

Usage scenarios and antenna configurations for 802.16 Relay

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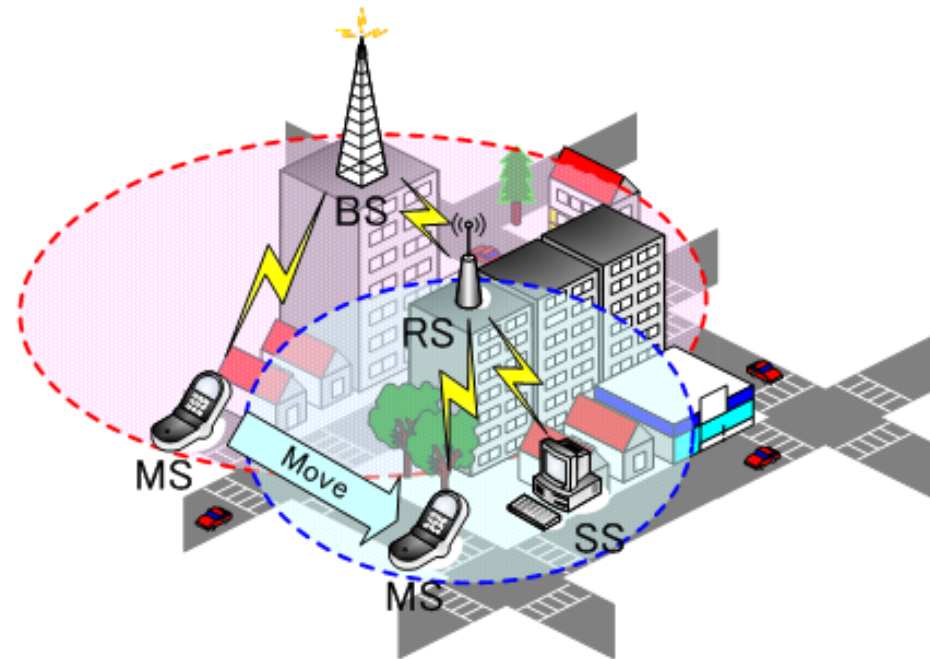
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Objectives of this contribution

- To indicate usage scenarios for each RS type
- To consider antenna configuration according to each scenario

Usage Scenarios for each RS type

- Fixed RS
 - **Open area**
 - The service is often not available in shadow area, such as street corner.
 - **Underground area**
 - The service is not available at underground shopping area or platform of subway.
- Nomadic RS
 - **Office / home**
 - Some room may be out of service area
- Mobile RS
 - **Open area**
 - Signal is unstable when on board moving vehicle



Antenna configuration for 802.16 Relay

- We need to consider antenna configuration according to each usage scenario.
- Antenna type is one of the important issues for our common understanding and future system evaluations.

Reference : IEEE C802.16mmr-05/002

RS Type 1 (High Capability)

- Purpose: Extend cell coverage (BS cell edge, dead spot)
- Required capability
 - Transmitting RS own preamble and relaying DL control messages
 - Providing MS with Network Entry procedure
 - Keep monitoring and detect UL Ranging code from MS
- Considered features
 - TX power Amp: smaller than BS, but higher than MS
 - A directional antenna as well as omni antenna can be considered for RS on BS-RS_{type1} link
 - RS_{type1} may have a limited authority to control MS (e.g., scheduling)
- RS_{type1} ⇔ Fixed / Nomadic / Mobile Infrastructure RS

Antenna configuration for 802.16 Relay

Table 1

		Case 1 (Fig.1)	Case 2 (Fig.2)	Case 3 (Fig.3)	Case 4 (Fig.3)
BS	(\leftrightarrow MS)	Omni or Sector	Omni or Sector	Omni or Sector	Omni or Sector
	(\leftrightarrow RS)			Directional	Array✘
RS	(\leftrightarrow BS)	Omni	Directional	Directional	Directional
	(\leftrightarrow MS)		Omni or Sector	Omni or Sector	Omni or Sector
MS		Omni	Omni	Omni	Omni

✘ Array antenna with multiple beams

Antenna configuration for 802.16 Relay

- Distance between BS and RS
 - Case 1 < Case 2 < Case 3, 4

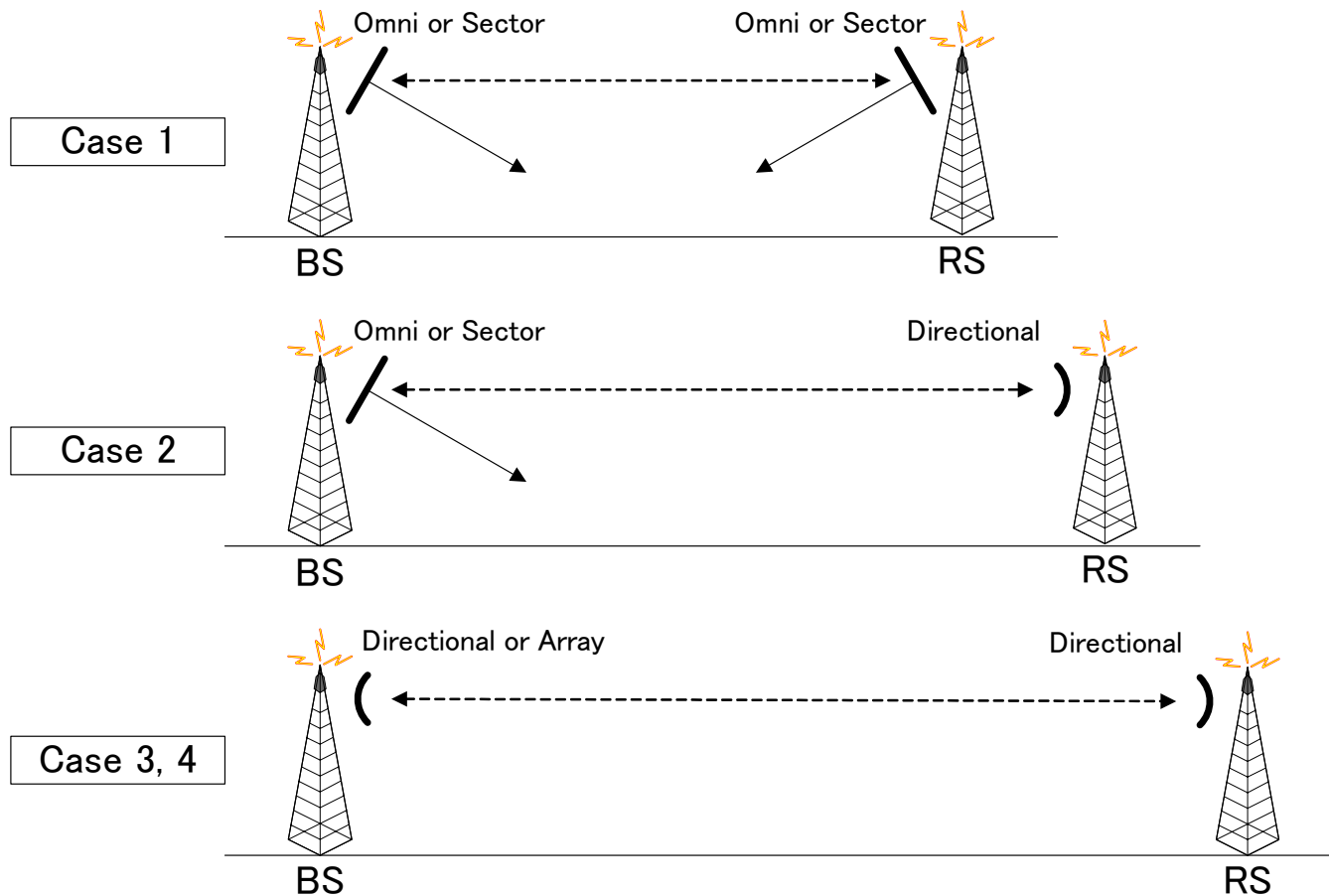


Fig.1

Antenna configuration for 802.16 Relay

Case 1

- Open area and office / home scenarios
- Increase of excessive interference to neighbors

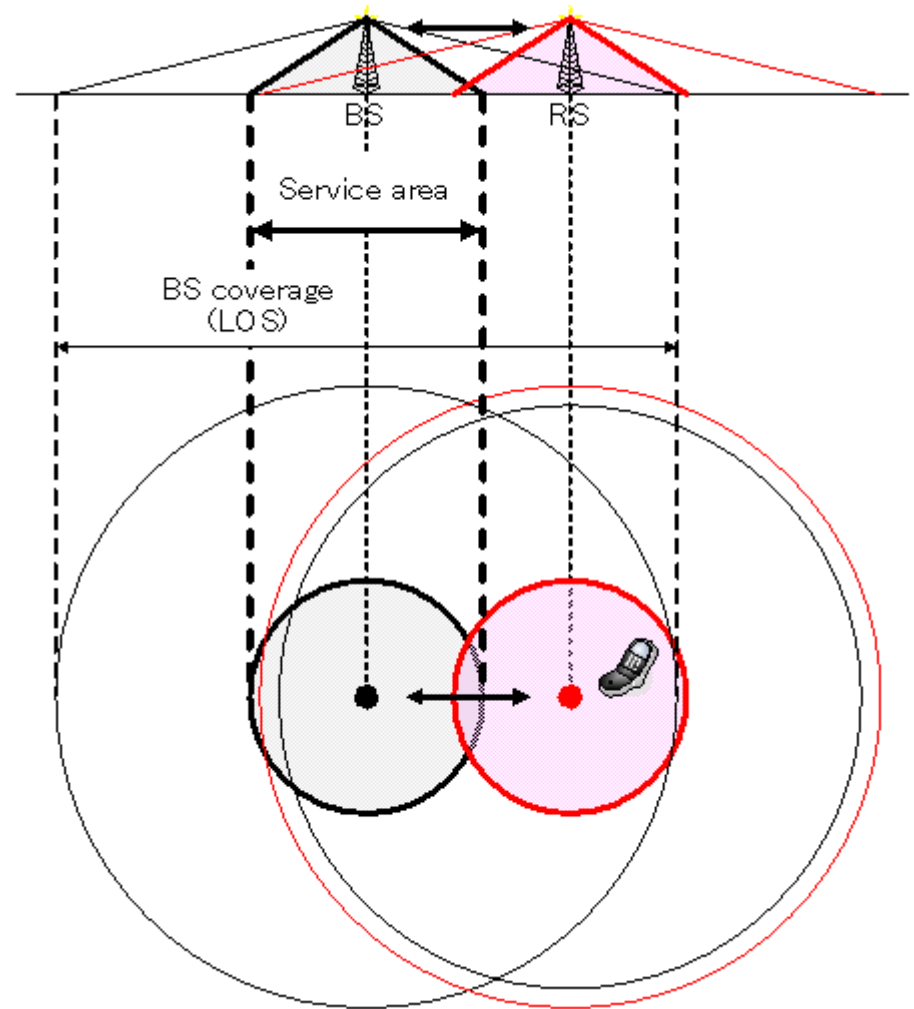


Fig.2

Antenna configuration for 802.16 Relay

Case 2 (RS : Omni + Directional antenna)

- Open area, underground area and office / home scenarios
- Excessive interference to neighbors is limited

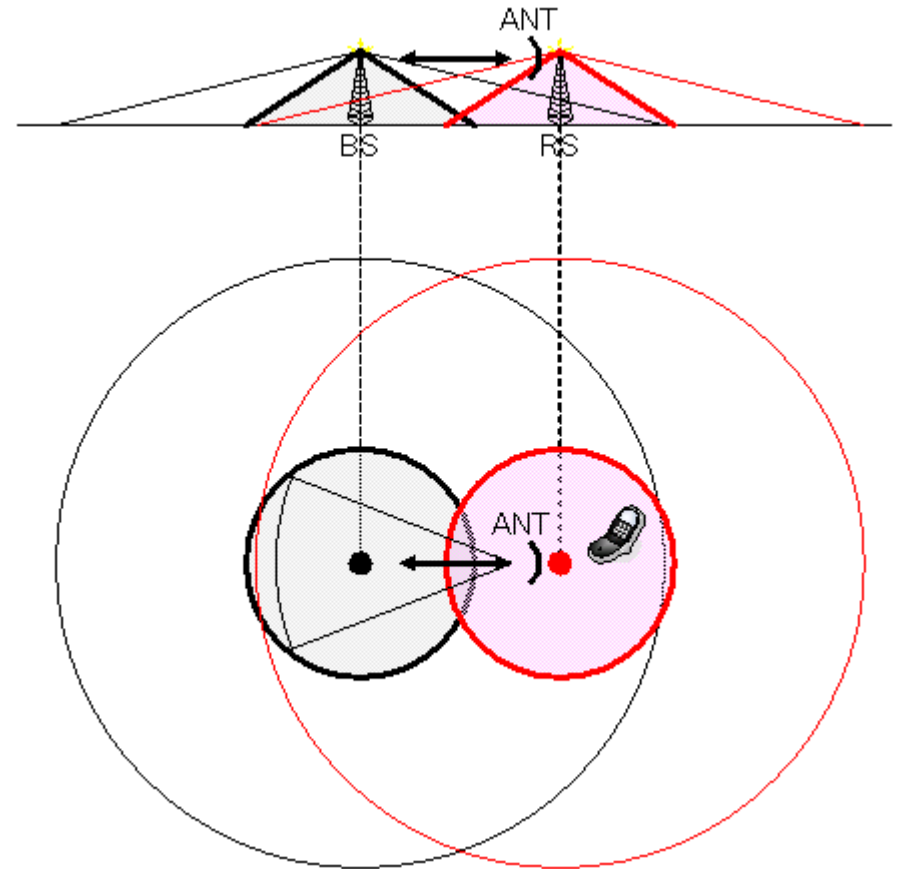


Fig.3

Antenna configuration for 802.16 Relay

Case 3, 4

- Open area scenario only
- Excessive interference to neighbors is limited

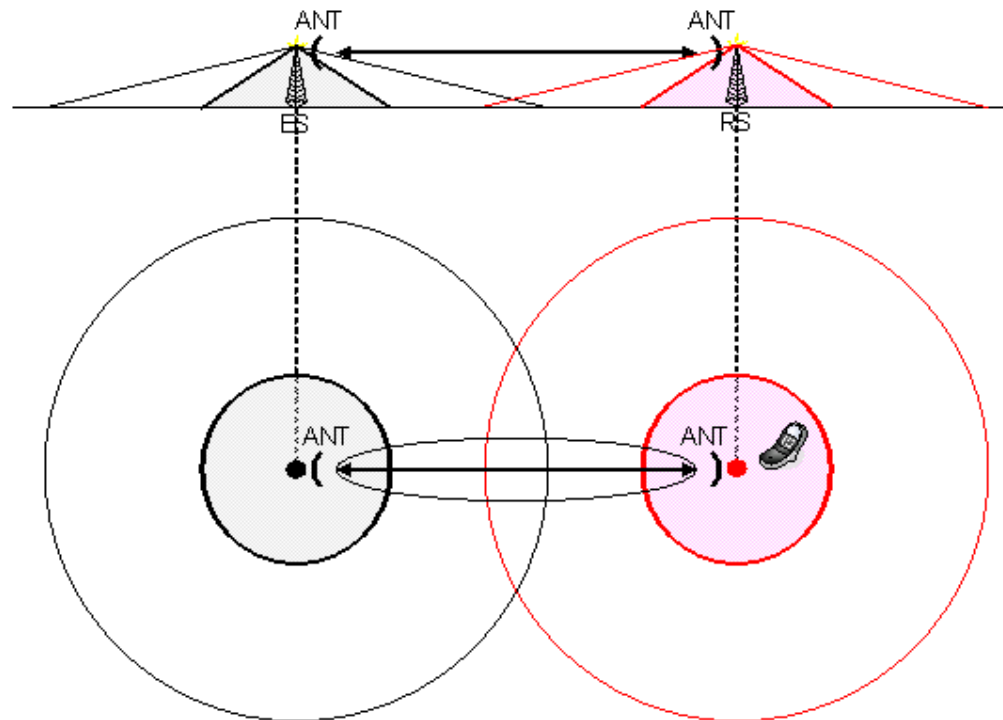


Fig.4

Antenna configuration for 802.16 Relay

Table 2

		Case 1	Case 2	Case 3	Case 4
Fixed RS	Open area	✓	✓	✓	✓
	Underground area	—	✓	—	—
Nomadic RS	Office / Home	✓	✓	—	—
Mobile RS	Open area	✓	—	—	—

Table 3

		Case 1	Case 2	Case 3	Case 4
Distance between BS and RS		<	<	≐	
# of ANT	BS	1	1	1+N	1+1
	RS	1	1+1	1+1	1+1
Additional antenna to conventional BS		No		Yes	
Interference to neighbors		Large	be limited		
Priority	Fixed RS		1 st	2 nd	
	Nomadic RS	1 st	2 nd	—	—
	Mobile RS	✘	—	—	—

✘ In case of mobile RS, avoidance of interference would be a critical issue.

Conclusions

We discussed:

- Usage scenarios for IEEE802.16 relay:
 - Fixed RS
 - Nomadic RS
 - Mobile RS
- Antenna configuration
 - Different according to each usage scenario
 - Fixed RS with a directional antenna towards BS can be a good choice.
 - For Nomadic RS, omni antenna can be a practical choice.