Project: IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)

Submission Title: [Possibility of using antenna arrays in IEEE 802.15.8]
Date Submitted: [14 May, 2012]
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Re: [IEEE P802.15 TG8 (Peer Aware Communications) Call For Applications (15-12-0202-01-0008)]

Abstract: [Exploring possibilities of using antenna arrays in IEEE 802.15.8]

Purpose: [Response to IEEE P802.15 TG8 (Peer Aware Communications) Call For Applications (15-12-0202-00-0008)]]

Possibility of using antenna arrays in IEEE 802.15.8

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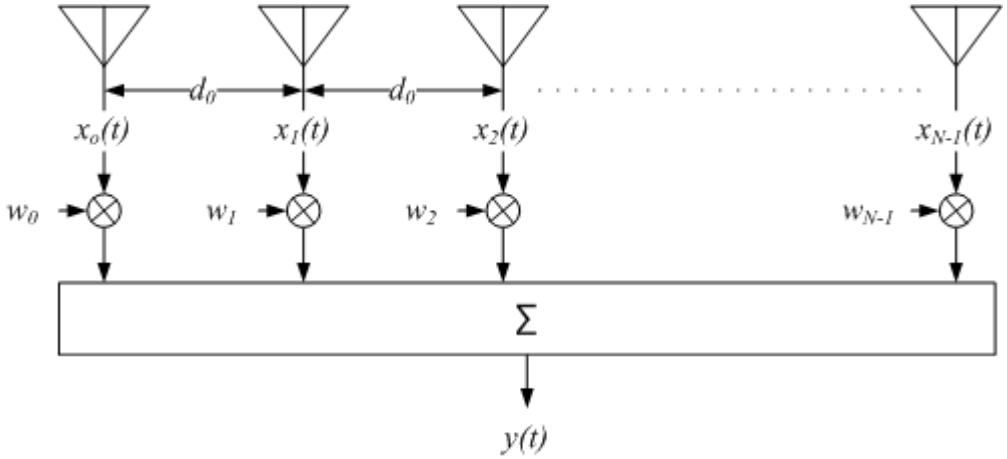
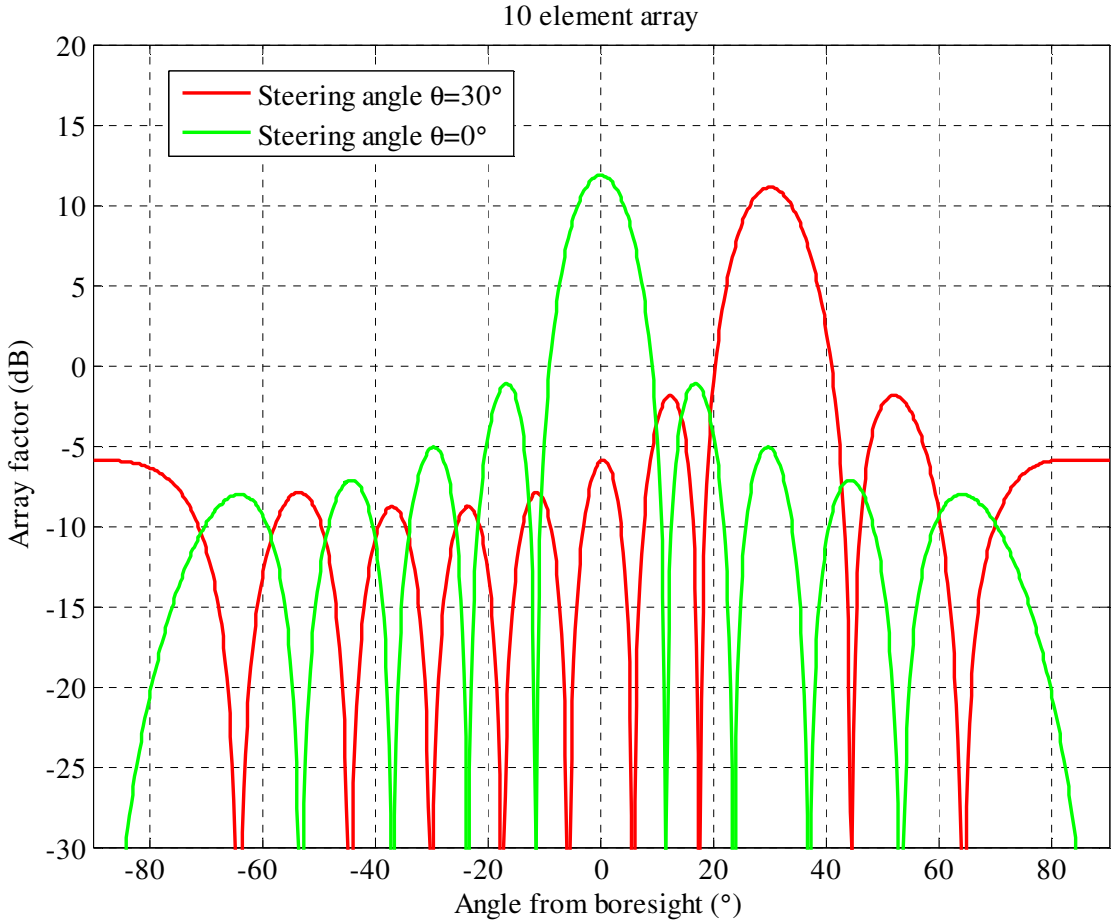
Antenna arrays

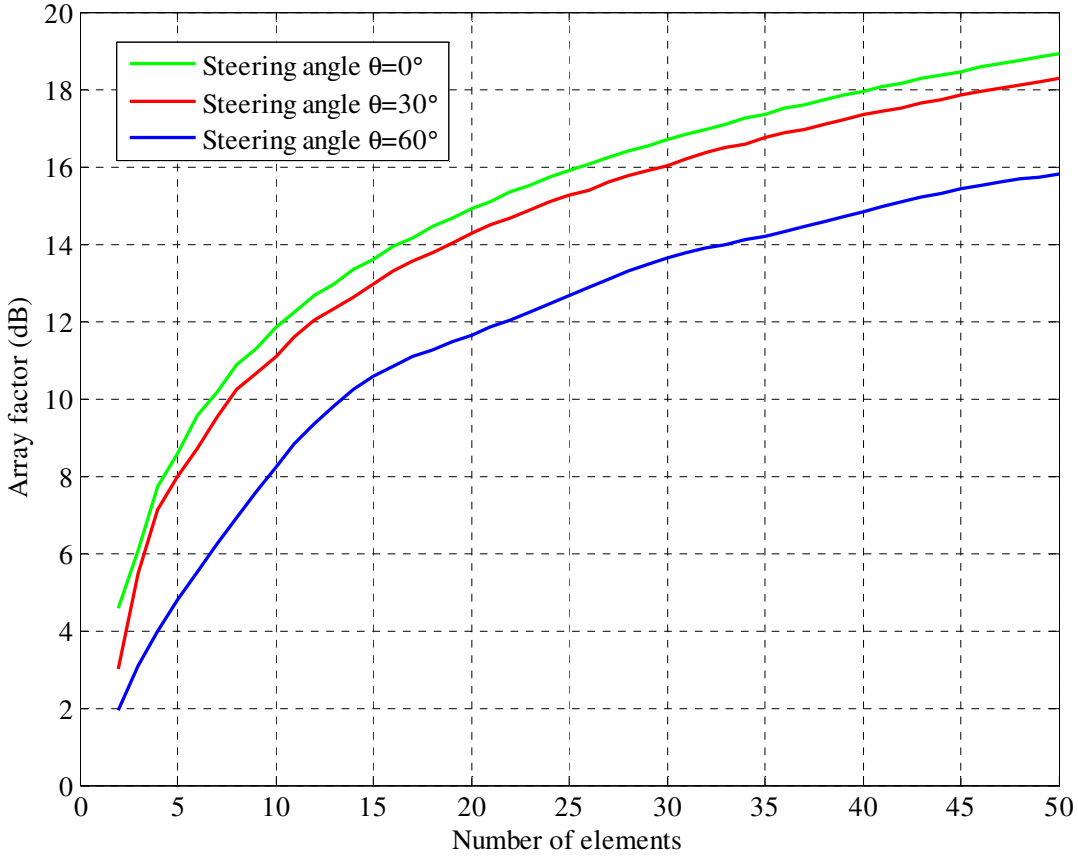


- By changing weights' distribution (w) array radiation pattern can be changed.
- They can be used to increase gain and interference resilience as well as for DOA estimation, etc..
- We will consider horizontal linear arrays with equidistant elements.
  - We are interested in increasing gain in the horizontal plane.
- We will consider weights distributions which give maximum gain in a prescribed direction.
  - Analogous to matched filtering in detection theory.

Antenna array patterns for 10 element array with $d_0=\lambda/2$



How big does antenna array needs to be to achieve a given gain?



For several bands and array gains array size is…

Steering angle (◦)	Gain (dB)	Number of elements needed	Size @ 900 MHz ISM (m)	Size @ 2.4 GHz ISM (m)	Size @ 5.8 GHz ISM (m)	Size @ 8 GHz UWB (m)
0	5	2	0.17	0.0625	0.023	0.019
60	5	6	0.83	0.31	0.13	0.094
0	8	5	0.67	0.25	0.1	0.075
60	8	10	1.5	0.56	0.23	0.17
0	14	15	2.33	0.875	0.362	0.26
60	14	35	5.67	2.125	0.88	0.637

Conclusions

- Basic properties of linear, half-wavelength equidistant antenna arrays were described.
- We investigated a maximum gain achievable for a given carrier frequency, steering angle and array size.
- Sizes of antenna arrays become practical for mounting on PAC devices only at bands higher than 5 GHz.