Data Logging System for Mobile Reception of Digital TV

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1. Introduction

Since the introduction of terrestrial digital TV broadcast in 90s, there have been several different systems [1] with different intrinsic characteristics being adopted in the world. Namely, ATSC [1, 2] is developed from northern American, is adopted in USA, Canada and Korea, etc., and is based on the 8-VSB modulation. DVB-T is developed from Europe and is adopted by Singapore, Australia and Taiwan [3], etc., and is based on the OFDM modulation technique. Japan develops their ISDB-T which applies the OFDM-like modulation technique. ATSC emphasizes to broadcast HDTV service in a 6MHz bandwidth. On the other hand, original OFDM ones emphasize the concept of "Just TV", which multiplexes several programs in one channel of 6, 7 or 8MHz. Especially, Taiwan is the only country where the 6MHz bandwidth for one channel is used in a DVB-T system. China has mandated her own digital TV system "DTTB" – [4, 5], in which, both of the multi-carrier and single-carrier systems mentioned above are included in this new standard. For now, the spectrum of digital terrestrial television is 533MHz ~ 599MHz in Taiwan, and the channel allocations are shown in Table 1.

Table 1 Channel Allocation of Digital Terrestrial Television of Taiwan

Stations	Channel	Frequency (MHz)	Channel	Frequency (MHz)
TTV	31	575	32	581
CTV	24	533	25	539
CTS	34	593	35	599
Air University	33	587	36	603
FTV	28	557	29	563
PTS	26	545	27	551

Just like the other wireless communication systems, the coverage of broadcasting wave is the key factor to ensure a stable service for viewers. Since the DVB-T emphasizes the indoor and mobile reception, the coverage for these kinds of service in metropolitan area should be more concerned. Two reasons for this point, firstly, metropolis people are the main viewers for DTV service, and secondly, the coverage is a little dynamic due to the continuous construction in city. Consequently, the goal of this paper is to design a mobile device, by which engineers can dynamically monitor the coverage of DVB-T signal when this device is either installed on a vehicle or even on a moving man. The measured signal data is sent back to office and the administrator is able to monitor it on a web page in a real-time manner. At the moving measurement end, the DVB-T signal strength is detected by a modified set-top-box, plus the local geographical data of GPS

(Global Positioning System) [6], which are then sent to central control office through the GPRS (General Packet Radio Service) [7] platform.

2. Hardware and Software Structure

For realizing this measurement system of DVB-T mobile reception, our design is using a GSM/GPRS module that communicates with both of GPS system and DVB-T system. We receive the real-time data that includes the current measurement date-time and current measurement location provided by GPS system; and the current frequency of channel we are watching and the field strength provided by DVB-T set-top-box as well. The RS-232 interface is employed between the GSM/GPRS module and DVB-T set-top-box.

In this work, for achieving to send the data back to the central control system, it is based on two ways; one is by SMS network system [8], the other is by GPRS network system. For the other end, at the central control system, we also design a JSP (Java Server Pages) [9] server for monitoring the received data in a real-time manner. The system structure is shown in Fig. 1.

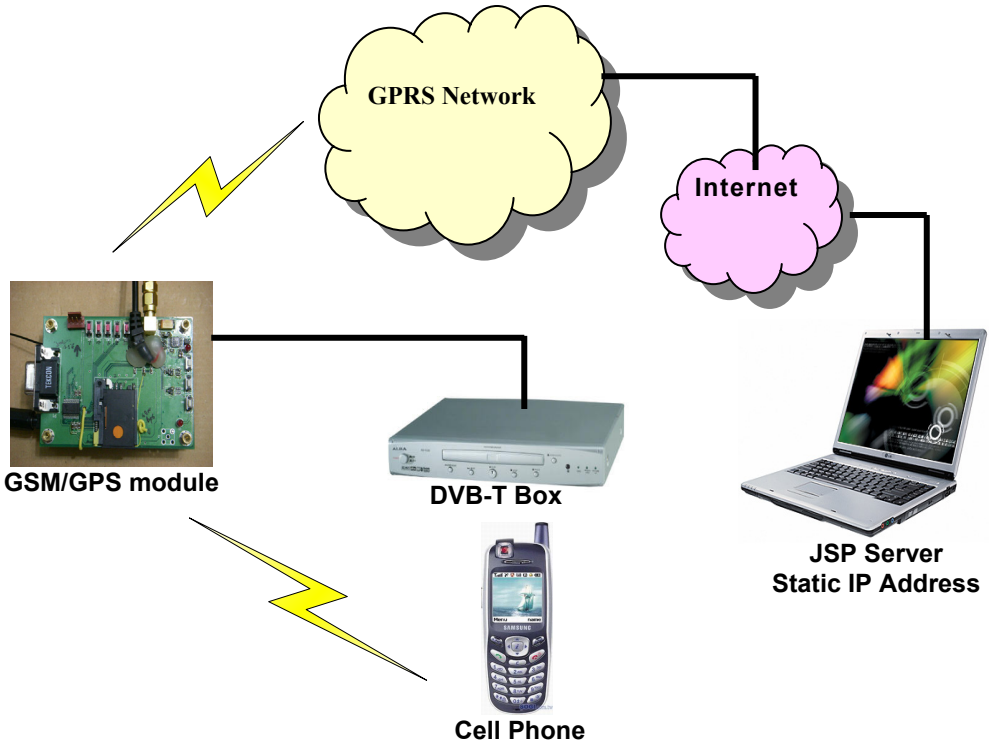
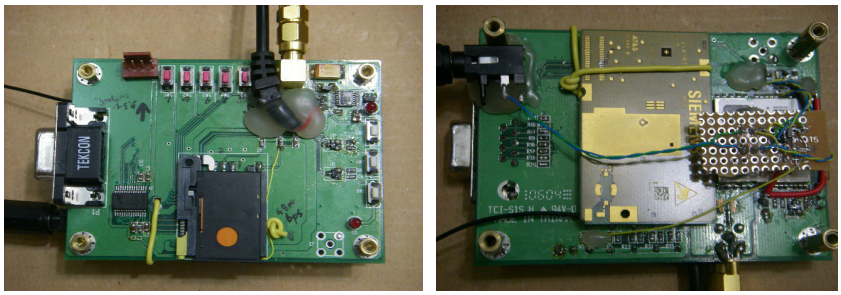


Fig. 1: Complete components of the proposed measurement system

Referring to Fig. 2, the Siemens TC45 [10] module is chosen as the main core of the system, since TC45 is an extremely slim and compact one, and is good for saving space on the application platform. On the module, it has a baseband processor, a power supply ASIC, a complete radio frequency circuit including a power amplifier and antenna interface, 9 out of 50-pin for being programmable as General Purpose I/O. For ease of integration with the Man-Machine Interface (MMI), TC45 comprises two serial interfaces. On the other hand, FALCOM JP7-T is selected as the GPS receiver. The JP7-T is designed to use LI frequency (1575.24MHz, C/A Code) of GPS and to perform the entire GPS signal processing, from antenna input to serial position data output. Fig. 2 (a)(b) is the final realized structure on a board of data logging system being designed in this project.



(a) Front side of board (b) Rear side of board

Fig. 2 Realized mobile module for DVB-T coverage monitoring

3. Real-Time Test and System Performance

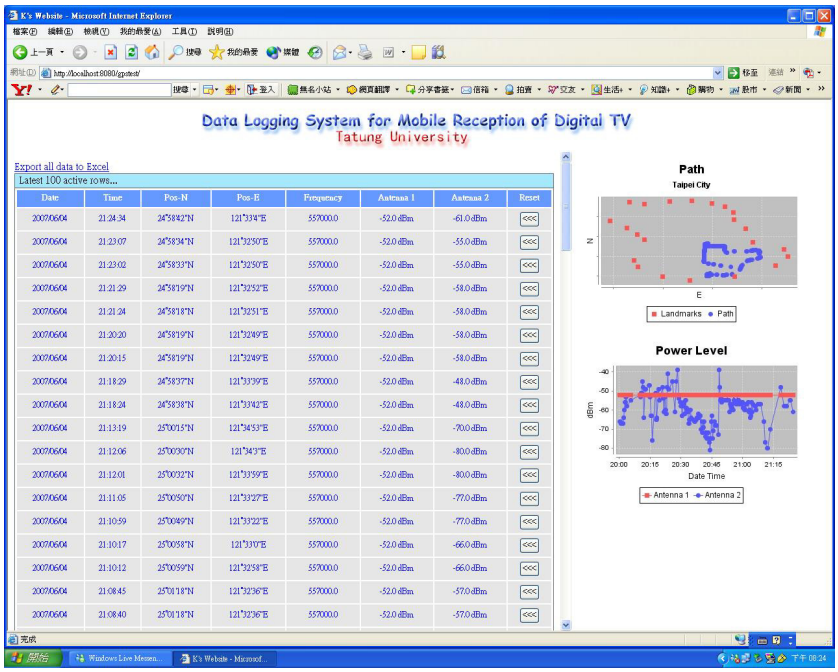
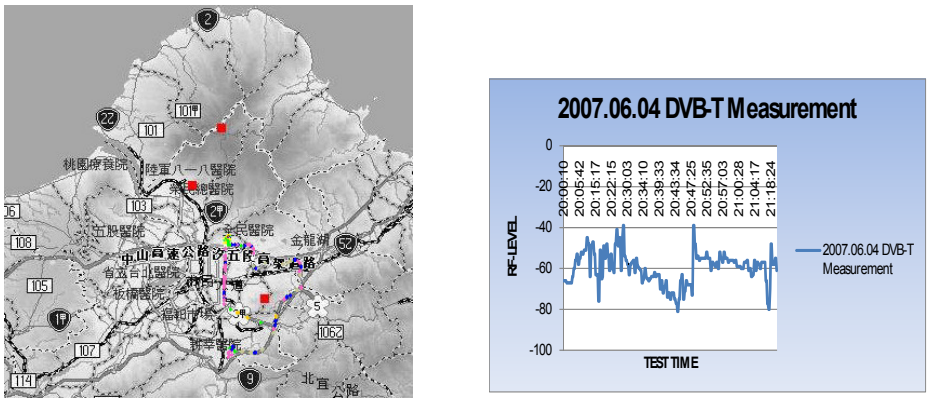


Fig. 3 Measured result of FTV shown in control centre

The web page at central control is designed by JSP, which links with an Apache HTTP server. The Microsoft Access is used to record all received data which are sent via HTTP connection. As seen in Fig. 3, the web page is separated into three major parts for record: Latest 100 rows of remote received data; curve of moving trace in measurement, and record of remote received power level. The latest 100 rows show the detail information of received data that includes the locations, frequency and power level. The web page provides the function of exporting data as well.

In measurement, one broadcasting program is chosen as the measure target. The routes of the measurement are mainly in Taipei city. Fig. 4 (a) shows a route on which the measurement was carried out, and the colour on map shows the related field strength that is also recorded on Fig. 4 (b). The measured data includes the current date and time (*i.e.* GPS date and time), coordinates, DVB-T frequency and field strength. All of the data are logged once per 15 seconds. The logging time may be changed due to the GSM transmission efficiency.



(a) (b)

Fig. 4 Measurement result of FTV

4. Conclusion

This paper presents the work, in which a mobile device is designed and realized to measure and monitor dynamically the coverage of the DVB-T broadcasting. Both of software and hardware is integrated to realize this module. Such a module is able to transmit back the DVB-T field strength, GPS geographic data, time and channel frequency, etc., to the control office. Via GPRS platform, the measured data can be displayed on a web page to show the related results in a real-time manner.

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