Safe and Efficient Use of Wireless Communication in a Large Hospital

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Wireless Communication in The Target Hospital

- Installed systems
  1. Wireless data communication
     - Wireless LAN in wards
  2. Wireless voice communication for staff
     - PHS (A kind of cellular phone)
  3. Wireless voice communication for patients/visitors
     - Partial permission for cellular phone use
- The Target University Hospital
  - A university hospital located in western Japan
    - 616 beds and 21 specialized departments
    - 1 building for inpatients
    - 12 wards of about 50 beds each
      - Each ward has 8-10 daytime/ 2-3 night nurses
    - Most accommodate from 2-6 persons
    - About 300 doctors and 350 nurses

Safety of Wireless Communication Use in Hospitals

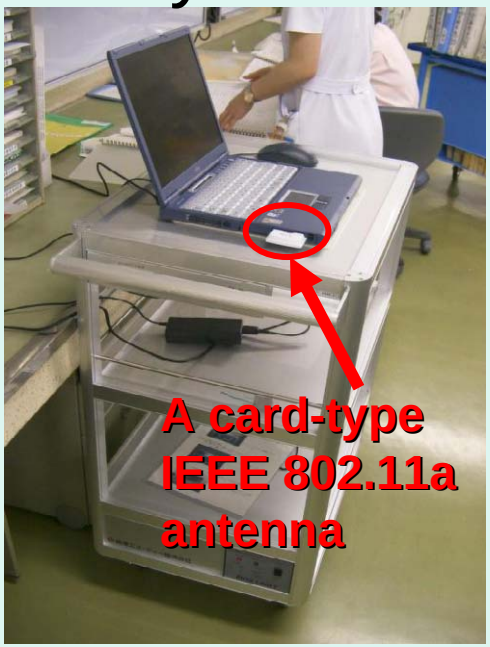
- No EMI was observed for 5.2 GHz radio waves until extremely high output power (3 W or higher) was irradiated [1]
- The power of the signal is limited by Japanese law

System	Output power (from the terminal)
2nd. Gen. Cellular phones	0.6~0.8W
3rd. Gen. Cellular phones	0.20~0.25W
IEEE 802.11b wireless LAN	10 mW / MHz (total output: 130~160 mW, approx.)

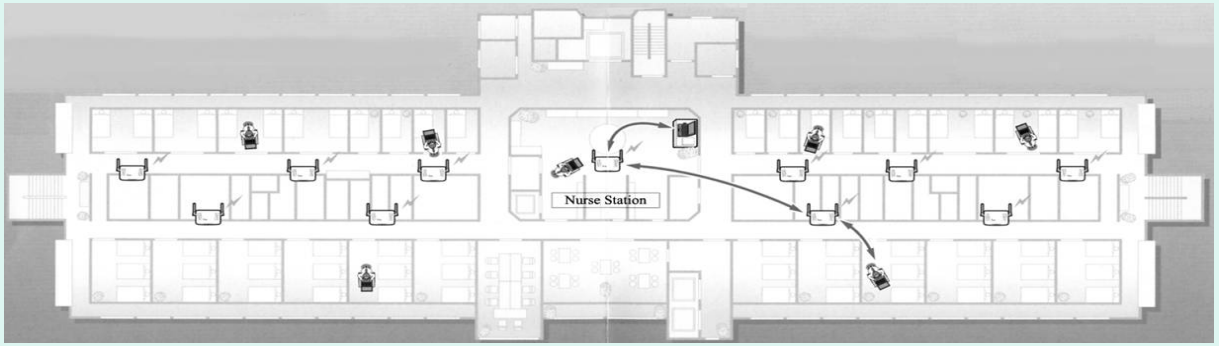
◎EMI will NOT occur when using PHS or wireless LAN in the Japanese legal setting

Wireless LAN System in the Target Hospital

- 72 HIS client terminals are connected with servers using wireless LAN
  - Terminals are limited to use in the wards by the medical staff
- IEEE802.11a standard is used
  - Apparatus that emit electromagnetic waves in the 2.45GHz band are often found in hospital wards
    - heaters, microwave ovens…
  - The data transfer rate is higher than that using IEEE802.11b/g



A notebook-type PC with an IEEE 802.11a antenna on a wagon



An image of the location of access points on one floor

Settings/Employment

- Security Settings
  - Connectable Media Access Control (MAC) addresses are registered for each access point
    - Only permitted PCs can connect to the hospital LAN
  - SSID value is different on each floor
    - An “Any” setting of the SSID is refused
  - OCB AES (128 bits) was adopted as a cipher system
    - High-speed encryption/decryption available
  - HIS user authentication with ID/passwords
  - Communication logging
- Currently used for
  - Patient ID confirmation with bar-codes
  - Entering patient information into an HIS at bedside
  - Browsing of patient data by doctors during rounds

Access Point
AP-5100 (ICOM inc.)

Improvements with wireless LAN

- Medical efficiency
  - Inputting patient information at bedside
  - Reviewing medical treatment charts
  - Sharing information
    - With an electronic patient record system, every staff member has access to registered information anytime/anywhere
- Medical safety
  - Reference to required medical information at the bedside is possible
  - Patient checks using barcode/tag scanning
  - Protection against input failures/mistakes
    - Eliminates the need to move from bedside to fixed terminals in the nurse station
- Personal information protection
  - Reduced use of paper memorandums

Wireless Voice Communication for Staff Members [2]

- Doctors have access to a public PHS terminal (WILLCOM, Inc.)
  - Cost effective service
    - US $8/month for use
    - US $4,500 to install 280 Terminals
      - Calls can be received freely
      - A limit is set at 3 numbers, designated for each handset, that can be called
- PHS (Personal Handy-phone System)
  - Uniquely developed in Japan
    - Completely digital
    - Frequency of radio waves: 1.9 GHz band
    - Handset output : 80 mW maximum
  - System structure is almost the same as for cellular phones
  - Public service available in some other Asian countries including China and Thailand

A PHS terminal for doctors in the target university hospital (WILLCOM Inc.)

Productivity Improvements with PHS

- Makes it unnecessary for nurses and pharmacists to physically search for a doctor
- Makes possible quick queries and feedback to the queries
- Number of terminals increased from 280 at start (Nov. 2004) to 440 (at the end of Nov, 2006)
  - Terminals provided to every chief nurse/every ward

Section received	Calls before introduction	Calls after introduction
Wards	1216	588
Visitor sections	458	356
Other sections	116	212
Total	1790	1126

Number of calls on weekdays (5days)

- Calls received at "other sections" increased, possibly because surgeons could not carry PHS into surgical rooms

Section Placing Call	Pharmacy	Clinical Lab.	Hosp. Affairs Section	Others
Before Installation	118	92	111	982
After Installation	23	66	38	412
Number Reduced	95	26	73	560
Rate Reduced (%)	80.5	28.3	65.8	57.0

Number of calls received in wards during working time by the section placing call

Mobile Voice Communication as a Service for Patients/Visitors

- Growing demand for the use of cellular phones
  - Over 100 million cellular phones are in use in Japan
  - Cellular phones are seen as indispensable for doing business
- Raising the Quality of Life (QOL) for inpatients
  - Free use of a phone can decrease stress and the sense of isolation
- Other factors
  - No reports of malfunction of medical devices have been made in recent years
  - Medical devices have improved protection against electromagnetic waves

Partial permission for the use of cellular phones is a welcome service for inpatients/visitors

Conditions for Cellular Phone Use in the Target University Hospital

- Cellular phone use is NOT allowed within 50cm of medical devices
- Cellular phones can be used only in visitor lobbies, single bed sickrooms, and in dining rooms
- The medical staff can use cellular phones at nurse stations and in conference rooms
- Patients connected to medical devices are prohibited from using cellular phones
- After a set time for turning out sickroom lights, the use of cellular phones is prohibited
- Staff members are not allowed to use a cellular phone during rounds, while walking, or during explanations to patients or their family

Discussion/Conclusion

- Mobile telecommunication systems in hospitals
  - Can be installed SAFELY with sufficient consideration
    - Cellular phone use should not be permitted in restricted areas
    - PHS is one of the safest and most convenient voice/data communication systems
  - Are very convenient and useful for staff/patients, but the **following problems must be addressed** [3]

1. Prevention of EMI with medical devices by signals
2. Prevention of noise caused by people talking on telephones
3. Prevention of accidents caused by lack of attentiveness of operators of communication tools
4. Prevention of private information leakage when using the camera or recording functions

- **References**

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[3] Hanada, E. Safe Use of Mobile Telecommunication Systems for Clinical Communication and Data Collection. Proc. First International Conference on Complex Medical Engineering - EMC2005 2005: 377-381.

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