The WISECOM Optimum Enterprise to Incorporation Earth-Stations Technologies and Satellite for Emergency Communications

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Abstract--This paper demonstrates the optimum' development of precise consolidates and anti strong shocks satellite terminal, to be used in emergency communication case. The satellite terminal equips GSM coverage in disaster regions as well as to set of telecommunications technologies services such as Wi-Fi, UMTS, WiMAX and TETRA, once the existing core Communication Infrastructure (CI) is exposed to heavy overloaded or destroyed by disaster or wars' case. It uses GSM back-hauling link as an aspect of restoration via satellite to transmission GSM network infrastructure in the special disaster safe region. As well as, using basic data services such as HTTP web browsing and email services are also equipped over WI-Fi access. Based on previous studies and the latest efforts of researchers, this study highlighted on incorporation GSM and WI-Fi via satellite as a suitable solution in emergency communication, also focus on particular terminal design and some of tests that have been undertaken are demonstrated in the study.

Keywords-- WISECOM, GSM, Earth-stations technology, ,WAT, Emergency communications.

1. INTRODUCTION

The destruction of the local telecommunication infrastructure is often come along with disasters or special case **such** as climb's team of mountains in remote areas and wars unanticipated, etc. In this respect an emergency case telecommunications services are very essential due to using a large set of wide-spread telecommunication technologies such as GSM, UMTS,WiFi, WiMAX, and TETRA and a satellite back-hauling link. Therefore telecommunications presents a flexible way for many victims of a disaster to connect with each other and for surviving and guide the workers to coordinate and combine their efforts [6]. Both in first response and long term disaster to purpose create high management phase, communication connection is the basis. One of the best solutions to cope the communication problem is to use satellite phones in the basis first critical hour after a disaster. With the high potential of more complex and huge technologies it is possible to reestablish and deploy a wireless telecommunication infrastructure to transfer both voice and data, but these solutions indeed need many hours and some days to be prepared to the venue of the disaster. The systems of which using of this kind are, for example, EMERGESAT and TRACKS.

Meanwhile the WISECOM (Wireless Infrastructure via Satellite for Emergency Communications) enterprise, an enterprise co-financed by the European Commission, aiming to fill his shortage by improving and developing a complete suitable solution that can be rapidly built and deployed instantly after the disaster, in this case and within the first day, recharging the traditional use of satellite phones. To achieve this WISECOM retrieval stores for local GSM or 3G infrastructures, allowing default mobile phones to be used in that event , and enables wireless measure data access (Wi-Fi or Wi-MAX). The system usually uses technologies be lightweight and rapidly widespread, the so called WISECOM Access Terminal (WAT), which can be carried by one person on board a flight and be Equipped within a few minutes [3,11] . With WISECOM enterprise some earth-stations and satellite technologies are achieved, the core objective of the WISECOM enterprise was the suitable design. Two different versions of the WISECOM system have been developed in previous times in order to satisfy the communication needs .The first version of the system integrates GSM and WLAN networks using the Inmarsat BGAN. The second versions of the system integrating GSM, WLAN/WiMAX and TETRA over DVB-RCS are intended to be deployed in a later phase after the disaster event [7, 1].As well for importance incorporation GSM, Wi-Fi, also WLAN/ WiMAX and TETRA over DVB-RCS are between expected earth-stations technologies taken into account, and the Inmarsat BGAN (Broadband Global Area Network) and DVB-RCS for the satellite technologies for instance in this case. In spite of the less space available in the satellite connects, BGAN has the benefits of being publicly available compared to DVB-RCS especially at the present time [5,4].

Information service and data are expected to be accomplished with the integration of Wi-Fi which take a main role to enable Wi-Fi –capable different devices of computers especially laptop to link to the terminal and then to connect to the internet, to receive many services such as web page access, voice over IP, or email , and Internet access and Location Based Services (LBS) which considered as a problem and most important ones are the provision of (LBS) to help the rescue team in locating the victims and transfer many solutions images. One of important challenges in the combine of Wi-Fi and GSM is how to ensure the high quality of service for voice services, once the passing in mixed with internet passing and cope on congestion [9].

This study will focus on and structured as follows. Highlight and overview of the WISECOM enterprise which explained shortly and mentioned in this part. Precise descrip-

tion of the architecture and the good design of the communication terminal to be developed will be given in the next sections related GSM and Wi-Fi consecutively. As well as design issues will be explained, especially the ones related to select of system components that can convince and certain quality of service requirements with hard limitation on size, power, capacity and weight. In addition it will be followed in other section through some discussion of the incorporation of the GSM and the Wi-Fi subsystems to the WISECOM Access Terminal (WAT). The general system shall be incorporated into a compact, lightweight suitable form, appropriate into one knapsack, and very easy to install and operate [16].

Meanwhile some tests will be used on the realized system depended on the briefed procedure given within the convenient framework of WISECOM. And the report found among them are voice call tests, single and broadcast SMS test according to their report. And how the voice over IP calls which registered also. The test procedures and outcomes are presented in next sections and the conclusion of this study [8].

2. GSM VIA BGAN (BROADBAND GLOBAL AREA NETWORK) DEVELOPMENT

To equipped voice and main data services like SMS or GPRS, in this respect WISECOM consider the run and use GSM through Broadband Global Area Network (BGAN) technology to be running in the WISECOM Access Terminal. The universal system architecture is pictorial in the Figure 1 below:

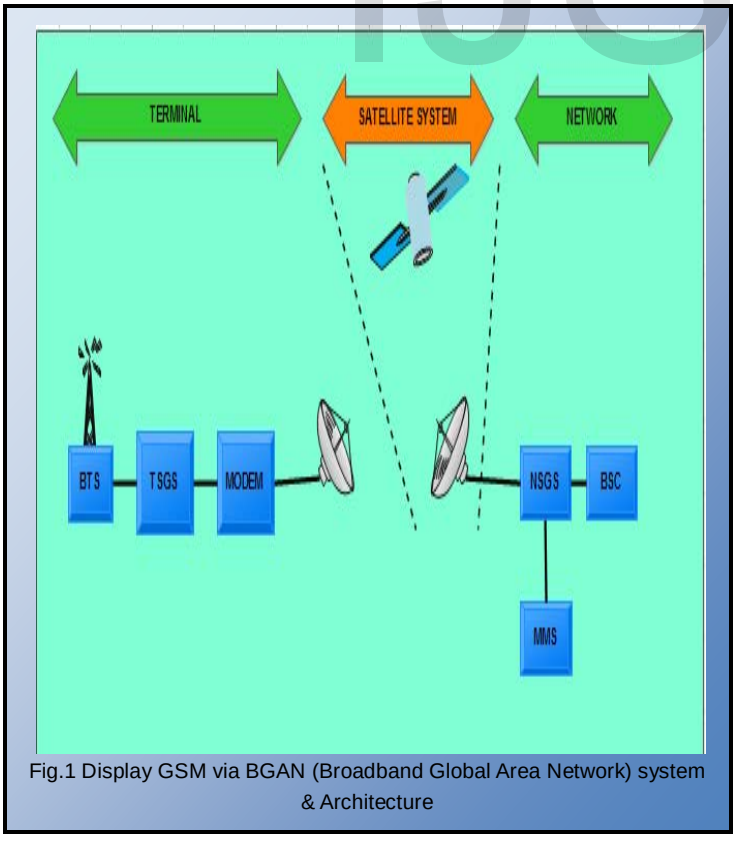


Fig.1 Display GSM via BGAN (Broadband Global Area Network) system & Architecture

The notion was first enhancing and developed within the wireless cabin enterprise and keep on increasing in developed into a ripe product by TriaGnoSys, so in commercially implemented in the aviation domain. The concept is to collapse the signal and the data communication between GSM BTS (Base Transceiver Station) and the BSC (Base Station Controller). Meanwhile the BTS performs packaging of GSM packets (signals and data) into IP packets. The GSM packets are later rehabilitated by NSGS (Network side GSM Server), successively to BSC, and turned into the core network components [10, 2] .The Figure 2 explained good example for TriaGnoSys aviation products in terms of hardware and software development and the importance role of GSM in system integration. In which GSM Connex Aero can connect to ground network over satellite or any other backhaul link. A number of satellite systems are supported. Including Inmarsate Swift broadband, Ku-and ka-band, as well as air –to- ground.

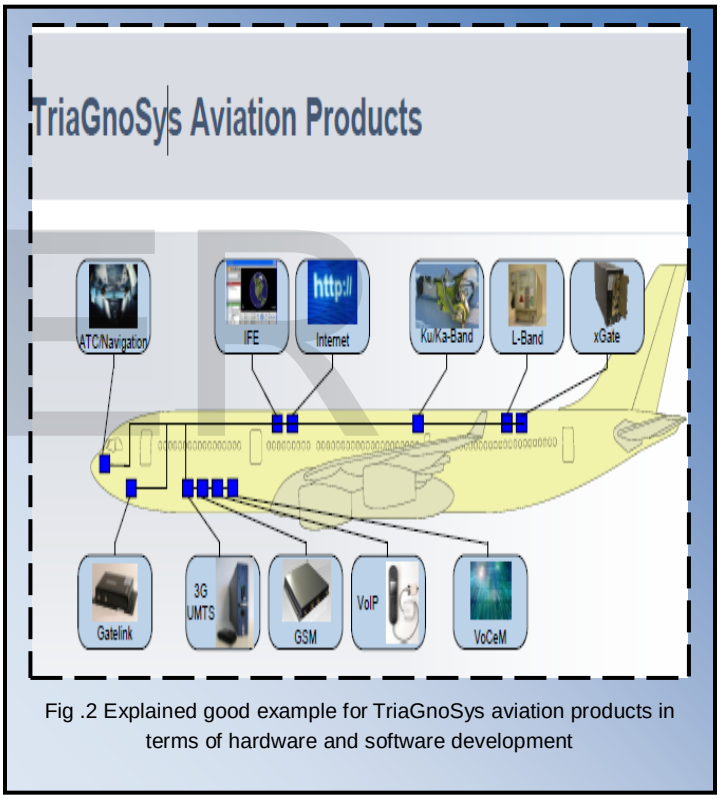


Fig .2 Explained good example for TriaGnoSys aviation products in terms of hardware and software development

While the TSGS is essential in case strong shocks industrial computer implements (MOGIS) TriaGnoSys'Mobile GSM Infrastructure. And the software which running the following tasks:

- Bandwidth of satellite on demand: the software demands dynamically the wanted bandwidth in the satellite modem in case no resources available, while next call will be blocked.

- Deactivation for BSC Signals: TSGS and NSGS deactivate most GSM signals messages which are sent recurrently to reduce the satellite usage and wanted bandwidth.

- Compacting IP and Codec have chosen: To effectively use the rare satellite resource, the TSGS will supports different kinds of voice Codec to minimize the size of the voice packets. Both GSM full-rate and Adapting Multi rate restrict band (AMR-NB) with rates as low as 4.75 Kbps are supported .More decrease in the transmission bit average is caught by strong IP/ UDP/ RTP header compacting[4,7,12] .

Other tasks like Quality of service support, GSM bits auto control tasks, pick of GSM service, and network administration are also supported .One of important the WISECOM user requirements countries that the WISECOM Access Terminal should be light and minimized in dimensions/ volume. The most requirements make rigorous limitation on the same choice of the subsystems to be put in the WISECOM Access Terminal. The selection technology for the BTS is IP. Access nano BTS .It equipped coverage of around 400 meters with high power in open entirely space. Therefore its small size, the BTS can be easily deployed and carried anyplace. Equipping GSM coverage to especially anywhere in the land, as long as there is satellite connectivity. The expectation satellite solving to be utilized is the inmost for example the BGAN technology.BGAN equipped data and voice services universally over its three satellites. As of 2008-20011 and onward, there are many operating satellites .As can see the figure below instance for Immersed BGAN planned coverage is broadly global, as can be seen. Current coverage includes that marked IOR (F1) – covering Europe, Africa, the Middle East and Asia, with the wide coverage explain in figure 2 (for instance the more than three satellites in the middle) and other satellite is scheduled to launch in the future , but does not represent a guarantee of service. The availability of service at the edge of coverage areas fluctuates depending on various conditions [1, 14.15].

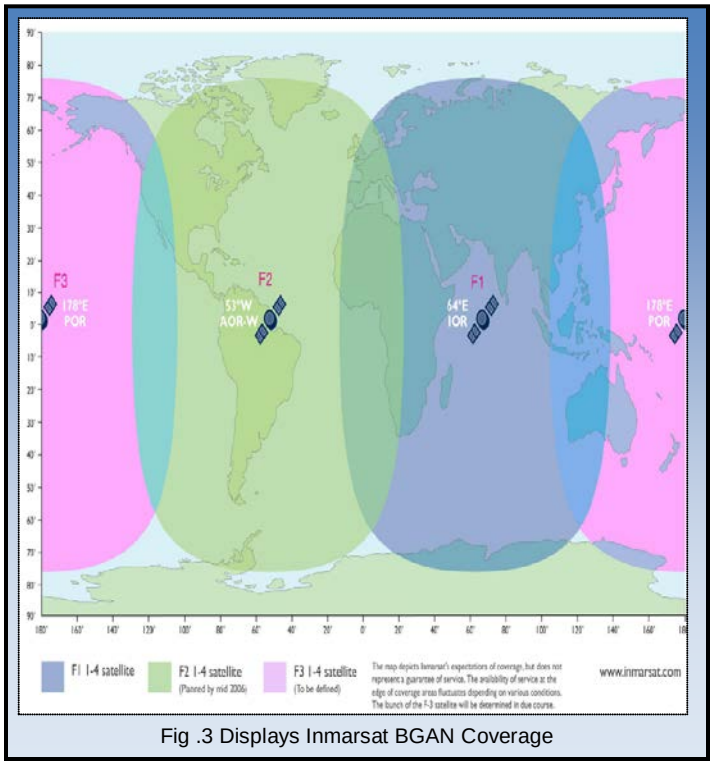


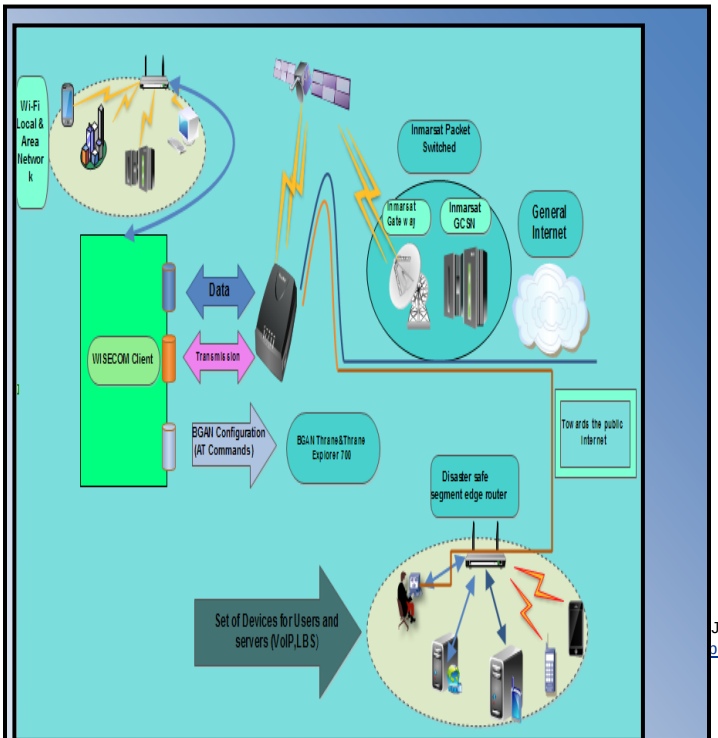
Fig .3 Displays Inmarsat BGAN Coverage

For WISECOM Access Terminal, just data service has been of special interest. In addition there different kinds of terminal to access the satellite. For instance the Thrane& Thrane Explore500 and Explore 700 which be Connected Anywhere in the World and, ideal for single users, who need to set up a complete broadband office in frequently changing locations. With High transmit Bandwidth & Highly Portable are the ones found to have differing between performance and dimension (size and weight). The small size of the satellite determines the maximum data average that can be attained in the satellite link. The phrase of the rare bandwidth resource is conducted via the phrase of passing classes. There are two kinds of class that could be opened for data communication: streaming and background class.

The streaming class usually obtains higher priority and guaranty the fix data average is available to the user. The Explorer 500 terminal is able for equipping streaming class connections up to 128 kbps. The user is charged depending on the time consumed on the connect. The rest of the satellite channel and its capacity are assigned to the particular background class. Here the available bit average may vary, and the user is charged depending on the volume of data which chosen and transmit on the satellite link. Figure 4 shows the three major elements of WISECOM Access Terminal.GSM base station, satellite modern and industrial PC. Here showed scale serves just to display approximate dimension. The three elements weigh roughly 4.5 kg [6, 8, 3].

Fig.5 Displays GSM via BGAN system Elements; from Left to right: IP. Access nano BTS, Siemens SimnaticMicrobox PC, Thrane&Thrane 700 BGAN terminal Supplying of Data Services over Wi-Fi

Figure 5 shows the universal overview of Wi-Fi via BGAN system architecture enhancing and developed in the framework of the WISECOM enterprise. The architecture is arranged of the WAT. Surrounded basically the Wi-Fi router (Linksys WRT54GLwith DD-WRT firmware). WISECOM Client and the BGAN terminal. At interactive the interface between the WISECOM client (WC) and the BGAN terminal, multi virtual interfaces often (using the same interface physically), can be supported for data transition. These virtual interfaces will be associated automatically with IP channels carrying an IP datagram from the WISECOM Access Terminal to the main Control Center in the disaster-safe part, or toward public IP networks. While authorization of users and their authentication is done over RADIUS server. It equipped the saving team they have particular credentials (password, username) with high access and unlimited to all IP services on one hand , and limits



ac cess by all authenticated users only to the HTTP service in other hand , including a particular web page to give all informative information relevant to the continuous the disaster[9,2].

The WISECOM Client (WC) also supports many passing administrations and priorities thanks to contribute in built-in tools (Linux tc command) which performing passing classification, passing shaping and running different queuing, overthrow, and scheduling some of the strategies. Moreover, the WC performs role of optimum use for cache and proxy in the limited satellite link bandwith.To manage the satellite dynamically and connection (using the satellite modem's at implement the commands) as for to the amount of passing to be carried via satellite link, and supports various HTTP proxy servers running to WISECOM emergency web page, which accessed by number of different users in the Wi-Fi general domain and particular prior to login, the database of users allowed to link to the system , while the VoIP linking implement via the system finally, VoIP tasks such as voice through voicemail ,voice conference and IP calls are equipped by using Asterisk VoIP server[16,13].

3. INCORPORATION OF GSM & WI-FI TO THE WISECOM ACCESS TERMINAL (WAT).

Software integration considers one of important challenge between GSM and the Wi-Fi elements of the WAT. The core emphasis is on the quality of services and network administration since other some features such as security and date compression can be run-in one after one and separately in each module without any interfacing one another. We are mentioned previously that the GSM and the WI-FI module each have its software on the GSM section and other internal Linux tool in the WI-Fi section.

The Wi-Fi passing administration tool may after the way the pacing is routed between the GSM base station and the satellite modem along .In this respect this should not produce much profound impact as long as the high priority is still given to the GSM passing. Moreover important issue in the mechanical incorporation. This related the packaging of all the mentioned system elements into consolidates and strong shocks satellite terminal case that can be carried by one person. While all WISECOM Access Terminal devices excluding the BGAN terminal can arrange constantly inside a housing case. The BGAN terminal with integrated satellite antenna must be run outside and directed to the satellite .For instance, clamps could be equipped on the WAT box in case the BGAN terminal snapped to protecting the equipment. Multi alterna-

tives as examples of anti strong shocks satellite terminal case with satellite are displayed in Figure 5[4,3,11].

Fig .6 Displayed Devices of anti strong shocks satellite terminal for WAT in emergency communications

Included rechargeable batteries for WAT and many cylindrical cells, 1, 2 V 15Ah as a suitable voltage for each, and 24 V 15 Ah batteries with the weight of 5 kg. In case that the wireless communication devices (BGAN terminal, Wi-Fi access point GSM BTS) will nonworking in transfer mode all the time. As well as DC current of less than 4, 5 A from 24 V battery can be spare enable to 3 hours of service time [2].

4. Outcomes & System Test

This study explained according to results WISECOM which conducted by members of rescue teams in the disaster area concerning at the GSM element, all basic tasks include GPRS data, voice, SMS- have been successfully tested in the especially configuration of the emergency WISECOM Access Terminal. As the GSM software/product that is already commercially used. In addition the basic test procedures are not more than discussing herein, Therefore to keep on latest Wi-Fi extensions. In this study researchers and according to many reports in this scope of WISECOM stated that the number of the tests has been performed to verify in specific BGAN modem, and to verify the support of many strong voice calls, based on the GSM codec used[14,4].

In addition and according to MOGIS specifications, they mentioned both native AMR and FR (the latter over transfer coding into AMR) the codec allow having strong calls. While in the Wi-Fi section, all network tasks and several services presented previously have been mastering running and tested as the report mentioned that. VoIP calls from users connected to the WAT (over Wi-Fi) to users connected to get the control center or users in the PSTN. One bidirectional voice calls using approximately 64 to 80 bits per second in bandwidth via satellite link. In this research and according into their report explain the LBS which developed by partners in WISECOM enterprise for the pursuit of members of rescue teams in the disaster region and determined the aim of victims also tested successfully via Wi-Fi over BGAN telecommunication platform which set up for the WISECOM demonstration. Eventually the Figures 6, 7 illustrate how the WAT is the power and the ability to reserve bandwidth via the satellite link to customize different passing flows and to support Quality of Services (Q o S) [8,14].

The previous Figure Displays the rates of the many different kinds of passing arriving from the local access scope to the WAT while the latter figure shows the rate of the passing transferred via satellite interface. In the first, the WESICOM Client receives signals passing at the rate, 700Kbps; the quality of services ensures the 4% of the bandwidth of the output of WISECOM Access Terminal is reserved for per passing. The test of bandwidth is allocated assigned using priorities. As the signals passing have the highest priority, it takes the all remaining bandwidth at time t =6_{∞} , signals passing will disappears, and then the GSM voice passing will takes the remaining bandwidth data passing keep on at the insured rate (4% of the bandwidth available via the satellite link),when it has lowest priority. End up at the time t=10_{∞}, GSM voice passing starts decreases and data traffic uses very the available bandwidth via the satellite link [5, 12].

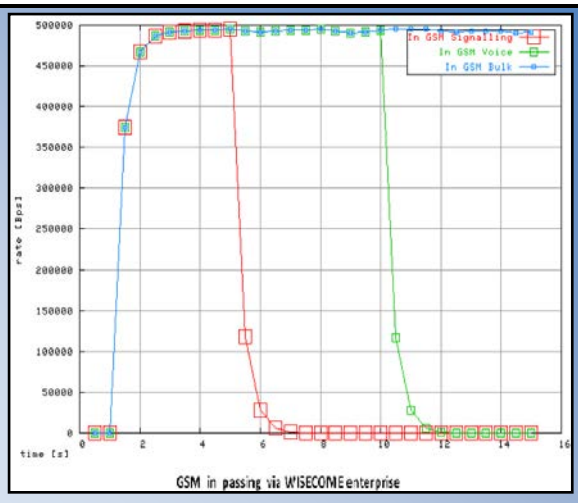


Fig. 7 Test Input Passing for Quality of Services Support

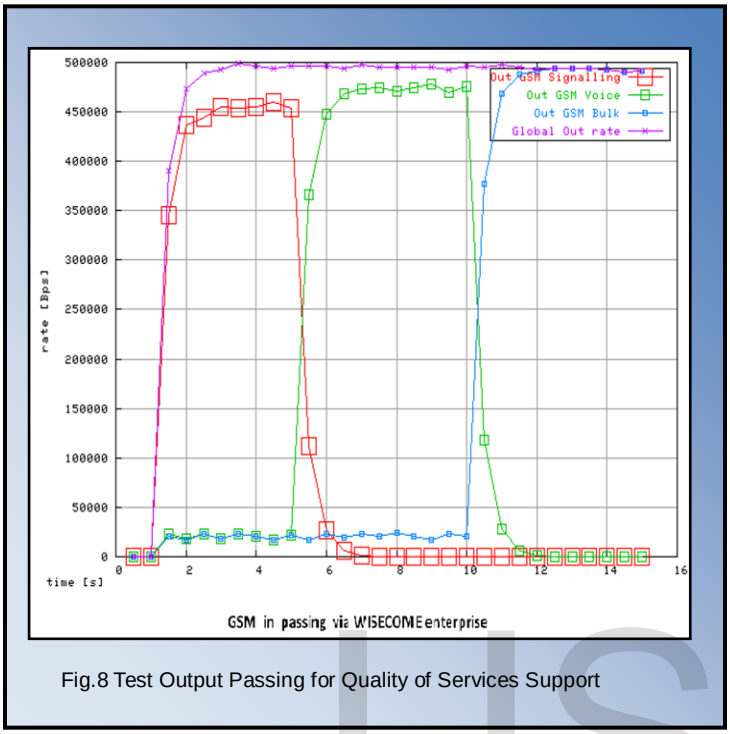


Fig.8 Test Output Passing for Quality of Services Support

5. Conclusion

The development and design of the WISECOM access terminal (WAT) have been explained in this study according into many researchers and studies related to this scope with a lot of results and facts by number of teams members to test collaborative WISECOM in emergency communication in exceptional cases like disaster , wars, fire and remote areas . The outcomes of test from both the individual GSM and Wi-Fi system have displayed according to many studies, also the power and capability of the WAT for equipping suitable voice and clear data services via satellite back-hauling link explained consequently a lot of studies. Moreover there are some incorporation issues that still need to be resolved, for example the conformity of the dynamic satellite in term capacity reservation mechanism between modules (GSM and Wi-Fi) this aspect get more enhancing and expanding in current time . The WISECOM generally effective enterprise in solving emergency communications and many countries adopting and adapting this high services in exceptional circumstances.

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