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# Broadcasting into the Future

MED Workshop on  
Future Technologies

Ian Goodwin, Kordia  
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# Contents

➤ Broadcast Spectrum

**Yesterday**

**Today**

**Tomorrow**

➤ Broadcast Spectrum efficiency

**The Digital Dividend**

➤ Broadcast Spectrum sharing

**Cognitive Radio**



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# Broadcasting yesterday



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# Broadcasting today - frequency bands

"AM"	MF-band	0.6 – 1.6 MHz
"HF"	Short wave	2 – 20 MHz
"FM"	Band-II	88 – 108 MHz
"VHF TV"	Band-I	54 – 77 MHz
	Band-III	174 – 230 MHz
"UHF TV"	Bands-IV & V	518 – 806 MHz
"DAB"	L-Band	1461.5 – 1490 MHz
"DTH"	Ku-Band	11,700 – 12,750 MHz

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# Broadcasting before DSO

"AM"

MF-band

AM. DRM ?

"HF"

Short wave

AM. DRM

"FM"

Band-II

FM. HD ? or DRM ?

"VHF TV"

Band-I

ATV

Band-III

ATV

"UHF TV"

Bands-IV & V

ATV, DTT & DVB-H

"DAB"

L-Band

Vacant

"DTH"

Ku-Band

DTH continues



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# Broadcasting at DSO

"AM"	MF-band	AM. DRM ?
"HF"	Short wave	AM. DRM
"FM"	Band-II	FM. HD ? or DRM ?
"VHF TV"	<b>Band-I</b>	<b>To close</b>
	<b>Band-III</b>	<b>To close</b>
"UHF TV"	<b>~500 – 700 MHz</b>	<b>DTT &amp; DVB-H</b>
	<b>~700 – 800 MHz</b>	<b>To close</b>
"DAB"	L-Band	DAB is unlikely
"DTH"	Ku-Band	<b>DTH continues</b>

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# Broadcasting after DSO

"AM"

MF-band

AM. DRM ?

"HF"

Short wave

AM. DRM

"FM"

Band-II

FM. HD ? or DRM ?

"VHF TV"

**Band-I**

**Digital Dividend**

**Band-III**

**Digital Dividend**

"UHF TV"

~500 – 700 MHz

DTT & DVB-H

**~700 – 800 MHz**

**Digital Dividend**

(DAB)

L-Band

DAB is unlikely

"DTH"

Ku-Band

DTH continues



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# Broadcasting after DSO

“VHF TV”

**Band-I**

**Digital Dividend**

**Band-III**

**Digital Dividend**

“UHF TV”

**~ 700 – 800 MHz**

**Digital Dividend**



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# After DSO - The Digital Dividend

"VHF TV"

**Band-I**

**Up for grabs ?**

**Band-III**

**DAB ?**

"UHF"

**~ 700 – 800 MHz**

**IMT cellphones**



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# Cognitive Radio



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# Cognitive Radio

“White Spaces”



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# Cognitive Radio

“White Spaces” = locally unused spectrum



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# Cognitive Radio

Existing

➤ DECT

➤ PHS

➤ WiFi



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# Cognitive Radio

## Existing

➤ DECT

➤ PHS

➤ WiFi

## Future prospects

➤ Cognitive Radio in Broadcast Bands ?



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# Cognitive Radio - Access Protocols



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# Cognitive Radio - Access Protocols

## ➤ **DECT**

Choose a channel

“Start using it”

measure error rate

if its too noisy - try another channel



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# Cognitive Radio - Access Protocols

- ➔ **DECT**
  - Choose a channel
  - “Start using it”
  - measure error rate
  - if its too noisy - try another channel
  
- ➔ **PHS**
  - Choose a channel
  - “Listen” for any existing users
  - if its busy - try another channel



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# Cognitive Radio - Who is the Victim?

➤ **DECT**

Another DECT user

➤ **PHS**

Another PHS user

➤ **WiFi**

Another WiFi user



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# Cognitive Radio - Who is the Victim?

➤ **DECT**

Another DECT user

➤ **PHS**

Another PHS user

➤ **WiFi**

Another WiFi user

➤ **In TV Bands**

**The viewer !**



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# Cognitive Radio in TV Bands?

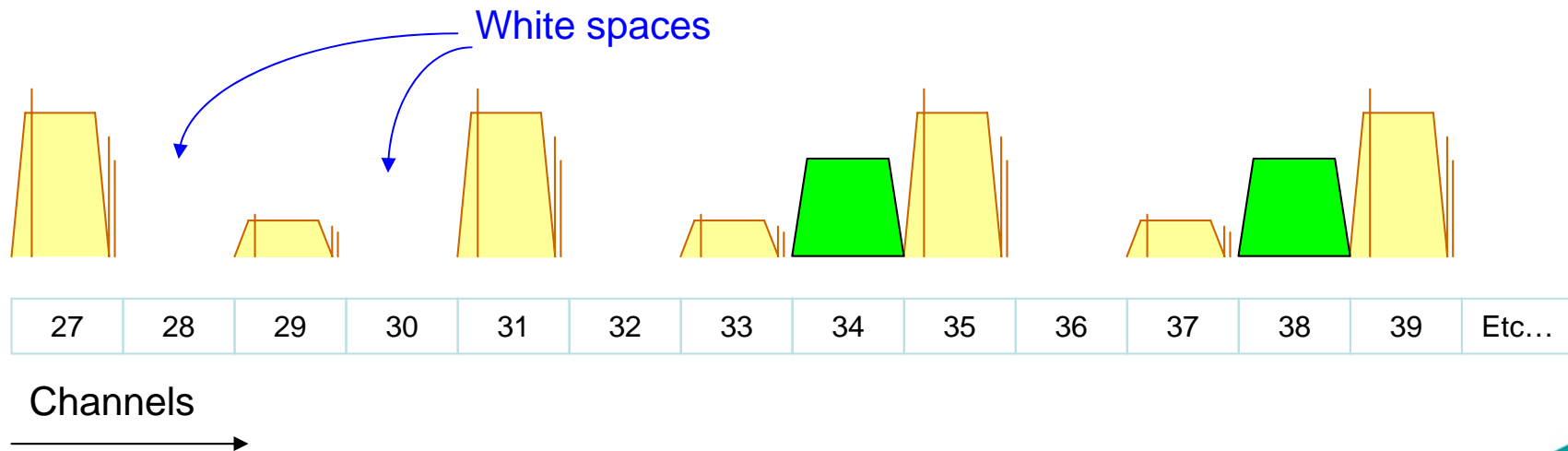
- ▶ Television bands - not tightly packed



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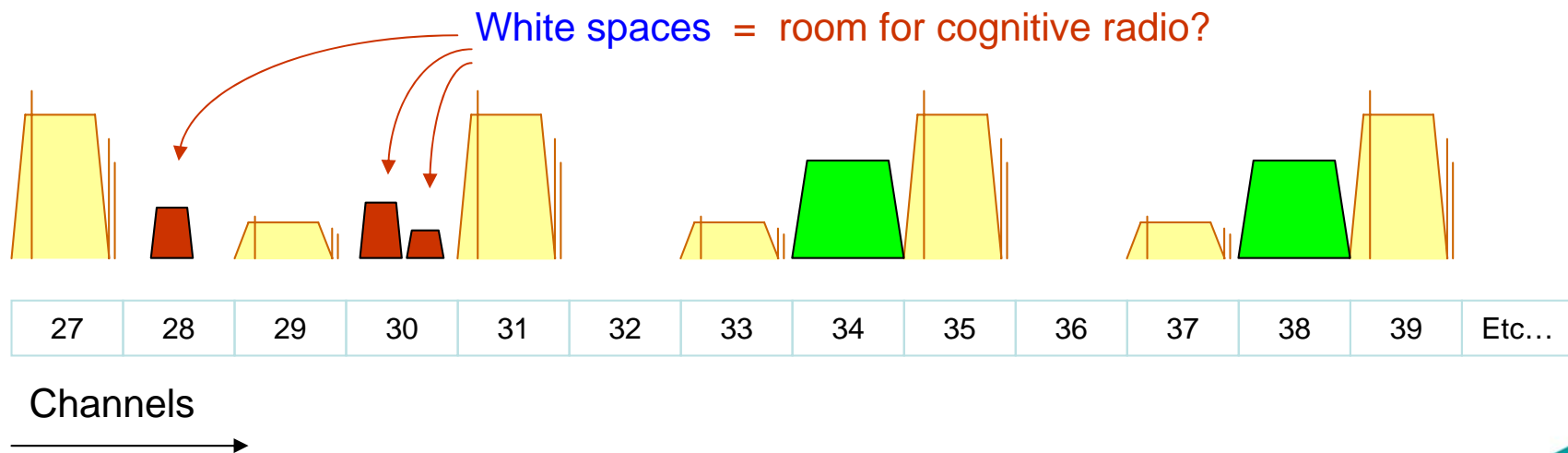
# White Spaces in TV Bands

► Television bands - not tightly packed



# Cognitive Radio in TV Bands?

- Television bands - not tightly packed



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# Cognitive Radio in TV Bands...

But

But

But ...



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# Cognitive Radio in Analogue TV Bands...

But

But

But ...

**Three problems . .**



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**1st problem:**

**After DSO, TV has a dense channel plan**

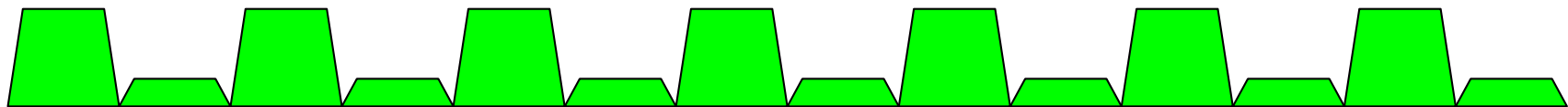


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## 1st problem:

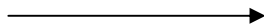
# After DSO, TV has a dense channel plan

No white spaces



27	28	29	30	31	32	33	34	35	36	37	38	39	Etc...
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Channels

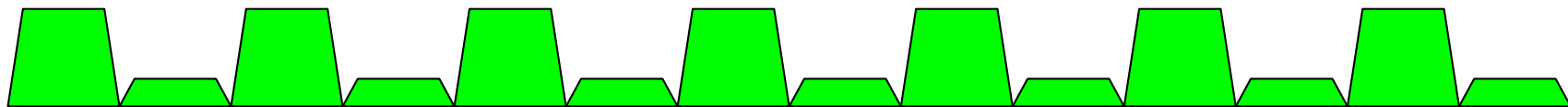


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## 1st problem:

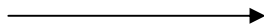
After DSO, TV has a dense channel plan

No white spaces = No Cognitive Radio in DTT bands



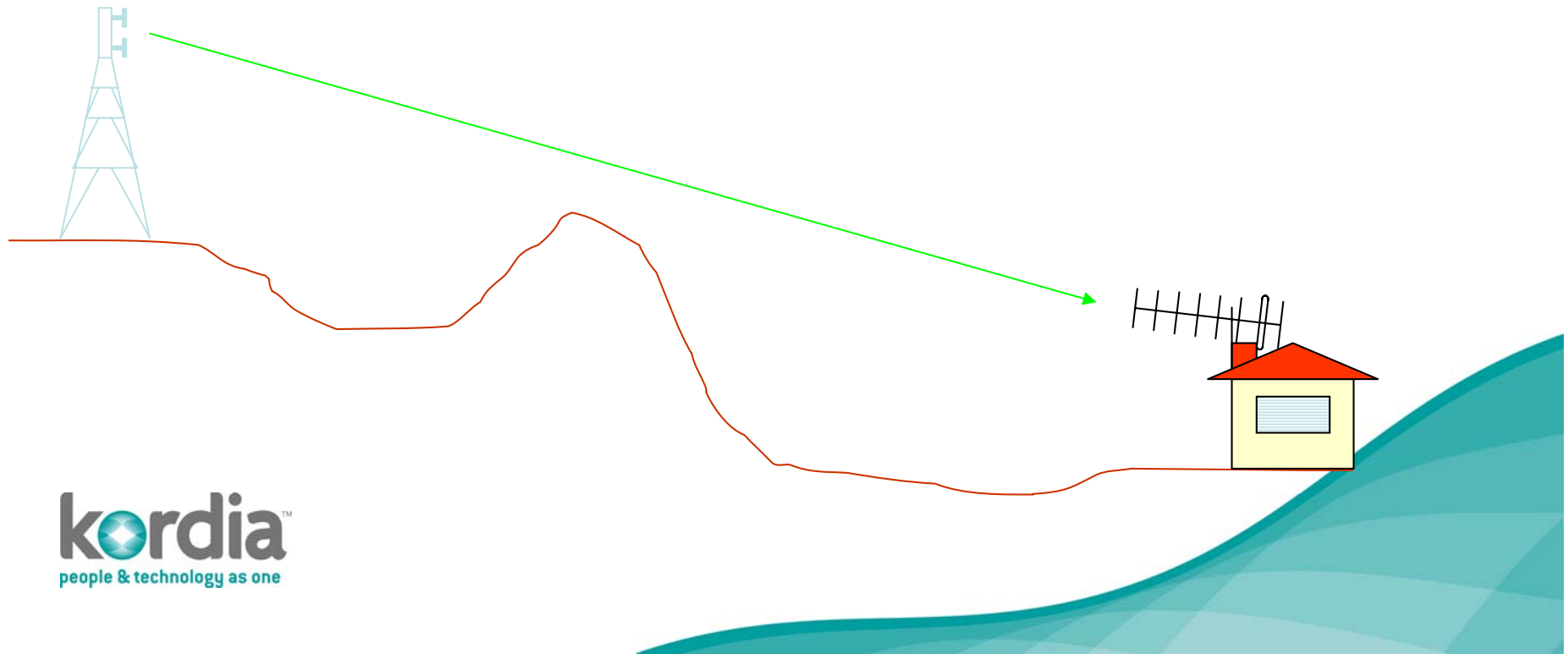
27	28	29	30	31	32	33	34	35	36	37	38	39	Etc...
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Channels



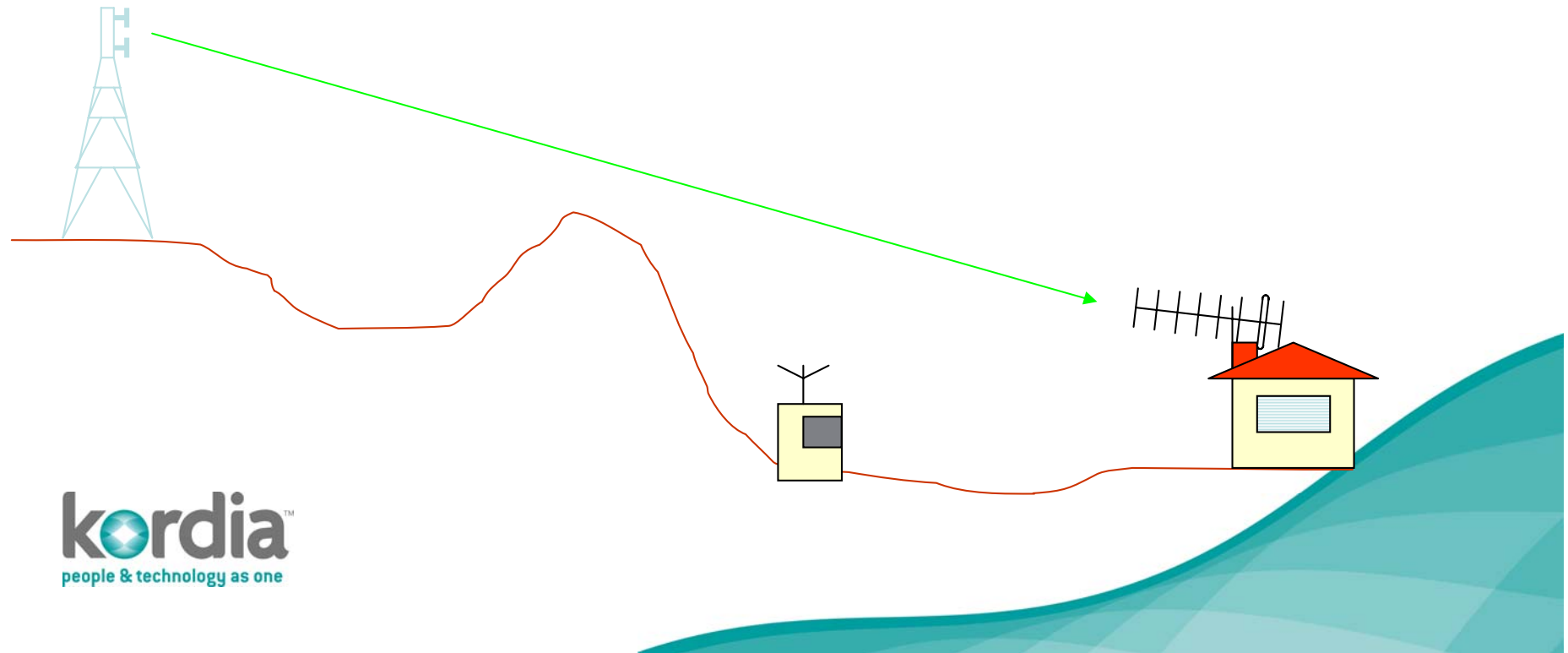
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## 2nd problem: The hidden node



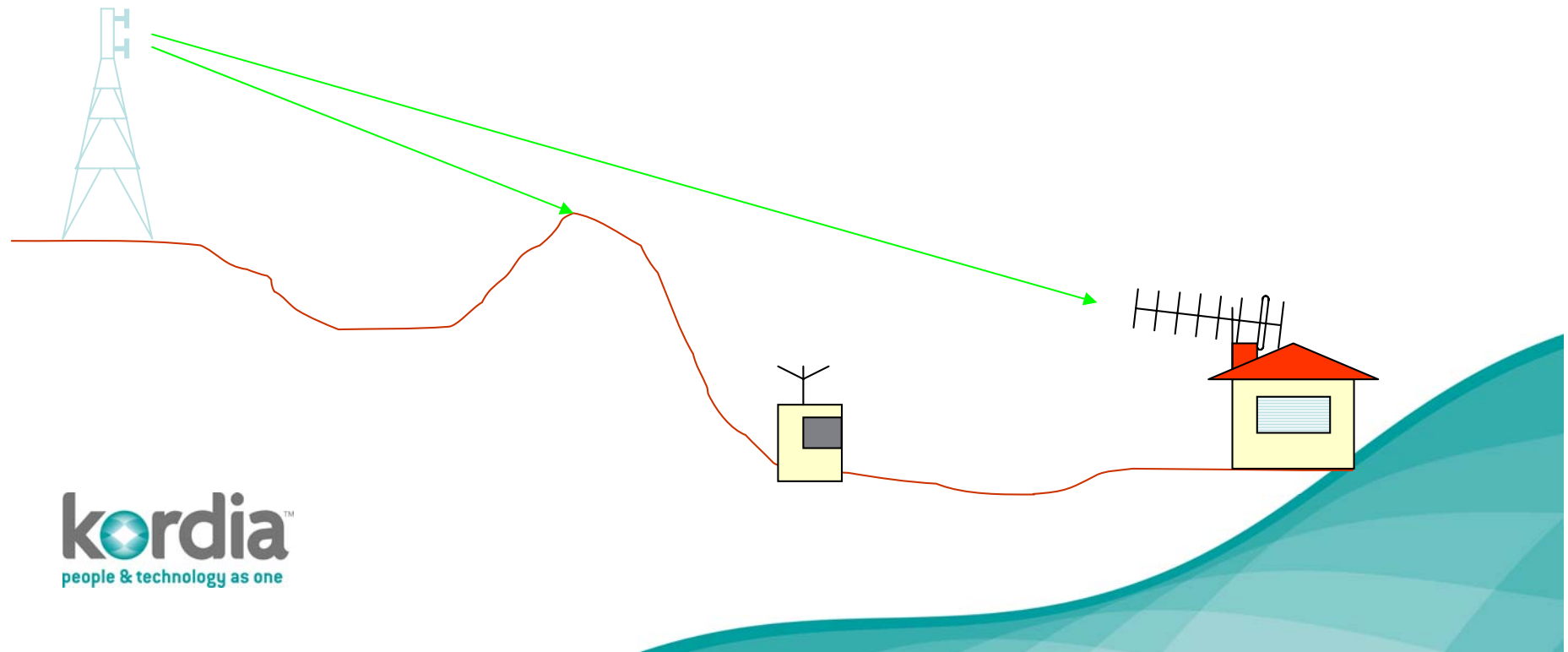
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## 2nd problem: The hidden node



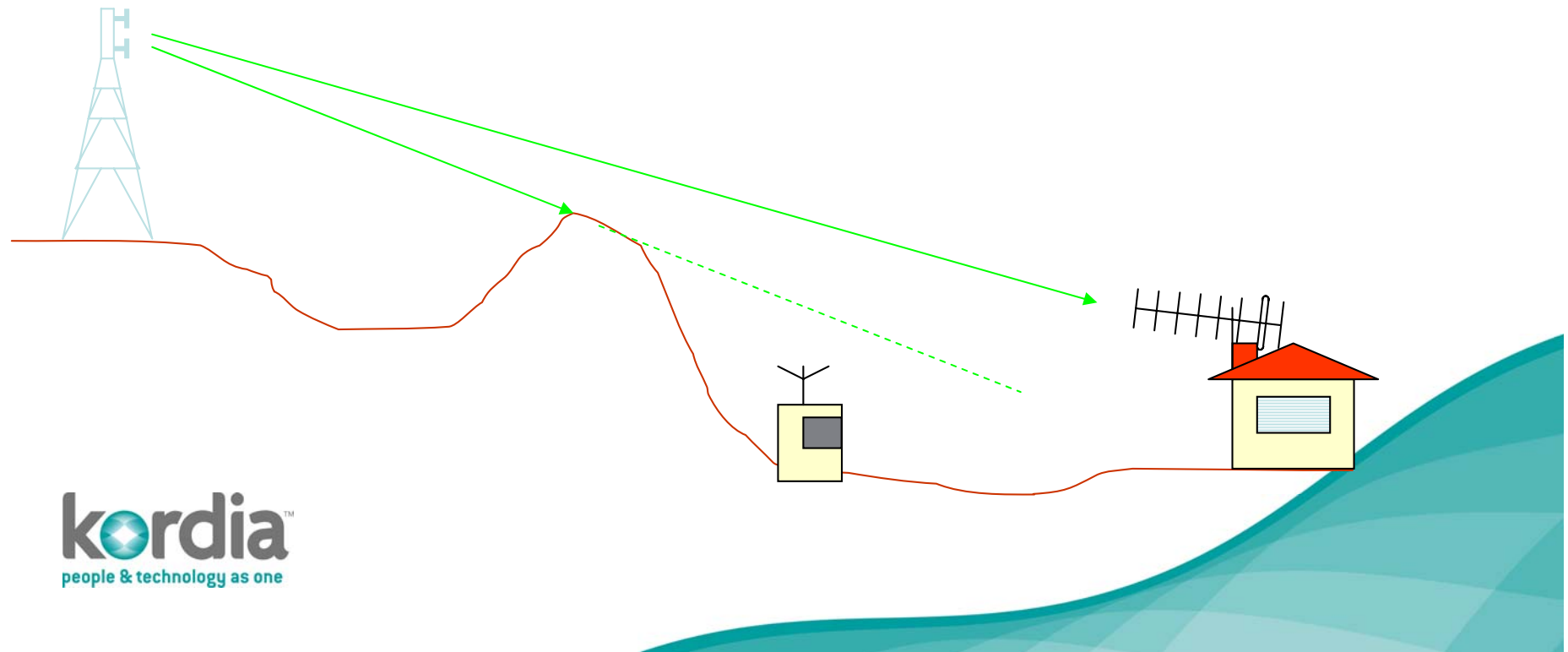
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## 2nd problem: The hidden node



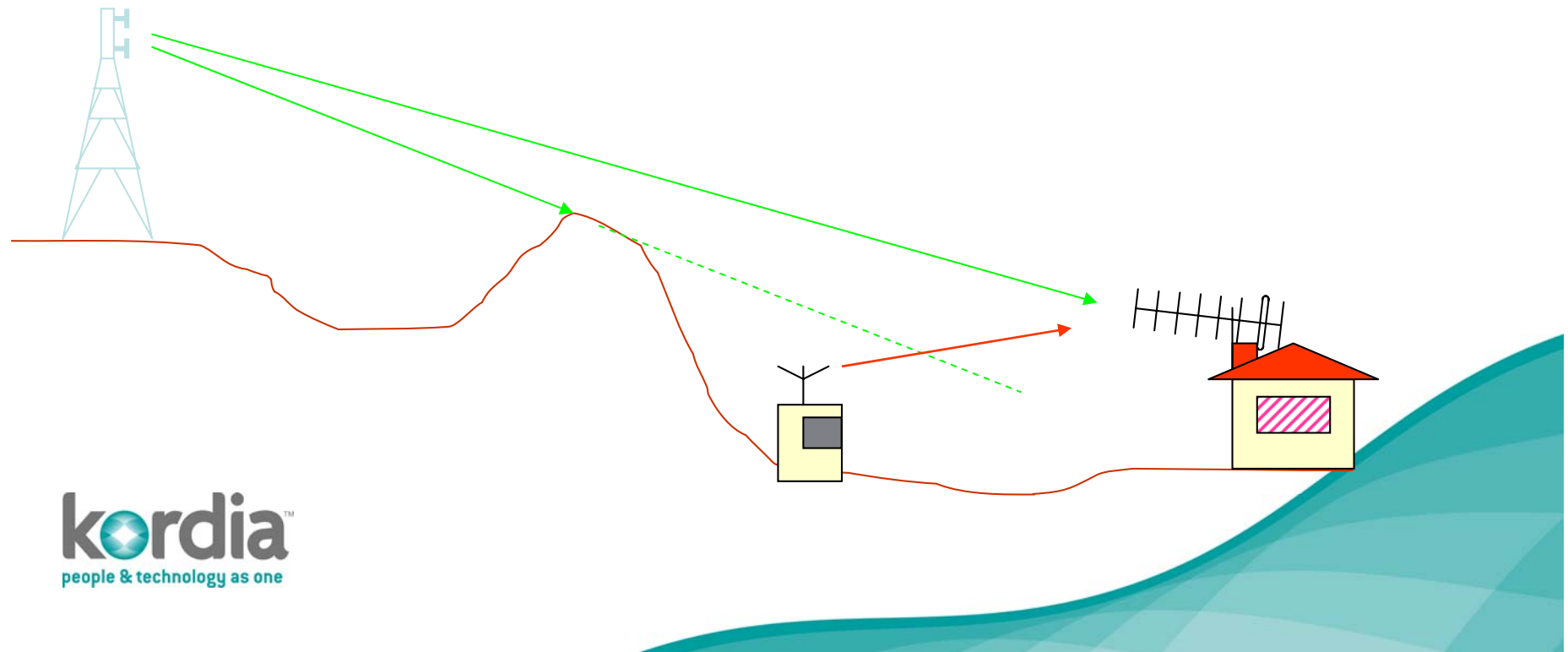
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## 2nd problem: The hidden node



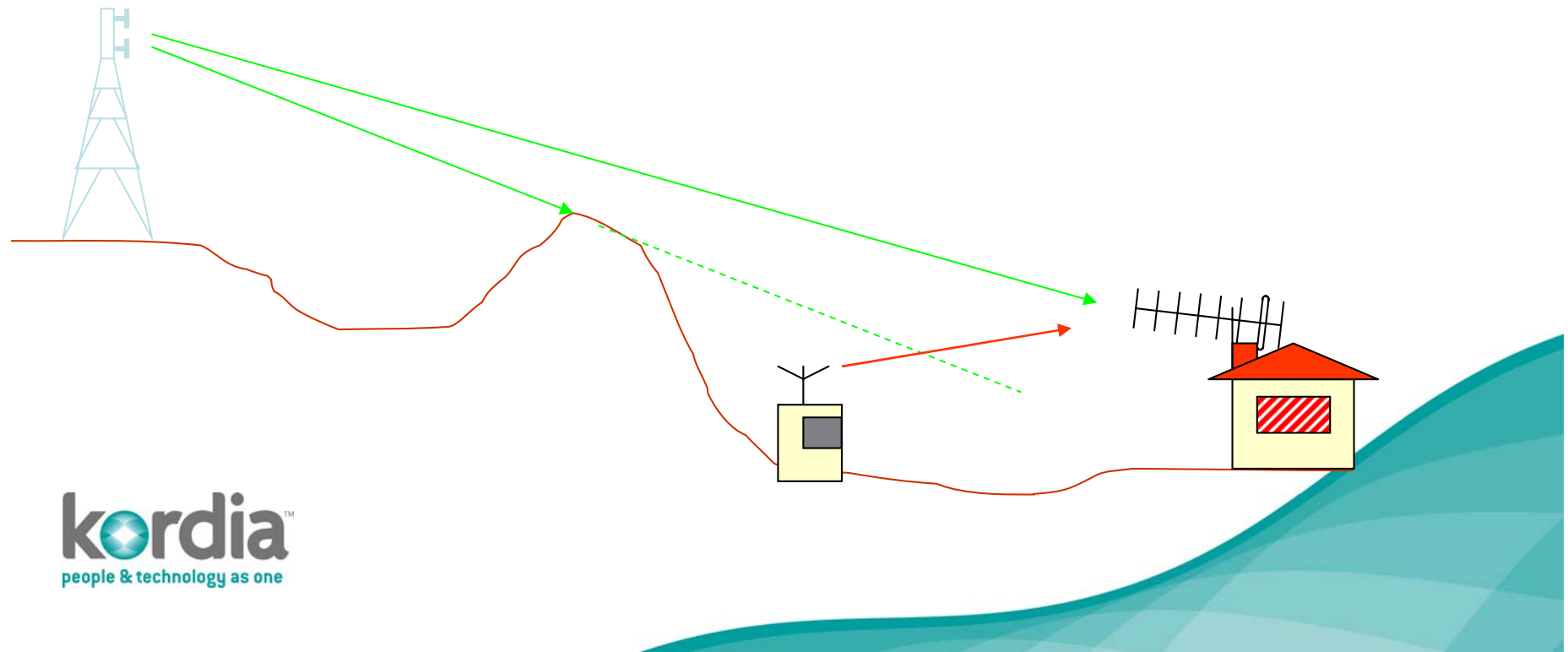
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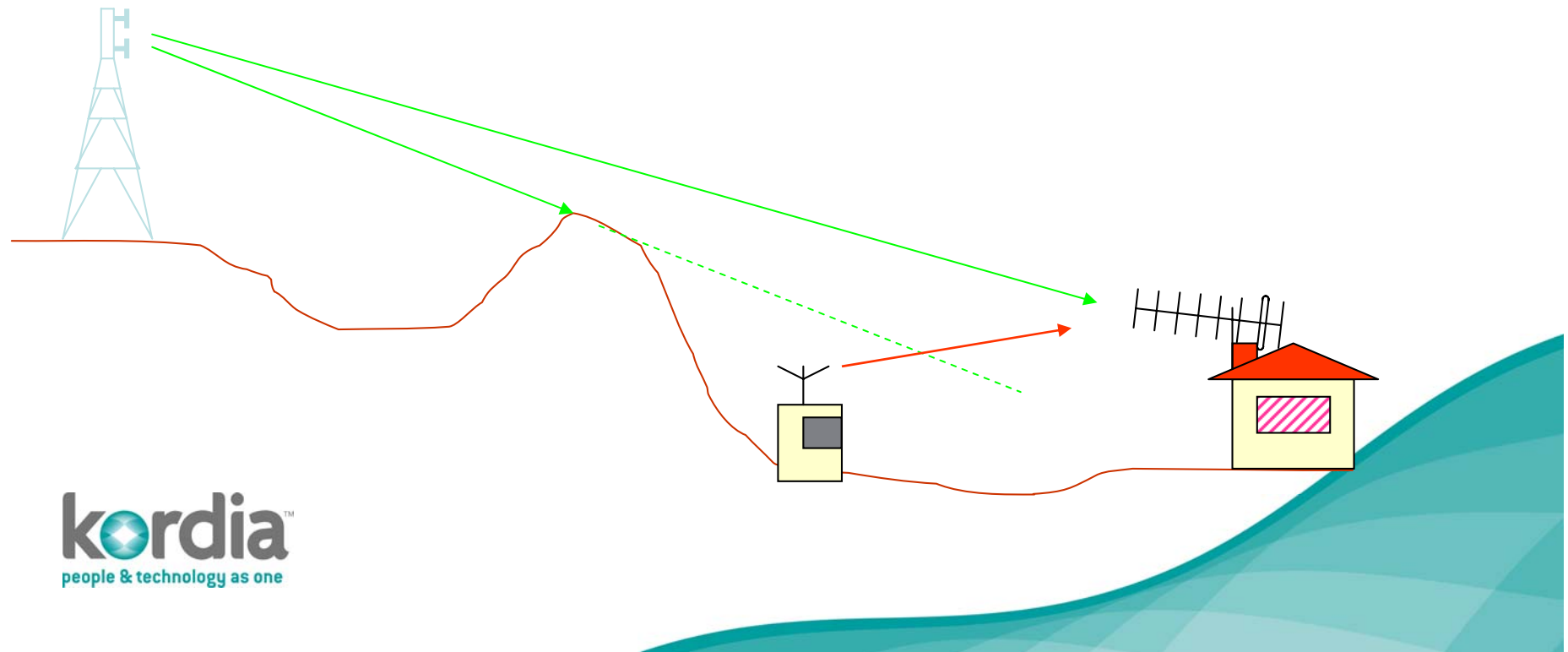
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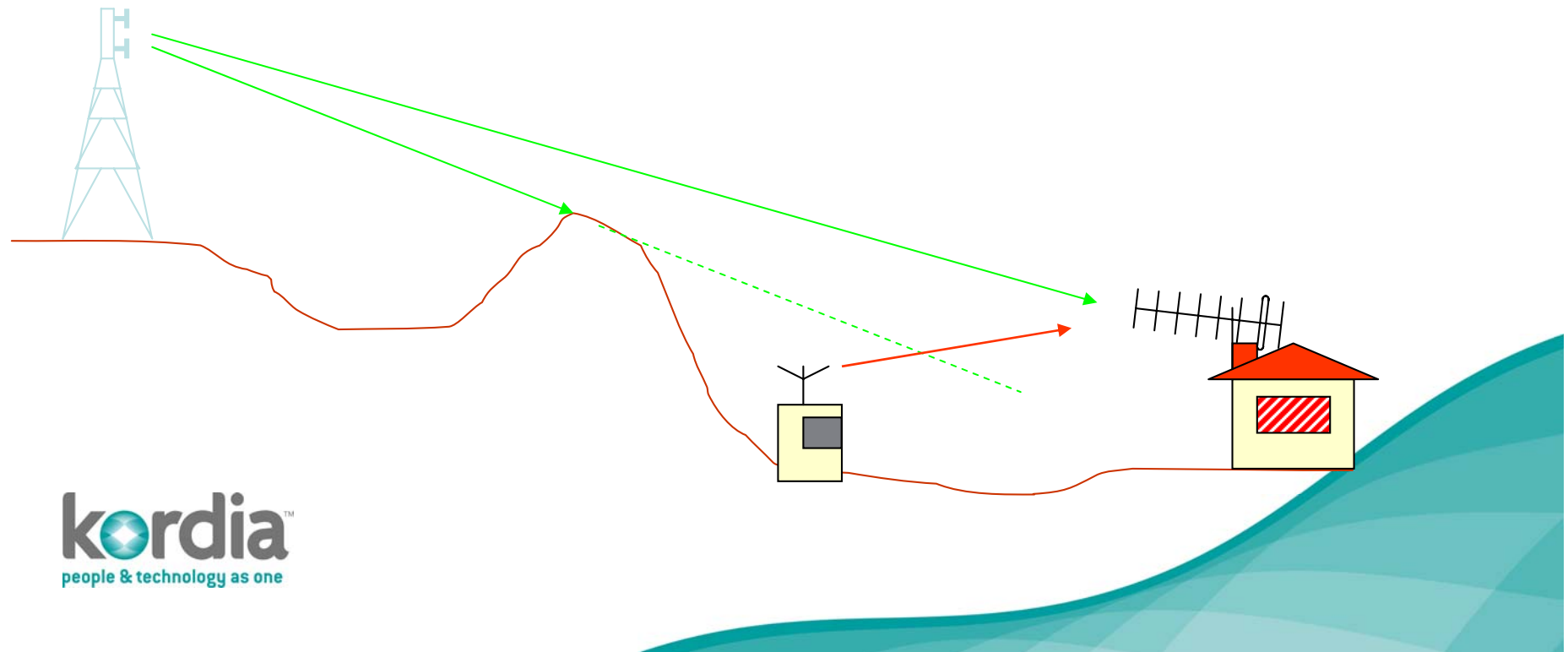
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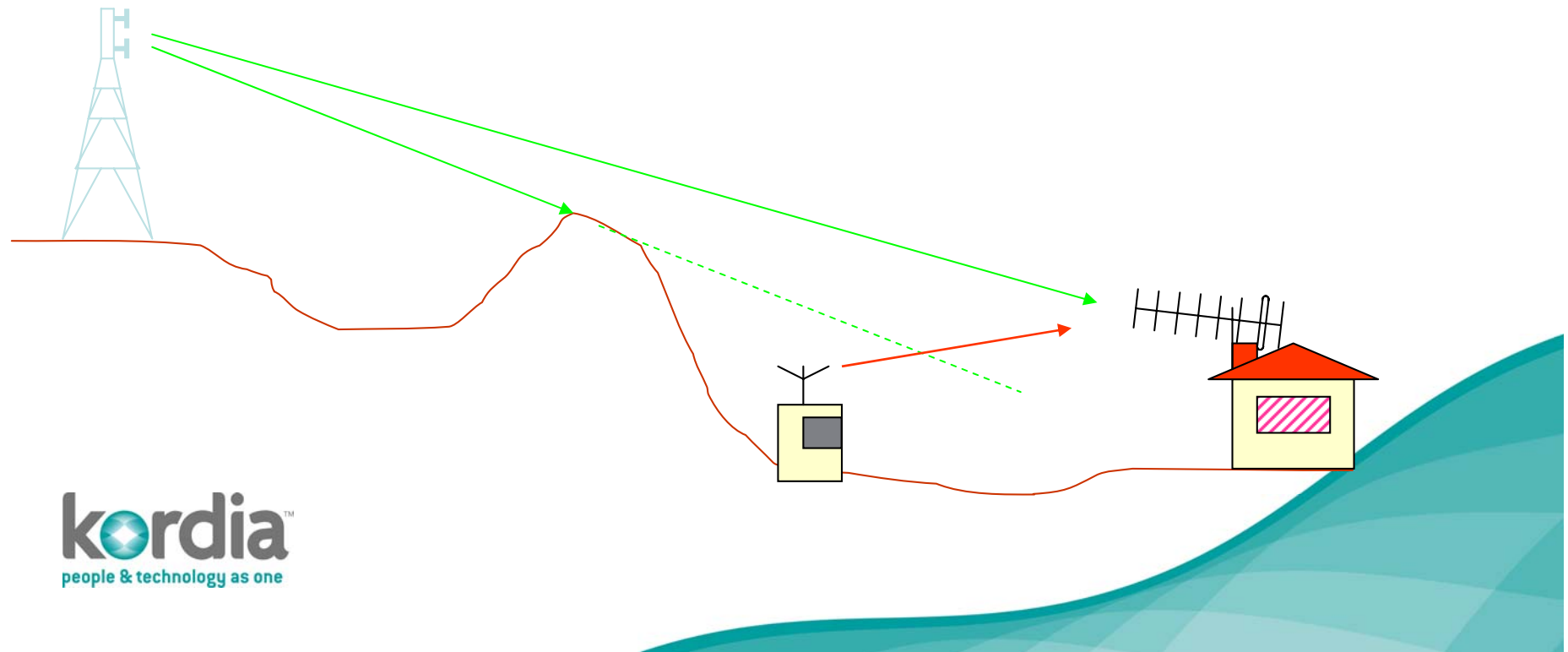
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## 2nd problem: The hidden node



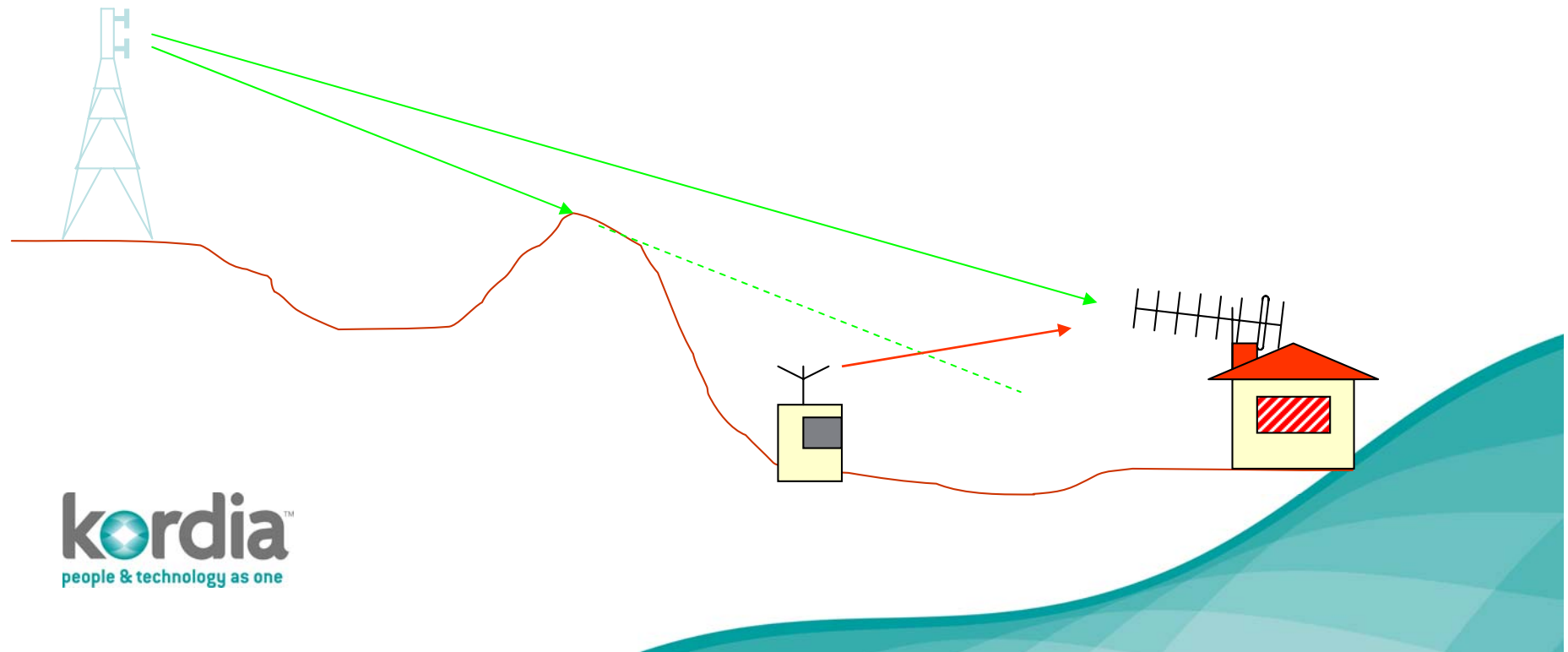
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## 2nd problem: The hidden node



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## 2nd problem: The hidden node



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## 3rd problem: Legislation

# Radiocommunication Act



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## 3rd problem: Legislation

# Radiocommunication Act

## The Management Rights Regime



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## 3rd problem: Legislation

# Radiocommunication Act

## The Management Rights Regime

The fine print ...



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# Cognitive Radio - the prospects

No Cognitive Radio in DTT bands



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# Cognitive Radio - the prospects

No Cognitive Radio in DTT bands

and

No Cognitive Radio in ATV bands



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## Last slide

➤ Broadcasting

Yesterday

Today

Tomorrow

➤ Broadcast Spectrum

**The Digital Dividend**

➤ Broadcast Spectrum

**Cognitive Radio**



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# Broadcasting into the Future

Thank you



**kordia**<sup>TM</sup>  
**people & technology as one**