Simulation of inmarsat c channels using matlab computer science

This report is all about Inmarsat-c channels its standards and simulation of C channels using matlab. The use of satellites for control, command, communications and navigation is an area of high end technology which has grown significantly over the last decade and been primarily dominated by the military. The establishment of mobile satellites is offering services to the public and commercial fleet operators the opportunity to take advantage of these developments. This communication channel implements Global Maritime Distress and Safety System and data transfer functions between INMARSAT-C compatible terminal and a land earth station. Compatible software, installed on embedded system controller is used for simulation of Inmarsat terminal. This controller transfer data to simulated Inmarsat satellite using a wireless transmission network. The satellite functions are implemented into another embedded system controller. This satellite communication controller is linked with Inmarsat terminal via wireless transmission network and with another land earth station using a secondary wireless channel. The land earth station is software implemented in a PC linked with simulated satellite using a wireless network. This center is able to manage messages received from Inmarsat terminal, via simulated satellite, and convert them into short text messages, automatically delivered to local network workstations, in faxes format or mail messages. The system can be consists as base for a GMDSS simulator.

2. INTRODUCTION

Inmarsat is an international organization which works for the satellite system for the support of mobile communication system. Another major function performed by this organization is radio determination services. The

organization provides this radio determination service through out the world according to the necessity of certain area in the whole world. The organization was established in 1979 and now comprises 56 member countries and since 1982 it has operated a global network of L-band satellites. These services were earlier provided for ships, then the after certain time passed and new technology grew this service was also provided for the aircraft and now, according to the recent convention the land users of mobile can also get the service throughout the world.

In the report software algorithms for the inmarsat C channels modulators and demodulators is discussed. Normally Sophisticated algorithms, including a fast Fourier transform (FFT)-based burst acquisition algorithm, carrier phase tracker, an innovative Doppler tracker, and acquisition symbol synchronizer, are developed and extensively simulated for reliable burst reception. The compact digital signal processor (DSP)-based demodulator hardware uses a unique personal computer test interface for downloading test data files.

Inmarsat provides services according to established international standards which enables the mobile to roam and operate throughout the world. But the criterion is the international licensing requirements should be strictly followed in the applicable regions. This thing is very beneficial for the user as the servicing terminal is global and the operating cost could be saved. Another important perspective regarding this service is for manufacturer point of view that manufacturers can build large market and great number of users and the production cost of equipment could be reduced to the minimum extent.

The Inmarsat Standards System has placed its foundation stone into the land mobile communications. Equipment is now being produced by many manufacturers throughout the world to technical standards introduced by IMWRSAT. This does not slow up innovative design or applications but ensures that all manufacturers of equipment operate efficiently through the satellites and fixed earth stations which provide access from the mobile to public and private telecommunications networks. Pre-operational services started in 989 in the Atlantic Ocean and are being expanded to the Pacific in the latter part of the year. The system is giving the users and manufacturers and opportunity to experience with the system throughout most of the world prior to full global commercial service which would be used globally at very frequent rate. The actual range of Standard-C facilities includes two ways of storing the messages and forwarding the data messaging as short burst of data.

Today's fleet operators are facing increasing competition and a plethora of legislation which regulates their industry. It has therefore become essential that the truck operator be able to maximize the utility of the vehicle and drivers hours while staying within the law. This requires careful real-time fleet management which is an area where recent developments in on-board computer systems, vehicle navigation system, personal computers, reliable mobile telecommunications and fleet management software now provide the operator with the required tools at an affordable price.

Throughout the world, truck owners face the same problems in maximizing the earning potential of the vehicle whenever it is on the road. In same countries return loads are not allowed to be carried by foreign vehicles while

in others, companies find it difficult to identify potential cargoes. While the former may take time to overcome, the latter is now being addressed in many countries with cargo brokers and clearing houses operating data bases which show what cargoes are available and their destination. With many trucks still being owner operated, services such as these are likely to assume even greater importance as competitive market forces increase.

The mergence of reliable navigation and communications systems throughout the world is now making it feasible for the truck operator to implement real-time fleet management solutions which will significantly improve his efficiency and profitability in the 1990s. In particular, the introduction of mobile satellite communications will integrate the truck and office and make the truck an integral part of the companies manageable assets.

3. BASIC DETAILS

Satellite is basically any object that revolves around a planet in an elliptical or circular orbit. Natural satellite of earth is moon. Else there are also the manmade artificial satellites orbiting around the earth. These satellites are very help full in resolving many issues and provide great technological benefits for human beings on the earth.

The path which a satellite usually follows is called an orbit. In the orbit, the farthest away point from Earth is the apogee, and the closest point is the perigee.

Artificial satellites generally are not mass produced. Most satellites are custom built to perform their intended functions. Exceptions include the GPS satellites and the Iridium satellites.

Satellites need to have certain ways of communication with Earth.

Satellite need to get information and transmit the information it collects.

It can relay information sent to it to another site on Earth. This is generally done using some type of antenna.

The information is transmitted using radio waves that move at the speed of light, this method allows for very fast communications.

All satellites must have a means of storing and analyzing the data collected, and ways of controlling its various systems.

The satellite subsystem that completes this role is called telemetry tracking and control.

Telemetry Tracking and Control is the main part or central part of the satellite and its operating system.

It stores every activity of the satellite and receives information from the ground station, takes care of any general thing the satellite needs to do

Telemetry Tracking and Control is made up of three components: Telemetry, Tracking, and Control

Every satellite needs a source of power

Factors to consider are cost, durability, and effectiveness.

Satellites use up a lot of electricity

Some possible power sources for satellites include: Solar panels Batteries , Nuclear power and Heat generators

4. INMARSAT

Since 1982 INMARSAT has been providing high quality service of direct dial telephony to the maritime community throughout the world, 24 hours a day. In February of this year British Airways began providing similar services to aircraft crossing the North Atlantic. By the end of 1989 aeronautical data and voice services will be available worldwide on many airlines for public calling and airline operational requirements.

Following the mobile reallocation of the L-band spectrum in October 1987 an Extraordinary session of the INMRSAT Assembly in January 1989 approved further enhancement to INMRSAT's convention to provide land mobile communication services.

Now, with the start of pre-operational Standard service, is poised to bring the benefits of satellite communications to all land mobile users throughout the world who have reason to travel beyond cellular or F3R coverage.

Today, INMARSAT is the only organization with a space segment role to provide land mobile satellite communication services throughout the world. It is therefore in a unique position to rapidly respond to the needs of user community and to provide services giving both public and private closed

user group access. In anticipation of these recent developments INMARSAT has, during the past year conducted an extensive series of trials and demonstrations of a low cost data and messaging service. These took place in East and West Europe, Australia and North America, and conclusively showed that the INWRSAT Standard C system is externally reliable and suited for land mobile use under all types of conditions and in all terrains.

5. STANDARD SATTELITE COMMUNICATION SYSTEM

The overall system design meets the goals of standardized system. Elements and details of this overall communication system described below

5. 1. COMS

At the remote site COMS is a low-power DC computer, INMARSAT-C radio, and independent power system in a single package. A message can be sent via INMARSAT-C to or from any device on the local-area network. COMS simply act as a filter, rejecting any packets that are not correct. GPS time messages are available from the INMARSAT- c radio, and COMS broadcast regular time packets onto the local area network.

5. 2. Local Area Network.

An EIA485 1ocal area network provides a simple digital communication link to elements of the ARCS. The LAN is reliable, low power, and noise immune.

5. 3. MACS

The monitor and control system is a low power DC computer, collection platform and independent power system in a single package. MACS collect hourly averaged scientific data from the DMS and utility data from the node data units then sends out the coded GOES data message. Monitor and control system can also send the same diagnostic data via INMARSAT if GOES is unavailable. It monitors van status and generates alarm messages. Monitor and control system has the ability to collect data sets from some instruments in the event the DMS is not operating.

5. 4. DMS

The data management system is the data collection workhorse for ARCS. It is a highly reliable implementation of a Sun workstation with copious tape recording capability. All elements of the DMs are redundant, including the processors.

5. 5. NDu

The node data units are small micro-power data collection devices that are placed in the network as required throughout the ARCS system. They perform monitor and control tasks on command and initiate certain alarm messages. One NDU is located in each sea container.

5. 6. COMSAT

COMSAT is a U. S. service provider for the INMARSAT satellite system. Messages can be transmitted to the ARCS in several different ways:

(a) Direct transmission from an INMARSAT-c radio;

(b) dial-up service to COMSAT;

(c) Internet email service provided by COMSAT.

5. 7. ARCS Base Station

The ARCS communication base station is a multi-tasking computer that performs several tasks:

(a) Monitor INMARSAT message traffic.

(b) Provide an operator interface for sending control commands to the remote sites.

(c) Routinely dial up and collect GOES data and forward them on to analysis sites.

(d) Send alarm announcements when emergency messages are received.

6. STANDARD C SYSTEM

The INMARSAT C system is the satellite system which usually provides two-way data communications from any place in the world. INMARSAT C terminals are very simple, cost effective and small in size to install any where at any point for example on vehicle , air craft and easy to hand carry from one place to another place. Communications via the INMARSAT C system are usually data or could be message based. Any information that can be encoded into data bits could be transmitted using the INMARSAT C system. Any kind of Messages whether short or long are transferred from C terminal at information rate of 600 bits per sec. Frequencies are from 1626.

5 MHz to 1645. 5 MHz for the transmit, and 1530. 0-1545. 0 MHz for the receiving. C system is available in all four satellites of INMARSAT and its coverage area is from all oceans through 40 or more earth stations. A NCS in each region controls communications traffic. A All INMARSAT maritime systems make use ofA 2-digitA codes to facilitate transmission and reception ofA various types of maritime information.

The typical INMARSAT C mobile earth station has a small omni-directional antenna. Antenna light weight and simplicity make it easily mounted on any place. Directional antennas are available which could be installed in fixed and movable modes. The main electronics unit is nearly 3 kg. Briefcase type terminals are available also and give benefit to international business travelers and field operators. Network architecture is shown below.

Figure 1 . Network Architecture

Some terminals have facility of built-in message preparation and display. Other terminals have serial port so that users can link their own personal computers or any other equipment for data transmission and reception. The power requirements of C terminals are good and can be easily achieved from battery and other resources. More than 100 different terminal models made by nearly 40 manufacturers are now approved to operate with C system.

Communication system using a cost effective mobile earth station suitable for installation and use on any type and size of mobile platform. The system is providing two way messaging service and data communications on a store and forward strategy, one way position and data polling and enhanced group

Call broadcast service able to address both groups and specific geographic areas.

The system interconnects with both Public and Private Networks to provide International, Regional or National services. The store and forward feature enables the system to interconnect with any terrestrial message or data network.

To keep the mobile equipment low costs and to minimize a very low G/T of -23dB/k at 50 elevations was selected to permit the use of a non-stabilized, unidirectional antenna. BPSK modulation is used and this coupled with the relatively low EIRP requirement of l2dBw can be achieved with a classA? aˆsA¬ HPA using existing semiconductors. To alleviate the effects of multi-path propagation on a very low gain antenna it was necessary to design a highly robust modulation and coding scheme. Transmissions frame the mobile take place between 1626. 5 – 1646. 5 M k and reception between 1530. 0- 1545. 0 MHz with tuning increments of 5 KHz. Standard C is therefore able to operate throughout all frequencies available on INMARSAT's existing and next generation satellites which are already assigned for Land Mobile use. The narrow channel spacing also helps ensure maximum efficiency in the use of limited spectrum.

The system has been designed with considerable flexibility in the access control and signaling protocols so that it can handle future new services and applications. The all digital design enables any type of data to be passed through the traffic channels due to the transparent nature of the transmission medium.

Current INMARSAT satellites have global beams providing coverage of about 1/3 the earth surface and to satisfy the design link budget requires a relatively high satellite EIRP of 21dbW is used. Third generation satellites now being specified will have spot beams and the Standard C system will be able to automatically identify the appropriate beam. Because of the high power requirements the forward carriers operate in a demand assigned mode when network conditions require. In addition the store and forward mode ensures maximum loading of the carriers at any given time which results in a highly cost effective service and mode of operation.

Network Coordination Station

Each Satellite Network Region is served by an NJS which manages central resources such as traffic channels for demand assigned operation together with signaling and traffic control. Each NJS transmits a NJS communication signal which is received by all MES's when the message transfer is not occurring. The Communication Channel is used to announce calls to mobiles waiting at the LESS, for broadcasting E messages and at various stages for protocol signaling packet transfer.

Land Earth Stations

Each LES serves as a gateway between the ground network and INMARSAT Standard communications and network system. The different types of interface provided at the LES are decided by the earth station operator; however, Telex and E message processing are mandatory. All mobile earth stations that are active in the network region are required to register with the Key. The copy of the list of registered mobile earth stations are held at

each LES and used as a reason for accepting or rejecting calls originating from the terrestrial network. In addition the location of every registered mobile earth station is held at the LES so that calls received at the LES for mobile earth stations that is on another ocean region can be redirected and the will call not be lost.

Figure 2. SES Example

7. BENEFITS AND APPLICATIONS

7. 1. ENHANCED GROUP CALLA

INMARSAT C terminals can receive multiple numbers of address messages known EGC. A specific header is inserted to the text to reference the group of mobiles and direct to the area for which the message is sent. Enhanced Group Calls can be transmitted in variety of languages and alphabets.

There are two main types of Enhanced Group Calls: A

SafetyNET

It provides an efficient and cost effective means of transmitting maritime safety and security information to vessels at sea and it is normally facilitated for different search and rescue coastguard co-ordination authorities. Short messages can be directed to mobiles and from mobile to any approaching specific regions.

FleetNETA

It allows information to be sent to a virtually limitless number of mobile terminals simultaneously which are pre-designated. It is highly recommended for use by services specializing in the advertisement of news, reports and any other information regarding roads and ports.

7. 2. SERVICESA

In bidirectional messaging INMARSAT C system can handle messages up to 32 kilo bytes in length. Every message from a mobile earth station is transmitted in data packets through satellite to a land earth station, where it is re-assembled and then sent to the final addressee via the local and international telecommunications networks. On the other side in the reverse direction callers can send messages to a single mobile earth station or to a group of mobile earth stations.

7. 3. Data reporting and polling

Many INMARSAT C system users need to acquire information from vehicles to cross-examine automatic data collection platforms at fixed or variable intervals. A

Data reporting allows the transmission of packets containing information of 32 bytes on request or on the base of pre-arranged intervals. On the other side polling allows the user base to interrogate a mobile earth station at any point of time, generating automatic transmission of the required information.

7. 4. POSITION REPORTING

INMARSAT C terminals can be connected with a wide range of navigation systems to provide a highly consistent, 24 hours position reporting capability. Position data can be derived from the earth based efficient systems and satellite based position fixing systems as global positioning system.

7. 5. Distress alertingA

In the event of emergency threat alerting equipment gives the signal. The equipment is attached with Maritime INMARSAT C terminals. An emergency signal is automatically generated and information in distress alert signal contains position and any other information to a rescue coordination centre. A

7. 6. INTERNET EMAIL

Most land earth stations offer internet electronic using the INMARSAT C service.

7. 7. APPLICATIONSA

INMARSAT C is used in the road transports fishing boats, land mobile and aeronautical military aircraft, helicopters and also used by news agency members, international business travelers and people doing work for aid collection and for remote monitoring plus data collection.

8. STANDARD-C CHANNELS8. 1. General

Different types of channels are used in INMARSAT standard C system. The channels are usually used not only in direct way communication from shore to ship but also inter-station links from shore to shore are used for network control process and monitoring.

8. 2. NCS Common Channel

The Network co-ordination station channel is a common channel which is time division multiplexed carrier transmitted continuously by the Network co-ordination station to all Satellite earth stations in the ocean region. Satellite earth stations tune to the Network control signal common channel when they are not operating. The channel operates on 1200 symbols per second with frame length of fixed standard of 8. 64s. The information is encoded at half rate convolution and interleaved on a frame to frame base. Data rate is therefore 600 bits per seconds and all messages and signaling information is transferred in the form of packets. In each one of the frame total of 639 bytes are available for packets. The very first packet in each frame is board packet. After this packet number of signaling channel descriptor packets are transferred which are used to transfer information concerning satellite earth station usage of the signaling channels associated with that TDM carrier.

8. 3. CES TDM Channel

The forward link is used with the help of CES TDM channel when the CES is communicating with a satellite earth station. The structure of CES TDM is similar to the Network co-ordination station common channel described in details above, and is used for carrying out call set up signaling shore-to-ship message and acknowledgement messages and call clear down signaling. A

CES can operate more than one CES Time division multiplexing channel and every channel is demand assigned by the NCS.

8. 4. SES Signaling Channel

The Satellite earth station signaling channels associated with each forward time division multiplexing channel are received both by the network control stations and by the CES mainly for signaling from the Satellite earth station to the shore stations. Access by Satellite earth stations to a Satellite earth station signaling channel is done with the help of algorithm known as slotted ALOHA scheme and the addition of one mechanism over it is reservation of slots in the channel. If more than one Satellite earth station transmits the data at the same slot collision occurs as seen at the receiving CES. To reduce the time elapsed before Satellite earth station is aware that its transmission is unsuccessful. Signaling channel descriptor packet in the forward time division multiplexed indicates the current status of all slots associated with that signaling channel. Slot timing is based on the time division multiplexed frame of 8. 64s.

Fourteen slots are allocated for the time of one data frame and 28 slots for future generation satellites. Any kind of Information which is to be transmitted in any slot is scrambled and half rate convolution encoded. The transmission rate is 600 symbols per second for current generation satellites and 1200 symbols per second for future generation satellites. Burst 120 information bits could be adjusted in one slot. The bursts do not contain acquisition preamble which are transmitted in the slots. This thing helps to maximize the signaling channel capacity.

8. 5. SES MESSAGE CHANNEL

Satellite earth station message channels are used by Satellite earth stations to transmit their messages to the chosen control earth satiations. Satellite earth station signaling channel is used in the call setup phase, but the message itself is sent on Satellite earth station message channel assigned by the control earth station. Access to the channel by Satellite earth stations is on a time division multiple accesses. The destination control earth satiations instructs each Satellite earth station to wait for the proper time to transmit, the time at which it can start transmitting. Once assigned a start time Satellite earth station will transmit its entire message without interruption. Any Information which is to be sent is formatted into fixed packets with fixed size and placed into the frames. Different frame sizes are available although the size is fixed for a particular transmission. Frame can contain between one and five packets depending on its size. Each packet contains 127 bytes of information. Frames are scrambled, at half rate convolution and interleaved. A preamble is added before transmission. Transmission rate is only 600 symbols for current generation satellites and it will reach to 200 symbols per second for future satellites.

8. 6. Inter-station Links

Control earth stations offering C services have bidirectional links with the network control signal of the same region. This type of link is used to transfer announcements and Enhanced Group Calls messages from a Control earth station to the network control signal for the subsequent transmission on the network control signal common channel. In addition, signaling is shared on

this link to make sure synchronization of access to Satellite earth stations and for the allocation of Control earth stations time division multiplexed channels by the network control signal. The transmission rate is 1200 bits in one second with no error correction techniques are employed.

8. 7. Inter-Region Link

Each network control signal is linked to the other Network control signals by inter region link channel. Mainly this channel is used to update other regions of any registration process by Satellite earth stations in a particular region. Automatic dial-up voice band data channels is used by this link over the public switched telephone network. These links operate at 600 bits per second, using CCITT V22 full duplex modems.

9. CHANNEL CHARACTERISTICS9. 1. Link Budget Considerations

The performance of customary analogue data links is specifically defined for a specific threshold value at the receiver demodulator and the link accessibility is defined as the %age of time that certain threshold value is likely to be achieved. Standard C uses ARQ technique to re-transmit error packets. Due to this reason changes in demodulator do not affect the standard quality of the received message but it affects only the counts of re-transmissions needed to make sure that the complete message can be decoded without error at the receiver.

In order to reduce the loading on the satellite the sum of energy per message transfer transaction must be reduce to limited extent. The forward link is more critical in terms of satellite resources and power reduction for

this will degrade the demodulator receiver and the error rate for the packets will increase. Therefore more repeat packets will be required and result will be satellite capacity utilization. And all this is because of extra total message energy required in transmitting the repeat packets. Over this the drawback one additionally drawback is the time needed to complete the message transfer would increase.

For best satellite capacity operation the satellite power should adjusted such a level that the sum of all message energy could be minimized. For this practice one forward TDM may serve many satellite earth stations and the power could be set to ensure a distribution of rate of error in packet across the satellite earth station population.

9. 2. Signal Processing Features

For the forward error correction half rate convolution is used on all the channels. A relatively short length allows the usage of maximum likelihood decoding techniques which can provide power in the region of 5 dB gain in an un-faded link. Similarly as a baseline for perfect performance limits, a decoder (Viterbi) has been assumed operating on three bit soft decision samples.

A data bit going through the encoder is capable to influence group of 14 consecutive symbols and that's why the fading bandwidth is much less as compared with the actual data rate. All fourteen symbols could be affected by a fade. Now for time division multiplexing and message channels encoded symbols are assembled in a block before its transmission. After that they are transmitted in a different order. This interleaving has great effect on signal

transmission. This interleaving process spreads transmission of the fourteen symbols connected with a given data bit over entire length of time which is large as compared to the fade duration.

De-interleaving of the encoded symbols at the receiver side is used to convert successfully the long duration fades into the arbitrary noise which the decoder is capable to tackle because only 14 symbols could be corrupted due to a usual fade. The redundancy established in to the transmitted symbol stream allows restoration of the original data. For the Satellite earth station signaling channel with burst mode, interleaving is not employed as the bursts are very short duration for any kind of major effect. Data scrambling is also used on all the channels and it is necessary to ensure enough symbol transitions for clock recovery on demodulator side.

Each packet contains the 16-bit checksum field which is transmitted on any of the INMARSAT C channels. Then it follows de-interleaving, decoding and descrambling operations, on the receiver checksum is calculated for each packet in order to find if the packet has been received is free of error or not.

Channel time is given in figure below

Figure 3. Channel time

10. DEVELOPMENT TOOLS10. 1. Simulation

In the simulation environment characteristics of the Standard-C system in respect of the channel environment and the protocols are used because the analysis by conventional techniques is not suitable for examining the performance of system and many types of simulators have been used.

Some of the simulations techniques and software programs are briefly described below:

1. Software program based on the TOPSIM language has been prepared to analyze the packet error rate in the forward and return links and the effect that various channel exhibit on performance.

2. LOTUS 123 has been used for analyzing the effect of certain traffic loading on a given network configuration. Using this software the results have been very useful in showing the capacity of the network and delays expected under different scenarios.

3. Simulator of testing demodulators is also there. This simulator allows the testing of demodulator functions in the multi-path fading conditions. Such kind of test equipment is not present in the market.

4. HOCUS simulation language was used to model the behavior of signaling channel. It provides useful feedback on the slotted Aloha channel characteristic, performance and the mechanism used to reserve slots.

10. 2. Test BedsEGC Sea Trials

Series of trials were carried out at sea and on land under controlled conditions by purchasing number of terminals. These experiments enabled INMARSAT to verify the performance of the Standard-C forward channel so that the whole system performance could be viewed under the load of real traffic scenario. And after that coast earth station and operational TMES has been developed. The TCES provides three independent functions.

It can behave as a CES, an NCS, or as both.

This allows a full network to be brought into service using this test-bed and a number of mobile terminals.

The third function provides monitoring and loading capabilities to stress the network.

The software is being written in the Ada language and it is intended that future services will be developed and tested on this test-bed.

11. CALL SET-UP PROCEDURES11. 1. General

Message transfer can be taken as three different processes due to the store and forward characteristic of Standard C channel.

1. DTE to DCE at the SES;

2. SES to CES (via the satellite);

3. CES to terrestrial network.

Each of the above process can be considered as a completely independent message transfer process. It allows the link of maritime satellite system as a memory to memory transfer between Control earth station and Satellite earth station.

11. 2. SES Originated Calls

Following figure is a sequence diagram for a satellite earth station originated call to a control earth station with a permanent time division multiplexed

channel. To transfer a satellite earth station originated message, the satellite earth station must tune to the control earth station so that message could be sent. After synchronizing to the frame of the control earth station time division multiplexed channel, the satellite earth station transmits a request signal in a randomly accessible slot on a satellite earth station signaling channel. When the request is processed the control earth station will command the satellite earth station to tune to a particular satellite earth station frequency of message channel and transfer the message.

Message packets are verified for errors by the control earth station and any needed retransmission are advised in the control earth station's acknowledgement packet. Upon completion of transfer the Satellite earth station is released and re-tunes to the network control signal common channel.

Figure 4. Call protocol

11. 3. Shore Originated Calls

Transfer of shore originated calls follow the same procedure as satellite earth station origination. The subscriber on earth places a call to the desired satellite earth station. The call is routed through the terrestrial network to the desired control earth station and this control earth station then checks for the accessibility of the required satellite earth station within the ocean.

A call announcement is transmitted on the network control signal common channel. If the call originated from shore is being transferred over an international PSTN, the subscriber would be billed for the complete message

transfer. Hence all steps must be taken to make sure the accessibility of the addressed satellite earth station.

12. WORKING OF PRE-AMBLELESS MODEL

preamble-less demodulation methods (or block demodulation methods), which demodulate received burst signal without any preamble, are proposed for burst mode satellite communications Preamble-less demodulators proposed so far once store the whole burst and calculate optimum carrier frequency and phase over the burst. These demodulation methods are based on the assumption that carrier phase and frequency are constant within the burst.

In mobile satellite communications, however, the carrier phase and frequency are not always constant, because channel characteristics are time variant due to multi-path fading and carrier frequency change. Under such conditions, conventional preamble-less demodulation methods cannot give a good demodulation performance over the entire burst signal. Tracking carrier signal variation capability is required for demodulating under such conditions. Inmarsat standard-C signaling channel is a typical preamble-less mobile satellite communication system. A coast site demodulator for Inmarsat standard-C system is actually developed using the proposed principle. It is confirmed that the developed demodulator well satisfies the specifications

13. DEVELOPED DEMODULATOR CONFIGURATION

Figure below shows preamble-less demodulator block diagram for Inmarsat standard-C coast earth station. It consists of 3 blocks, carrier pre-estimator (block I), clock timing recovery (block 2) and fine carrier recovery (block 3). The carrier pre-estimator, carried out by the block 1, extracts coarse carrier frequency offset. The carrier pre-estimator is composed of a filter-bank, frequency- Multipliers, a FFT bank, and a maximum power detector. The filter-bank improves the input S/N ratio in order to suppress the degradation, caused by the frequency–multiplier. Frequency-multipliers generate a carrier signal component from the modulated signal. The FFT bank calculates its power spectra over the filter-bank band width. The power detector detects maximum power spectrum position (i. e. the carrier power center).

Figure 5. SES demodulator

14. SOME ADVANTAGES OF SATTELITE COMMUNICATION'S

Satellite communications are simple and easy to use. A ship equipped with a ship earth station can send a telex or make a telephone call directly to shore or other sitcom-equipped ships as easily as if the call were being made between two offices ashore. In most countries, subscribers can dial the satcom-equipped ship directly, without operator assistance.

Maritime satellites provide near global coverage to about the 75 degree latitudes which means a ship can be virtually anywhere and still be reached.

A ship equipped with a ship earth station can be contacted 24 hours a day. This instant accessibility greatly assists ship owners in the management of their fleets.

Some modem telecommunications services are available only to ships with a ship earth station. Automatic, direct dial telephone calls and medium and high-speed data communications, for example, are not possible over conventional radio communications. The satcom-equipped ship can access company data bases and computer systems, while shore-based computer systems can monitor ship performance and other data.

15. SAFETY

The present maritime distress and safety system will be replaced beginning in 1992 with a new system. The GMDSS planned and developed by the international Maritime Organization. Equipment carriage requirements to enable ships to perform specified distress and safety communications functions will be mandatory for all SOLAS convention vessels. The SOLAS Convention applies to all passenger vessels and cargo vessels of 300 tons gross tonnage and larger making international voyages. The implementation period for the Global Maritime Distress and Safety System will extend over a period of seven years, from 1 February 1992 to 1 February 1999, by which time all SOLAS ships will be in compliance. Carriage requirements will vary somewhat depending on the areas of operation for the applicable ships.

The INMARSAT system is a major ingredient in the Global Maritime Distress and Safety System. It brings rapid, reliable communications to the aid of the mariner to help him avoid danger and to provide a means for assistance when all else fails. In addition to INMARSAT Standard-A ship earth stations, the new developments of the small Standard-C ship earth station and the

Enhanced Group Call system for receipt of Maritime Safety Information fit nicely into the GMDSS equipment package.

16. CONCLUSION

Satellite Communication provides true global coverage with ignoring the world boundaries. The area where the consumers are sparsely located at a vast area on earth is the one area where Satellite is the only option besides providing broadcasting, monitoring, position location and mobile services to ground, maritime and users in air.

The Standard-C system has been well received by both users and manufacturers. The current demand for terminals by users is very high and market research has indicated that a user base of well in excess of 200, 000 exists globally, if land mobile vehicle location services are taken into account. INMARSAT is currently at the final stage of system proving and pre-operational trials are about to start with both land and sea based users involved. A number of manufacturers are currently building ground station (CES) equipment and Mobile Earth Stations and INMARSAT has ordered the Network Coordination Stations for the system; the first of which will be installed in June 1989. The Standard-C communications system is based on digital mobile satellite communication system allowing the use of very compact mobile earth station (SES) equipment suitable for fitting on all sizes of vessels. The system makes very efficient use of satellite capacity despite the fact that the mobile terminals operate under conditions of very severe multi-path propagation. It will provide an economic means of transmitting messages and data to and from mobile earth stations. Its transparent packet

message transmission method and flexible protocol design mean that it will be able to accommodate a wide range of new system enhancements in the future. The development of maritime satellite communications is having an impact as great as the invention of the wireless telegraph. The benefits of satellite communications, with high consistency, simple operation and multi-modal facilities cannot be ignored and, in fact, are being eagerly welcomed aboard ships for their business, safety and social features. The ability to correspond with a vessel anywhere in the world, at any time of day, and to know that one can be advised immediately of any difficulties.

17. REFERENCES

http://www. otesat-maritel. com/Files/Sailor_3020C. pdf

http://www. hoka. com/code300-32/inmarsatca. htm

http://www. marconi-marine. com/products/sailor/pdf/Sailor_H2095C. pdf

http://www. cellular. co. za/inmarsat-overview. htm

http://www3. interscience. wiley. com/journal/114129813/abstract? CRETRY= 1&SRETRY= 0