Wireless Communications for Vehicle Safety

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Yuji NAKAMURA

Land Mobile Communications Division, Radio Department

Ministry of Internal Affairs and Communications, Japan

Japan's Organizational Framework for the Promotion of ITS

The Strategic Headquarters for the Promotion of an Advanced Information and Telecommunications Network Society (IT Strategic Headquarters)
(Headed by the Prime Minister)

Four-Ministry Liaison Conference

National Police Agency (NPA)
Traffic Bureau

Ministry of Internal Affairs and Communications (MIC)
Telecommunications Bureau

Ministry of Economy, Trade and Industry (METI)
Manufacturing Industries Bureau

Ministry of Land, Infrastructure and Transportation (MLIT)
Road Bureau, Road Transport Bureau

〇 Japan ITS Promotional Conference (held in September 2004)

→ Joint effort by industry, academia, and government to develop the "ITS Promotional Guideline," taking ITS World Congress 2004 as an opportunity to develop the guideline.

Promotion Progress of ITS in Japan

February 1995 — The Advanced Information and Telecommunication Society Promotion Headquarters formulated **"Basic Guidelines on the Promotion of an Advanced Information and Telecommunications Society."**

⇒ ITS was clearly defined as a key priority to promote.

July 1996 — The five ITS-related ministries and agencies of the time (the National Police Agency, the Ministry of International Trade and Industry, the Ministry of Transport, the Ministry of Post and Telecommunications, and the Ministry of Construction) formulated **"Comprehensive Plan for Intelligent Transport Systems (ITS) in Japan."**

⇒ Compilation of plans including development of ITS, activities towards its implementation, and schedules

March 2001 — The Strategic Headquarters for the Promotion of an Advanced Information and Telecommunications Network Society (IT Strategic Headquarters) formulated the **"e-Japan Priority Policy Program."** based on the **"e-Japan Strategy."**

⇒ ITS was positioned as a priority IT policy to focus on.

June 2002	— **"e-Japan Priority Policy Program 2002."**	
July 2003	— **"e-Japan Strategy II."**	
August 2003	— **"e-Japan Priority Policy Program 2003."**	Formulated by IT Strategic Headquarters
June 2004	— **"e-Japan Priority Policy Program 2004."**	
February 2005	— **"IT Policy Package 2005."**	
January 2006	— **"New IT Reform Strategy."**	

September 2004 — Japan ITS Promotional Conference formulated **"ITS Promotional Guideline."**

October 2004 — **"11th ITS World Congress Nagoya, Aichi 2004."**

July 2005 — **ITS EXPO** in conjunction with the EXPO 2005 Aichi, Japan

"New IT Reform Strategy" (excerpts) [IT Strategic Headquarters, Jan. '06]

IT Policy Key Category 1

Fostering IT Structural Reform
Resolution of IT-related issues encompassing Japanese society

- Healthcare structural reform through IT

- IT-driven environmentally friendly society

- World-renowned safe and secure society

- **World's safest road transport society**
  Prevent proactively traffic accidents with ITS

- World's most convenient and efficient e-administration

- Strengthen corporate competitiveness through establishment of IT management

- Meaningful existence throughout one's life

IT Policy Key Category 2

Establishment of IT Infrastructure
Support the IT structural reform in providing an infrastructure for the ubiquitous network society

- IT society stemming from universal design

- Establishment of a digital divide-free infrastructure free

- World's safest IT society

- Capacity building in anticipation of next-generation need

- Development of advanced world-class IT personnel

- Promotion of R&D that will form the basis of the next-generation IT society

To the rest of the World
Sharing Japan's ICT structural reform efforts with the rest of the World and making international contributions

- Boast Japan's presence in the international competitive society

- International contributions by providing problem-solving models

3

The world's safest road traffic environment

Targets:

Cut the number of traffic fatalities and serious injuries by creating **safe driving support systems** that cooperate with traffic infrastructure.

Policies:

1. **Form a collaborative committee in early fiscal 2006** to work towards the realization of safe driving support systems.

2. **Conduct large-scale verification testing of safe driving support systems on some regional public roads by fiscal 2008**.

3. **Start deployment of safe driving support systems throughout the country** with a focus on sites where traffic accidents occur frequently and **promote the widespread use of On Board Units that are compatible with those systems from fiscal 2010**.

4. **Develop the technologies necessary for interactive communications systems for pedestrians, roads, and vehicles by fiscal 2010**.

"Society with World's Safest Road System"

　　Implementation of safe driving support systems"

　　Smooth transportation through use of

(1) Implementation of safe driving support systems

Reduce the number of traffic accident fatalities and traffic accidents through the implementation of safe driving support systems that cooperate with infrastructure.

[Concrete policies]

(1)　Promotion of comprehensive approach to implementing the safe driving support system

　　　(Cabinet Secretariat (CS), NPA, Ministry of Internal Affairs and Communications (MIC), METI, MLIT)

　Promote the following approach, which will contribute to the establishment of the elements and system in 2006, for realizing the implementation of safe driving support systems

(i)　　Promotion of a Driving Safety Support System (DSSS) using communications between road infrastructure and vehicles　NPA

(ii)　　Promotion of Advanced Cruise-Assist Highway System (AHS) (MLIT)

(iii)　　Promote development and spread of Advanced Safety Vehicle (ASV) (MLIT)

(iv)　　Promote development and spread of telecommunications systems (MIC)

(2)　Promote technical development of Safe Driving Support Systems

　　　(NPA, MIC, METI, MLIT)

(3) Smooth transportation through use of ITS

Bring about smooth transportation through provision of accurate road traffic information to drivers and optimization of traffic demand, reducing both the environmental burden and risk of traffic accidents.

(1) Promoting provision of road transport information

(i) Promote provision of advanced road transport information (NPA, MIC, METI, MLIT)

In 2006, industry, academia and the government join forces to study a service for providing road and transport information that collects and uses data (probe data) from cars using VICS devices to provide more advanced road and transport information.

A probe for collecting data from cars is also studied using various media such as mobile telephones, etc.

(2) Promotion of optimized transport demand

Promote spread of ETC

Promotion of "New IT Reform Strategy" and "Priority Policy Program 2006"

[New Council]

April 2006 - Based on the "New IT Reform Strategy", the **"ITS Promotion Council"** was established to plan large-scale verification tests and to discuss direction of future safe driving support systems.

The participating members are:

- 4 ITS-related agencies/ministries (NPA, MIC, METI, MLIT), Cabinet Secretariat
- Nippon Keidanren (Japan Business Federation), ITS Japan

Working group set up to develop concrete testing plans, etc.

[members]   4 ITS-related agencies/ministries (NPA, MIC, METI, MLIT), Cabinet Secretariat,

Nippon Keidanren (Japan Business Federation),

ITS Japan,

ITS Japan's "J-safety Committee" steering members (Toyota Motors, Nissan Motors,

Honda, Hitachi, OKI Electric Industry)

[Research Schedule]

2007   :   Pilot testing

2008   :   Large-scale verification testing of safe driving support systems on some regional public roads

2010   :   Start deployment of safe driving support systems nationwide and promote diffusion of

On Board Units

ITS Initiatives taken by MIC

Research and Development

- Ubiquitous ITS R&D project, launched FY2005, funded by NICT operating expenses grants, expected to run for a period of three years

- Vehicle-to-vehicle and vehicle-to-road communication technology, ITS application of terrestrial digital broadcasting, \700 million in 2005/\680 million in 2006

- ITS applications of RFID systems

Standardization Activities

Locally developed ITS technology submitted to ITU for consideration. Several ITU recommendations (including VICS, DSRC and millimeter wave on-board radar) have already been formulated. Focus now shifts to standardization of next-generation millimeter-wave ITS telecommunications technology.

Legislation and Regulation

VICS (FM multiplex broadcasting and radio beacons) --> enacted 1994

ETC --> enacted 1997   DSRC --> enacted 2001

60 GHz low-power millimeter-wave radar --> enacted 1995

76 GHz low-power millimeter-wave radar --> enacted 1997

Support for Private-Sector Initiatives

Support for ITS Info-Communications Forum (Secretariat = ARIB)

Others

ITS discussion in Study Group for Wireless Broadband Promotion (final report December 2005)

Study by the Information and Communications Council on "Efficient Radio Spectrum Usage in the VHF/UHF bands".
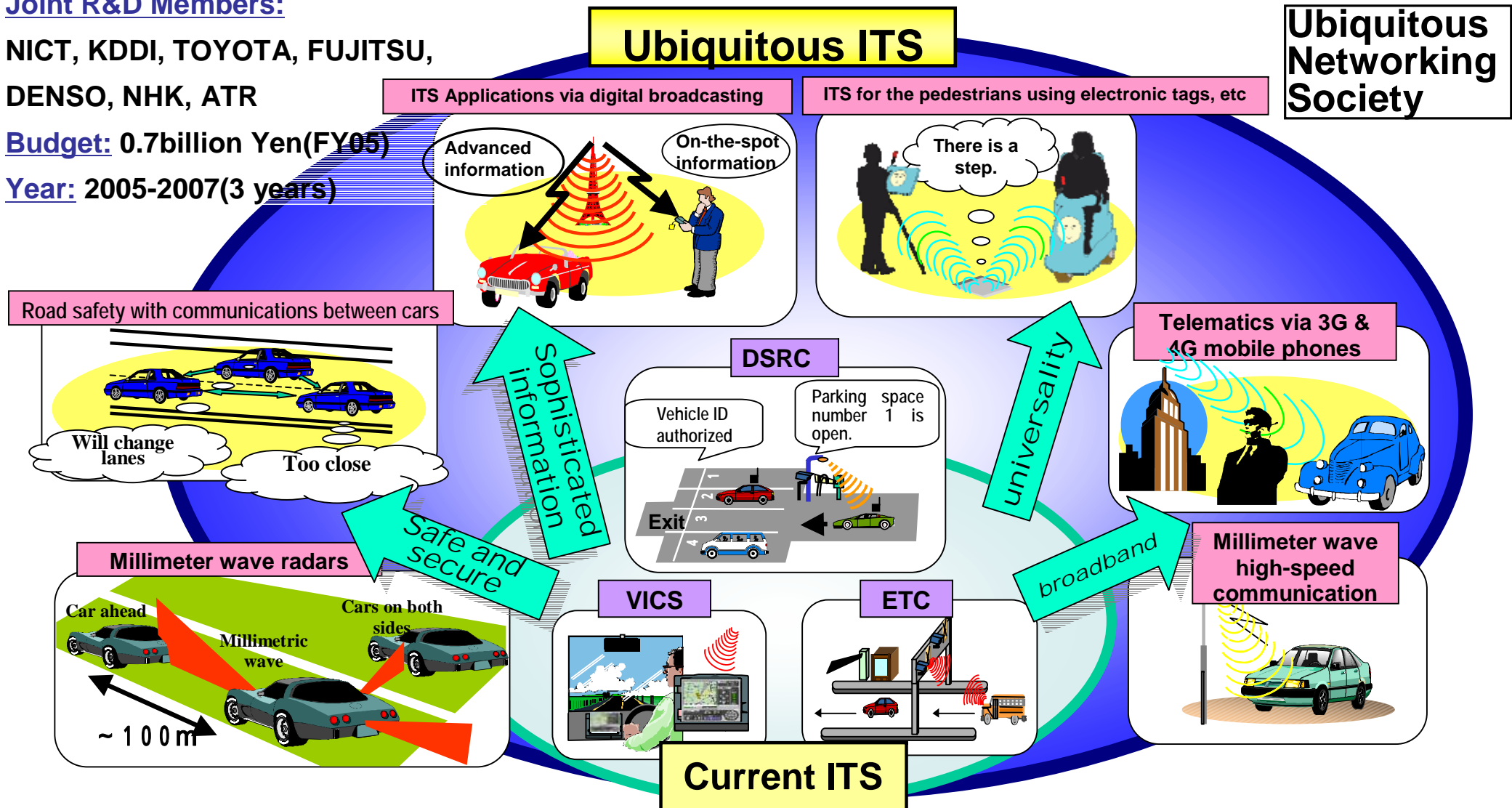
R&D Project Toward Ubiquitous ITS

"Ubiquitous ITS" where anyone can enjoy any information, anytime, anywhere and without any special operation, will realize a safe and secure transportation society where anyone can move comfortably and freely.

Joint R&D Members:

NICT, KDDI, TOYOTA, FUJITSU, DENSO, NHK, ATR

Budget: 0.7billion Yen(FY05)

Year: 2005-2007(3 years)

Ubiquitous Networking Society

Ubiquitous ITS

ITS Applications via digital broadcasting

Advanced information

On-the-spot information

ITS for the pedestrians using electronic tags, etc

There is a step.

Road safety with communications between cars

Will change lanes

Too close

Sophisticated information

DSRC

Vehicle ID authorized

Parking space number 1 is open.

Exit

universality

Telematics via 3G & 4G mobile phones

Safe and secure

Millimeter wave radars

Car ahead

Millimetric wave

Cars on both sides

VICS

ETC

broadband

Millimeter wave high-speed communication

Current ITS

International Standardization of ITS Radiocommunications

ITU-R SG8 Working Party 8A(WG2)

(Question ITU-R 205-3/8 and ITU-R 51-3/8)

Elements of ITS
Overall objectives of ITS
Radio-based ITS service
Spectrum requirements
Interconnect requirements
Technical specifications
Definition of "telematics"

Automatic determination of location and guidance

ITU Recommendations on ITS

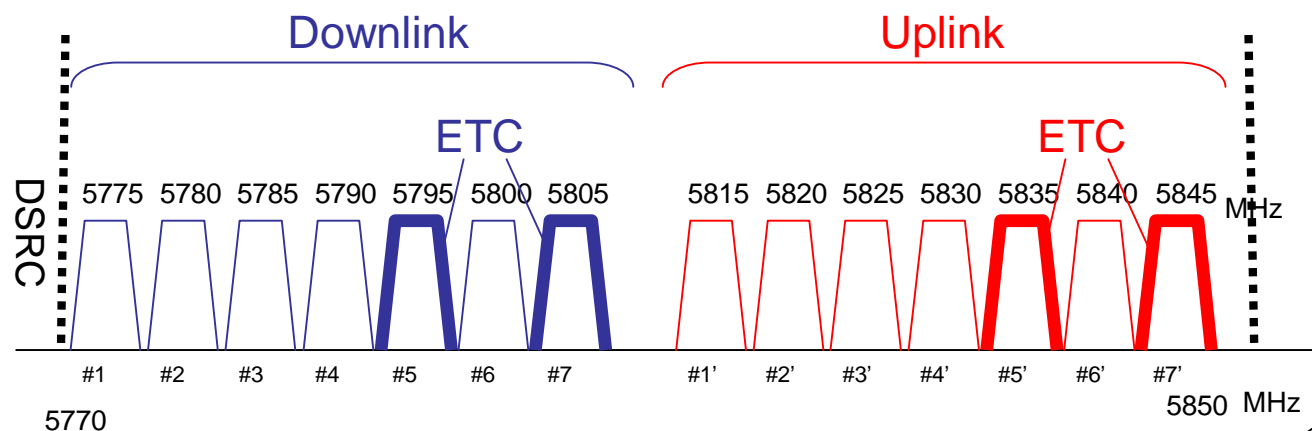| 1998	M.1310	Objectives and Requirements
2000	M.1451	Functionalities
2000	M.1452	Short Range Rader (60/76GHz)
2000	M.1453	5.8GHz DSRC
2002	M.1453-1	5.8GHz DSRC Revised
2005	M.1453-2	5.8GHz DSRC Application Sub Layer

New Services using DSRC System
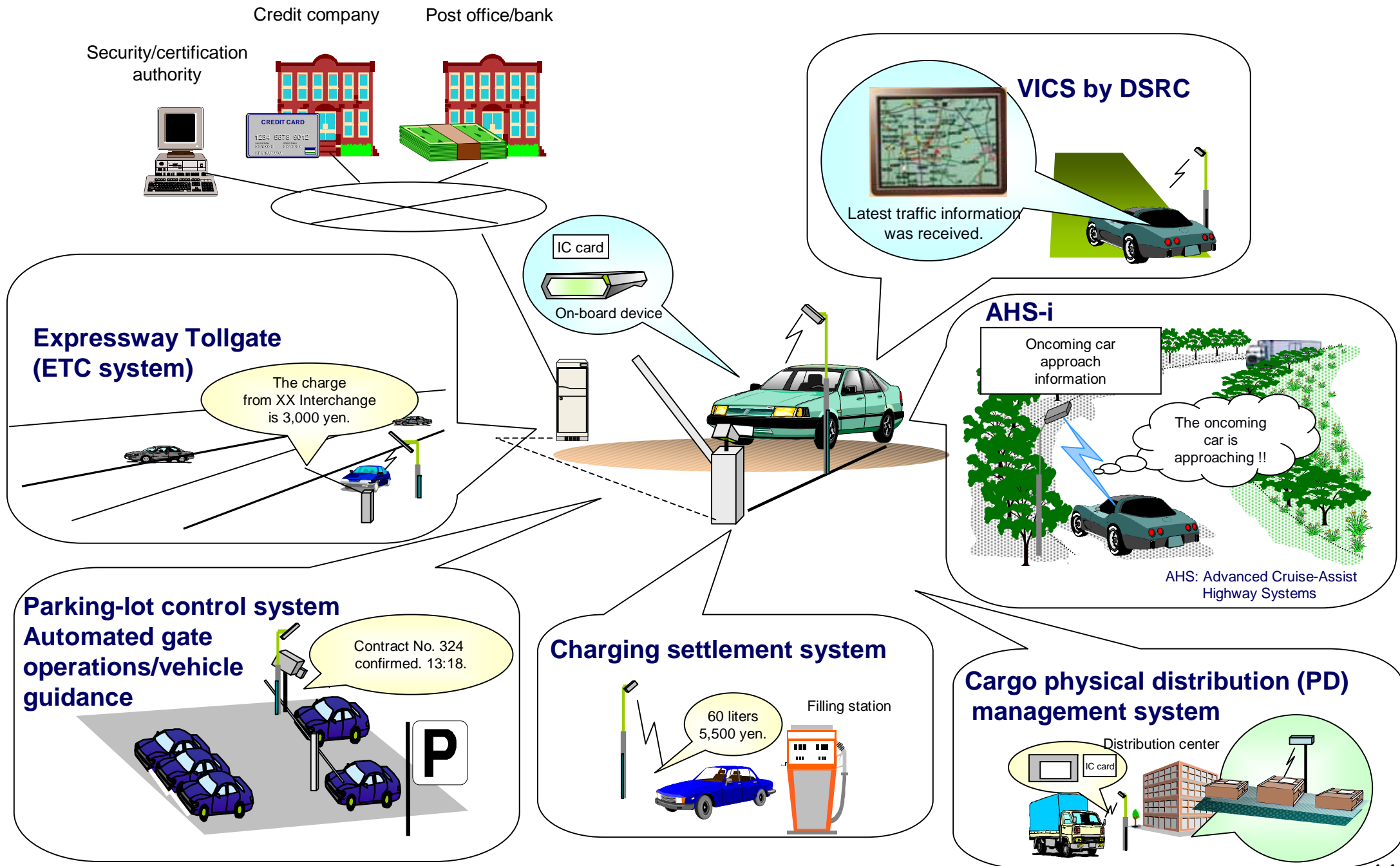
Technical Specifications of DSRC in Japan

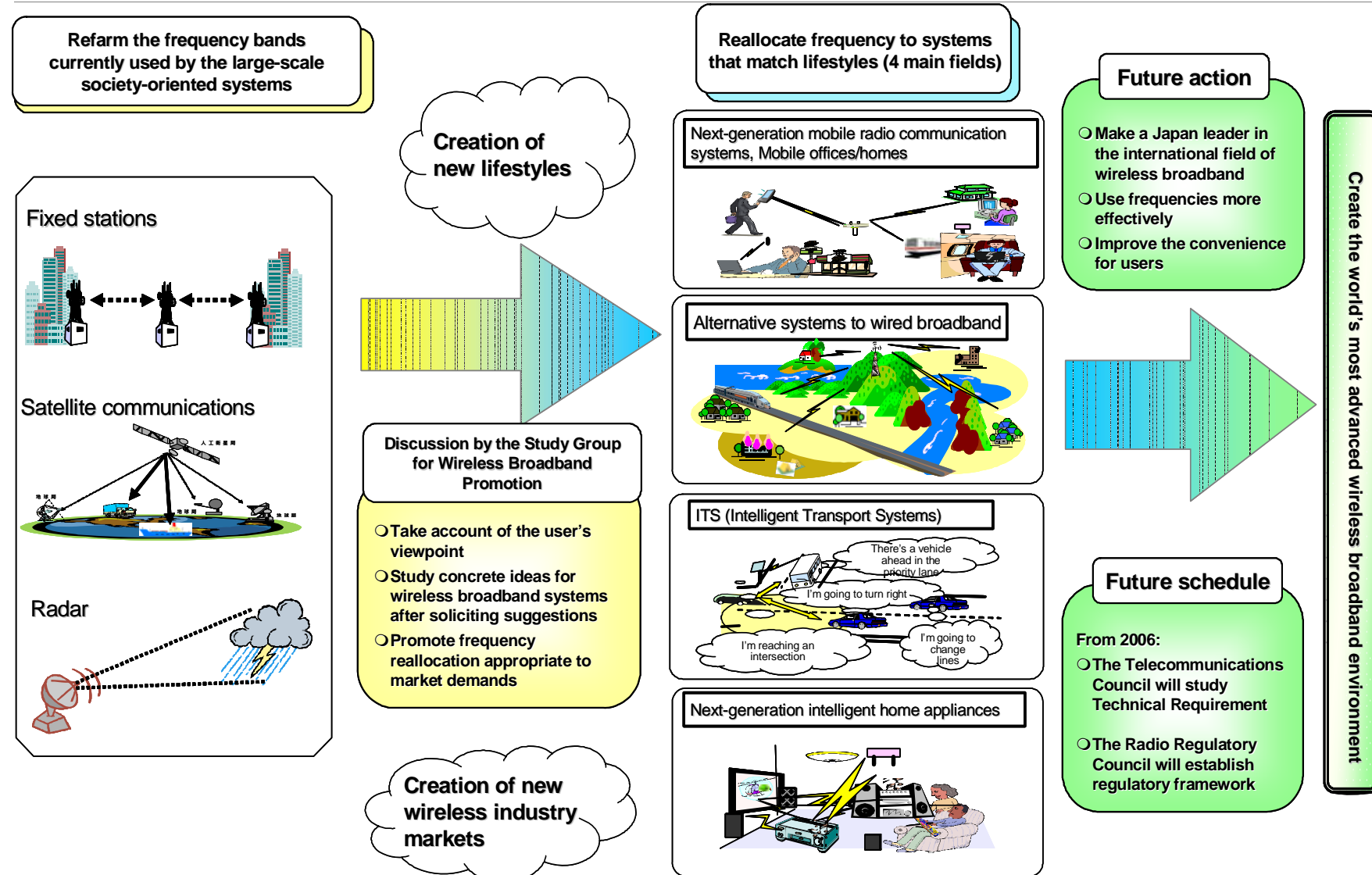|	DSRC	
Frequency band	**5.8GHz band**	
System	**Active system**	
Occupied bandwidth	**4.4MHz**	
Channel –Downlink	7	
– Uplink	7	
Modulation	ASK,QPSK (ETC ; ASK only)	
Data rate	1Mpbs/ASK 4Mbps/QPSK (ETC ; 1Mbps only)	
Communication	TDMA/FDD	
Maximum Power supplied to Antenna	Base Station	Mobile Station
	300mW	10mw

Characteristics of DSRC
- High data rate
- Suitable for rapid movement
- Suitable for multiple lanes

Downlink

Uplink

ETC

ETC

DSRC

5775 5780 5785 5790 5795 5800 5805   5815 5820 5825 5830 5835 5840 5845 MHz

#1 #2 #3 #4 #5 #6 #7   #1' #2' #3' #4' #5' #6' #7'

5770

5850 MHz

Study Group for Wireless Broadband Promotion

Overview of the Study Group for Wireless Broadband Promotion

Refarm the frequency bands currently used by the large-scale society-oriented systems

Reallocate frequency to systems that match lifestyles (4 main fields)

Fixed stations

Satellite communications

Radar

Creation of new lifestyles

Discussion by the Study Group for Wireless Broadband Promotion

○ Take account of the user's viewpoint
○ Study concrete ideas for wireless broadband systems after soliciting suggestions
○ Promote frequency reallocation appropriate to market demands

Creation of new wireless industry markets

Next-generation mobile radio communication systems, Mobile offices/homes

Alternative systems to wired broadband

ITS (Intelligent Transport Systems)

There's a vehicle ahead in the priority lane
I'm going to turn right
I'm reaching an intersection
I'm going to change lines

Next-generation intelligent home appliances

Future action

○ Make a Japan leader in the international field of wireless broadband
○ Use frequencies more effectively
○ Improve the convenience for users

Future schedule

From 2006:
○ The Telecommunications Council will study Technical Requirement
○ The Radio Regulatory Council will establish regulatory framework

Create the world's most advanced wireless broadband environment

This study group mainly aimed at developing the world's most advanced wireless broadband services environment and providing concrete measures for frequency reallocation. We discussed the following issues openly, as well as at an industry-wide level.

Study of developments in both domestic and international wireless broadband services
Identification of future wireless broadband usage and market
Identification of challenges in wireless broadband promotion, examination of measures for promotion, etc.

Summary of New Systems and Proposed Frequency Bands

○ Next-generation mobile radio communication systems, Mobile offices/homes

- Radio communications that enable users to communicate wherever they are, without awaking to where the service is available.
- Radio communications that ensure the required quality of communications.

  Example systems: Cellular phones (Enhanced 3G, 4G offering 100Mbps transfer rates even when on the move)

  Proposed frequency bands: Enhanced 3G : 800Mhz band, 1.5*, 1.7, 2.0 and 2.5GHz bands

  4G : 3.4-4.2GHz band, 4.4.-4.9GHz band

  * Proposed by "the Action Plan for Spectrum Reallocation"
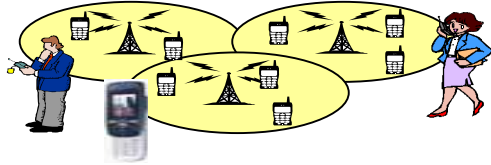
- Radio communications that have continuous access to the Internet at anytime upon request.
- Radio communications that can be used in conjunction with Cellular phones and Wireless LANs,etc.

  Example systems: Broadband mobile wireless access (BMWA) that supports continuous IP connection (WiMAX (IEEE 802.16e), Next-generation PHS (Personal Handyphone System), etc.)

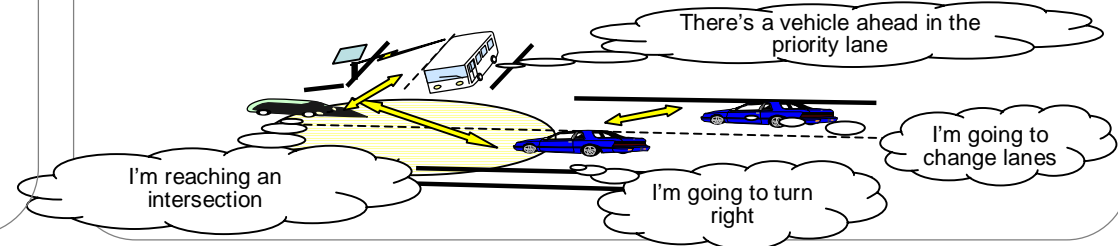 Proposed frequency band: 2.5GHz band
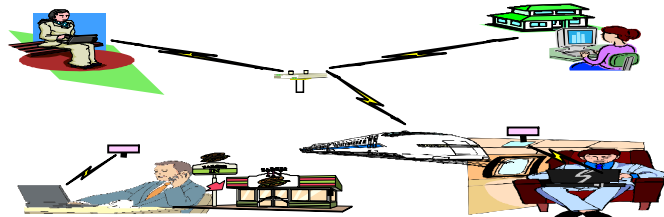
○ Alternative systems to wired broadband

- Radio communications that can provide network at lower costs within areas not suitable for wired broadband such as rural area.
- Radio communications that use the systems based on international standards or those used in urban areas will be deployed in rural areas, with respect for costs.

  Example systems: FWA that can be used under the Non-Line-of-Sight (WiMAX (IEEE 802.16-2004), iBurst, Advanced DS-CDMA, etc.)

  Proposed frequency bands: 1.5 and 2.5GHz bands (rural use of frequency bands used by mobile radio communication systems in urban areas)

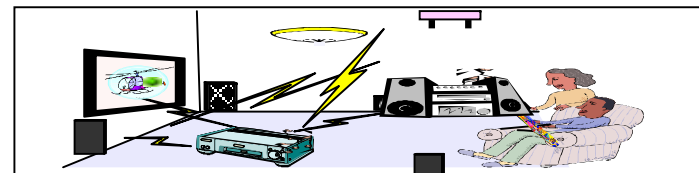 4.9-5.0GHz band (frequency band available for registration) etc.

○ ITS (Intelligent Transport System)

- Radio communications that can establish ad-hoc radio communications instantly.

  Example systems: Advanced ITS that reduce the road accidents

  Proposed frequency bands: Vehicle-to-Vehicle communications: VHF and UHF bands, etc.
  Road-to-Vehicle communications: 5.8GHz band (expand the current frequency band) etc.
  Millimeter-wave radar to identify obstructions on the road: 78-81GHz band

There's a vehicle ahead in the priority lane

I'm reaching an intersection

I'm going to turn right

I'm going to change lanes

○ Next-generation intelligent home appliances, Home networks

- Short-range radio communications that can establish interconnection more easily than wired communications

  Example system: Next-generation intelligent home appliances

  Proposed frequency band: 5GHz band (joint use with wireless LANs, enhanced WiFi system, etc.)

14

Efforts for ITS for Safety and Security

car in front

car on the right

car on the left

Wireless communication that construct ad hoc wireless communication networks instantaneously and to determine the distance.
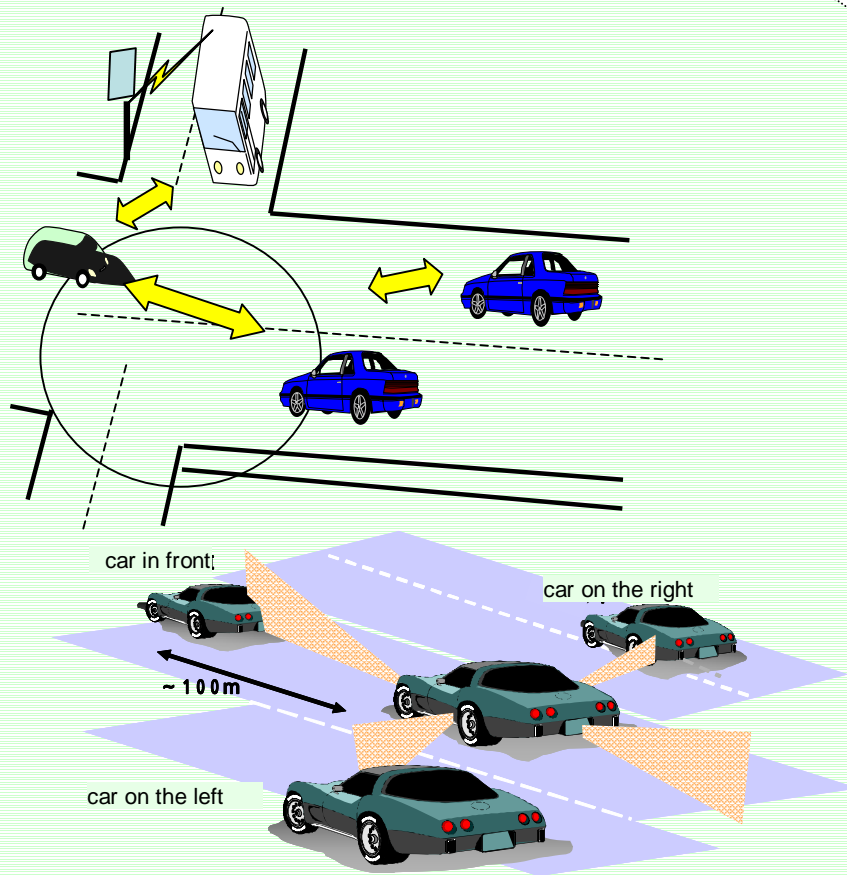
Overview

Vehicle-to-Vehicle communication system and road-to-Vehicle communication system.
Millimeter wave radar system to sense the distance between vehicles or vehicle and obstacles.

Proposed Frequency band

VHF/UHF bands for vehicle to vehicle communication

5.8GHz bands for road to vehicle communication

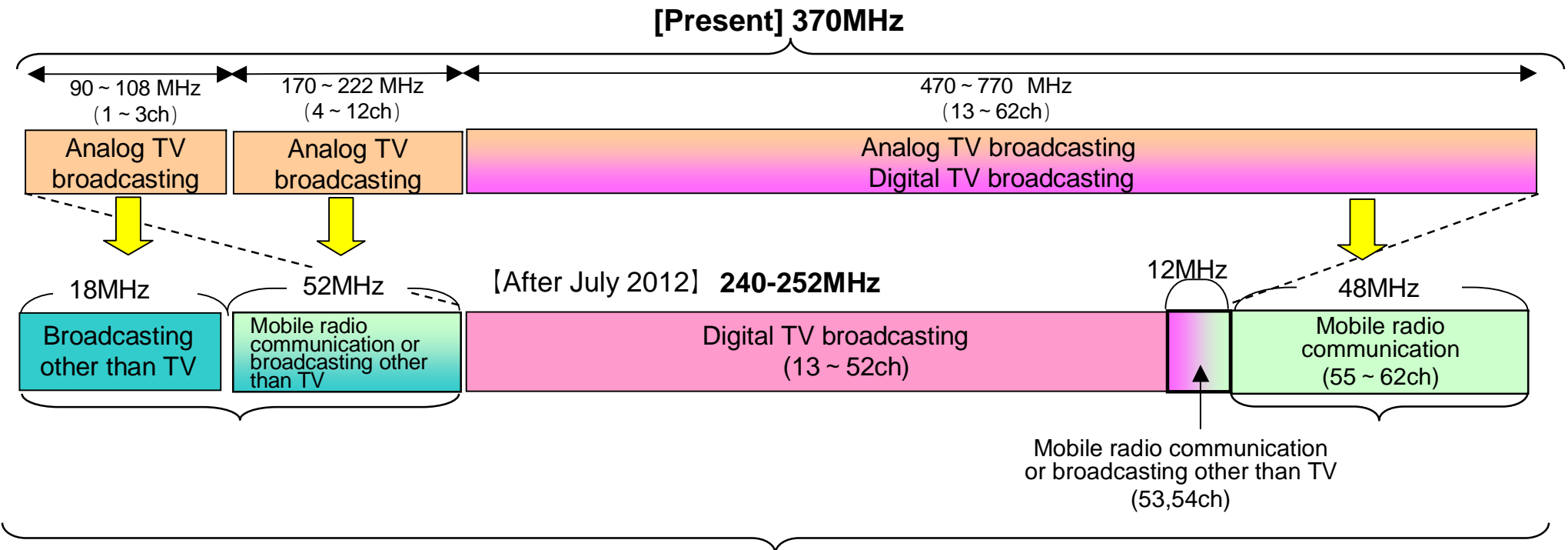78-81GHZ bands for millimeter-wave radar using 79GHz band

Future Efforts

Execute a ubiquitous ITS R&D that organically connects vehicles, roads, and people so that information can be used without any special operations anytime, anywhere, by anyone and with anything.

Execute a large scale demonstration experiment on a support system for safe driving under the cooperation of public and private sectors. (FY08)

Promote efforts to realize a safe driving support system (FY10)

Consideration on strategies for efficient radio spectrum usage in the VHF/UHF bands

Currently, terrestrial TV broadcasting uses radio spectrum from channel 1 to 62 in the VHF/UHF bands, which amounts to a bandwidth of 370MHz. Digital TV broadcasting is deployed in the UHF band among these bands.

[Present] 370MHz

90　108 MHz
1　3ch

170　222 MHz
4　12ch

470　770　MHz
13　62ch

Analog TV broadcasting

Analog TV broadcasting

Analog TV broadcasting
Digital TV broadcasting

18MHz

52MHz

After July 2012　**240-252MHz**

12MHz

48MHz

Broadcasting other than TV

Mobile radio communication or broadcasting other than TV

Digital TV broadcasting
(13　52ch)

Mobile radio communication
(55　62ch)

Mobile radio communication
or broadcasting other than TV
(53,54ch)

Issue to be considered: Develop specific plans for the use of radio spectrum amounting to 130MHz
which will be open for reallocation by digitalization of terrestrial TV broadcasting.

March 2006	MIC consulted for Information and Communications Council for "technical conditions for efficient radio spectrum use"
April 2006	Invite proposals from the public on radio systems that can be introduced in the VHF/UHF bands (March 27 to April 27)
	MIC received as many as 181 proposals from 100 institutions and individuals.
	Based on the proposals, consider technical conditions for efficient radio spectrum use, including conditions for sharing radio spectrum between different services, such as mobile service and broadcast auxiliary service
June 2007	A partial report is expected on "technical conditions for efficient radio spectrum use in the VHF/UHF bands"