

**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]

**Source:** [Igor Dotlic, Huan-Bang Li, Marco Hernandez] Company [NICT]

Address [3-4 Hikarino-oka, Yokosuka, Kanagawa, Japan]

Voice:[+81-46-847-5066 ], FAX: [+81-46-847-5431 ], E-Mail:[dotlic@nict.go.jp]

**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)]

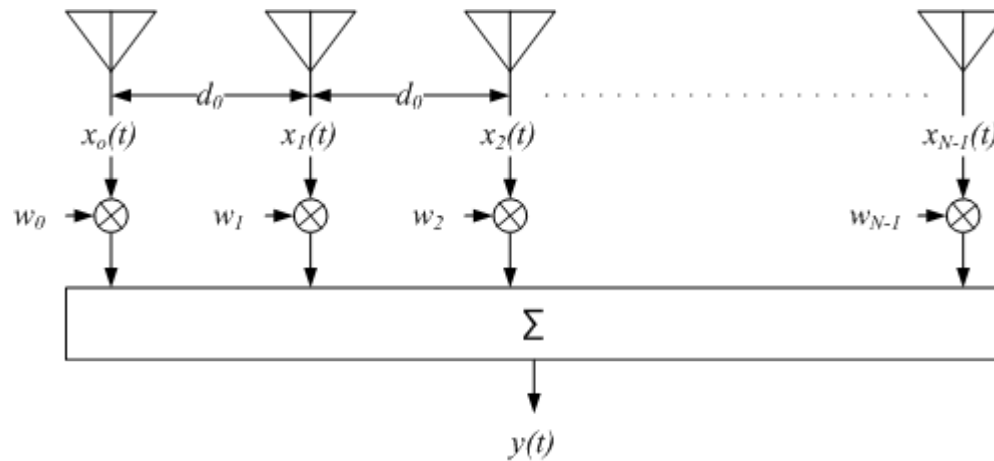
**Notice:** This document has been prepared to assist the IEEE P802.15. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) reserve(s) the right to add, amend or withdraw material contained herein.

**Release:** The contributor acknowledges and accepts that this contribution becomes the property of IEEE and may be made publicly available by P802.15.

# Possibility of using antenna arrays in IEEE 802.15.8

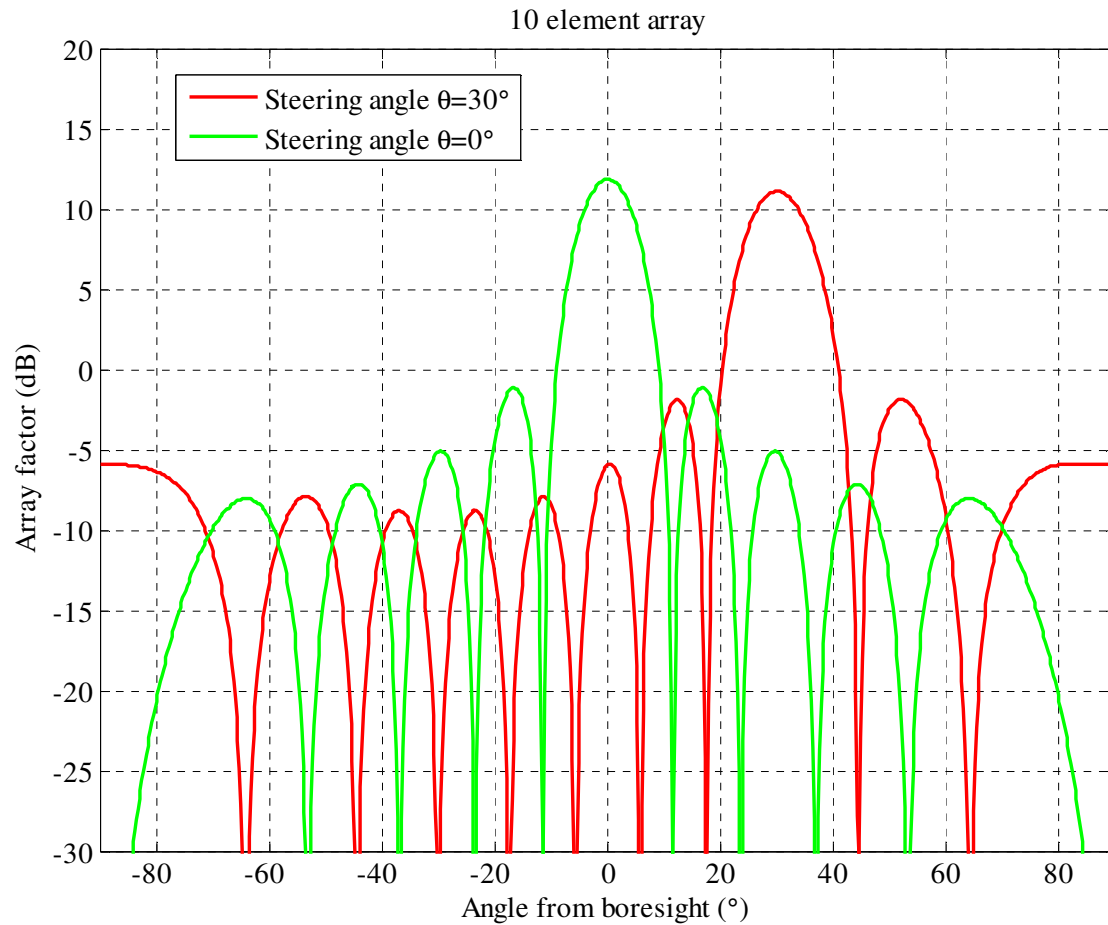
Igor Dotlic, Huan-Bang Li, Marco  
Hernandez, Ryu Miura (NICT)

# Antenna arrays

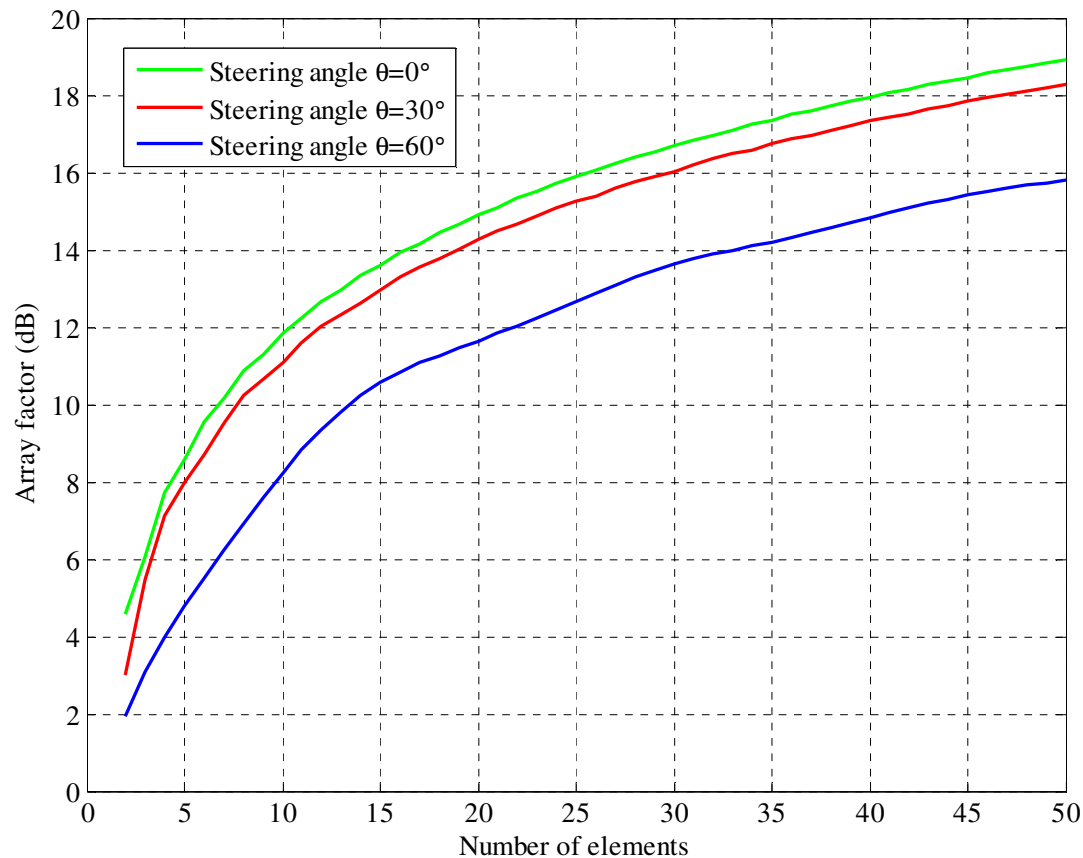


- By changing weights' distribution ( $w$ ) array radiation pattern can be changed.
- They can be used to increase gain and interference resilience as well as for DOA estimation, etc..
- We will consider horizontal linear arrays with equidistant elements.
  - We are interested in increasing gain in the 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.