Wireless Local Area Networks and Fixed Wireless Access

ARIB, Japan

May 2004

Outline

Standardization and Applications of

- **5 GHz Band Broadband Wireless LAN**
- **Quasi-millimeter and Millimeter Fixed Wireless Access**
- **60GHz Band Fixed Wireless Access**
- **Infrared Wireless LAN**

Overview of ARIB Standards for WLAN and FWA in Japan

Standard Code (Enactment date)	Scope
STD-T33 (Feb.1999)	2.4GHz WLAN (802.11b)
STD-T50 (May.2002)	Infrared WLAN
STD-T58 (Oct.2000)	FWA (P-P, 22/26/38GHz bands)
STD-T59 (Mar.2000)	FWA (P-MP, 26/38GHz bands)
STD-T66 (Mar.2003)	2.4GHz WLAN (802.11b)
STD-T70 (Nov.2002)	HiSWANa (5GHz band)
STD-T71 (Jun.2003)	5GHz WLAN (802.11a)
STD-T74 (May.2001)	High speed WLAN(60GHz band)
STD-T83 (Dec.2002)	HiSWANb (25GHz band)

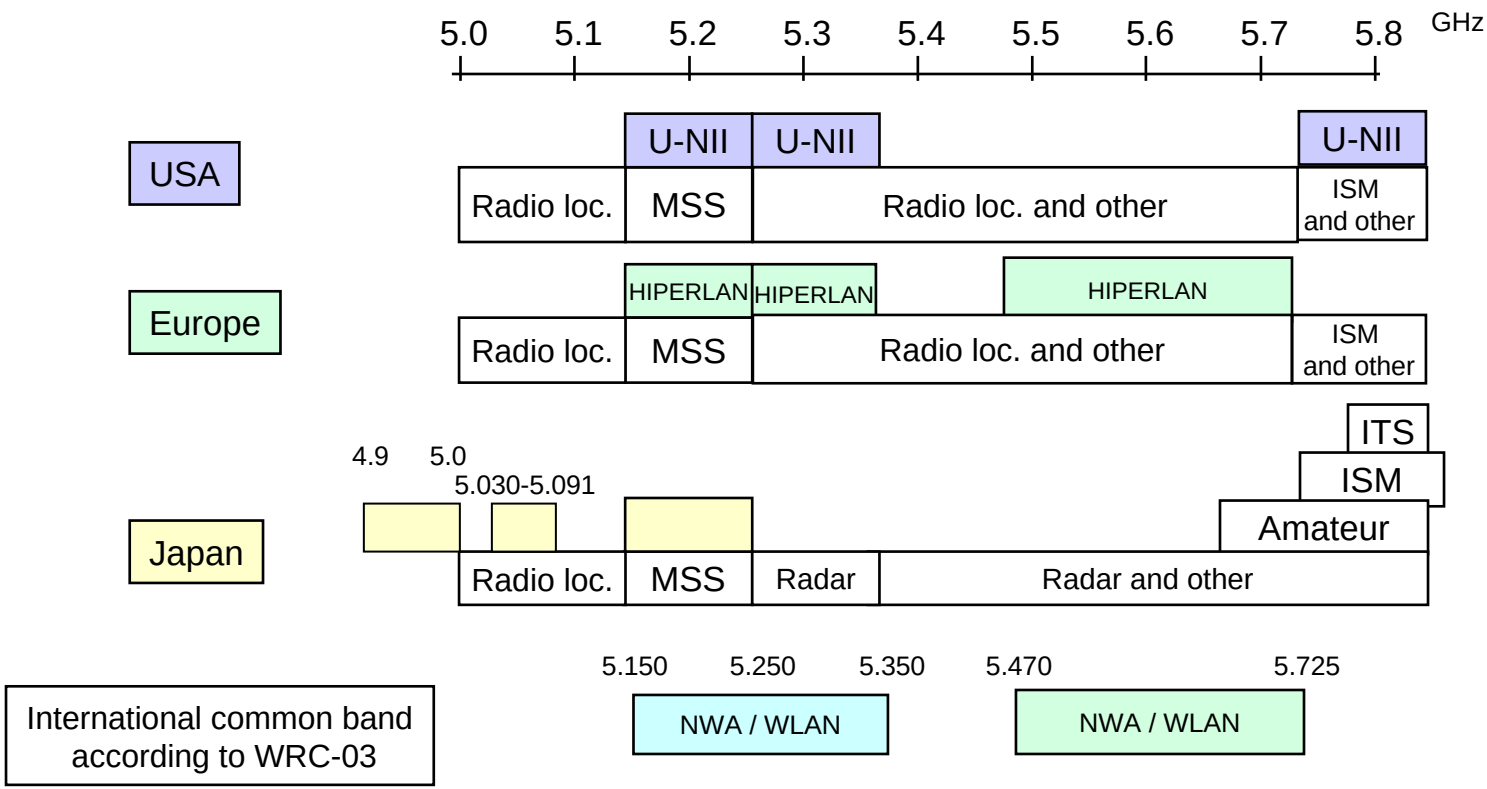
WLAN: Wireless LAN FWA: Fixed Wireless Access

Standardization and Applications of

5GHz Band Broadband Wireless LAN

Frequency Assignment of 5GHz Band in USA, Europe and Japan

- USA : 5.15-5.35 GHz, 5.725-5.825 GHz
- Europe : 5.15-5.35 GHz, 5.47-5.725 GHz
- Japan : 5.15-5.25GHz, 4.9-5.0GHz, 5.03-5.091 GHz



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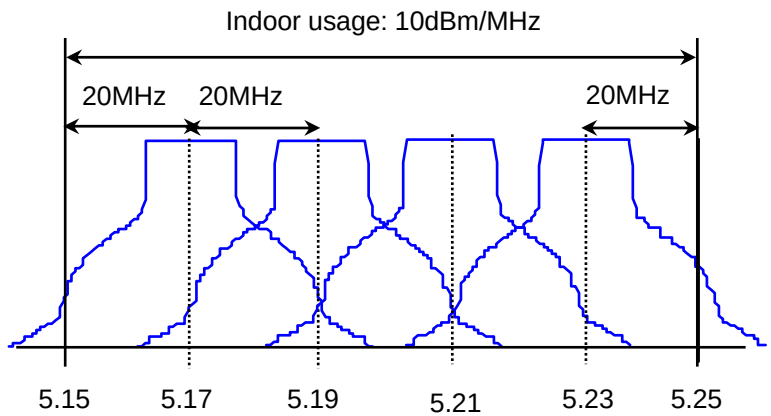
IEEE802.11a Parameters (ARIB-STD-T71)

Modulation Method	OFDM For each subcarrier BPSK, QPSK, 16- QAM, 64- QAM
Number of Subcarriers	52 subcarriers (Including pilot signals) 64 point FFT
Method of Correction	Convolution coding K=7, R=1/2, 2/3, 3/4 Viterbi Decoding Interleave in symbols
Transmission Rate	6 Mbit/s (BPSK, R=1/2) required 9 Mbit/s (BPSK, R=3/4) optional 12 Mbit/s (QPSK, R=1/2) required 18 Mbit/s (QPSK, R=3/4) optional 24 Mbit/s (16- QAM, R=1/2) required 36 Mbit/s (16 - QAM, R=3/4) optional 48 Mbit/s (64- QAM, R=2/3) optional 54 Mbit/s (64- QAM, R=3/4) optional
Channel Allocation	4 (100 MHz) , 8 (200 MHz in US) 20MHz Channel Interval

NTT & Lucent agreed upon a joint proposal, July 1998

Complete standardization, September 1999

Allocation of frequency in Japan



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Specifications of HiSWANa (ARIB STD-T70)

AP (Access Point)

Capacity	:	1800 cc
Power Supply	:	AC 100V
Frequency	:	5.15GHz - 5.25GHz (four carriers)
Standard	:	ARIB STD-T70 (HiSWANa)
Antenna	:	Omni antenna (2 branch)
Network I/F	:	10base-T / 100base-TX automatic recognition
Transmission Speed	:	Maximum of 36 Mbps (variable)
Connections	:	126MTs
QoS control	:	Guaranteed minimum bit rate or best effort (equal for each user)
Authentication	:	Authentication by AP or NW server
Maintenance	:	User management server (AP authentication) or Operation server (NW authentication) (remote reset / soft remote load)

MT (Mobile Terminal)

Capacity	:	45cc or less
Power Supply	:	Supplied by PC card slot
Frequency	:	5.15GHz - 5.25GHz (four carriers)
Standard	:	ARIB STD-T70 (HiSWANa)
Antenna	:	Built-in antenna
Terminal I/F	:	PC Card interface(32bit card bus)

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Activities of hotspot service in Japan

Company (Boldface type shows commercial service firms)	Wireless interface	Charge	Starting date	Service areas	Note
NTT East	IEEE802.11b	M: 200 yen ($1.80)	2003.1	Tokyo, Kanagawa, Chiba, Saitama, Hokkaido, and expanding to others areas in Japan	Option service of joining Flet's services in NTT. (necessary to contract separately with ISP)
NTT West	IEEE802.11b	M: 800 yen ($7.30)	2002.7	Osaka, the main city in western Japan	<Same as above>
NTT Communications	IEEE802.11b IEEE802.11a	M: 1600 yen ($14.50) D: 500 yen ($4.50)	2002.5	Kanto area, Osaka, Sapporo, Sendai, Nagoya, Fukuoka, etc.	International roaming can be used.
NTT-BP	IEEE802.11b (HiSWANa)	M: 1500 yen ($13.50) O: 300 yen/12hours ($2.7)	2002.12	Station yards for Keio Line, Keikyu Line, Sotetu Line, and spots in the station vicinity	Down-loading of contents by PDA can be used.
NTT Docomo	IEEE802.11b	M: 2000 yen ($18.20)	2002.7	Tokyo, Kanagawa, Chiba, Saitama, and Niigata	
Rikei	IEEE802.11b	D: 500 yen ($4.50) W: 1000 yen ($9.10)	2002.11	7 areas in Tokyo; other areas	The printout service can be used
Wicom	IEEE802.11b	M: 2480 yen ($22.50)	2002.7	Hokkaido (inc. Sapporo)	Deploying both NWA and FWA services
JR Central & NTT-ME	IEEE802.11b	M: - 800 yen ($7.30) D: 200 yen ($1.80)	2003.4	JR Central stations; other stations	Trial (A charge is necessary)
Yahoo!BB	IEEE802.11b	Free (Trial)	2002.5	Starbuck's, McDonald's, and coffee shops/restaurants	
JR East & Japan Telecom	IEEE802.11b	Free (Trial)	2001.9	Station yards in Tokyo, Ueno, Shinagawa, Yokohama, Sapporo, etc.	
FREESPOT (service name)	IEEE802.11b	Free & Charge	2002.7	Coffee shops, food shops, hotels and public facilities in Japan	

(M: monthly, D: daily, W: weekly, O: other) $ indicates U.S. dollars.

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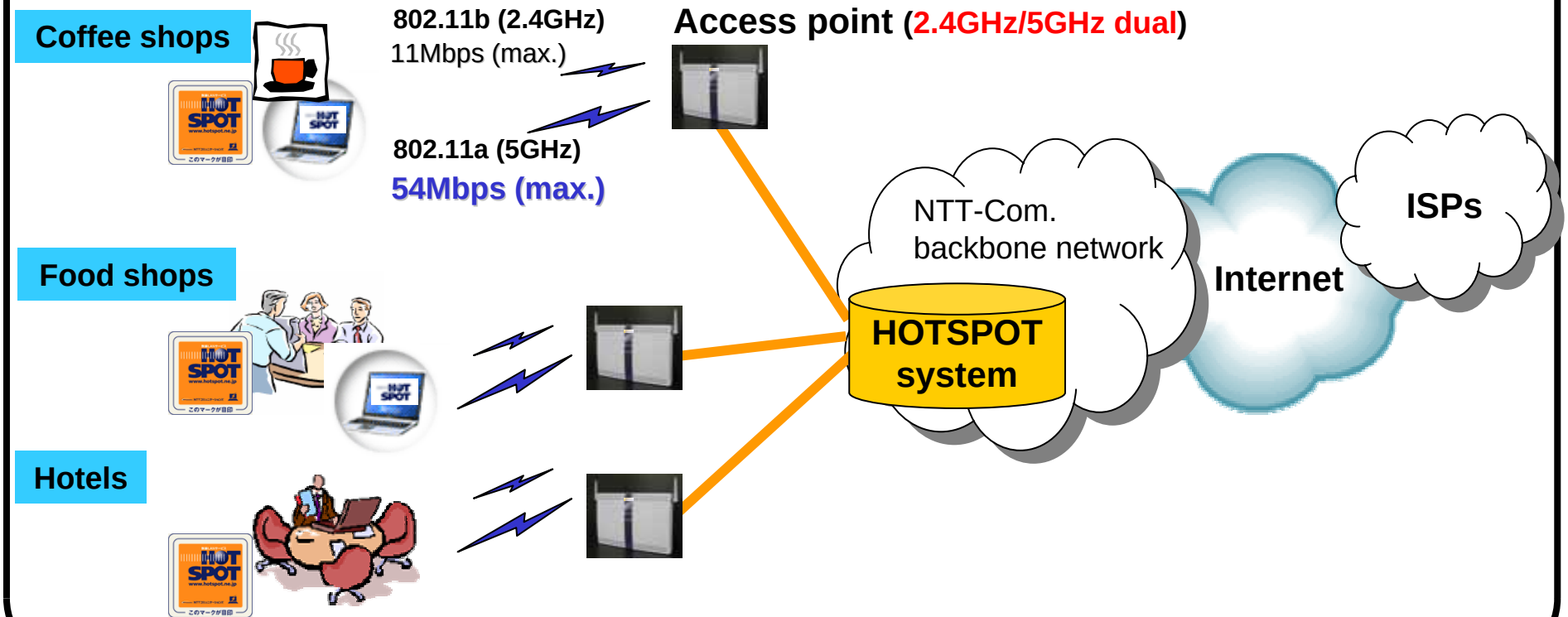
NTT Communications Service - [HOTSPOT] (1) -

- Deployment at about 500 areas offering fast-food shops and hotels.
- Wireless LAN devices used in the office and at home can be used in public spaces.
- Use wireless LAN systems of IEEE 802.11b/a (2.4/5GHz bands).
- Monthly charge for both personal use and enterprise use is about U.S. $14.50 (1,600 yen).
- Roaming connection with West Japan Railway (JR west), Japan Air Lines (JAL) group, etc.

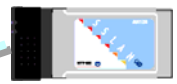


NTT Communications Service -[HOTSPOT] (2) -

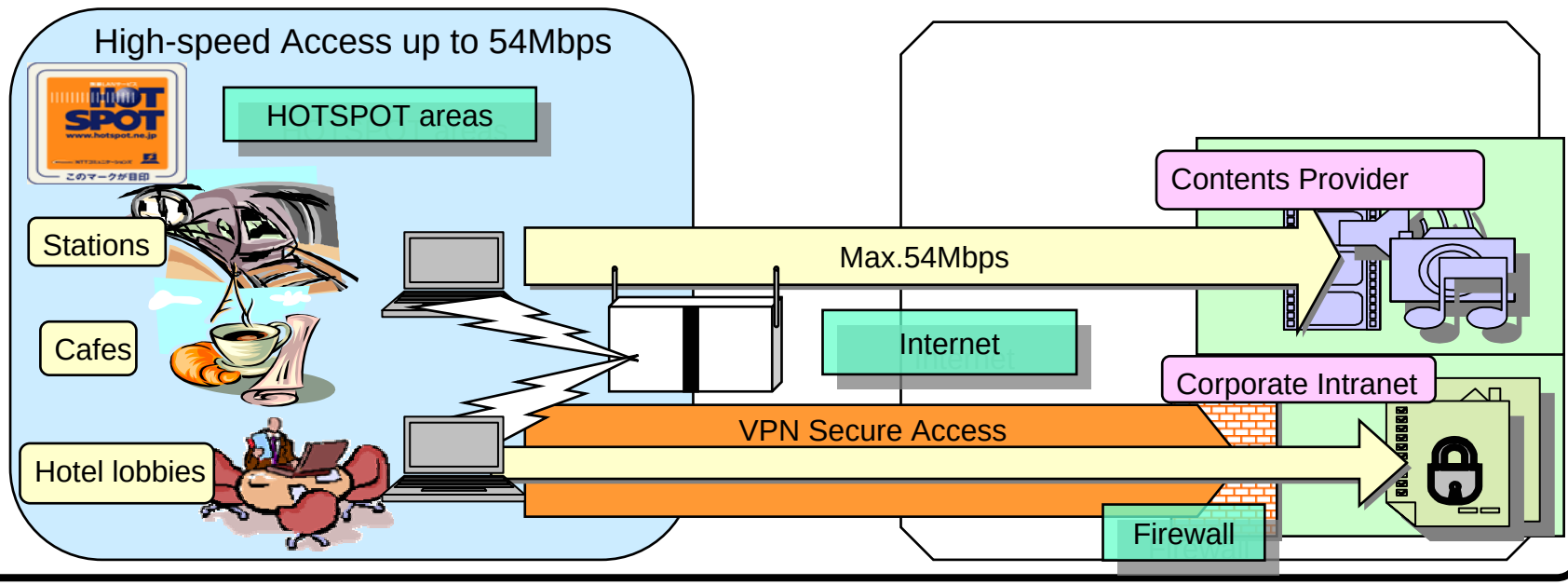
HOTSPOT Access Point
& PCMCIA Card

Coffee shops

HOTSPOT
Access Points



Wireless LAN
Cards



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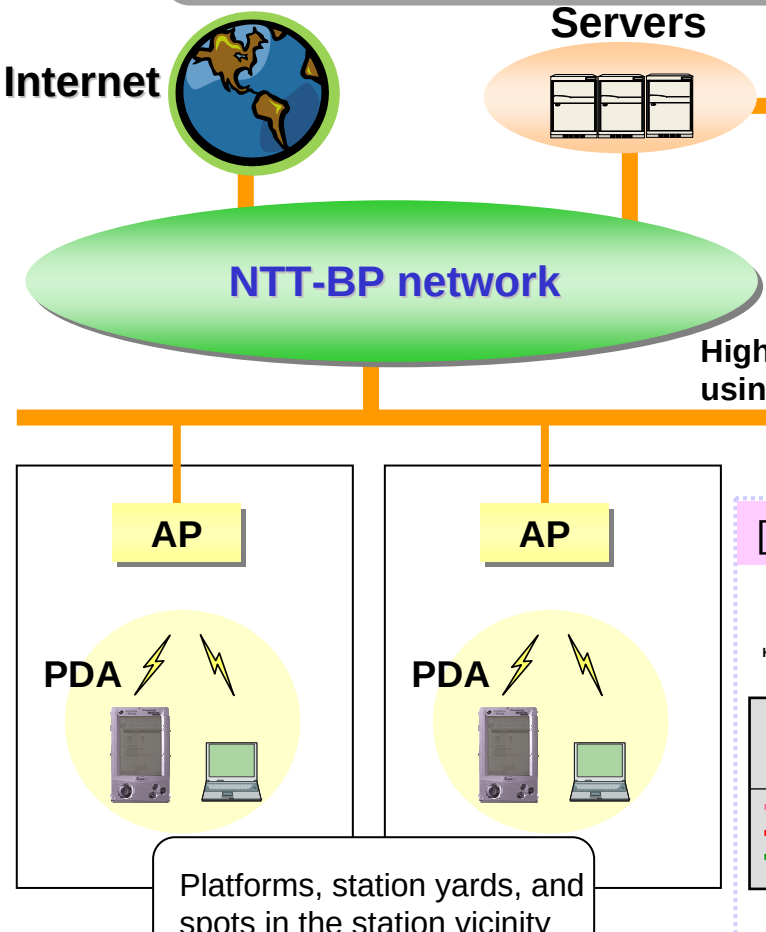
NTT Broadband Platform Service (NTT-BP)

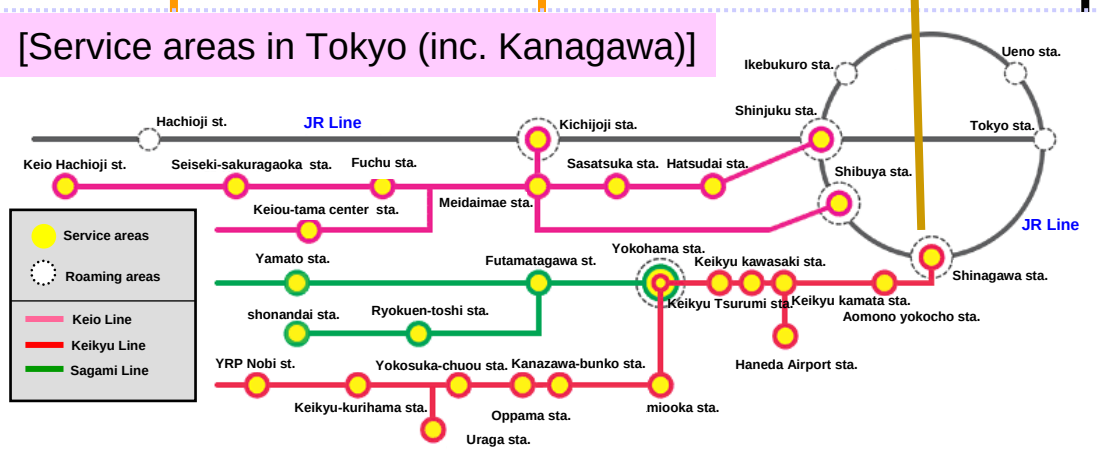
Service using PDA is mainly deployed in train stations and surrounding areas.
The monthly charge is about U.S. $13.50 (1,500 yen).



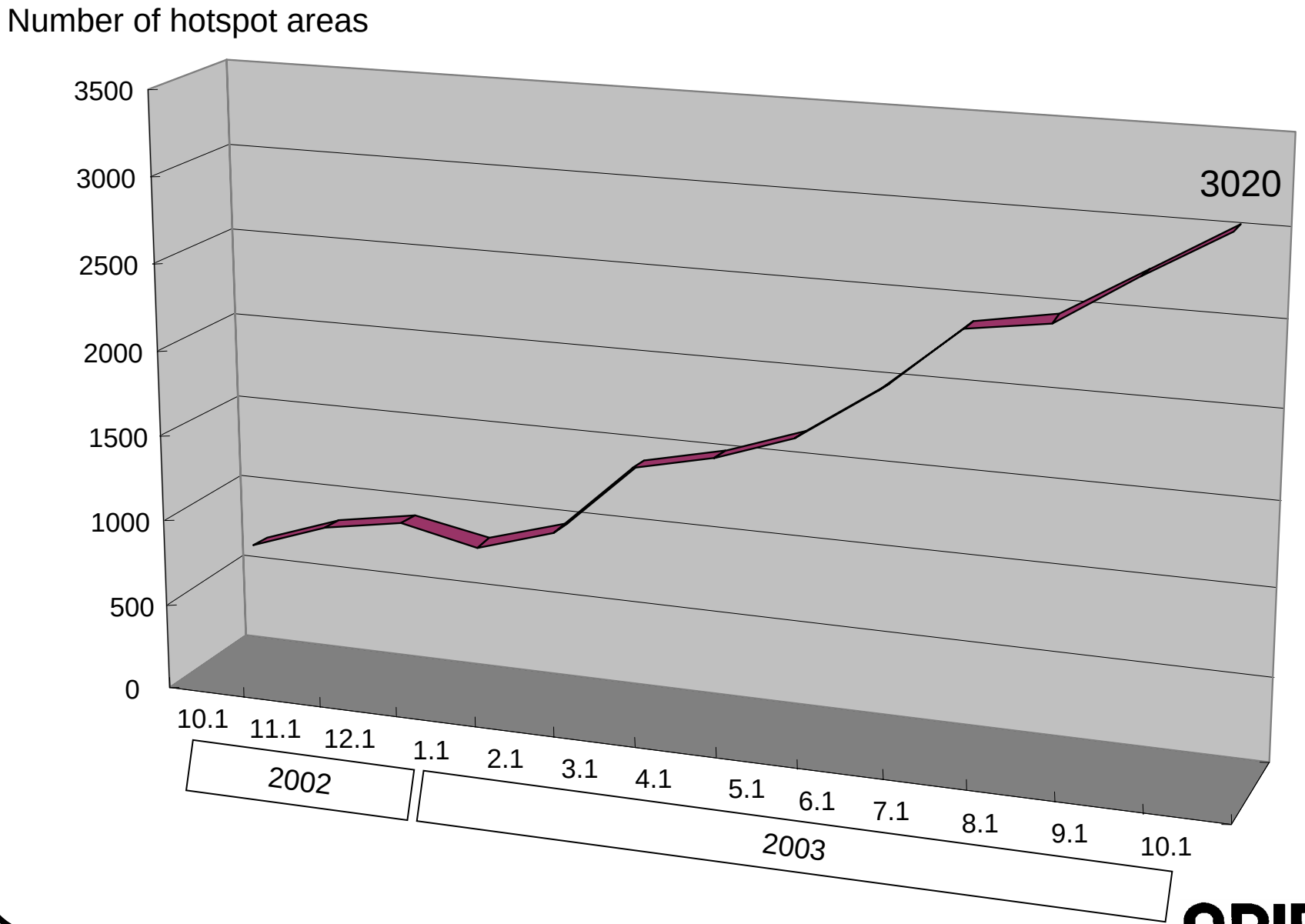
Shinagawa Station of Keikyu Line

Supports both HiSWANa and IEEE802.11b

[Service areas in Tokyo (inc. Kanagawa)]



Increase in Number of Hotspot Areas in Japan



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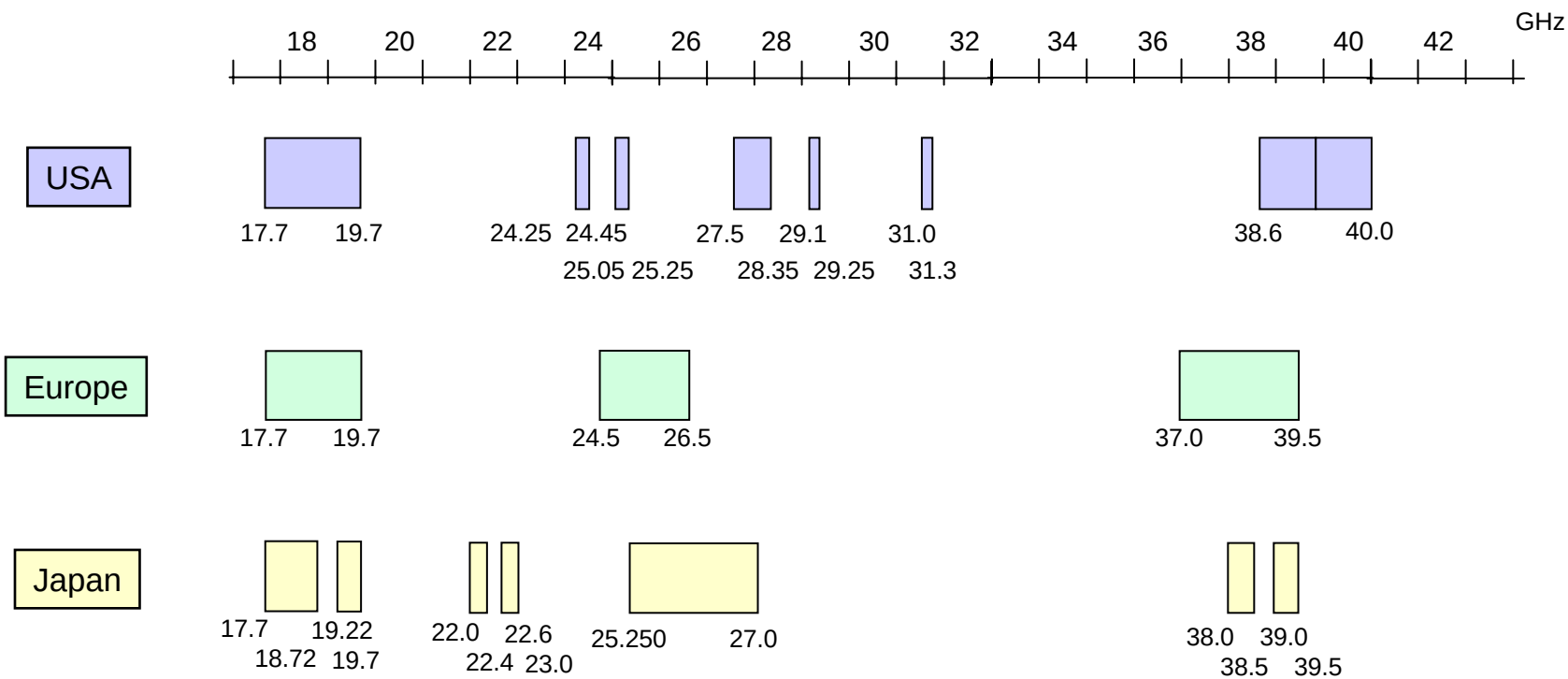
Standardization and Applications of Quasi-millimeter and Millimeter Fixed Wireless Access

Frequency Assignment of 18 - 40GHz Band in USA, Europe and Japan

USA : 17.7-19.7 GHz, 24.25-24.45 GHz, 25.05-25.25 GHz, 27.5-28.35 GHz, 29.1-29.25 GHz, 31.0-31.3 GHz, 38.6-40.0 GHz

Europe : 17.7-19.7 GHz, 24.5-26.5 GHz, 37.0-39.5 GHz GHz

Japan : 17.7-18.72 GHz, 19.22-19.7 GHz, 22.0-22.4GHz, 22.6-23.0GHz, 25.25-27.0 GHz, 38.0-38.5 GHz, 39.0-39.5 GHz



Technical Requirements for Quasi-millimeter and Millimeter FWA

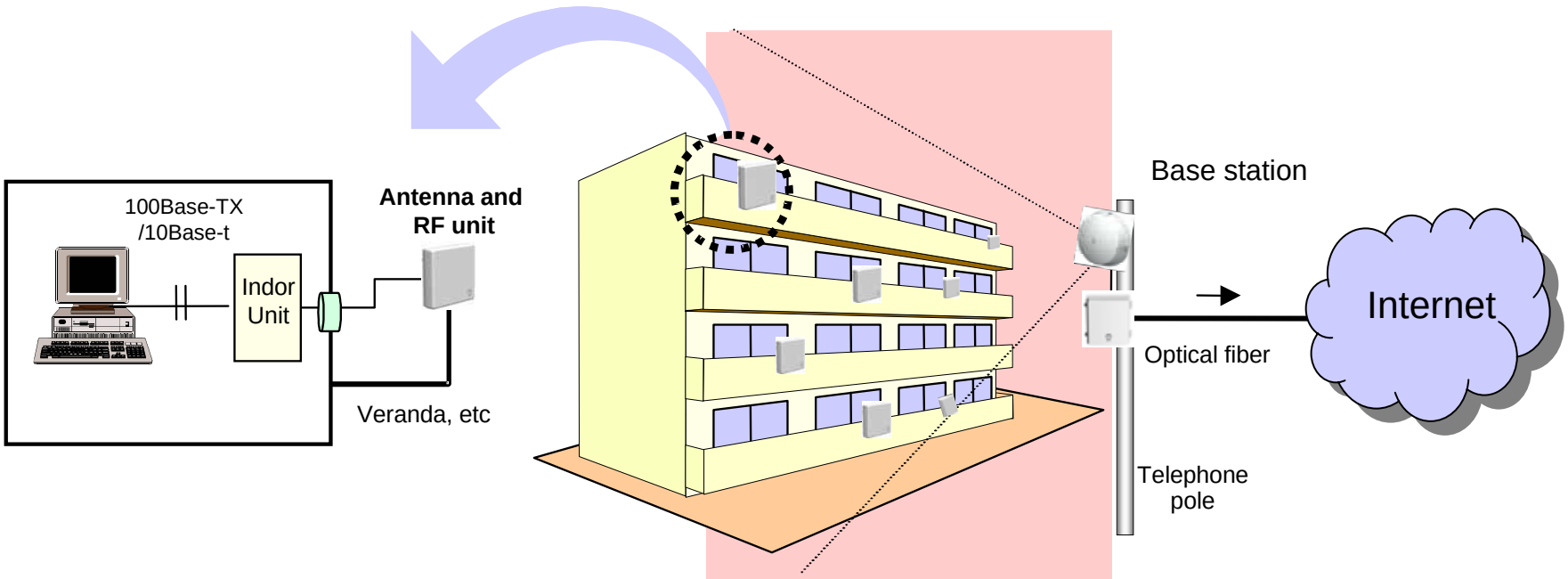
System Configuration	Point- to-point (ARIB STD-T58)	Point- to-multipoint (ARIB STD-T59)
Target	Corporate User	Residential User
Frequency Band	22, 26, 38 GHz	26, 38 GHz
Duplex	FDD	FDD, TDD
Access	———	TDMA, FDMA
Modulation	4PSK, 4FSK, 16 QAM or higher	GMSK, 4PSK, 16QAM or higher
Transmission Speed	~156 Mbit/s	Not specified
Transmission Power	~ 0.5W	

Activities of Quasi-millimeter and Millimeter FWA services in Japan

Company	Service menu (Bitrate)	P-P or P-MP	Starting date	Service areas
NTT East	Internet access (46Mbps max)	P-MP	2002.9	Eastern Japan (For apartment houses' users)
NTT West	Internet access (46Mbps max)	P-MP	2003.12	Western Japan (For apartment houses' users)
NTT Communications	Leased line (1.5-150Mbps)	P-P	2000.3	The main city in Japan
KDDI	Leased line (196kbps-150Mbps)	P-P	2000.7	Tokyo, Nagoya, Osaka, Fukuoka
BroadBand Com.	Leased line (-150Mbps)	P-P	2000.7	Hiroshima, Fukuoka, Okayama, Miyazaki, Kitakushu

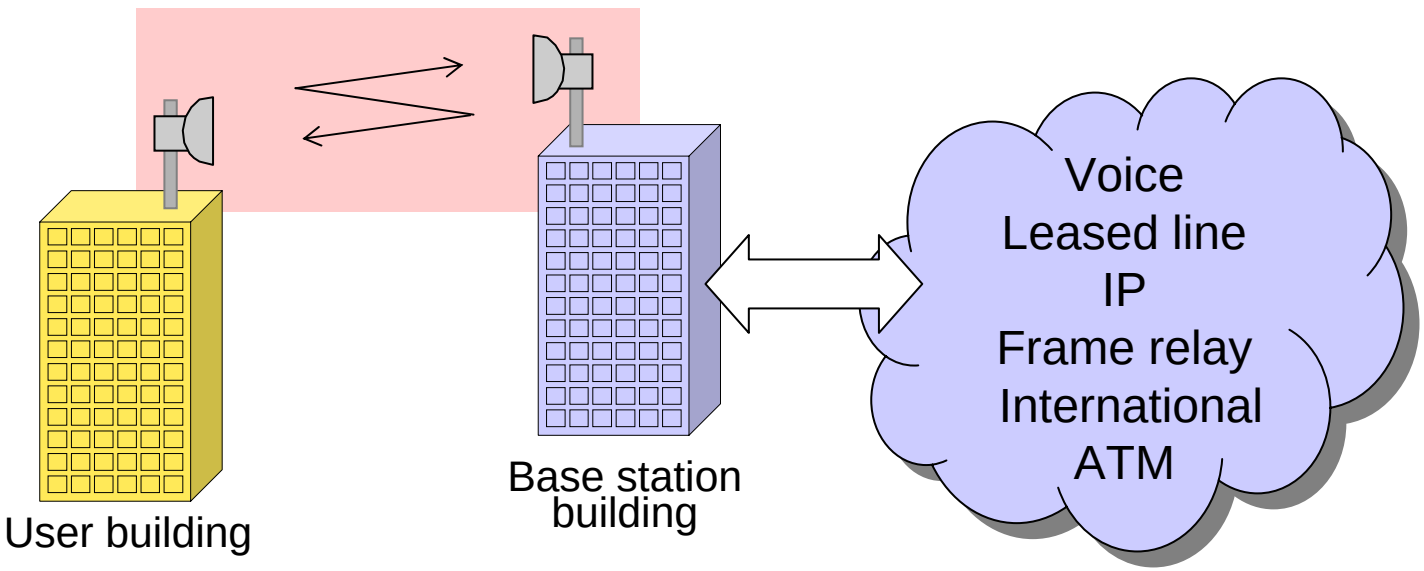
NTT East and West Service
- [B FLET'S wireless type] -

This is Internet best effort access service using FWA with 46Mbps speed (max) for a building, an apartment user.

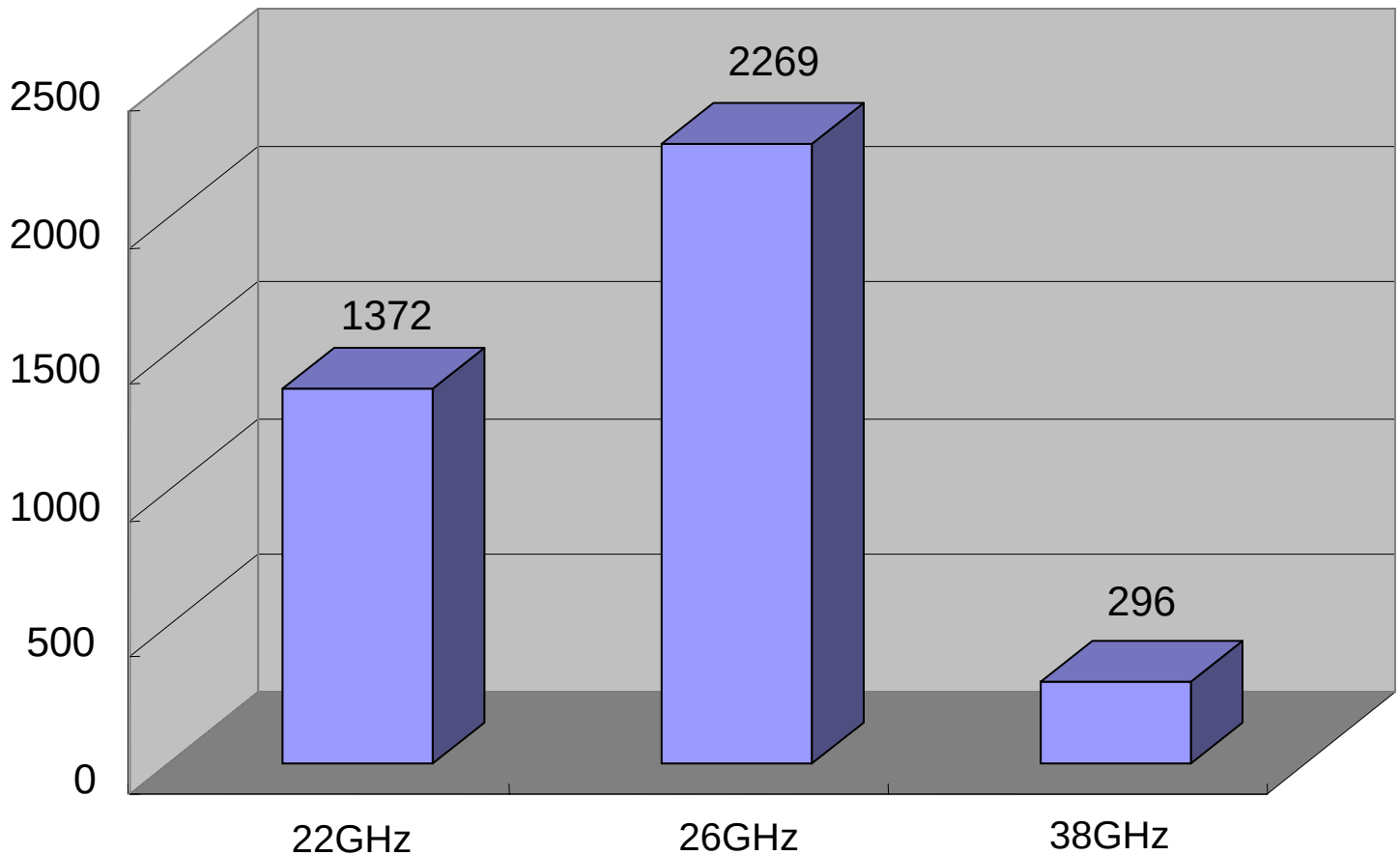


NTT Communications Service - [Airaccess] -

- Airaccess is a high-speed access line that connects a user's building to the backbone network.
- High performance by directly connecting base station building to user building.



Number of Radio Stations as of Dec. 2003 in Japan



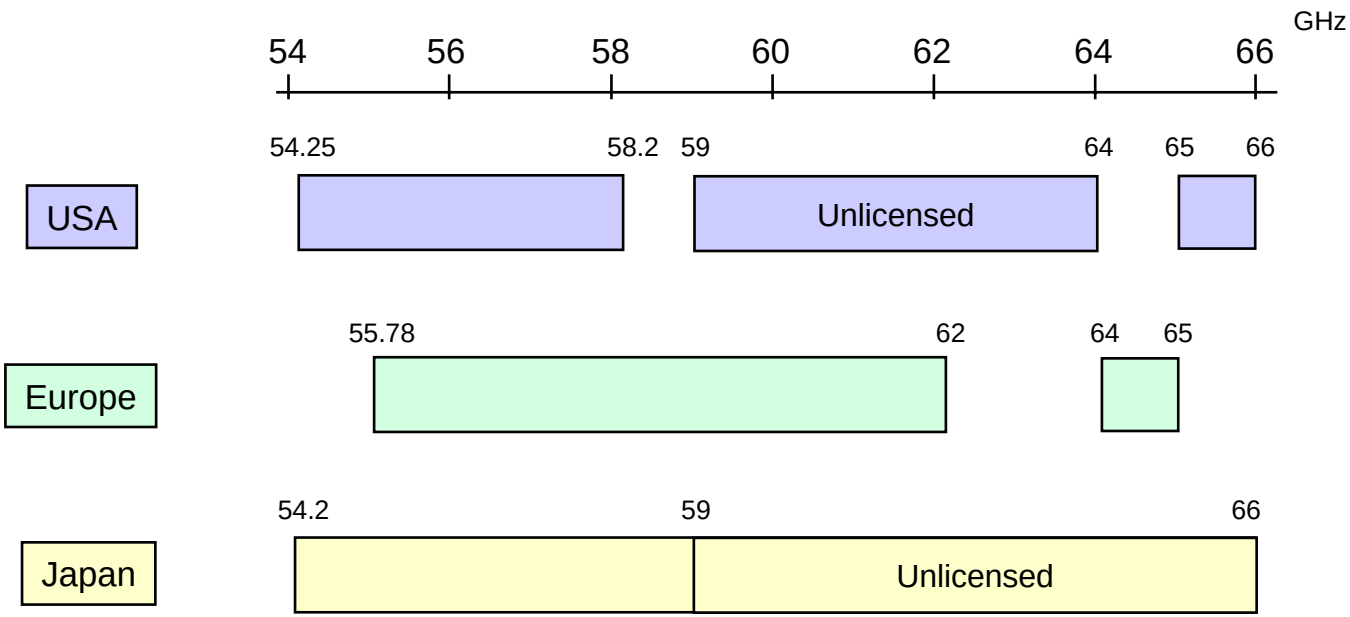
Standardization and Applications of 60GHz Band Fixed Wireless Access

Frequency Assignment of 60GHz Band in USA, Europe and Japan

USA : 54.25-58.2GHz, 59-64GHz, 65-66GHz

Europe : 55.78-62GHz, 64-65GHz

Japan : 54.2-66GHz

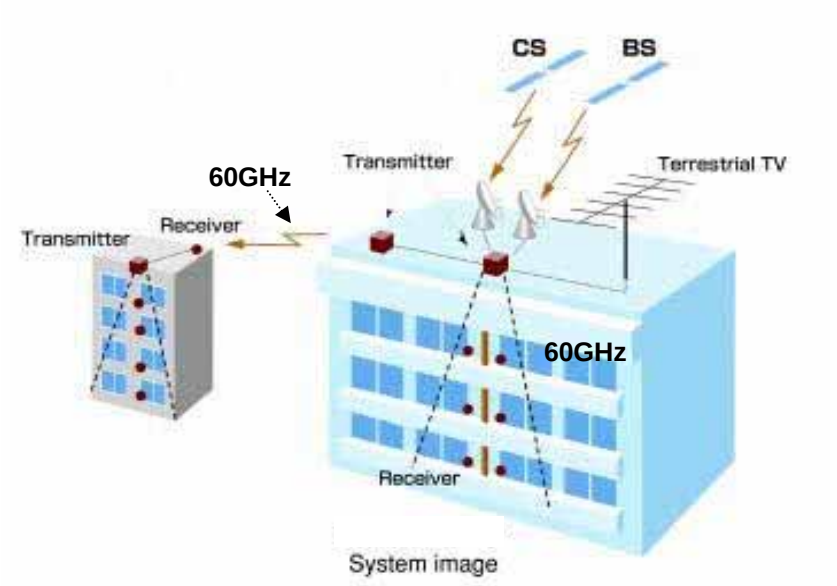


Technical Requirements for 60GHz Band FWA

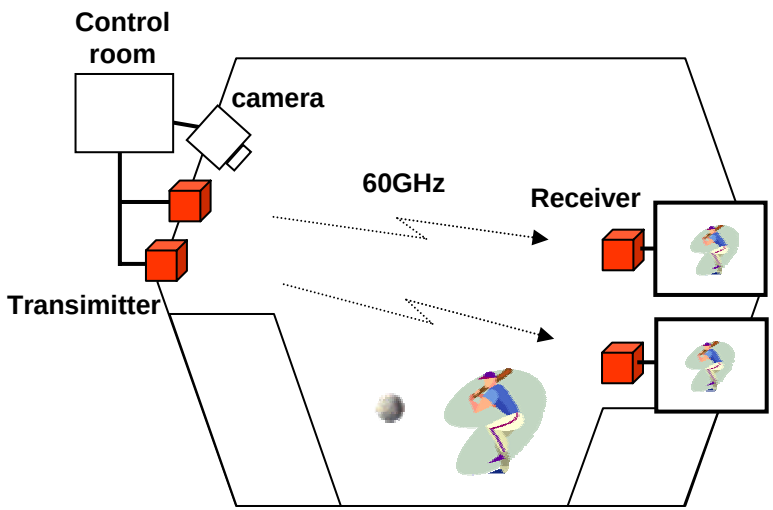
	Licensed	Unlicensed
Frequency (GHz)	54.25 - 59	59 - 66
Technical requirements	[Duplex method] Simplex, Broadcasting Full/Half duplex, FDD TDD etc. [Modulation] AM, FM, PM Combination possible [Tx power] Less than 100mW	[Housing condition] Transmitter is put in one housing that cannot be opened easily. [Tx power] Less than 10mW

Applications for 60GHz Band FWA

Vertical connected wireless link*1



Indoor video distribution system*2



Gigabit wireless link system*3

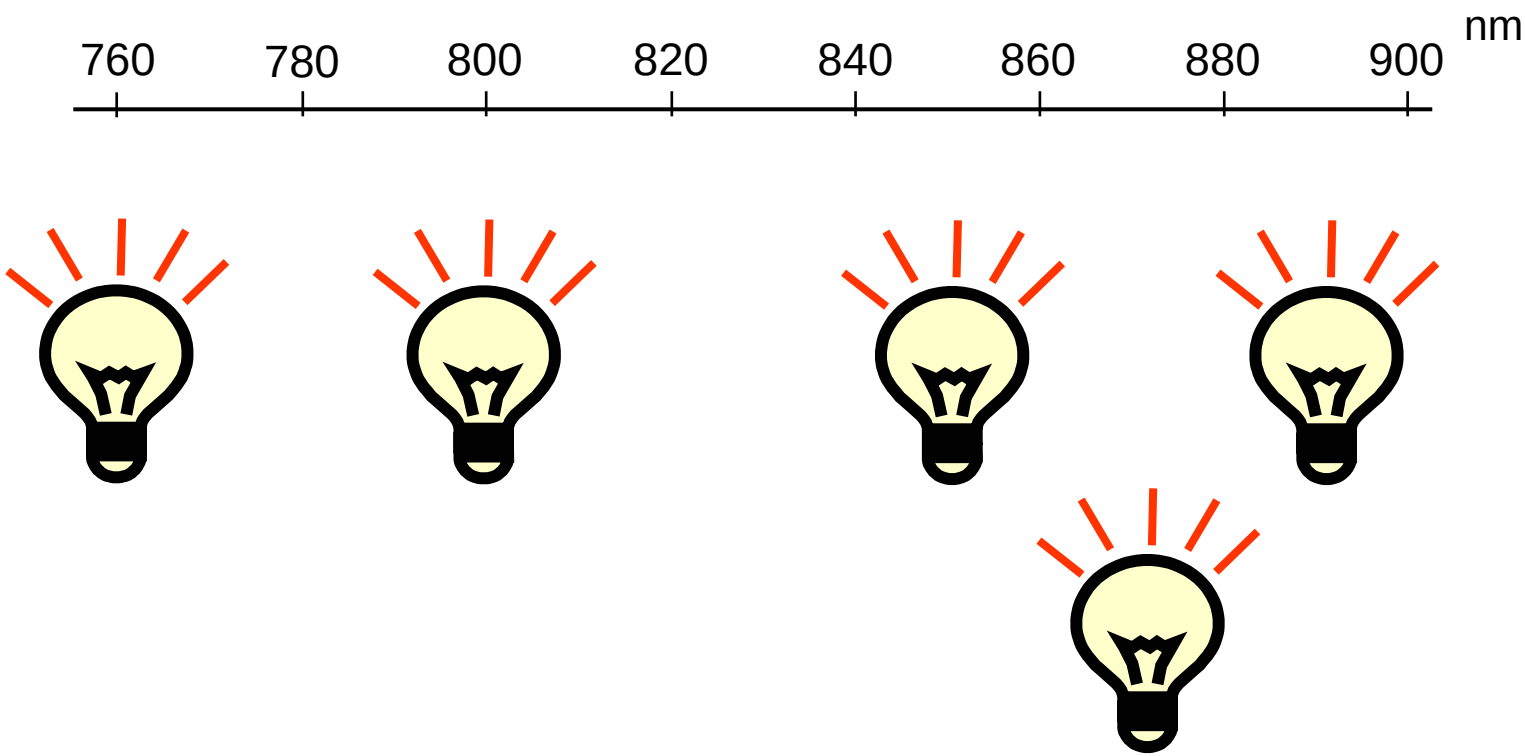
*1:http://www.scat.or.jp/news/newsh15/n030201.htm, *2: Y.Miyanaga, et.al. ,"Experimental of Video Distribution System in Indoor Athletic stadium using 60GHz millimeter-wave", Proceeding of The 2004 IEICE General Conference, SA-9-3, March 2004. *3: http://pcweb.mycom.co.jp/news/2002/11/28/20.html

Standardization and Applications of Infrared Wireless LAN

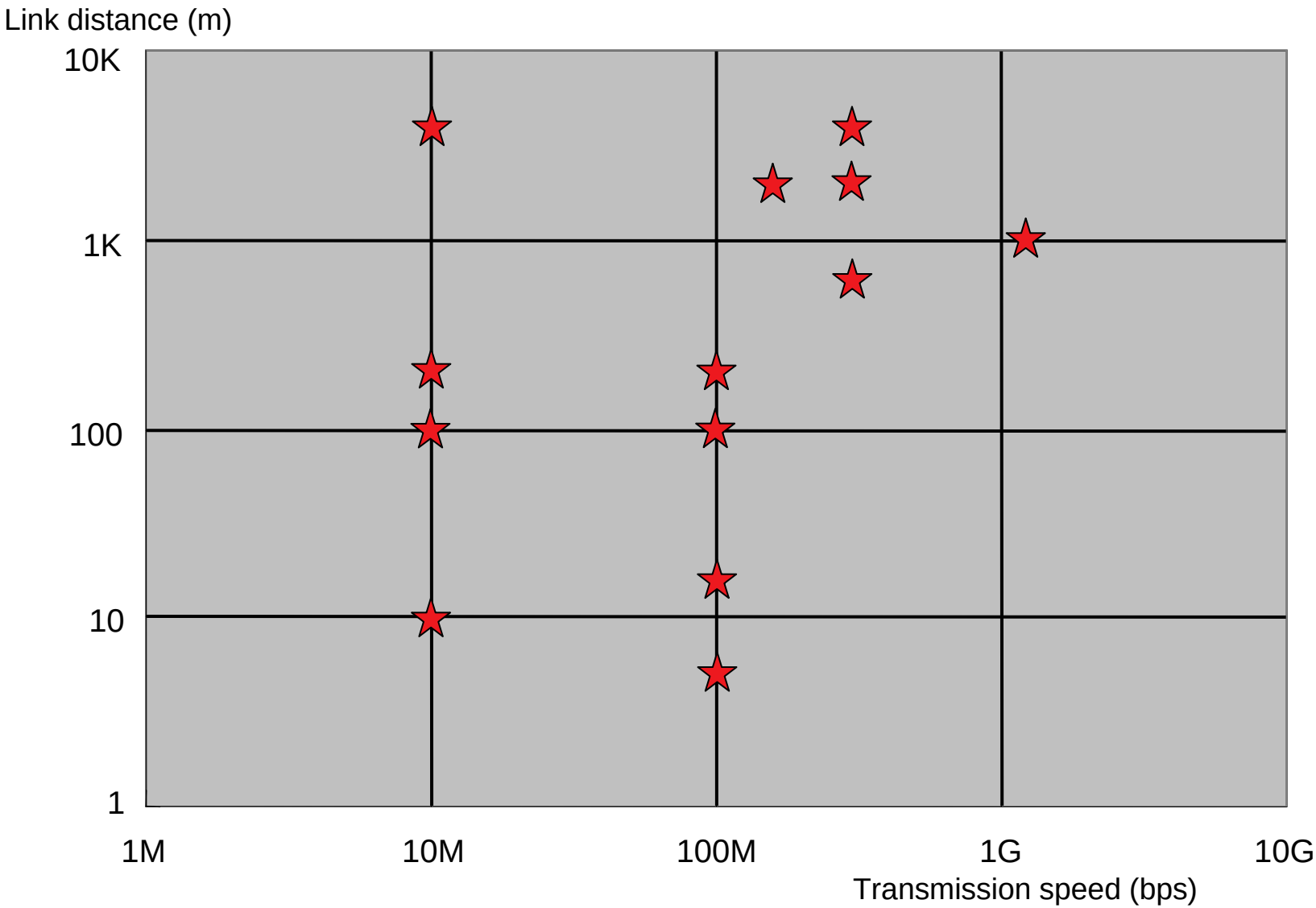
Technical Requirements for Infrared Wireless LAN

Transmission speed	10Mbps	100Mbps
Infrared transmission device	IRED, LD, etc	LED, LD, etc
Infrared receiver device	PD, etc	PD, APD, etc
Access method	CSMA / CD	
Modulation	Intensity modulation	
Link distance	1 - over 10m	
Transmission quality	BER < 10^{-8}	
Wavelength	680 - 1600nm	

Practical Wavelengths in Japan



Application field of Infrared Wireless LAN Systems



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