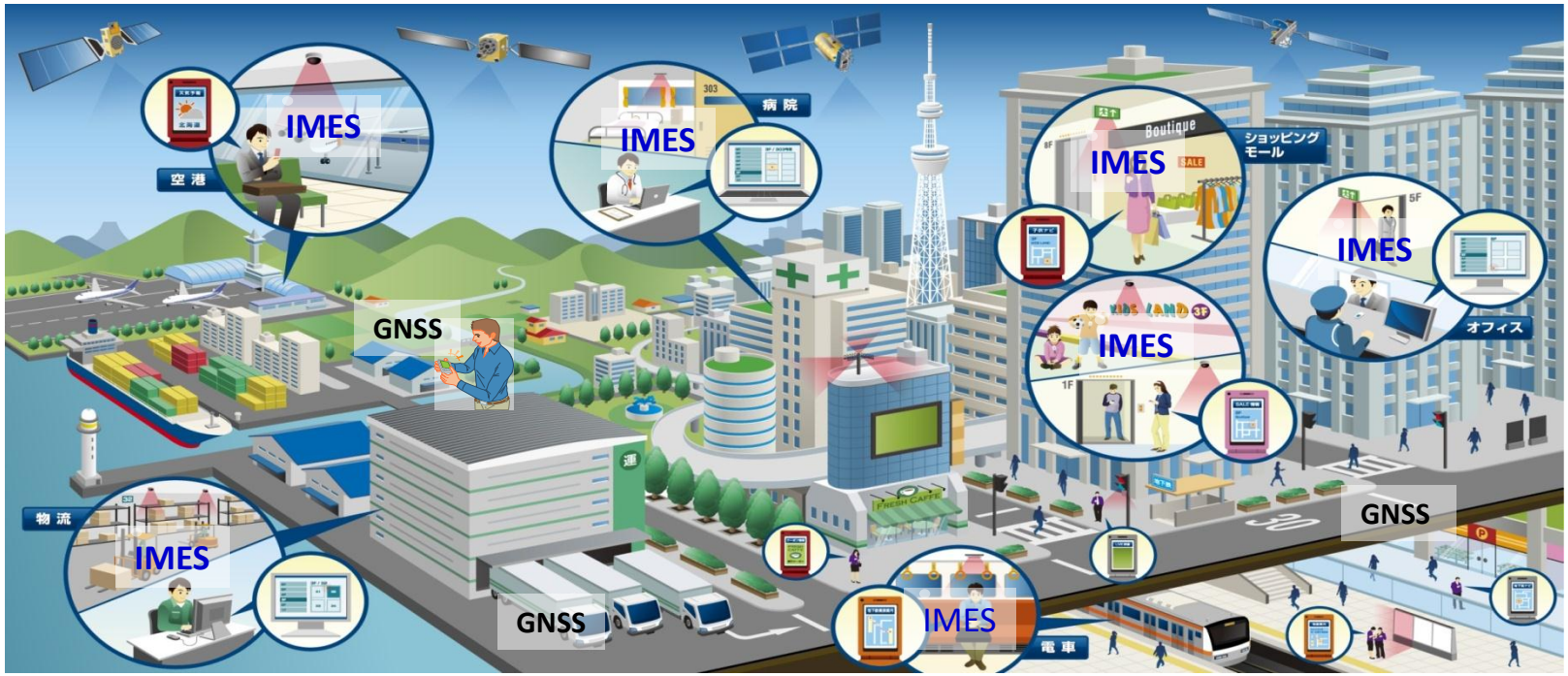
IMES: The Ultimate Solution for 3-D Indoor Position



Dinesh Manandhar

GNSS Technologies Inc., Japan

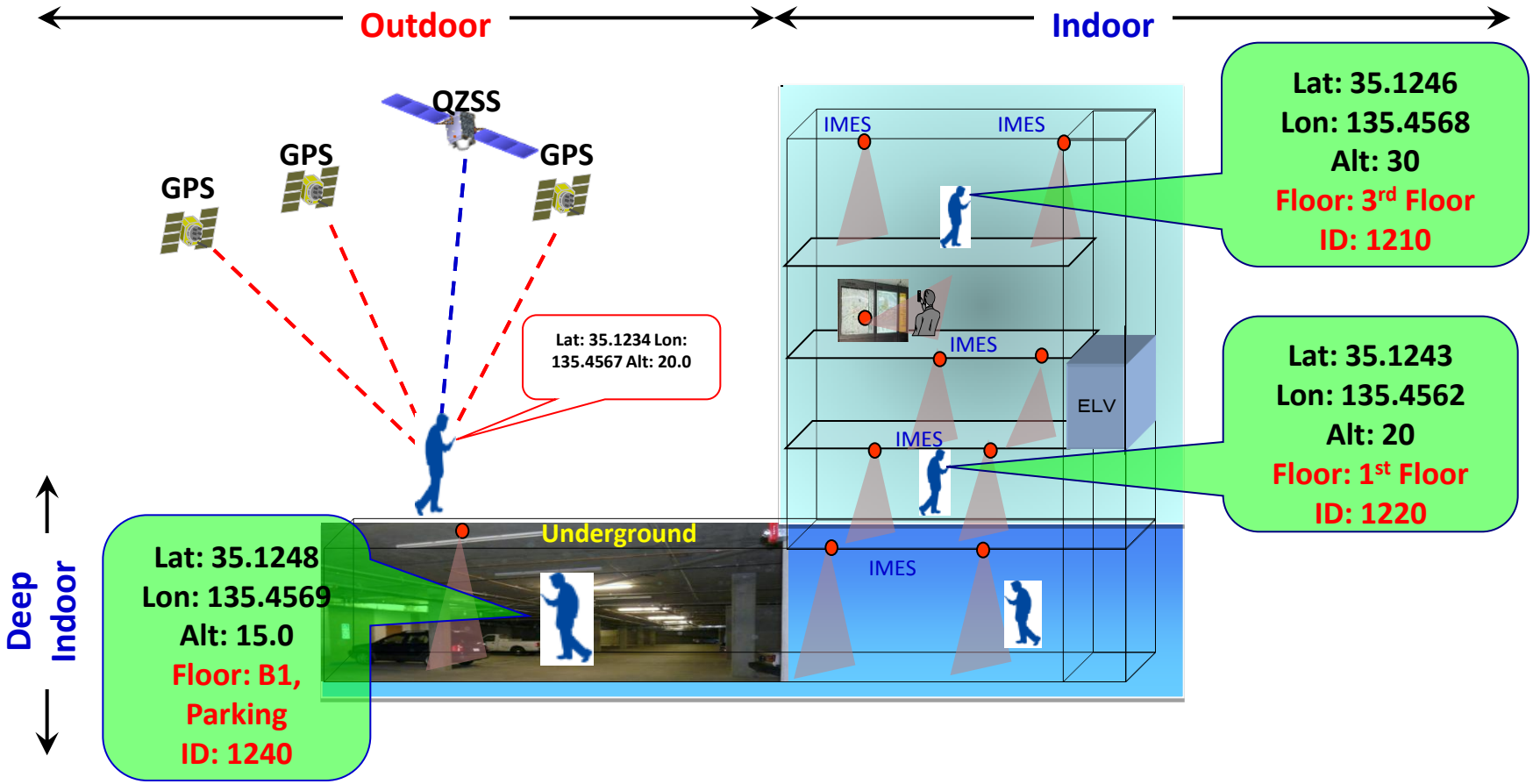
3rd Invitational Workshop on Opportunistic RF Localization for Next Generation Wireless Devices
Co-located with Geo-location and emergence of indoor applications

May 7, 2012, New Orleans, LA, USA

Characteristics of IMES

- Same Signal Structure as GPS/GNSS
  - Replace NAV Data by Position Information: LLH and Floor ID
  - Compatibility with GPS Receiver
- Seamless Navigation
- No Need to Compute Pseudorange
- No Additional Power Consumption at the Receiver
- No Change in Receiver Hardware
- One Tx. Unit provides 3-D Position Data
- Provide Stable Accuracy
- No Clock Synchronization at the Transmitter

Seamless 3-D Navigation



Use GNSS Receiver for both Outdoors and Indoors

GPS vs. IMES Signal Structure

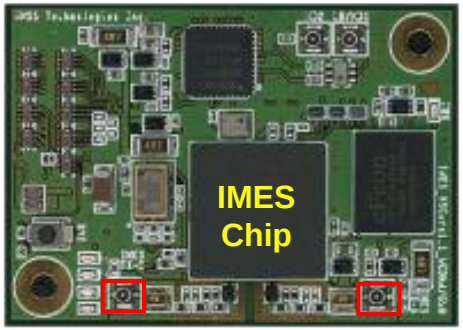
Item	GPS	IMES
Center Frequency	1575.42MHz	1575.42MHz +/- 8.2kHz
PRN ID	1-32	173-182
PRN Code Chip Rate	1.023MHz	1.023MHz
PRN Code Length	1ms	1ms
Data Rate	50bps	50 / 250 / 500 bps
Modulation	BPSK	BPSK
Polarization	RHCP	RHCP

IMES Transmitter and Receiver

IMES Transmitter Specification

Frequency	**: 1575.42MHz +/- 8.2 kHz**
Channels	**: 2**
PRN code	**: 173-182**
	Expandable to other PRN
Bit Rate	**: 50 / 250 / 500 bps (selectable)**
RF Out Power	**: -30dBm at PIN output**
Power Cons.	**: 150mW (Typical)**
Size	**: 12mm x 12mm**
Power	**: 3.3V / 1.2V**
PIN	**: 232pins exposed pad**
Package	**: AQFN**
Signal Spec.	**: IS-QZSS V1.0**

IMES Core Module

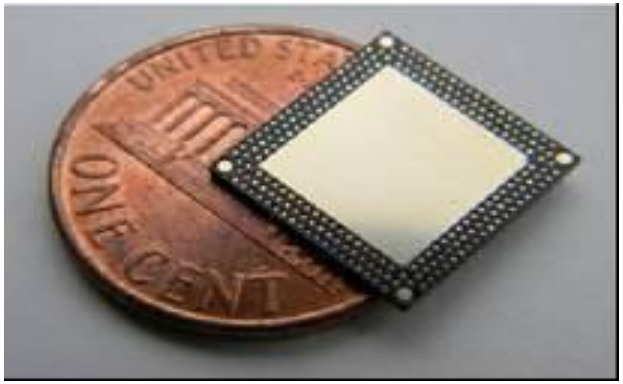


SIZE : 29mm x 41mm

IMES Transmitter

SIZE : 85mm x 15mm

IMES Transmitter Chip

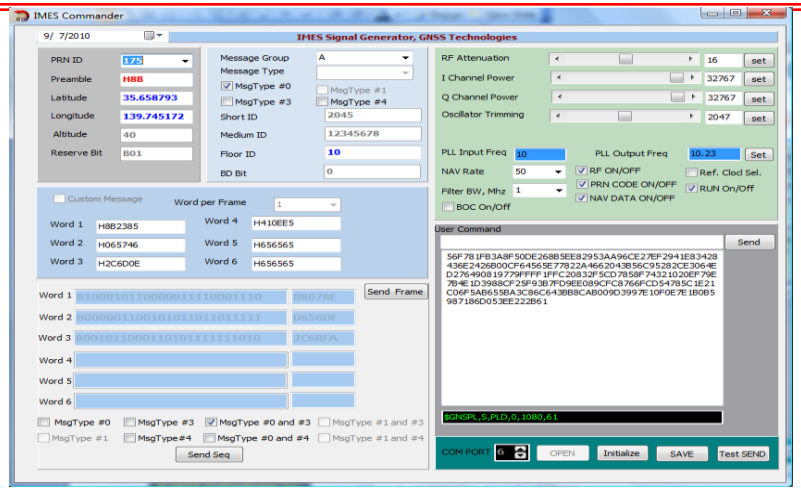


SIZE : 12mm x 12mm

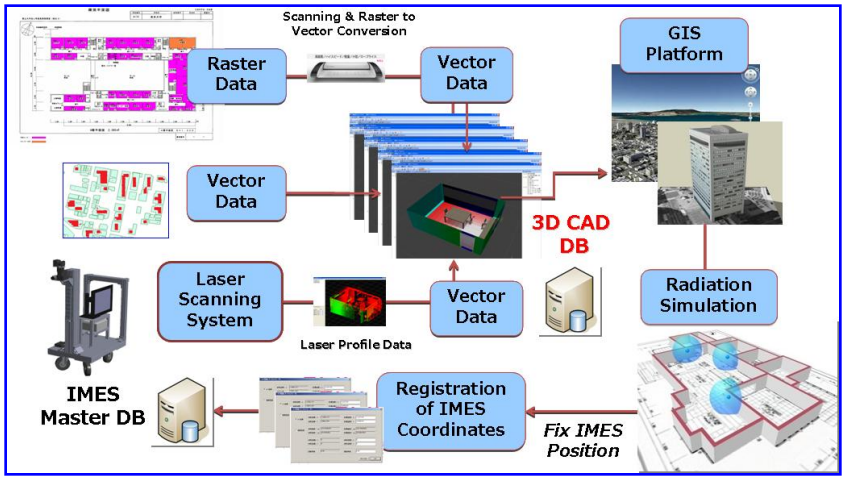
IMES / GPS Receiver

SIZE : 80mm x 45mm x 15mm

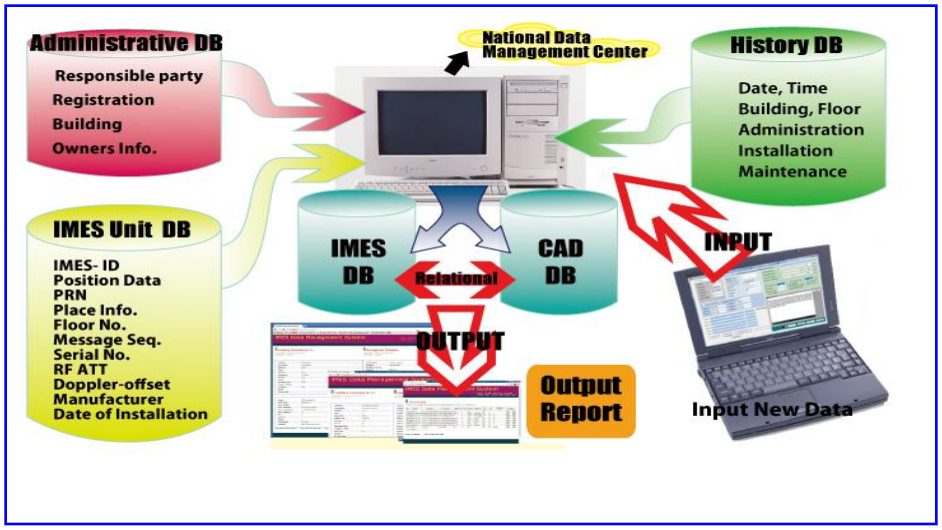
IMES Total Solution Tools



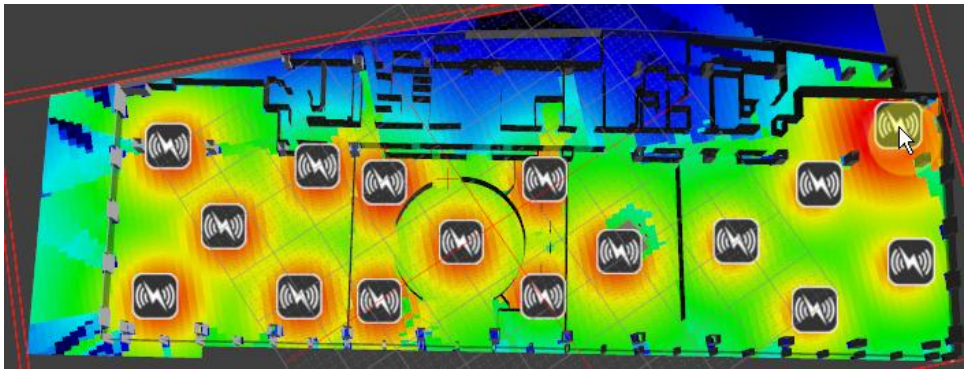
IMES Transmitter Management Tool



IMES Coordinate Generator Tool



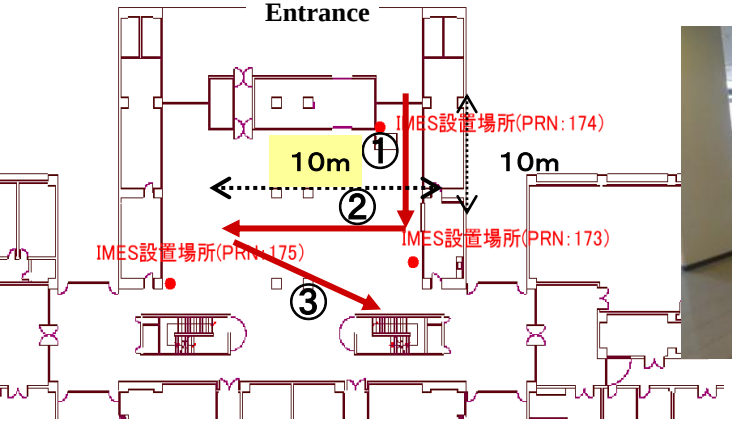
IMES Database Management Tool

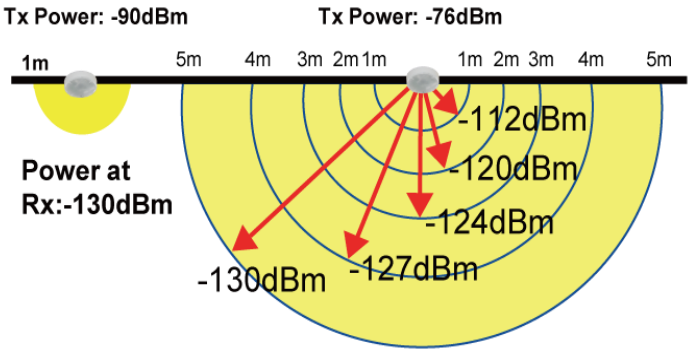


IMES Signal Propagation Simulation Tool

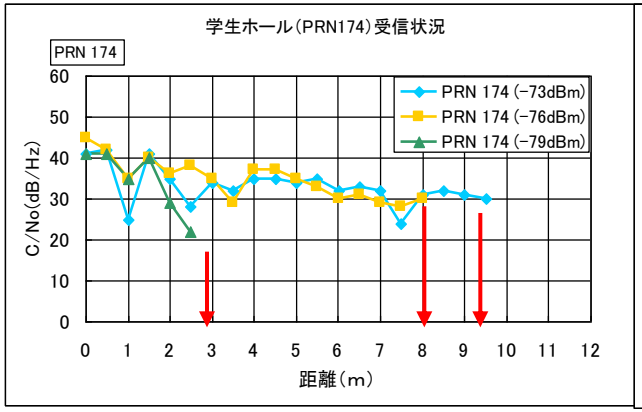
IMES Tx Signal Strength vs. Distance

The Graphs show the Typical iMES Signal Propagation in Indoor Area

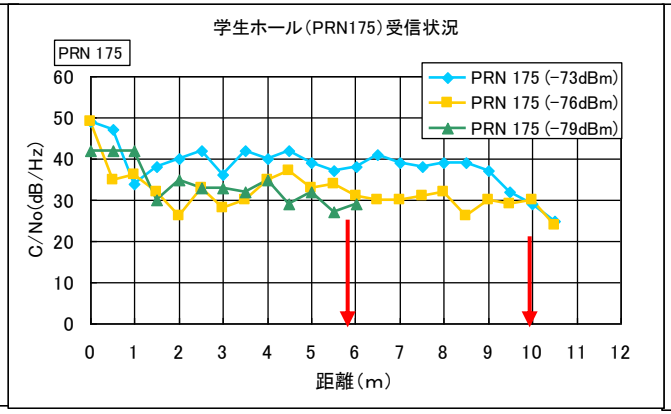




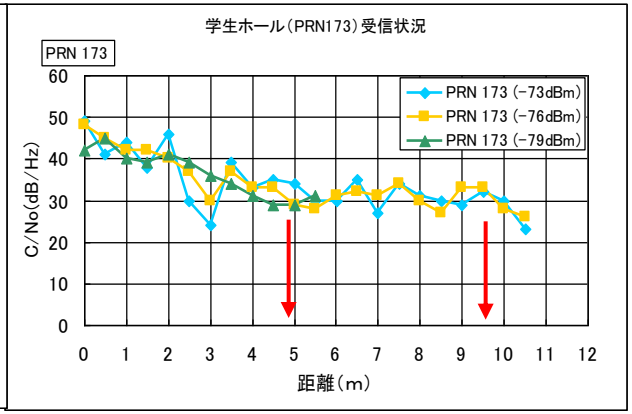
IMES Signal Power Reduces with Distance as shown above



Signal Propagation for PRN 174 for Transmit Power -73, -76 and -79dBm



Signal Propagation for PRN 175 for Transmit Power -73, -76 and -79dBm

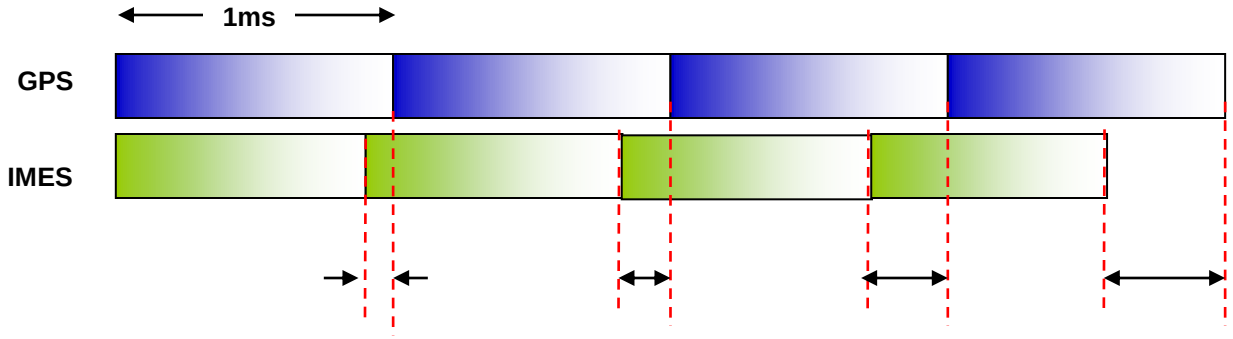


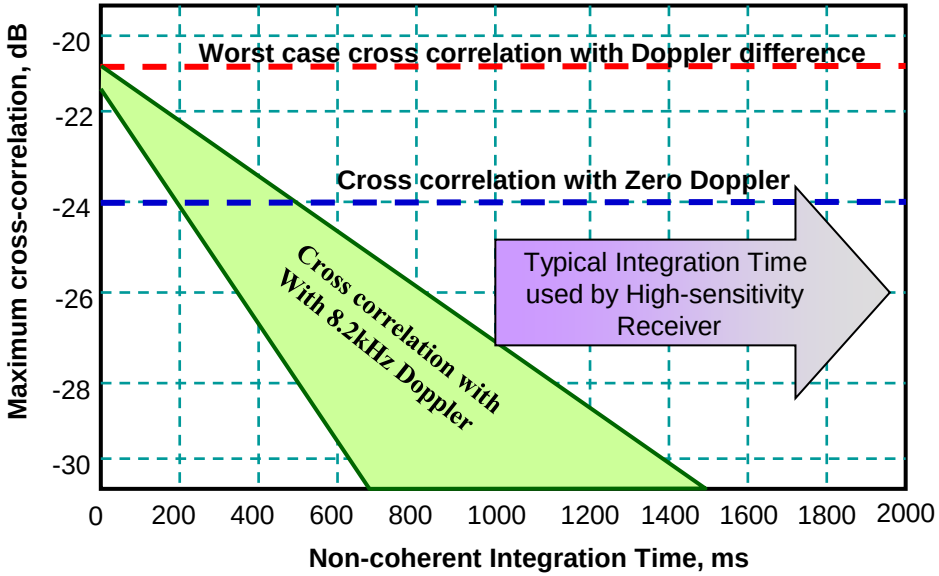
Signal Propagation for PRN 173 for Transmit Power -73, -76 and -79dBm

Method to Avoid Interference to Weak GPS Signal

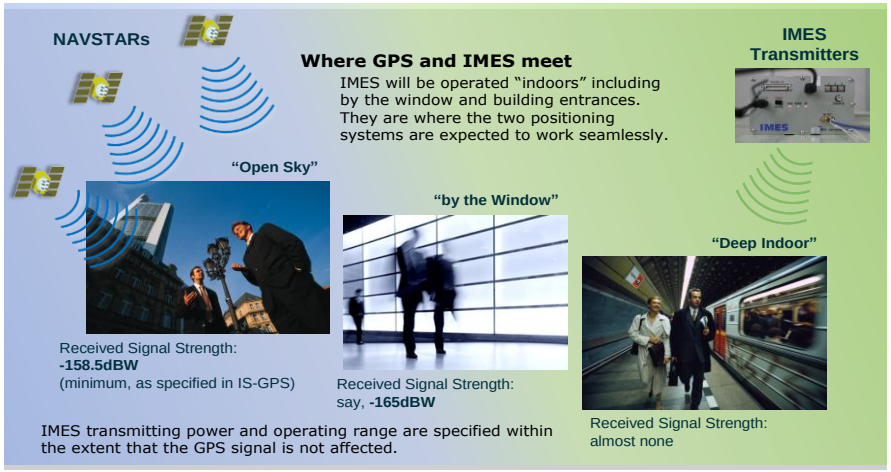
GNSS Technologies Inc.

IMES Center Frequency is Shifted by 8.2kHz from GPS L1C/A Band to Avoid Interference to Weak GPS Signals





GPS and IMES - getting together



Source: Lighthouse Technology and Consulting

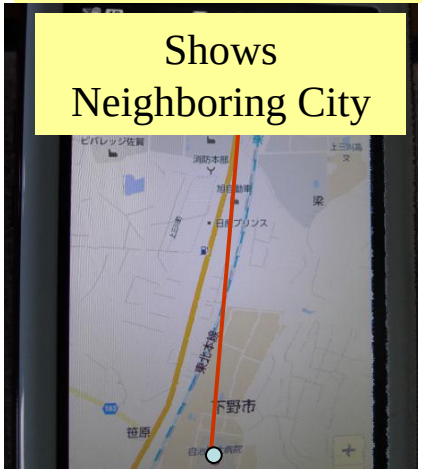
Experiment Samples to show Position for Availability, Accuracy and Stability by IMES V.S. WiFi

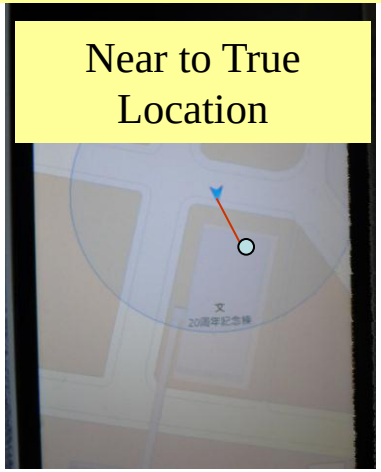
GNSS Technologies Inc.

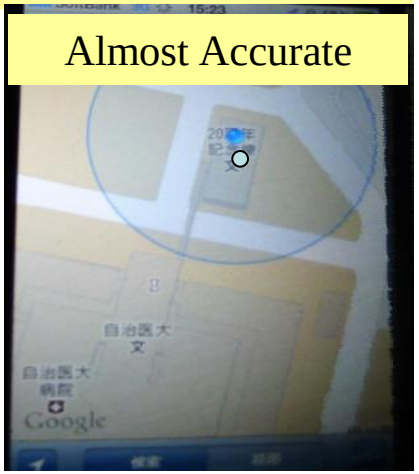
IMES

13th Floor Elevator Hall

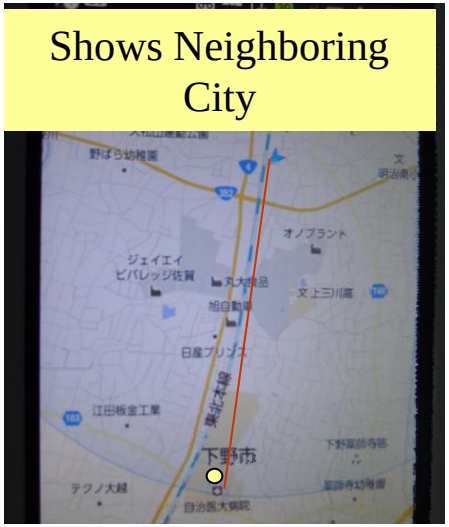
Position by Smartphone (Hybrid Solution)

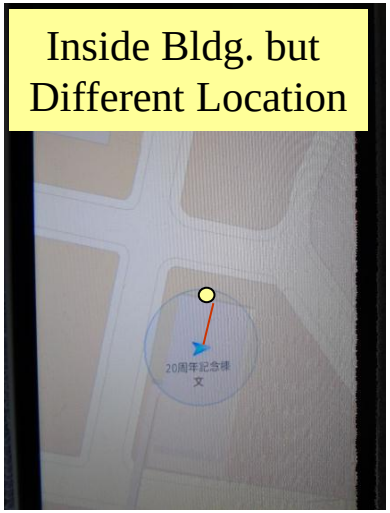


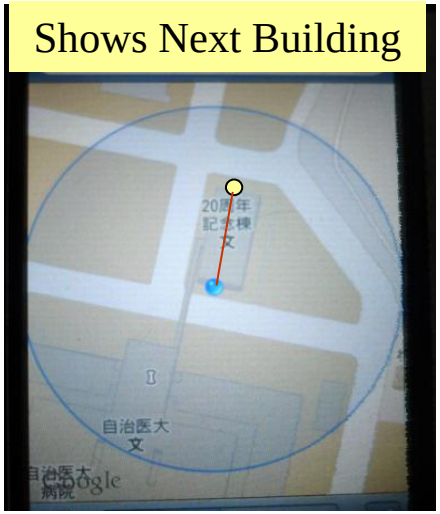




Position by Mobile Phone (GPS Only)

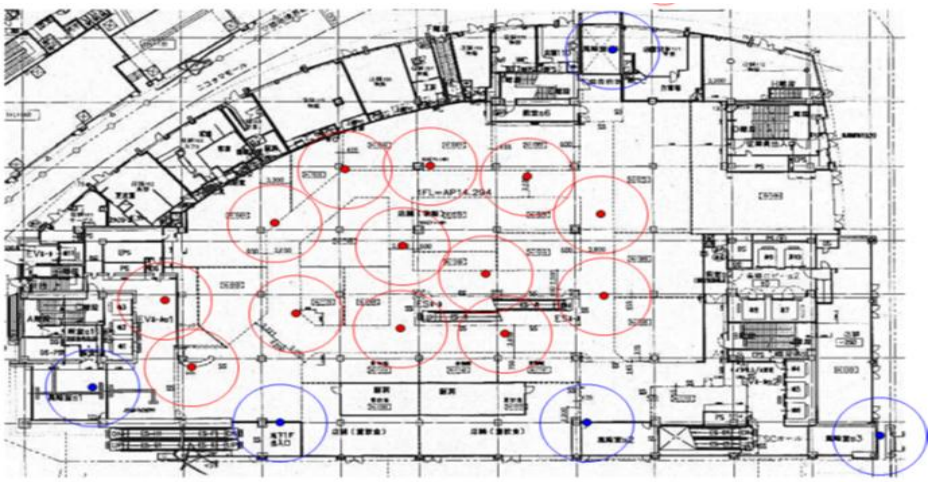






The first showcase in Japan for iMES in Large Shopping Mall managed by Tokyu Railway Corp. Group

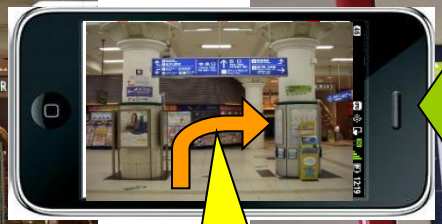
IMES will be installed in all the Floors of "RISE" Shopping Mall and over 50 Companies to Develop IMES based LBS.



GNSS Technologies Inc.

Location Business Japan 2012

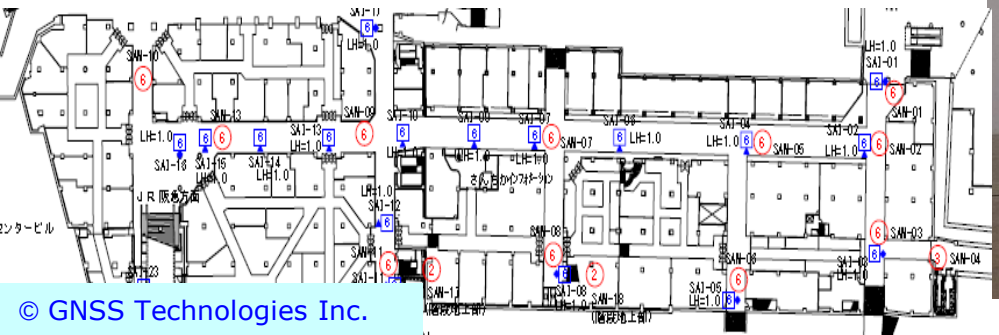
Map Guidance System using IMES provides Smart-phones an accurate position at Entrance/Exit of Subway Stations



Go Straight 20m
Turn Right
Follow the Arrow

Underground Shopping Area

Underground Passage



Local Map Information Box at Stations

The Box has IMES Transmitter Device. Mobile phone users can get the local map, guidance and other information of the area.

Board Members of Community Health Informatics R & D Organization

GNSS Technologies Inc.

Chairman

Dr. Kinosada, Gifu University

Vice-Chairman

Dr. Honda, Nagasaki University
Dr. Aihara, Jichii Medical University

Directors (Public Service Corporation)

Japan Medical Association
Japan Dental Association
Japan Pharmaceutical Association
Japan Hospital Association
All Japan Hospital Association
Japanese Association of Psychiatric Hospitals
Pharmaceutical and Medical Devices Agency

Directors (Academic)

Dr. Ishikawa,	National Cancer Center
Dr. Utsu,	Kagoshima University
Dr. Seki,	Gunma University
Dr. Fujimori	Hokkaido University
Dr. Morikawa	Tokushima University Hospital
Dr. Toriyabe	Niigata University
Dr. Yokoyama	Prefectural University of Kumamoto University

Directors (Industry)

Mr. Hayashi	Board of Director DELL Corporation
Mr. Odagiri	General Manager Nippon COMSYS
Mr. Fuji	Fuji Management Company
Mr. Kanoh	Board of Directors Global Software
Mr. Yonekawa	Senior VP NTT Resonant Inc.
Mr. Torimoto	**President GNSS Technologies**
TBD	Nichii Gakkan
TBD	PASCO

Home Care Service Demand

GNSS Technologies Inc.

Source: Ministry of Health, Labor & Welfare

YEAR	2002	2005	2008	2010	2011	2012
No of Persons that need Home Care (millions)	0.97	2.01	2.55	2.69	2.78	2.89

At least Two IMES Transmitter Required at each Place

Number of Hospitals in Japan

Bed Size	No of Hospitals		Percentage Ratio	
	2010	2009	2010	2009
20 - 49	1,007	1,026	11.6	11.7
50 - 99	2,225	2,270	25.7	26.0
100 - 149	1,431	1,432	16.5	16.4
150 - 199	1,327	1,319	15.3	15.1
200 - 299	1,124	1,124	13.0	12.9
300 - 399	729	736	8.4	8.4
400 - 499	367	370	4.2	4.2
500 - 599	197	197	2.3	2.3
600 - 699	115	115	1.3	1.3
700 - 799	53	54	0.6	0.6
800 - 899	33	34	0.4	0.4
above 900	62	62	0.7	0.7
Total	**8,670**	**8,739**		

Total No of Hospitals	8,670	
Hospitals with more than 100 beds	5,438	
No of IMES Tx required to cover each bed	**1.3 mil.** (1,350,640)	**1.9mil** (1,898,000)

Source: Ministry of Health, Labor & Welfare

IMES Consortium

- **Established : 23rd JUNE 2011**
- **Members**
  - **Industry : 100**
  - **Individuals: 160**
- **Major Activities:**
  - **Public Relations for Broader Range**
  - **Deployment and Growth of IMES**
  - **Suggestion and Advice on Standardization of IMES Specifications**
  - **Guidelines for Utilization and Installation of IMES**
  - **Globalization of IMES Activities**

Board Members

Head	Naohiko Kohtake, KEIO University
Directors	GNSS Technologies Inc.
	ISID
	TOYOOKA Consulting
	Satellite Positioning Research and Application center
	SEIKO EPSON
	HITACHI ISE
	Lighthouse Technology and Consulting
	Japan Space Forum
Observer	JAXA

Contact Information

Company : GNSS Technologies Inc.

Address : 6-12-5 Shinjuku,
Shinjuku-ku Tokyo
160-0022 Japan

Tel : +81 3 5312-4600

Fax : +81 3 5312-4605

E-mail : sales@gnss.co.jp

Web : www.gnss.co.jp