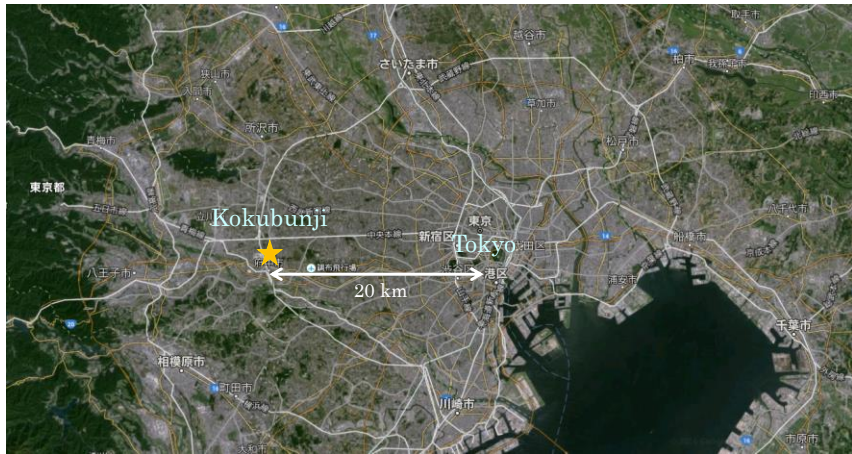


Measurement method and instruments of railway noise in Japan

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Hearing Instrument

Particle Counter

Sound & Vibration Measuring Instrument

Medical equipment

Report for Forefront of Technologies

Click for more information

Click for more information

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Sound & Vibration Measuring Instruments



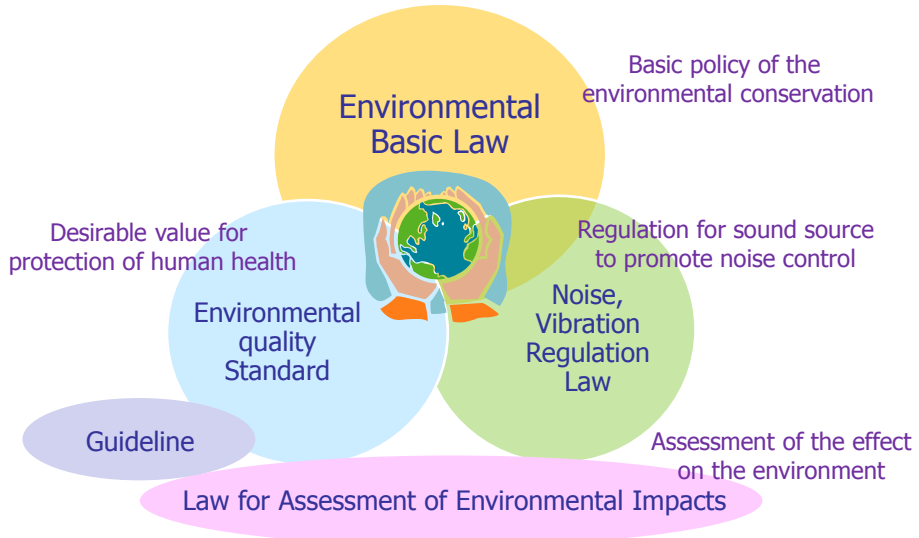
- Microphone & Accelerometer
- Sound level meter
- Vibration meter
- Frequency Analyzer
- Application software
- Calibrator
- Calibration system



Contents

- Regulation law and Standard in Japan
- Measurement method of railway noise
- Basic measurement system
- Advanced measurement system
- Case study of wireless measurement for railway noise

Environmental Law and Standard in Japan



Environmental Basic Law

Environmental Basic Law 1967/8, 1993/11

Noise Regulation Law 1968/6

Factories LA5, L_{max}

Construction Work LA5, L_{max}

Road Traffic Noise LA_{eq,T}

Vibration Regulation Law 1976/6



Environmental quality standards

Environmental quality standards
for Aircraft Noise 1973/12

WECPNL → Lden (2013)

Aircraft noise measurement / evaluation manual (2009)

Environmental quality standards
for Shinkansen Superexpress Railway Noise 1975/7

LAS,max

Shinkansen Superexpress noise measurement / evaluation manual (2010)

Environmental quality standards
for Noise 1998/9

General residential area

Areas facing roads

L50 → LAeq (1999)

Evaluation manual of environmental quality standards for noise (2000)

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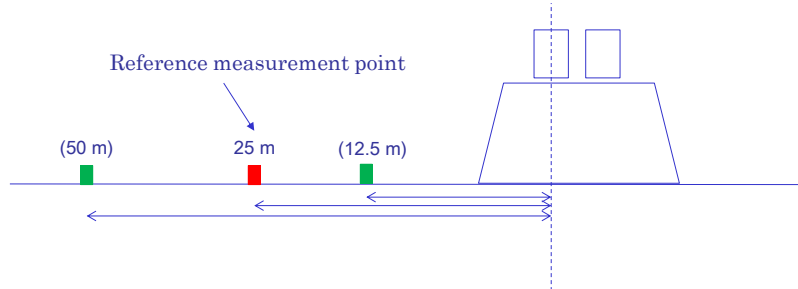


Assessment and Guideline

Guideline of Noise measures during the railway of
new construction or large-scale improvement
1995 LAeq,T

Law for Assessment of Environmental Impacts 1997/6

Desirable value of Environmental quality standards for Shinkansen Superexpress Railway Noise



Desirable value of Environmental quality standards for Shinkansen Superexpress Railway Noise

- Measure a series of $L_{A,Smax}$ for 20 trains
- Sort in descending order of $L_{A,Smax}$
- Calculate power average for $L_{A,Smax}$ of Top 10

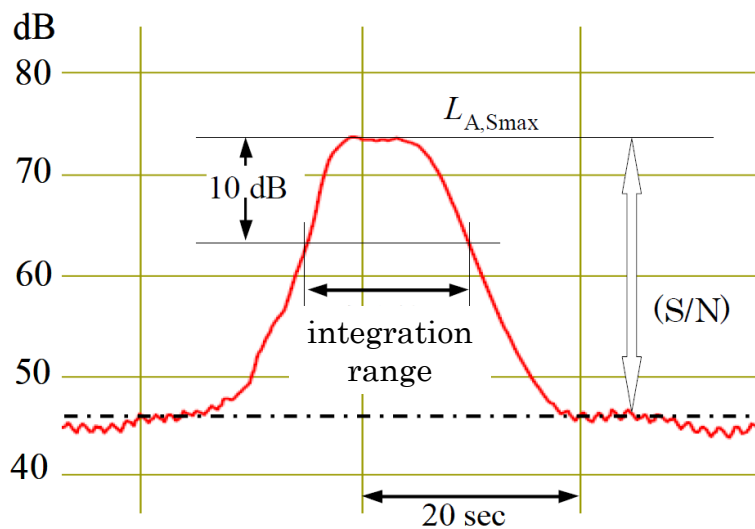
$$\bar{L}_{A,Smax} = 10 \log_{10} \left\{ \frac{1}{n} \sum_{i=1}^n 10^{(L_{A,Smax_i})/10} \right\} \quad (\text{dB})$$

Area	Desirable value
I (Residential area)	$\leq 70 \text{ dB(A)}$
II (Commercial area)	$\leq 75 \text{ dB(A)}$



Guideline value of Noise measures during the railway of new construction or large-scale improvement

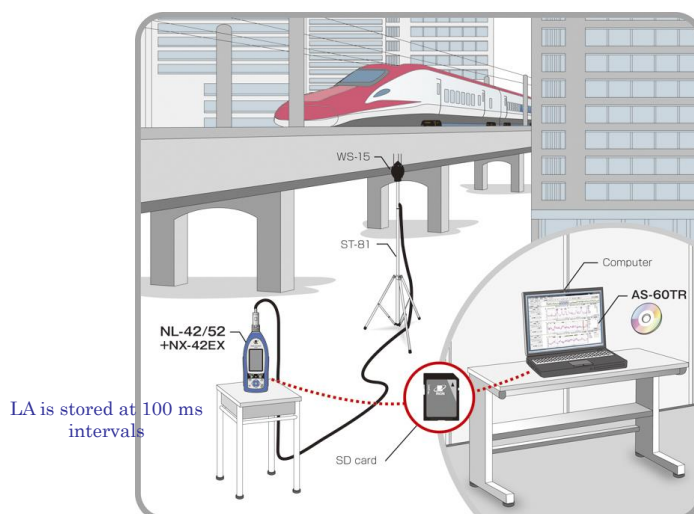
Category	Guideline value	
	Day time (7 – 22)	Night time (22 – 7)
New construction	$L_{Aeq} \leq 60 \text{ dB(A)}$	$L_{Aeq} \leq 55 \text{ dB(A)}$
Large-scale improvement	Sound level should be improved less than before improvement	

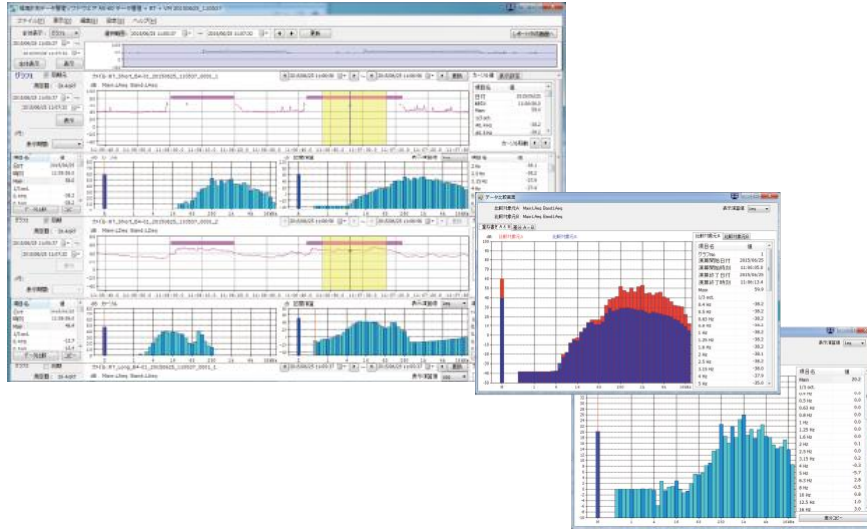


Measurement system for railway noise



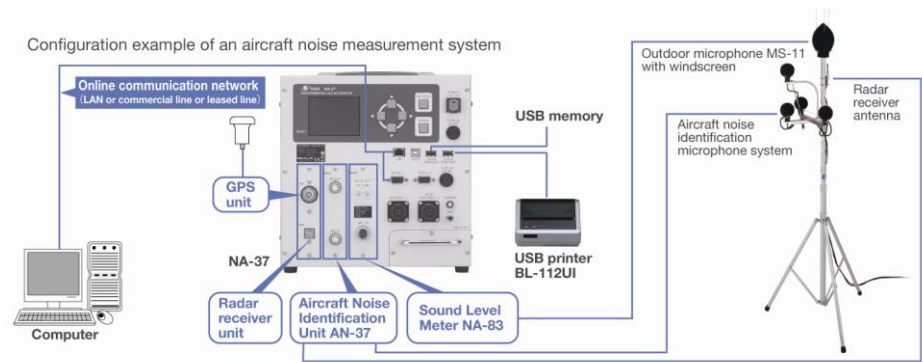
Basic system





Advanced noise monitoring system

Noise Monitoring System NA-37



Noise monitoring instrument



Main microphone

3 axial microphones

Environmentally durable storage case

Noise monitoring instrument

- An actually installed apparatus



Main microphone

3 axial microphones

Environmentally durable storage case



高速自動車道脇に設置されている、騒音・大気測定器格納施設

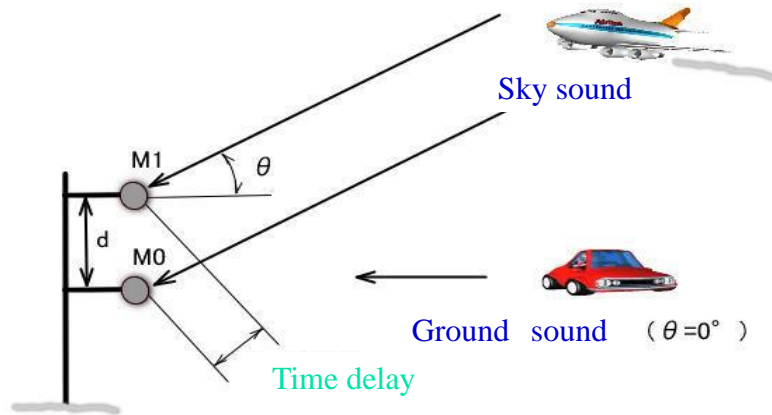
高速道路周辺などの
環境騒音の測定に。

- ① 風向・風速計
- ② 高速自動車道
- ③ 大気測定吸気口
- ④ 騒音・大気測定機器格納キュービクル
- ⑤ 屋外用マイクロホン

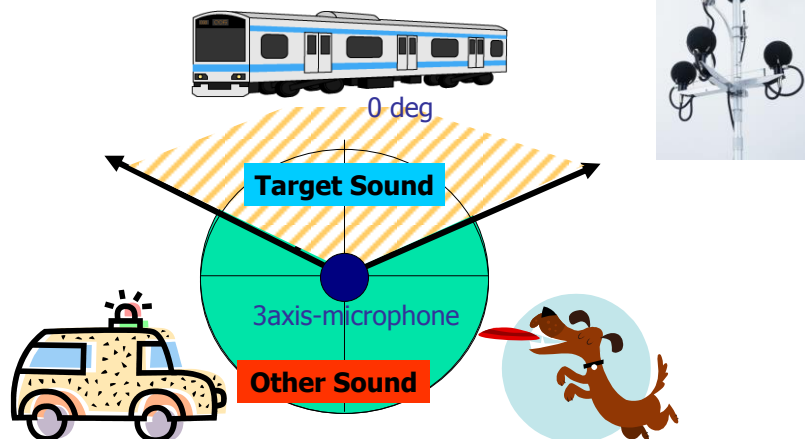


マイクロホン設置例

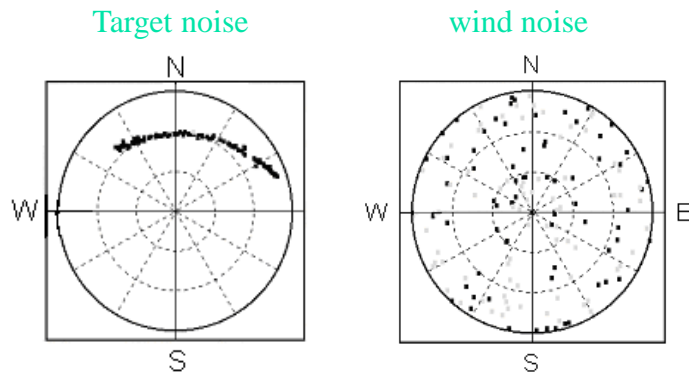
Principle of sound identification



Measuring Target Area Configuration



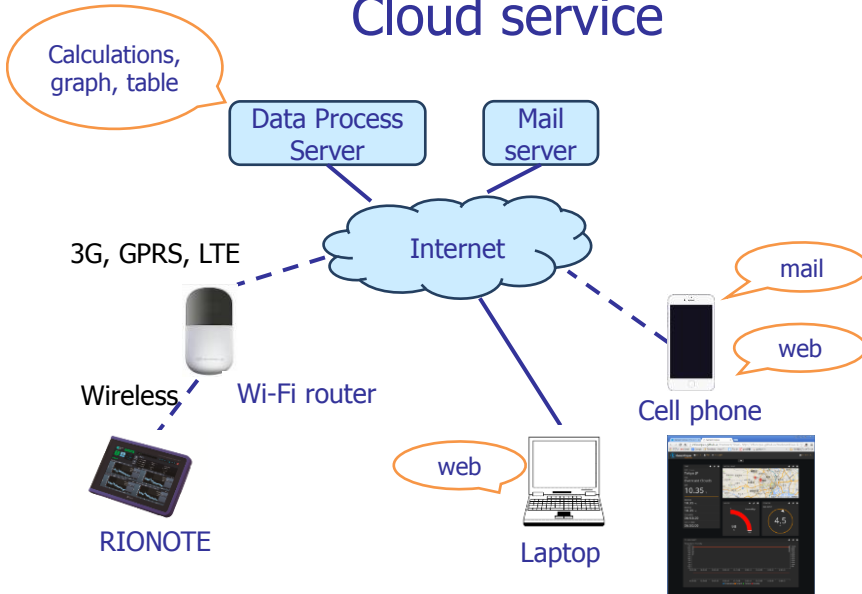
Discrimination of a vector pattern



Cloud application
in future plan



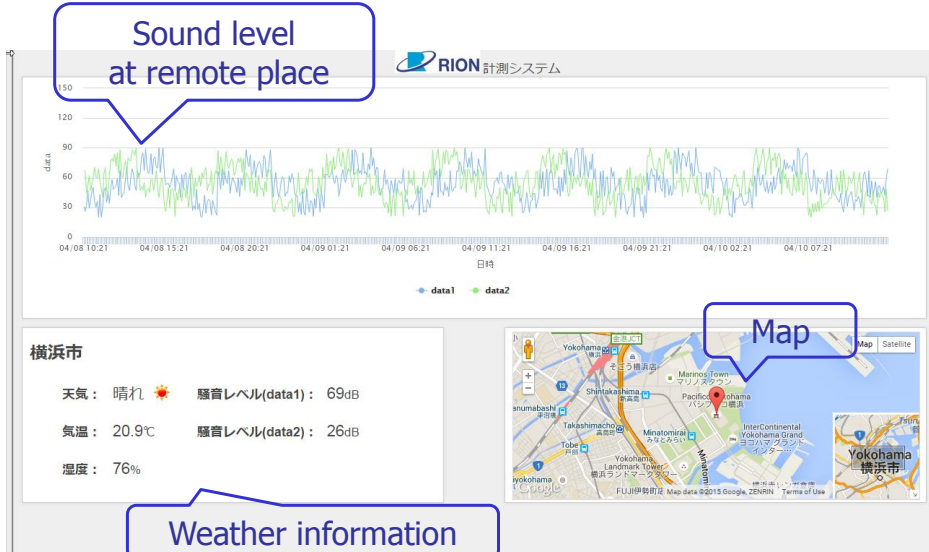
Cloud service



2015 Thailand



Cloud – web (future plan)



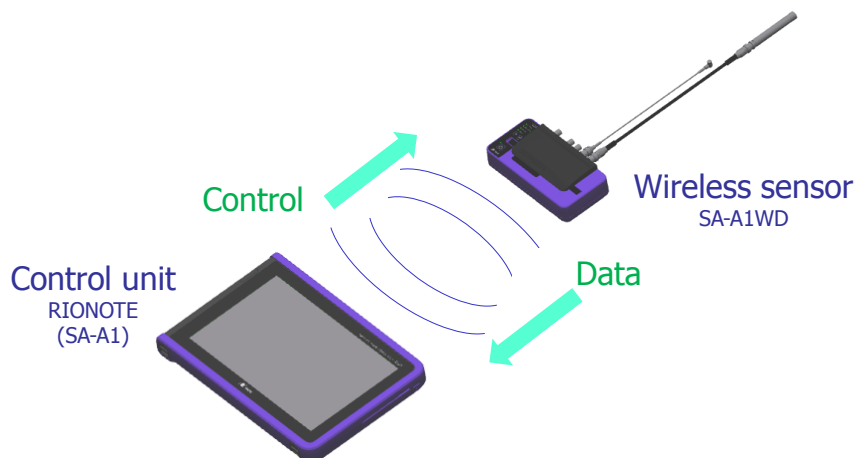
Weather information

2015 Thailand

Case study of wireless measurement

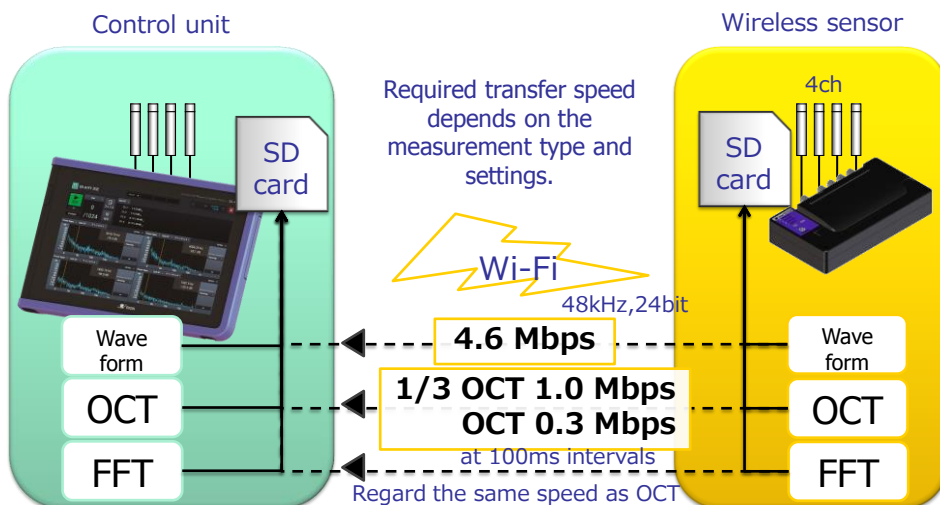


Configuration of Wireless measurement system





Requirement for transfer speed

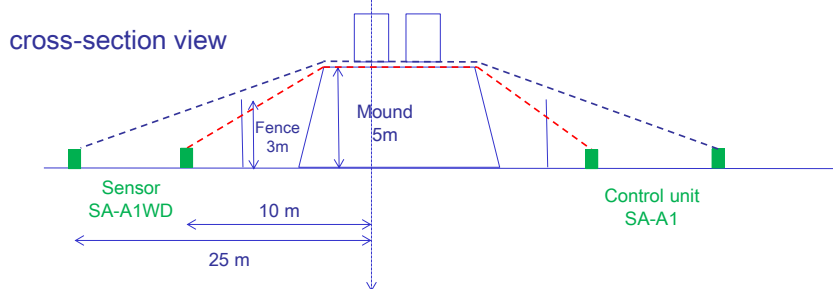


Railway 1

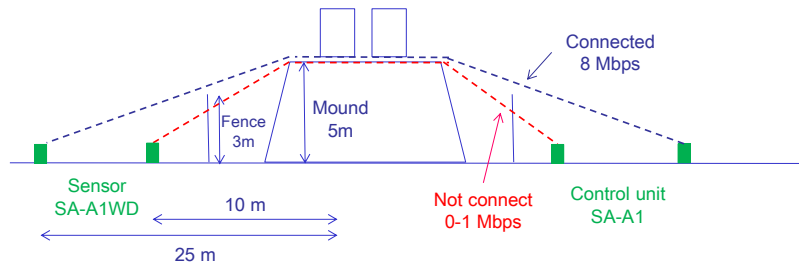


Normally 7.5 Mbps, 2 Mbps when train is passing

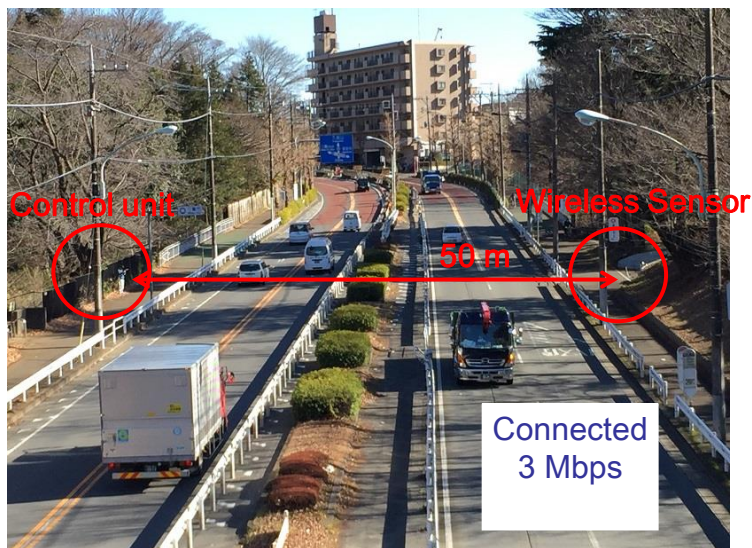
Railway 2



Result



Road traffic noise 1



Road traffic noise 2



Connected

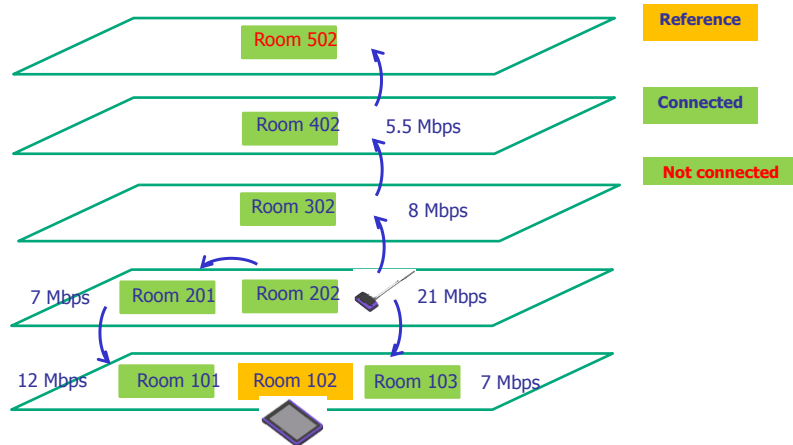
Normally 12 Mbps, 4 Mbps when bus and large cars stops at signal



Reinforced concrete (RC) building



Reinforced concrete (RC) building



Conclusion

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- Measurement method of railway noise
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Thank you very much for your
kind attention.

