

# Proposed text for the physical structure of ranging channel

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# **Proposed Text for the Physical Structure of Ranging Channel**

*May, 2009*

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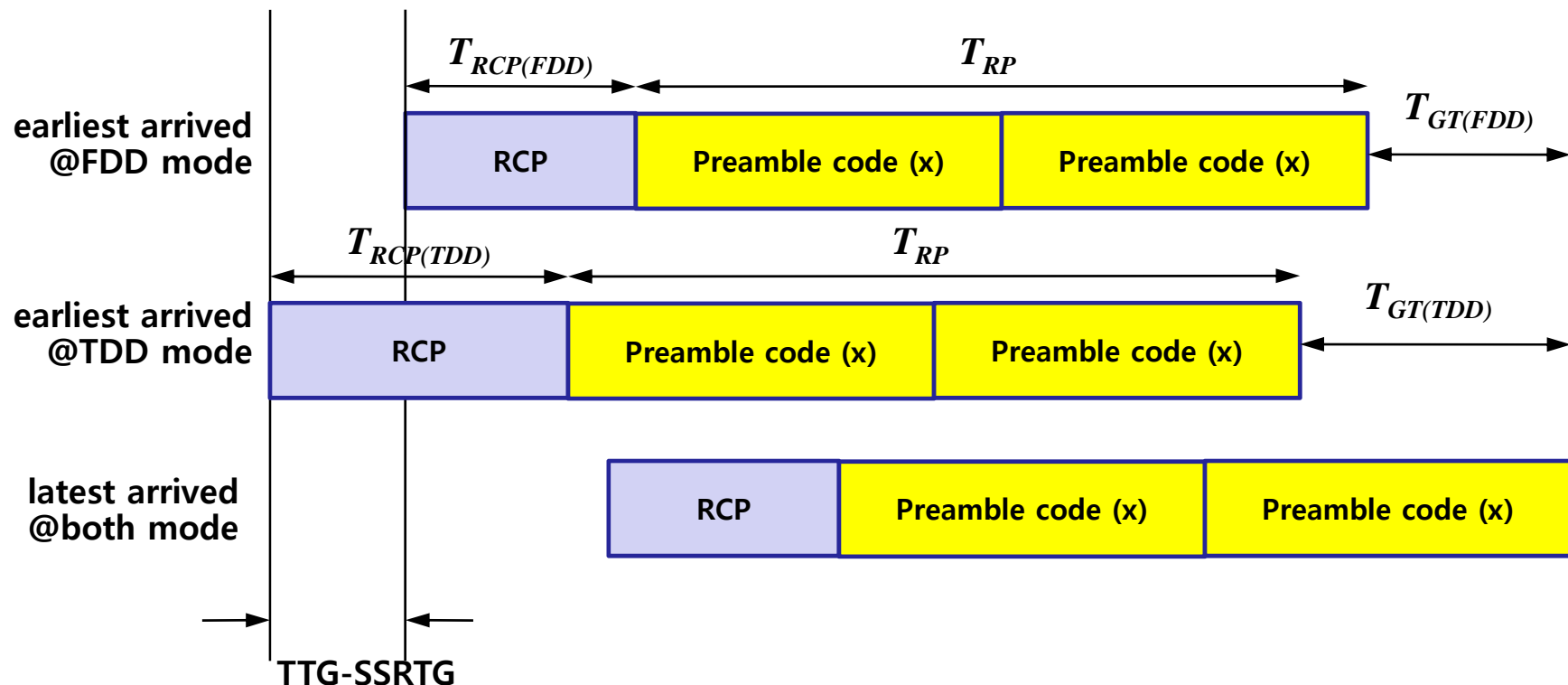
# Introduction

- **For the PHY structure of 16m Ranging channel, we need to decide the following items**
  - Amount of Resource (1 subband vs. 2 subbands)
  - Subcarrier Spacing (= Preamble length)
  - Ranging Format
  - Ranging Sequence

# Proposed RNG Format

- **Key Features**

- Repeated Structure can provide enough link performance margin (at least 3dB) for high coverage
- In TDD mode, its RCP can be extended by exploiting a TTG prior to the first UL subframe



# Supportable Cell Coverage

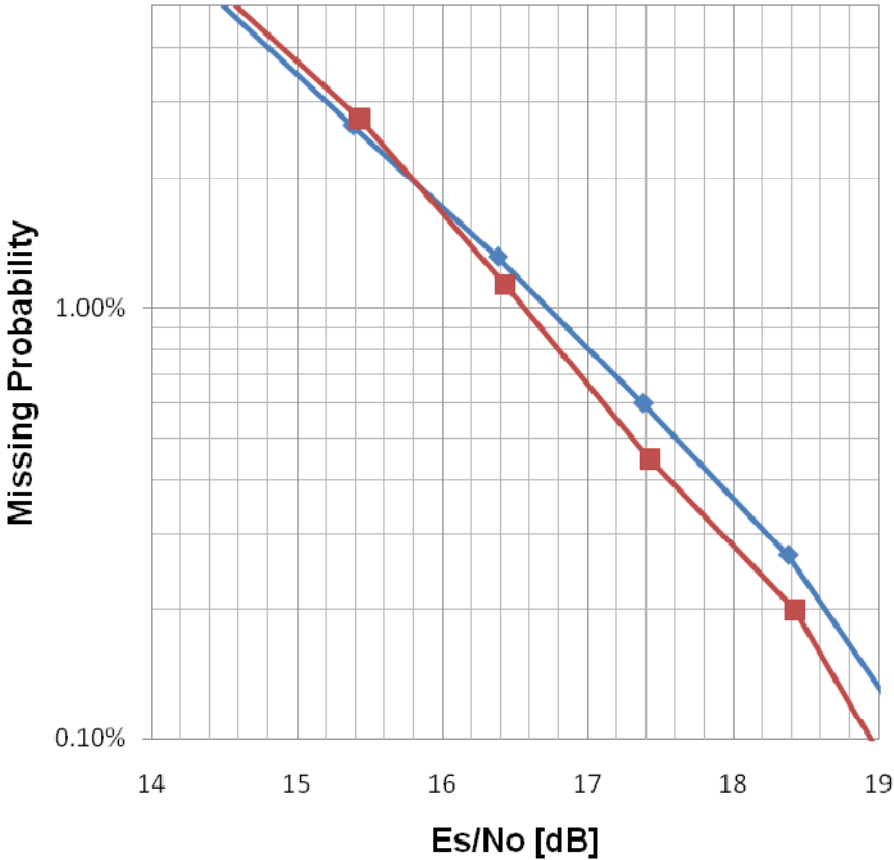
- **Assumption**

- 10MHz CH BW (=11.2MHz sampling rate),
- Type 1 subframe, 1/8 CP length

Format No.	$T_{RCP}$ (sample)	$T_{RP}$ (sample)	Occupied subframe	$T_{GT}$ (sample)	Cell coverage	Duplex
2	960 ( $=0.5T_b+3.5T_g$ )	5120 ( $=5T_b$ )	1	832	11.14 km	FDD
3	1256	5120 ( $=5T_b$ )	1	1128	<b>15.11 km</b>	TDD
4	6336	8192 ( $=8T_b$ )	3	6504	84.86 km	both

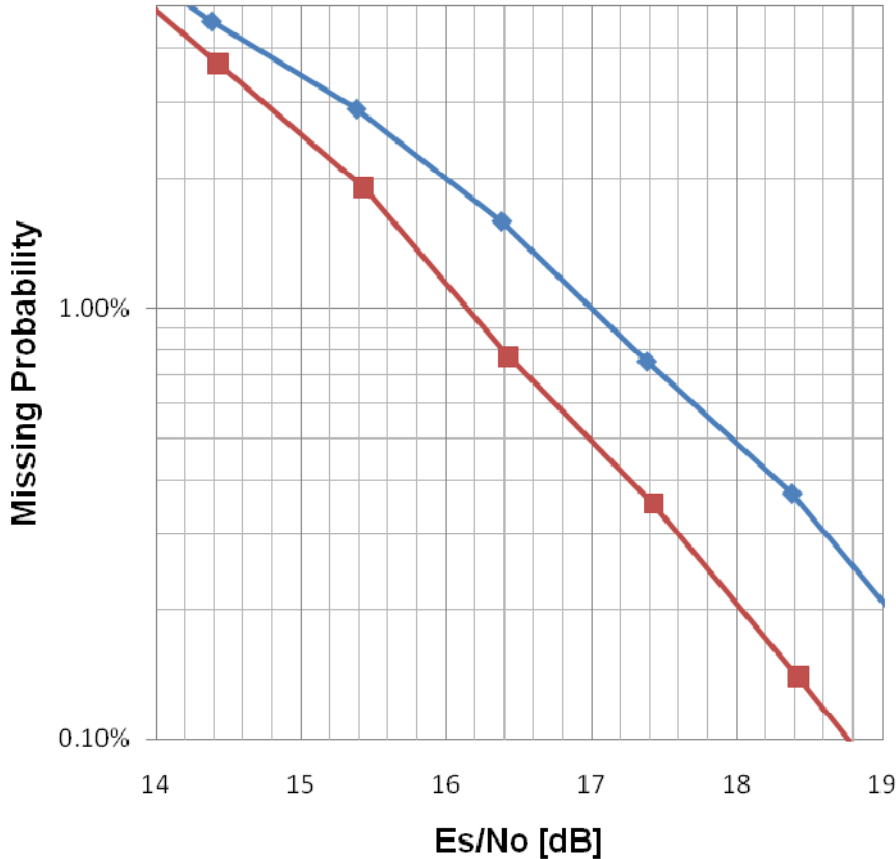
# Detection Performance (1 vs. 2 subband)

### MP vs. EsNo (Ped B 3km/h)



◆ 1subband     ■ 2subbands

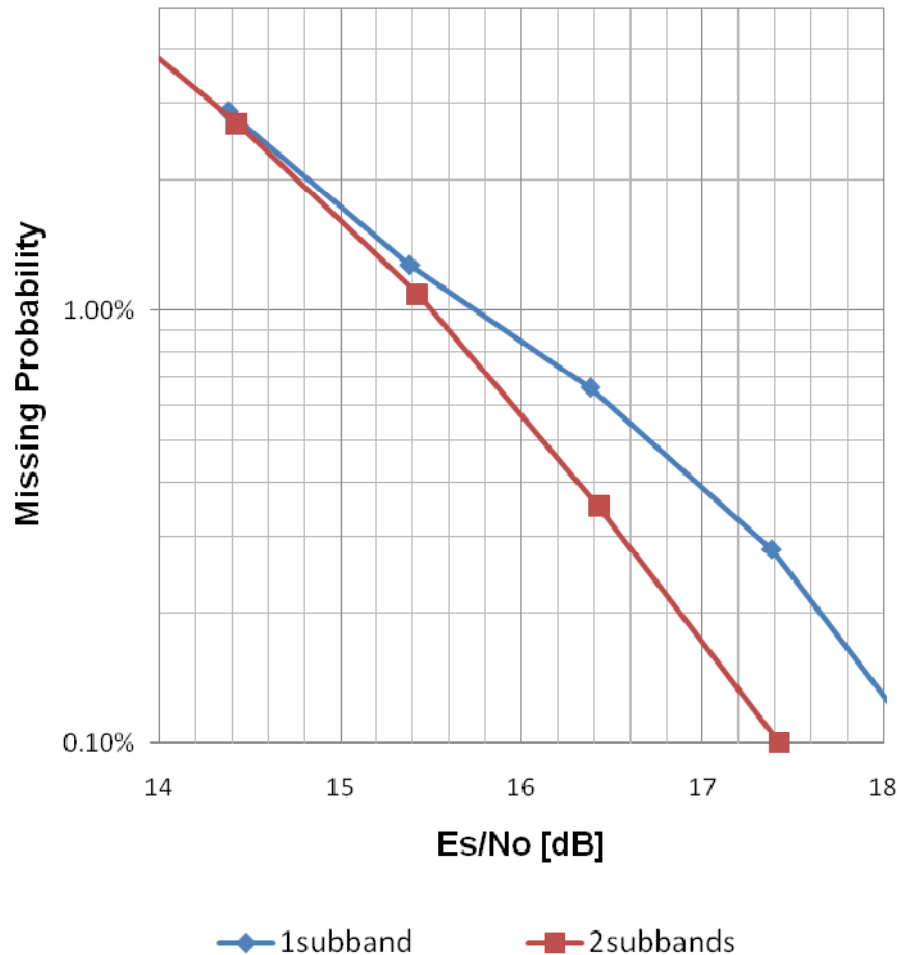
### MP vs. EsNo (Veh A 120km/h)



◆ 1subband     ■ 2subbands

# Detection Performance (1 vs. 2 subband)

MP vs. EsNo (Veh A 350km/h)



- **Analytic Remarks**

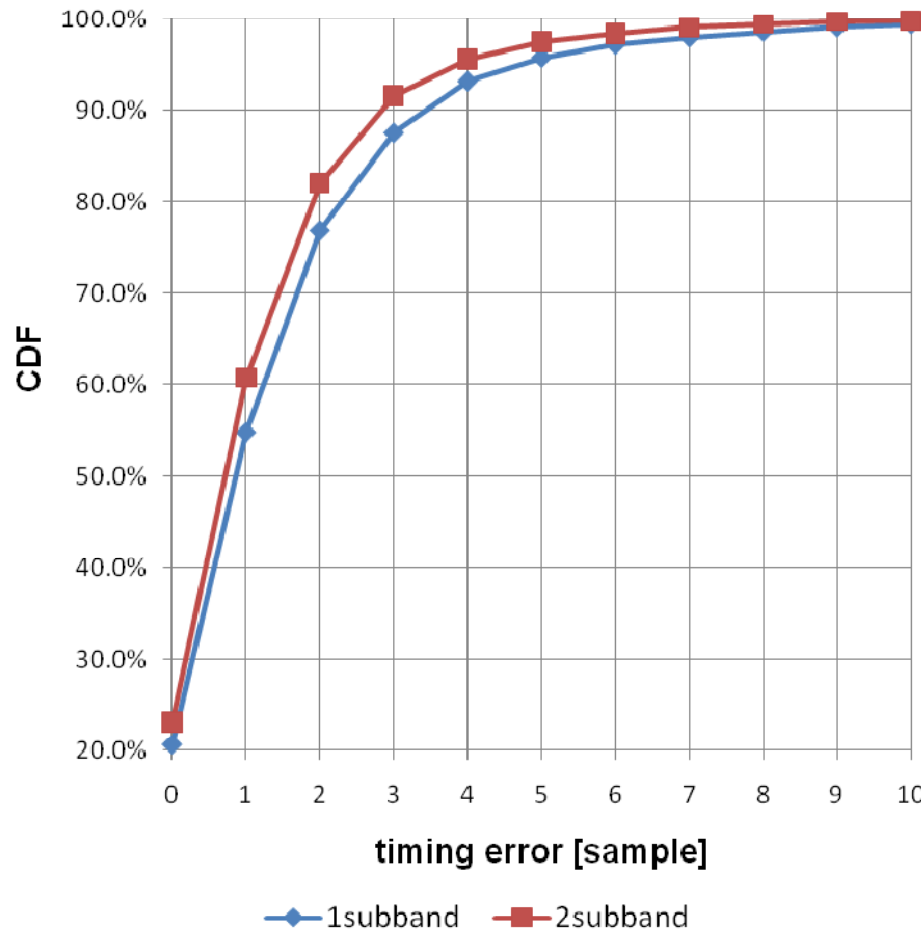
- To measure its performance for link margin and coverage, link level performance should be evaluated in terms of Es/No (symbol power per noise density) not just SNR
- The relation between Es/No and SNR is

$$Es/No[dB] = SNR[dB] + 10\log_{10}(\text{Number of Tones})$$

- In spite of its double overhead, the performance gain of 2 subbands is only about **0.2 ~ 0.8dB** @1% MP

# Timing Accuracy (1 vs. 2 subband)

Timing Accuracy (VehA 120km)



- **Analytic Remarks**

- The distributions of timing error are collected at their operating  $E_s/N_0$  (16.2dB for 2subband, 17.0dB for 1subband)
- Both 1 and 2 subband can achieve enough timing estimation accuracy



# Link Budget Analysis

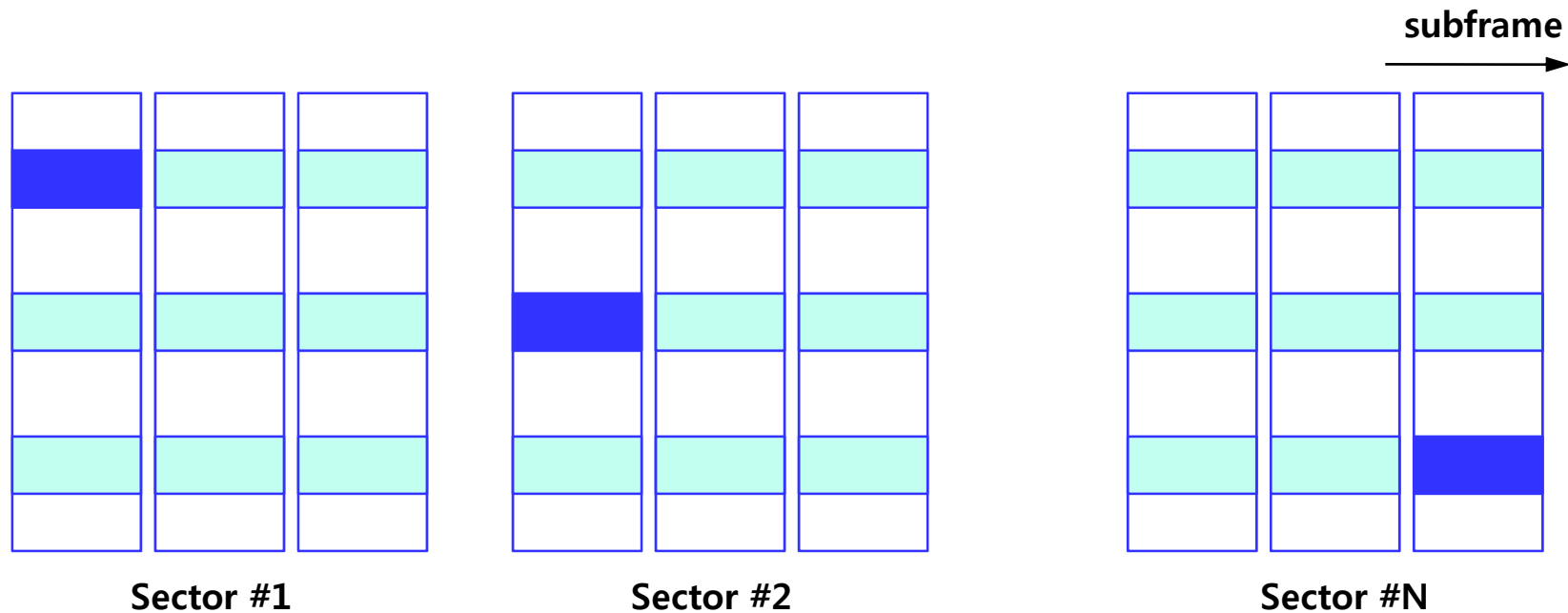
- Receiver sensitivity

Parameter	Value1 (1subband)	Value2 (2subband)	Unit	Comment
Subcarrier spacing	4.375		kHz	= 11.2MHz / 1024 / 2.5
Number of tones	173	349	tones	Length of sequence
Required CINR	-5.58	-8.85	dB	Assuming PedB 3km/h
Receiver sensitivity	<b>-115.8</b>	<b>-116.0</b>	dBm	

- In case of 2subband, we can get only **0.2dB** receiver sensitivity gain at the expense of its double overhead
- For this analysis, we set the common parameters as follows
  - Noise PSD = -174 dBm/Hz, Noise Figure @BS = 5 dB,
  - AMS max transmit power = 23dBm, No PAPR gain

# Consideration on Reuse Factor (i)

- **Two ways to increase the reuse factor of ranging**
  1. Different ranging codes for each sector
  2. Different ranging regions for each sector
- **For example of the second way,**
  - Based on the allocated ranging configuration parameters



 : subband used for traffic,

 : subband allocated for the sector's ranging

# Consideration on Reuse Factor (ii)

Cell coverage	RTD	No. of cyclic shift	No. of roots	Subband	No. of RNG regions	Reuse factor
1km	6.67us	19	4	1	1	43.0
				1	4	172.0
				2	1	87.0
				2	4	348.0
5km	33.33us	5	13	1	1	13.2
				1	4	52.9
				2	1	26.8
				2	4	107.1

- **Note & Remarks**

- Zadoff-Chu sequence as ranging sequence
- By exploiting different ranging regions, Ranging with 1 subband can provide sufficient reuse factor

# Conclusion

- **Ranging structures occupying 1subband or 2subbands resource have**
  - Almost same link level performances in terms of  $E_s/N_0$
  - Sufficiently accurate timing estimation capabilities
  - Similar link budget margins in terms of receiver sensitivity
  - Capability of providing enough reuse factor by using different ranging regions
- **Therefore, 2subband ranging is not favorable**
  - Because its overhead penalty
- **Our suggest remedy is**
  - Proposed text #1 in C80216m-09/0989