract the 25 dB preamplifiers gain. So the noise floor on a Pennant is actually -135 dBm, that is 40 dB better than on the transmitting vertical tower.

TX Antenna: - 50 dBm (Noise – 95 dBm) S/N = 45 dB



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