

Some Recent Results For MW Antenna Arrays

Dallas Lankford, 11/4/09, rev. 5/23/11

DFA And DDFA Tests, December 2008 Through April 2009

As is well known from tests in North Louisiana since December 2008 when dual MW flag arrays were first used, from tests in North Louisiana since February 2009 when dual MW delta flag arrays were first used, and from tests in Grayland, Washington in April 2009 when a dual delta flag array was used in place of the quad delta flag array for one of the four nights of a DXpedition, dual flag and dual delta flag arrays (DFA's and DDFA's) are excellent splatter reducing DX antennas for the MW band. The following logs are from the Grayland dual delta flag array test in April 2009. For additional information about dual and quad flag and delta flag arrays (DFA's, QFA's, DDFA's, and QDFA's) which I developed, see "Phased Flag Arrays" and "Phased Delta Flag Arrays" in The Dallas Files.

Some Of The 4/21/09 Grayland Dual Delta Flag Array Loggings

receiver = Perseus,
antenna = dual delta flag array,
preamp = 10 dB gain p-p Norton,
computer = Clevo D901C quad,
recording = BlacX eSATA external caddy, IOGear eSATA 3 Gbps Express Card, 1.5 Tb external HD

- 550 Alaska**, Anchorage, KTZN, IDed as "AM Five Fifty KTZN Anchorage, This is The Zone," about 1200, 4/21
560 Alaska, Kodiak, KVOK, IDed as "AM Five Sixty KVOK Kodiak," about 1300, 4/21
567 New Zealand, Wellington, EZ listening music, //963 about 0739, 4/21
576 Russia, Oyash, R. Mayak (at 1 MW Oyash dominates the other Russians on this frequency) about 1100, 4/21, with Moscow Nights interval signal, weak, but the IS was easily heard and the language had the right sound and cadence for Russian
590 Alaska, Anchorage, KHAR, IDed as "KHAR Five Ninety, Anchorage," about 1000, 4/21
594 Australia, Horsham, male talker, over and under New Zealand, about 0840 – 0850, 4/21
594 Japan, Tokyo, //729, NHK1 interval signal about 1300, 4/21
594 New Zealand, various, female talker, //612//1251 about 0840 – 0850, 4/21
612 New Zealand, Christchurch, female talker, //594//1251, about 0840 – 0850, 4/21
620 Alaska, Homer, KGTL, 0859, 4/21, IDed as "KGTL Homer," strong interference from at least two others on frequency, a mess
630 Alaska, Juneau, KJNO, IDed "The Capital's Information Station, Six Thirty, KJNO, Juneau, Alaska," about 1200, 4/21
640 Alaska, Bethel, KYUK, IDed as "Hello, I am [unintelligible name] from Bethel, Alaska, [unintelligible] KYUK Six Forty AM in Bethel, Alaska," about 1100, 4/21
648 Russia Ussuriysk, VoR, poor, interval signal (Pictures at an Exhibition, AKA "Great Gate of Kiev") at about 1300, 4/21
650 Alaska, Anchorage, KENI, IDed as "News Radio Six Fifty KENI," about 0700, 4/21
670 Alaska, Dillingham, KDLG, about 0629, 4/21, "KDLG" ID followed by the weather report, strong over KBOI Boise
670 Hawaii, Hilo, KPUA, IDed as "I am Gordon Deal reminding you that The Wall Street Journal This Morning will continue right after the latest news on Sixty Seven AM KPUA Hilo, your source for news, sports, and information," about 1300, 4/21, strong, clear, and almost alone on the frequency
680 Alaska, Barrow, KBRW, IDed as "You are tuned to North [unintelligible] Public Radio, Six Eighty KBRW Barrow," about 1312, 4/21, but now I can't find this ID on the 4/21 recording anywhere near 1312, I know I heard Barrow, but apparently I made an error in the time or date or both when writing my notes
693 Japan, Tokyo, // 774, English lessons, short musical interlude just before ToH, time pips, 4/21
702 Australia, various, (Sydney, 2BL, presumed) ABC musical fanfare at ToH, followed by ABC news with male and female, weak, 1300 and later, 4/21
729 Japan, Nogaya, //594, NHK1 interval signal about 1300, 4/21

738 Tahiti, Papeete, as early as 0550, but not very clear until around 0700 and later, mostly male and female French talkers, 4/21
738 Taiwan, Baisha, BEL2, 100 kW, Yuye Guangbo Diantai (Taiwan Area Fishery Broadcasting Station), nice male or female Chinese singing with EZ listening music, 1252 and later, 4/21, mostly extremely weak, //1143
747 Japan, Sapporo, //774, English lessons, short musical interlude just before ToH, time pips, 4/21
750 Alaska, Anchorage, KFQD, IDed as “Seven fifty KFQD News Talk, Seven Fifty,” about 0700, 4/21
760 Hawaii, Honolulu, KGU, on the DDFA, IDed with “You are listening to AM Seven Sixty, KGU, Hawaii's Christian Talk,” 0559, 7/21
770 Alaska, Valdez, KCHU, IDed as “KCHU, Public Radio for Valdez, Prince William Sound, and the Copper River Valley,” about 0700, 4/21
774 Japan, Akita, //1386 and lots of others, English lessons, short musical interlude just before ToH, time pips, 4/21
780 Alaska, Nome, KNOM, IDed as “KNOM in Nome,” about 0900, 4/21
790 Alaska, Glennallen, KCAM, IDed as “Great radio for the great land, this is The Voice Of The Copper River Valley, KCAM, Glennallen,” about 0900, 4/21
792 Australia, Brisbane, weak or faded most of the 4/21 recording
800 Alaska, Juneau, KINY, IDed as “Alaska's Capital City, Hometown Radio,” about 0900, 4/21
820 Alaska, Fairbanks, KCBF, ESPN program, IDed as “Eight Twenty Sports Fairbanks,” about 0700 4/21
828 Australia, Geraldton Bluff, presumed, ABC musical fanfare about 1300, weak, under Japan, 4/21
828 Japan, Osaka, //774, English lessons, short musical interlude just before ToH, time pips, 4/21
850 Alaska, Nome, KICY, Voice Of The Arctic, religious song just before 1300, 4/21, then IDed by a fast talking female as “[unintelligible] KICY Nome”
855 Australia, various, ABC musical fanfare about 1300, weak, 4/21
873 Japan, Kumamoto, //774, English lessons, short musical interlude just before ToH, time pips, 4/21
882 New Zealand, Auckland, EZ listening music, //963 about 0716, 4/21
891 Japan, Sendai, NHK1 interval signal about 1300, 4/21
920 Alaska, Soldotna, KSRM, IDed as “News Talk Ninety Two KSRM,” about 0700, 4/21
930 Alaska, Ketchikan, KTKN, IDed as “Nine Thirty Ketchikan, Alaska,” about 0700, 4/21
940 Hawaii, Waipahu, KKNE, off key female singer in Hawaiian with accompanying music, non-stop through the top of the 0600 hour, continued for quite some time, then a second (?) female singer, signal strength fair to poor, finally a male singer in Hawaiian with music, very nice, signal much stronger, continued through top of the hour again with no ID, but eventually about 0703 an English ID “AM Nine Forty KKNE Waipahu, Hawaii”
963 China, usually given as unknown location, but Dalian is 5 times as strong as any other Chinese on this frequency, also, Dalian has been reported in the past as a CNR or CRI station on 963, time pips 3 low and 1 high, CNR or CRI interval signal, about 1300, 4/21
963 New Zealand, Canterbury, EZ listening music, 0650 – 0900 and later, 4/21, // 981 about 0654, //882 about 0716
972 South Korea, Dangjin, HLCA, //1134, 4/21, about 1300, partial KBS interval signal after time pips at ToH
981 New Zealand, Kaikohe, EZ listening music, //963 about 0654, 4/21
1008 New Zealand, Tauranga, male talker, //1035//1044//1098//1107//1278, fair to good, 0730 – 0750 and later, 4/21
1008 Japan, Osaka, presumed, ABC jingle surfaced out of a mess about 1300, 4/21
1017 China, Changchun, presumed, nice oriental music, followed by easy listening non-oriental music, then CNR interval signal at about 1200, 4/21
1017 Japan, Fukuoka, JOLB, // 0774, about 1300, 4/21
1017 Philippines, Davo City, DXAM, here it is August 21 and just yesterday I got around to listening for DXAM on my 4/21 recording made from the dual delta flag array, about 1248 a fast male Filipino talker appeared, followed by a somewhat off key female singer, then about 1259 a “Radyo Rapido” ID, followed by a badly off key female singer “Falling In Love With You” in English, and about 1301 “DXAM, Radyo Rapido, diyes disisiyete (ten seventeen)” ID, after which the signal weakened until about 1310 when another off key singer was noted, followed by a lengthy announcement of “winning numbers,” namely various one digit lottery numbers, a mention of Super Lotto, and a lottery number consisting of six 2 digit numbers, also mentioned was “9 pm drawing” which is consistent with a 1300 UTC drawing, more details could have been included, this was the clearest of the receptions of DXAM during the 4 days I was at Grayland.
1017 Tonga, Nuku'alofa, presumed, female talker in English before 0730, 4/21, faded down but then faded up again with nice harmony island music about 0750

1035 New Zealand, Wellington, male talker, //1008//1044//1098//1107//1278 and later, mostly weak, 0730 – 0750, 4/21

1044 China, Changzhou, presumed, it is 10 times the power of the other Chinese on frequency, time pips 3 low 1 high, CNR or CRI interval signal, about 1300, 4/21

1044 New Zealand, Dunedin, male talker, //1008//1035//1098//1278 and later, fair to occasionally good, 0730 – 0750, 4/21

1080 Alaska, Anchorage, KUDO, IDed as “This is Alaskan Progressive Voice News Ten Eighty KUDO Anchorage,” about 0700, 4/21

1089 Japan, Sendai, //774, English lessons, short musical interlude just before ToH, time pips, 4/21

1098 Marshall Islands, Majuru, V7AB, Radio Marshalls, presumed, male talkers in island language, about 0730, 10/21, quite clear, but then faded after a few minutes, back again 0736 stronger and clearer than before, some of the talking in the background, including a woman's voice, was New Zealand

1098 New Zealand, Christchurch, male talker, //1008//1035//1044//1107//1278 and later, about 0730 – 0750, 4/21, mostly weak and under Marshall Islands, but occasionally quite clear

1107 New Zealand, Tauranga, male talker, //1008//1035//1044//1098//1278, weak, but enough audio to determine //, about 0740 – 0750, 4/21

1125 Japan, various, //774, English lessons, short musical interlude just before ToH, time pips, 4/21

1134 Japan, Tokyo, strong throughout the evening up to 1300 and later, 4/21

1134 South Korea, Kimpo, //972, 4/21, about 1300, partial KBS interval signal after time pips at ToH, under Japan

1140 Alaska, Soldotna, KSLD, IDed as “This is Eleven Forty KSLD, The King, Soldotna,” about 0700, 4/21

1143 Taiwan, Baisha, BEL3, 100 kW, Yuye Guangbo Diantai (Taiwan Area Fishery Broadcasting Station), nice male or female Chinese singing with EZ listening music, 1252 and later, 4/21, mostly extremely weak, //738

1170 Alaska, North Pole, KJNP, “You are tuned to One One Seven O, your Gospel Radio, KJNP, North Pole, Alaska,” about 0700, 4/21, strong and clear, not nearly as strong or clear an hour earlier, but nevertheless IDable with phrases like “Tonight at North Pole is [unintelligible],” “Not all Alaska,” and “This is Alaska.”

1170 Philippines, Poro Point, DWVA, Voice of America, complete interval signal with a few notes missing under splatter at about 1100, 4/21, 7 note part of the VOA IS with 2 notes missing due to splatter at about 1300, all underneath Bellingham, WA, a Korean (presumed), and a 3rd very weak English language station, or maybe it was VOA in English as some of their announcements are in English, but at times before and after 1100 there was a 2nd oriental talker which may have been VOA

1205.970 China, Yanbian, 200 kW, presumed (although there is no other Chinese with anything like 200 kW power per asiawaves), male and female talkers in presumed Chinese before and after 1100, mention of “CNR” at about 1100, 4/21

1242 Japan, Tokyo, JOLF, Japanese male talkers, 3 low coo coo pips and one high at about 1300, 4/21

1251 New Zealand, Auckland, female talker, //594//612 about 0840 – 0850, 4/21

1251 Russia, Razdolnoye, 500 kW per asiawaves, VoR interval signal (Pictures at an Exhibition) at about 1300, 4/21

1278 New Zealand, Eltham or Napier-Hastings, //1008//1035//1044//1098//1107 and later, (only Napier reported once previously from Grayland), talk, 0730 – 0750, 4/21

1287 Japan, Sapporo, strong, with some fades, about 0850 – 0900, mainly male and female talkers in Japanese, occasional jingles, 4/21

1323 China, Huadian, presumed, 600 kW per new asiawaves addition April 2009, CNR interval signal about 1300, 4/21

1386 Japan, various, //774, English lessons, short musical interlude just before ToH, time pips, 4/21

1386 South Korea, Mokpo, HLAM, MBC chimes interval signal, about 1200, 4/21

1475 Malaysia, Kota Kinabalu, transmitter on with 1 kHz tone about 1047, 4/21, few details at sign on because of weak signal strength, weak to fair to occasional good signal strength throughout the 1047 to about 1334 transmission period, sign off with weak but audible choir version of the Malaysian national anthem starting about 1332, transmitter off immediately about 1334.

1503 Micronesia, Kosrae Island, Tofal, V6AJ, Voice of Kosrae, faded up about 0711, 4/21 with harmony singing island music using the DDFA, weakened and then faded completely by 716, reappeared weakly with island music and singing about 0753, brief male talker about 0758 followed by female talker, quite strong at times, heavy Seattle splatter which started just before the top of the hour spoiled any chance for an ID, weak island music again after 0800, faded until island music with singing in harmony slowly faded up again around 0938, quite good at times by 0941,

faded completely by 0955, but then appeared again about 1014 sporadically with brief episodes of island music and singing in harmony, sometimes way under Japan. Even though no definite ID was heard, who else could it be? (Again 4/22 on the QDFA, occasionally quite clear with island music between 0700 and 1100. The 1 kW Micronesian receptions are among the high points of my trip to Grayland.)

1503 Japan, Akita (with other synchros perhaps helping a little), JOUK, // 594, about 1015, 4/21, sometimes over presumed Micronesia, // 594

1548 Australia, Emerald, weak or faded on most of the 4/21 recording, but occasional crystal clear audio such as around 1345

1566 South Korea, Cheju Island, presumed, I did not try for an ID, good throughout the 4/21 evening

1575 Thailand, Ban Phachi, Voice of America, 4/21, quite clear, several VOA interval signals around 1300, then just after 1300 the following announcements “You are listening to the Voice of America, Washington, DC,” “Welcome to the Voice of America in Vietnamese,” and then into Vietnamese programming, good to very good signal

1593 Japan, NHK2 synchros, with English lessons, //774, about 1300, 4/21

1593 New Zealand, Christchurch, presumed, EZ listening American rock and roll, 0711 – 0715 and later, 4/21

1602 Japan, Yokote, //774, English lessons, short musical interlude just before ToH, time pips, 4/21

1701.03 Australia, Brisbane, Radio Brisvaani 400 W, presumed due to off frequency, about 1300 and later, unknown language heard, maybe an island language, not Hindi, occasional music, one with drums and harmony singing about 1322, 4/21

Flops, June 2009

I attempted to develop compact or otherwise simplified MW quad arrays with MW splatter reduction equal to my original QDFA during June of 2009. Several possibilities naturally suggested themselves, namely variations on a square quad array of passive verticals, flags, or delta flags, or an in line quad array of passive verticals. In all cases EZNEC simulation predicted MW splatter reduction as good as the original QDFA. All of these arrays were implemented here in North Louisiana, but unfortunately none of them had good nulls. In other words, they were all flops as far as MW splatter reduction was concerned. The quad passive vertical arrays, both square and in line, were the worst; their splatter reduction (null aperture depth) was almost nil. Later Guy Atkins tested a square quad delta flag array a second time at Grayland in October 2009 and got the same poor MW splatter reduction results as I had gotten here in North Louisiana in June 2009. Just because EZNEC predicts a good null pattern for a MW array does not mean that the array will actually have a good null pattern in practice. What you hear is what you get.

Dual Flag Array Variants, Summer 2009 To Present

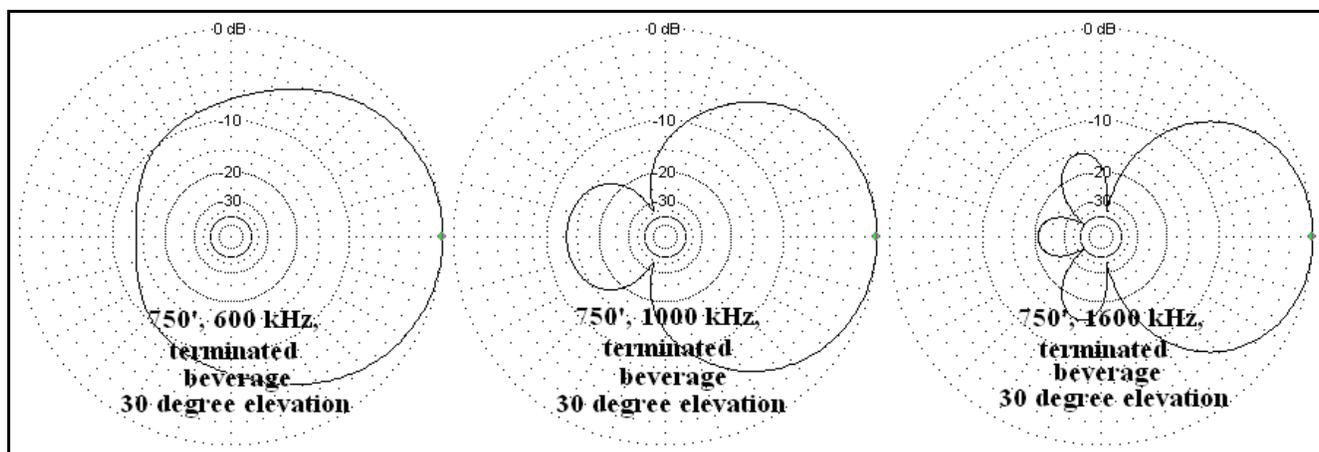
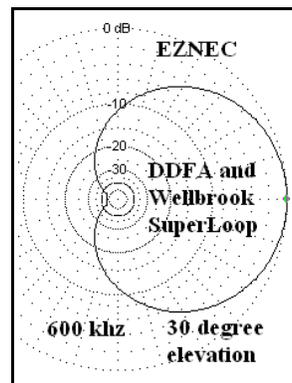
During preparations for testing a quad flag array at Grayland in April 2009, I found that delta flag elements were easier to transport and erect. Delta flag antennas were developed by [K6SE](#) as simplified flag antennas, requiring one mast instead of two. I built the first MW delta flag array in February 2009 to simplify construction of the first quad flag array. I called these kinds of phased arrays by their generic names, abbreviated DFA, QFA, DDDFA, and QDFA.

In the summer of 2009 a Wellbrook dual big flag (“SuperLoop”) array and Wellbrook dual K9AY array were tested by John Bryant at Grayland. At first the flag elements for John's tests were 17'x60', but this caused overloading on some Japanese MW signals, so he reduced the size to 17'x30', about 510 square feet, which eliminated the overloading. The smaller Wellbrook array element area was about the same as the DDDFA which I had tested previously in April 2009 at Grayland. John observed that the splatter reduction of this smaller Wellbrook dual flag array was as good as the larger Wellbrook dual flag array (no surprise here), and superior to a Wellbrook dual K9AY array with K9AY elements of about 250 square feet (no surprise here either, as it is well known that K9AY null patterns are sensitive to ground variations). The Wellbrook dual flag arrays (“SuperLoop” and smaller) elements were spaced 40 meters apart, somewhat wider than the 100' spacing which I used in April 2009 at Grayland. The gains of the Wellbrook antenna heads were not stated. John later tried some sort of radials with the Wellbrook dual K9AY array, and the nulls were improved as a result, but according to my understanding of his account, the Wellbrook dual K9AY array with radials did not have as good splatter reduction as the Wellbrook dual flag (“SuperLoop” and smaller) array. These differences could also have been the result of Wellbrook's use of a variable phaser which may not have been adjusted for optimum null depth and aperture in the case of the dual K9AY. In my opinion, it is virtually impossible to use a variable phaser to adjust a dual, and especially a quad, delta or flag MW array for optimal null depth and aperture. During my development of dual flag and quad delta flag MW arrays in late 2008 and early 2009 I tried variable phasers and was

never satisfied with the results.

It is widely believed that flag and delta flag antennas and arrays are ground independent, but that has turned out not to be the case as was discovered during tests of a QDFA by Bjarne Mjelde and Odd-Jorgen Sagdahl at Kongsfjord in September 2009 where it was reported that radials are necessary for good QDFA nulls when the ground is extremely poor, like at Kongsfjord. The low band QDFA insensitivity they observed at Kongsfjord has yet to be explained or resolved, but could also be due to the extremely poor ground at Kongsfjord. Perhaps the low band insensitivity can be resolved by larger delta elements, large flag elements, preamps at the antenna elements, or some combination thereof.

A similar Wellbrook dual flag array (“SuperLoop”) was recently tested by Guy Atkins at Grayland during a February 18-21, 2010 DXpedition. Guy used 17'x60' flag elements, spaced 150', with unspecified terminating resistors. Results with the Wellbrook dual flag array were excellent, as would be expected with any reasonable dual flag array. According to EZNEC simulation, the patterns of a 100' spaced DDFA and a 150' spaced Wellbrook dual flag (“SuperLoop”) array are identical; see the figure at right. So it seems that larger dual flag (“SuperLoop”) arrays do not have better splatter reduction than smaller dual delta flag arrays. Two definite very rare Indonesians and two tentative very rare Indonesians were heard during the February 18-21, 2010 DXpedition, if I understand the reports and audio clips correctly. Also, Guy recently posted an article on his [blog](#) titled “Beverage Antenna Embarrassed, Slinks Away in Shame During Shootout with Wellbrook Array” which contained 8 audio clips comparing a 750' beverage and the Wellbrook phased dual flag array (which he calls a “2 SuperLoop” array). The audio clips dramatically illustrate the superiority of the Wellbrook dual flag (“2 SuperLoop”) array over a 750' beverage. So it seems that Guy has confirmed that the Wellbrook variant of my dual flag array design is excellent.



If the dual flag array pattern and beverage patterns above are examined, it is not difficult to see why a dual flag or dual delta flag array outperforms a 750' beverage in the MW band. If a dual flag or dual delta flag array pattern is optimized for maximum splatter reduction, it can have a 10 to 25 dB signal to splatter ratio advantage over a 750' beverage through a 90 degree null aperture. It is likely that even a 1000' or somewhat longer terminated beverage would not perform well compared to a dual flag or dual delta flag array at Grayland, Quoddy Head, and similar MW DX sites.

Null Steered QDFA's, 4/20/10

Recently Guy Atkins stated on his blog that he will soon test yet another Wellbrook flag array which he described as follows. *Each of the two pairs of loops are combined together in anti-phase through equal length feedlines and a combiner, and then the resulting signals are routed to the receiver through two more identical coax lengths and a phaser with balance and phase controls. It's the phaser box that allows adjustment for the best F/B ratio across the band.* Guy remarked that the four Wellbrook loops are deltas, and that the Wellbrook deltas are terminated (delta flags) with 1000 ohm resistors. Guy also said that the sizes of the Wellbrook deltas were the same as the deltas of my

QDFA and my null steered QDFA. This is a fairly accurate description of my null steered QDFA which was published about five months ago in The Dallas Files, except that according to Guy the Wellbrook array contains no LC phase shift for each pair of deltas and the placement of the Wellbrook amplifiers was not discussed. No mention of the QDFA, null steered or otherwise, was given by Guy.

Active Flag Arrays, 5/23/2011

I discovered active flag antennas and arrays entirely by accident in early January 2011 while trying to find the optimal resistor value to achieve the deepest horizontal flag antenna null. It was during the horizontal flag tests that I discovered connecting a high Z input impedance amp, specifically a high intercept, low noise, FET follower, directly to the horizontal flag increased the signal level output. It is surprising that this has not been done before. After all, flag antennas and flag arrays have been around since at least June 2000; see [here](#) for an account of their discovery and development. And flag antennas and flag arrays have been amplified before, but not with a follower connected directly to the antenna element. Similar remarks can be made for loop (no resistor) antennas and arrays. My discovery was inspired in part by a BF981 top band preamp designed by Carlos, N4IS which he informed me about on October 4, 2010. Carlos' preamp used a high Z LC tuned circuit and 6x BF981 dual gate MOSFET amplifier. I wanted a broadband version for testing with my MW arrays, so I tried a 1x BF981, but its intercepts were not as high as I wanted. Next I tried both of my high intercept, low noise, FET follower active whip amplifiers. Their intercepts are, of course, excellent, and they worked well. These early experiments were done with the BF981 broadband amp and the active whip amps connected to the lead in at the receiver, so none of these were active flag antennas or active flag arrays. It was not until early January 2011 that it dawned on me to "activate" flag antennas and flag arrays. The early development of active flag antennas and active flag arrays is described [here](#). Additional information about active flag antennas and active flag arrays are found in The Dallas Files.

Activating flag antennas and flag arrays eliminates low (MW) band pre sunset and post sunrise insensitivity which heretofore was occasionally an issue.

It just occurred to me day before yesterday that the high Z preamp I use eliminates flag resistor loss, something that NX4D, N4IS, and I have discussed many times in the past. My high Z preamp is a FET follower. That means essentially no power is required at the input. Only voltage. A high Z input follower merely "follows" the input voltage, which is virtually identical to the open circuit voltage. The output voltage of a high Z input follower is approximately the same as the input voltage, generally somewhat less, about 6 dB less in the case of my J310 - J271 follower. The output of a high Z input FET follower also provides power for the the feeder (coax or twin lead). If gain is desired, merely add an LIN to the output of the follower; see the antenna simulations in "Hi Z PPL's For Loop And Flag Arrays."

Now here is the point. What is the open circuit voltage of a loop (with no resistor), and what is the open circuit voltage of a flag (with a resistor)? They are approximately the same! The open circuit V of a loop is found as follows. Use KVL (Kirchoff's Voltage Law) to find the output voltage V across a very large value resistor R at the output of a loop with a voltage E induced by a passing electromagnetic wave: $E - ij\omega L - iR = 0$, so that $i = E/(R + j\omega L)$, from which $V = iR$, namely $V = ER/(R + j\omega L)$, and the magnitude of V is virtually identical to E. The open circuit voltage V of a flag with 1000 ohm resistor and large value resistor R at the output is: $E - i \times 1000 - iR - j\omega L = 0$, so that $i = E/(1000 + R + j\omega L)$, from which $V = iR$, namely $V = ER/(1000 + R + j\omega L)$, and the magnitude of V is virtually identical to E. So the resistor causes virtually no flag loss when a high Z input FET follower is attached directly to the flag element.

Active Loop Arrays, 5/23/2011

I used to think that the nulls of dual active loop (no resistors) arrays were only mildly worse than the nulls of dual active flag (nominal 1000 ohm resistors) arrays. I was mistaken. How I missed this in the past, I do not know. The nulls of dual active loop arrays are much worse than the nulls of dual active flag arrays, virtually nonexistent unless a variable phaser is used with the dual active loop array. Even when a variable phaser is used (a bad idea), the nulls of a dual active loop array are about 10 dB worse than the nulls of a dual active flag array, and non-nulled signals of the dual active loop array are attenuated compared to the same non-nulled signals of a dual active flag array. Even worse, EZNEC does not correctly calculate the phase delay of a pattern. So it appears that something akin to mutual antenna impedance degrades the EZNEC calculated pattern of dual active loop arrays. If so, this might explain why Wellbrook uses variable phasers for their dual loop arrays. I also tested the dual active loop (no resistors) array with a

(variable) modified Misek phaser, and got fair nulls, about 10 dB less than for a dual active delta flag (1000 ohm resistors) array. So the null steered dual active loop (no resistors) array is a distant 2nd behind a dual active flag (1000 ohm resistor) array as far as splatter reduction is concerned. On the other hand, a properly adjusted null steered dual active loop (no resistor) array does seem to have nulls about as good as a 1000' terminated beverage at many MW frequencies, and much better at the low end of the MW band.

Because of the phasing issue of dual loop (no resistor) arrays, it will probably be difficult, if not impossible, to develop quad active loop (no resistor) arrays with MW band splatter reduction as good as quad active delta flag (1000 ohm resistors) arrays.