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DIGITAL MODULATION/DEMODULATION EQUIPMENT FOR THE INTELSAT INTERMEDIATE DATA RATE (IDR) SERVICE

by

P.F. Robinson

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Our plant was one of the earliest factories in China to produce ferrite magnetic cores. With a history of over thirty years, production is large scale, types of products are numerous, and specifications are complete. Large amounts of products are used in such equipment as carrier wave, digital, and fiber optic communications, program control switching devices, instruments and gauges, television sets, reception and recording devices, and so on. Our plant's ferrite products are divided--in accordance with materials--into such types as manganese zinc, nickel zinc, magnesium zinc, and so on. In accordance with magnetic properties, they are divided into such types as high magnetic permeability, high magnetic saturation, high stability low loss, and so on. In accordance with external form, they are divided into such forms as container shape, square container shape (RM type), EE type, EI type, EP type, EC type, UF type, and U type.

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M1.2KG adjustable container shaped magnetic core--losses small, price low, appropriate for use in making 10-500KHz wave filter inductance.

M2KB nonadjustable container shaped magnetic core--magnetic permeability high, price low, appropriate for use in making 10-1000KHz inductance devices and transformers.

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As far as detailed technical characteristics are concerned, we welcome users to consult the product documentation of our plant and come to the plant for face to face discussions.

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SHZ MINISTRY OF POSTS AND TELECOMMUNICATIONS SHANGHAI COMMUNICATIONS EQUIPMENT PLANT

-Satellite Communications-

DIGITAL MODULATION/DEMODULATION EQUIPMENT FOR THE INTELSAT INTERMEDIATE DATA RATE (IDR) SERVICE

P.F. Robinson

Translation of "INTELSAT Zhong Su Shu Jyu Ye Wu Yong De Shu Zi Tiao Zhi Jie Tiao She Bei"; TELECOMMUNICATIONS INFORMATION, 1990-4, pp 2-8

This article introduces designs associated with completely new specialized satellite modulation/demodulation equipment (Marconi P3801) used especially in INTELSAT intermediate data rate (IDR) services.

In the article, discussions are made of primary requirements associated with designs as well as factors influencing implementation. In conjunction with this, equipment is introduced. The equipment that is introduced not only includes modulators and demodulators but also includes relevent spare cut over and remote control equipment.

I. INTRODUCTION

Following along with the introduction to the world of the Edition 4 revision of the INTELSAT IDR Standard IESS-308, large scale digitizing of international relay telephone services through INTELSAT satellite series is bound to occur.

This article introduces the designs associated with completely new modulation/demodulation equipment (Marconi P3801) used specially in INTELSAT IDR services. The equipment in question is appropriate for use in relatively low bands of standard regulation criteria rates. The standard is 64-8448kb/s.

The purpose of the equipment in question is to receive surface data through appropriate standard CCITT ports. In conjunction with this--through medium frequency connections--it will be passed to earth station radio frequency equipment. This article, first of all, makes a to the point critique with regard to important requirements. After that, factors influencing modulator/demodulator implementation are generally described, and, finally, equipment is introduced.

2. SYSTEM REQUIREMENTS

The aim of IDR services lies in supplying various types of digital services through satellites. The most common use is to make use of one iteration reuse level (that is, 1544 or 2048kb/s) or two iteration reuse level (6312 or 9448 kb/s) taking relay telephone and connecting it to modulation/demodulation equipment.

Detailed requirements associated with systems are introduced in Reference [1] and Reference [2]. Therefore, they do not belong to the scope of this article. Precisely determined main requirements associated with modulation/demodulation equipment designs include:

(a) 1544/2048/6312/8448kb/s data rate frame header structures, supplying official business circuits (ESC) and backward alert transmission characteristics

(b) conformance with CCITT recommended V.35 data confusion

(c) 3/4 rate perforation scroll encryption, opting for the use of soft decision maximum likelihood decryption

(d) four level coherent phase shift keying (PSK) modulation.

3. OPERATING REQUIREMENTS

Besides system requirements which References (1) and (2) specify as having to be observed, there are also a good number of operating requirements which are indispensable for earth station operating personnel to successfully make use of modulation/demodulation equipment. These requirements include a number of basic equipment characteristics as well as a number of auxilliary (however, indispensable) systems. The latter include:

1:N reserve switches, intermediate frequency shunts/parallel circuit subsystems, and cabinet type casings.

Below, we will introduce these operating requirements as well as their influences on equipment design methods.

3.1 Modulator/Demodulator Set Ups

One of the important aspects associated with INTELSAT IDR services is standard permissible point to multiple point working.

The result is that, with regard to the designs of devices /3

being numerous, the significance is that equipment which combines into one transmiting and receiving (for example, INTELSAT IBS services [3], which are normally opted for the use of in setting up) are already no longer appropriate for use. Seen from the point of view of earth station operating personnel, they firmly assert that--with regard to IDR--the method which has the best cost benefits, the greatest flexibility, and the most compactness is modulation and demodulation equipment in structures separated from each other, and, in conjunction with that, independent.

With regard to requirements for low equipment costs and compactness, further steps toward satisfying them are also due to making use of the technologies set out below for their achievement.

Digital Implementation Channels. It is now possible to make use of digital technology to realize most modulation and

demodulation functions. This then permits large scale integrated technology, simplification of production/maintenance test measurement procedures, and simplification of certain equipment data rate conversion programs.

Specialized VLSI. Large numbers of uses of digital technology are specialized uses of VLSI, providing even more opportunities. Specialized VLSI makes equipment volumes small. Energy consumption is low. Reliability is high.

Surface Installation Technology. Once again, the most advanced sealed and assembly technologies will provide opportunities in automated plant assemblies with comparatively small actual dimensions and low costs.

Use is made of all the technologies described above to make extremely small, ingenious, and cost effective modulation and demodulation equipment achieve realization. Besides this, a high degree of interchangability between sending equipment and receiving equipment further simplifies production processes as well as earth station operating personnel storing sets of spare parts.

3.2 Surface Connections

Due to the fact that there are a large number of cases which are capable of occuring, system standards do not completely stipulate all data rates and surface equipment connections. Fortunately, CCITT Recommendation G.703 completely specifies corresponding connections for the applications which are normally the most probable to foresee (data rate range is 1544-8448kb/s). The document in question--in accordance with data rates--specifies equilibrium and nonequilibrium line connections as well as permissible input clock fluctuation amounts. In order to make demodulators operate accurately, it is necessary to make use of narrow band phase lock ring circuits as well as first in first out data buffers--basically eliminating this type of input clock fluctuation.

In order to simplify processes associated with manufacturing firm production and new set ups of earth station operating personnel--in equipment design--one very important area is changes in surface connection types (and related data rates) being capable of using equipment set ups to make tiny and simple changes in order for realization.

As far as any earth station installation is concerned, demodulator equipment may be more able to satisfy required

targets than modulation--taking modulator surface connection circuits and any other components related to data rates used and putting them on one "secondary" printed circuit board. Demodulators also opt for the same type of method.

3.3 Intermediate Frequency Connections

As far as connections to earth station radio frequency equipment is concerned, it is possible for them to be 70MHz or 140MHz. The former is comparatively conventional in earth station freqency conversion equipment which is currently available. However, it is only capable of connecting to 36MHz band widths. In cases where transmiter band widths are 72MHz, there will necessarily be limitations imposed. The latter is capable of connecting to full 72MHz band widths.

It is required that any IDR modulation/demodulation equipment manufacturing firm be capable, in all cases, of supplying the two types of options in order to avoid product uses being limited. Obviously, seen from the point of view of production, all efforts possible should be exerted to reduce differences between these two types of options.

3.4 Distant Terminal Monitoring and Control

Between modulation/demodulation equipment and central computers, there is a need for a monitoring and control connection. The communications channel in question is used in order to send control data to modulation equipment (for example, precisely determining channel frequency). In conjunction with that, it is possible to switch over connection status information and alarms from equipment. This type of method is capable of relying on one computer, carrying out operting control monitoring with regard to the possibly large numbers of modulators/demodulators. Computers are able to install long range transmission equipment. Besides this, computers are capable of carrying out routine internal operations including recording incidents as well as accumulation of erroneous code rate statistical values.

In order to make considerable amounts of equipment capable of conveniently connecting to one computer, there is a requirement for distant terminal connections using multiple plug trunk line configurations to operate. Industrial standard RS-485

connections are appropriate for use in the applications in question. Because it is possible to make use of 1200 meter electrical cables and there is no need for a relay device, at a maximum, it is possible to take 32 pieces of equipment and connect them to one computer port. Also, electrical cable is not expensive. All that is required is two pairs of twisted dual lines.

3.5 Spare Cut Over

According to standard procedures, earth station equipment associated with carrier transmission relay services uses hot spare set ups in operations. Modulation/demodulation equipment normally also uses 1:N set ups to operate. Through spare cut over systems, one spare equipment unit is capable of serving for any equipment on the line (according to standard regulations, the maximum is eight units). This system can be divided into two different areas--cut over functions and control functions. Applied to the systems in question, there is a requirement for sending and receiving controls to be completely independent (one to one correspondence with division of modulator and demodulator structures in terms of external form).

Modulator cut over can be automatically controled (that is, malfunction detection). It can also be controled by operating personnel. Control functions include: /4

(a) through programs, taking spare transmission frequencies set ups to "Malfunction" on line frequencies

(b) through programs, taking spare transmission power level set ups to "Malfunction" on line equipment power levels

(c) causing spare intermediate frequency output initiation, blocking "Malfunction" intermediate frequency output associated with on line equipment

(d) controling swith indicator number configuration to take signals from "Malfunction" on line equipment and tie them into spare equipment.

Modulator cut over functions include sending the large numbers of signals set out below, which are capable of being used in IDR:

(1) as far as basic band service data inputs are concerned--based on data rates--it is possible for them to be balanced or unbalanced

(2) in the case of intermediate output signals, it is possible for them to be 70 or 140MHz

(3) modulator standard clock outputs (deduced from input service data)

(4) with regard to dual circuit ESC voice inputs, each circuit is a balanced signal in all cases

(5) as far as ESC data inputs and relevent clock outputs are concerned, in all cases, they are balanced signals in the same way

(6) four different back alarm initiation signals. Obviously, the same control and cut over functions are required to be appropriate for use in demodulation spare cut over systems.

As far as 1:N spare function realization is concerned, it represents one of the key parts of IDR modulation/demodulation "systems". Primary factors influencing control function design are generally described below.

1. It is necessary to implement control functions with high reliabilities (because they represent single point malfunction mechanisms within spare systems). Moreover, the functions concerned should be easy to combine together with modulator/demodulator equipment associated with carrier transmission services.

2. Various 1:N spare groups should be independent (for the sake of earth station reliability). In conjunction with this, it should be possible to use automatic methods (that is, initiated by malfunctions of individual pieces of equipment). Through the devices in question, operating personnel (that is, the panel) or distant terminal monitoring connections do the controling.

3. Sending and receiving functions should be independent--structurally separate--however, also almost the same (in order to simplify manufacturing firm storage and managers' spare stockpiles).

4. "Active" control circuits do not carry actual services. They should be able to be separated from sending service cut over circuits in order to reduce as much as possible any maintenance interruptions.

The considerations described above are prerequisites associated with the design of single processor boards. The single processor boards in question are a set of integrated transmiting or receiving spare groups to implement all the functions discussed above. Through meticulously designed 1:N spare set up modulator/demodulator equipment, making use of a

specialized metal shielded trunk line will take operating parameters (frequency, electrical level, and so on) and shift them from on line equipment to spare equipment, so being able to realize this objective.

The principal factors influencing cut over functions are:

1. Cut overs of various levels of signals require possessing extremely high reliability. The influences on the signals they carry can be ignored in calculations (because connections are basically specified at modulator/demodulator equipment locations). It is best to make use of relays (appropriate specifications) to act as cut over components.

2. Various types of signal cut overs should be able as much as possible to be interchangeable (simplifies spare part stockpiles).

3. Due to the fact that--in the majority of situations--cut over switches are equivalent to the primary connections between modulation/demodulation equipment and the remaining parts of earth stations, connections with these ports should be able to go through modification wiring to make it easy for earth stations to expand and install new services.

Marconi's understanding of these requirements has already been manifested in the design of single cut over bench boards. One half of the board in question is used in transmiting. The other half is used in receiving. Each cut over switch fits a certain relay, and it is possible to conveniently connect from the front of the bench board to all necessary earth station connection signals.

3.6 Intermediate Frequency Parallel Circuits/Shunts

In the majority of earth station installations, it is estimated that it is possible there will be certain modulator/demodulators distributed to given transmiter units. As a result, there will also only be one frequency conversion equipment unit. This then requires that intermediate frequency parallel circuit/shunt circuit subsystems take certain modulator/demodulator connections and change them into an earth

station connection. Besides this, it is possible there will be a requirement for a large set of modulator or demodulator spare groups (for instance approaching an upper limit of 8) and certain transmiter connections. Therefore, there are also certain frequency conversion devices. This requires intermediate frequency parallel circuit/shunt circuit installations to include capabilities to provide certain earth station connections (generally 4). The overall requirements can be summarized as: flexible intermediate frequency parallel circuit/shunt circuit installation, the ability to supply at a maximum 9 modulator/demodulator units (8 units on line and 1 unit spare) as well as 4 earth station connections. Between two sets of connections, there are flexible connection line installations. /5

4. EQUIPMENT INTRODUCTION

The P3801 modulator/demodulator equipment developed by the Marconi Company specially for use in INTELSAT IDR services possesses the characteristics set out below:

(a) independent modulator/demodulator units

(b) use being made of custom VLSI and compact designs associated with surface installation technologies

(c) data rates as 64-8448kb/s, surface connections capable of on site changes

(d) integrated set frame/ESC functions (no matter how selected)

(e) 70 or 140MHz intermediate frequencies

(f) compatible with INTELSAT IBS/Eutelsat SMS

(g) system selection items:

(i) as far as housings are concerned, installation of full 1:8 modulator/demodulator spare groups

(ii) in the case of 1:N spares, equiped with combined

automatic cut over or remote control

(iii) intermediate frequency parallel circuits/shunts

(iv) remote control and monitoring computers.

Equipment includes certain hardware component parts, that is

(a) modulator bench boards

(b) demodulator bench boards

(c) 1:N spare control bench boards

(d) 1:N cut over bench boards

(e) intermediate frequency parallel circuit/shunt boards

(f) remote control and monitoring computers

Below, we give a to the point introduction to various constituent parts.

4.1 Modulator Bench Boards

Modulator equipment is installed in a one unit (1.75 inch) high bench board, appropriate for installation in a 19 inch wide rack. It includes its own main power supply and forced air cooling. Fig.1 is a common basic bench board. It can be used with modulators. It can also be used with demodulators. Bench board design guarantees that, on panels, it is possible to carry out equipment utilization as well as operating all necessary control and monitoring required. Besides this, it is also equiped with an RS485 multiple plug trunk line connection to carry out distant terminal (computer) control and (or) monitoring.

Within bench boards, option is made for the use of modular methods, plugging in certain printed circuit boards and modules. This guarantees flexible set ups and fast malfunction location/ repair. Fig.1 is a basic line and block chart for modulators. What is worth paying attention to is that monitoring and control printed circuit boards as well as synthesizers are interchangeable between modulator and demodulator bench boards.

Transmission surface connection printed circuit boards are

one plug in type secondary printed circuit board. They contain actual connections which are fully visible in use and data rates that vary in different components. They include line connections (and line decryption) circuits as well as fluctuation eliminating buffers. Fluctuation elimination circuits make use of narrow band phase lock loops, supplying standard clock outputs coming from bench boards. In order to supply clocks associated with surface outputs corresponding to quasisynchronous buffers, as far as standard clocks are concerned, selection can be made to go through to relevent demodulators (via spare cut over) (see following).

Transmission set frame/official business printed circuit boards realize 1544, 2048, 6312, and 8448kb/s data rate official business voice encryption and frame header formation. With regard to other data rates, it is possible to leave out this printed circuit board.

In accordance with CCITT recommendation V.35, modulator printed circuit boards disrupt code with regard to data flow. In conjunction with this, 1/2 rate scroll encryption is completed, and perforation circuits subsequently take encryption and turn it into 3/4 rate. After these processes, wave forms are stored in modulators. Use is made of full digital forms to complete four level phase shift keying modulation. In this way, it is then completely unncecssary to use ordinary analog channel form wave filters used previously in association with these data rates. Terminal orthogonal frequency mixers make use of two basic oscillations which can be selected at will as either 138MHz or 86MHz (already installed before factory test measurements), causing final intermediate frequency output to be 70 or 140MHz.

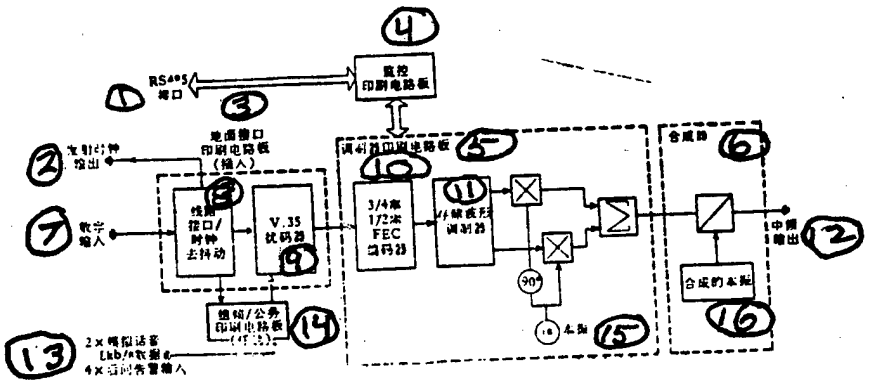

Fig.1 IDR Modulator

Key: (1) Connection (2) Transmission Clock Output (3) Surface Connection Printed Circuit Board (Plug In) (4) Monitoring and Control Printed Circuit Board (5) Modulator Printed Circuit Board (6) Synthesizer (7) Digital Input (8) Line Connection/Clock Fluctuation Elimination (9) V.35 Code Disrupter (10) 3/4 Rate and 1/2 Rate FEC Encryption Device (11) Wave Form Storage Modulator (12) Intermediate Frequency Output (13) 2 x analog voice (kb/s data) 4 x back alarm input (14) Set Frame/Official Business Printed Circuit Board (15) Basic Oscillation (16) Synthesized Basic Oscillations

Synthesizer modules contain synthesizers themselves as well as terminal frequency mixer/amplifier stages. Synthesizers operate in the 190-262MHz range. Frequency mixers/amplifiers are capable of receiving inputs in the 50-90MHz and 100-180MHz range, supplying outputs in conjunction with this. With regard to 70 MHz intermediate frequency modulators, mixing device input is 138 MHz. Output can be in the range of 52-88 MHz. The numbers corresponding to 140 MHz intermediate modulators are 86 MHz and 140 - 176 MHz.

Monitoring and control printed circuit boards take panel monitoring/control or RS485 distant terminal connection and modulator circuit connections. They process a step further all malfunction indications associated with the machines in question.

In conjunction with this, whatever the excitation is, operations subsequently occur (for example, transmission of alarm indicator signals).

4.2 Demodulator Bench Boards

Demodulator equipment is installed in the same one unit (1.75 inch) high bench boards. Generally speaking, the principal functions and modulator functions are opposite to each other. Fig.2 is a demodulator line and block chart.

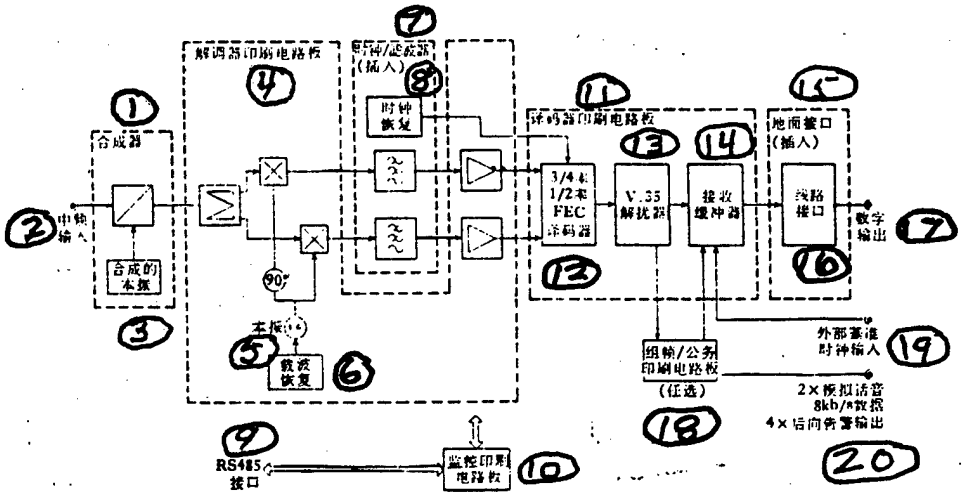

Fig.2 IDR Demodulator

Key: (1) Synthesizer (2) Intermediate Frequency Input (3) Synthesizer Basic Oscillation (4) Demodulator Printed Circuit Board (5) Basic Oscillation (6) Carrier Wave Restoration (7) Clock/Wave Filter (Plug In) (8) Clock Restoration (9) RS485 Connection (10) Monitoring and Control Printed Circuit Board (11) Decryption Printed Circuit Board (12) 3/4 Rate 1/2 Rate Decryption Device (13) V.35 Descrambler (14) Reception Buffer (15) Surface Connecton (Plug In) (16) Line Connection (17) Digital Output (18) Set Frame/Official Business Printed Circuit Board (19) External Standard Clock Input (20) 2 x Analog Voice 8kb/s Data 4 x Back Alarm Output

Synthesizer module and modulator design are the same. In cases where intermediate frequencies are 70MHz, it is possible--within a range of 52-88MHz--to select inputs and outputs as 138 MHz. 140MHz inputs are 104-176MHz. Outputs are 86MHz. Demodulator printed circuit boards include automatic gain control circuits, coherent wave detector, and carrier wave restoration functions. In cases where frequency deviation is relatively

large, carrier wave restoraton circiuts make use of sophisticated acquisition circuitry in order to help with signal recovery. With regard to times when data rates approach permissible lower limits of 64kb/s, this point is even more important. What is worth paying attention to is the fact that, in demodulators, components that are determined on with a view to data rates (that is, channel formation wave filters and restoration circuitry) are all contained on reception port printed circuit boards (the printed circuit boards in question also include ground connection circuits). Demodulator printed circuit boards supply three bit soft decision outputs, for the use of decryption device circuitry.

Decryption device printed circuit boards contain maximum likelihood rate forward error correction decryption devices and relevent perforation circuitry, V.35 descramblers, and Doppler quasisynchronous buffers.

Forward error correction decryption devices make use of a module of VLSI. With regard to all data rates, it realizes 1/2 rate maximum liklihood algorithms. Doppler/quasisynchronous buffers are capable of taking recovery demodulator clocks and converting them into ground clocks at the place in question. The ground clocks at the place in question are capable of acting as bench board exterior standards (if appropriate, through spare switches). Buffer maximum capacity is 128kb. They are capable, at 8448kb/s data rates, of storing a nominal 16ms. Actual storage dimensions and slip amplitudes are capable--in accordance with gradual 16 bit increases, set by program--of making slip amplitudes at various suitable data rates be fixed in all cases at a whole number multiple. /7

Receiving set frame/official business printed circuit boards and corresponding transmiting printed circuit boards have functions which are opposite to each other. Here, it is necessary to have a module of plug in subcomponents to supply frame synchronous circuitry. It requires eight 125 μs delay lines to make the various frame character codes associated with complex frames be checked at the same time.

Receiving port printed circuit boards contain all the different components based on actual connections being used and data rates. It is a modular, plug in type secondary printed circuit board.

4.3 1:N Spare Control Bench Boards

Modulator or demodulator spare groups are controled by a one

unit (1.75 inch) high bench board appropriate for installation on 19 inch wide equipment racks. The bench boards in question have a processor plug in module, spare control cut over relays, and spare modulator or demodulator configurations.

In cases of normal operation, control outputs associated with the bench boards in question are obtained through normal or abnormal indications associated with various equipment items within detector spare groups. However, for the sake of maintenance requirements, it is possible to select control by operating personnel of the equipment in question (panel). Besides this, it is also possible to achieve control from RS485 connections (using automatic control for operating personnel or from distant terminal center earth station computers).

4.4 1:N Cut Over Bench Boards

Cut over bench boards are six unit (10.5 inch) high bench boards suitable for installation on 19 inch wide equipment racks.

They are capable of containing relay printed circuit boards and modules from transmiting and receiving circuits set out below:

1. Basic band service printed circuit boards associated with equipment taking services and connecting them to spares. In cases where ground connections being used are looked at, balanced or unbalanced types are supplied.

In conjunction with this, it is possible to select any of the components set out below.

2. Intermediate frequency coaxial relay modules associated with intermediate frequency signals connected to spare equipment. The modules in question are capable of improving the safety of modulator on/off controls and are easy to connect to off line equipment to do test measurements. In conjunction with this, they are capable of making one spare group to tap off to a certain transmiter.

3. Taking standard clocks and connecting them to clock printed circuit boards associated with reserve equipment. These printed circuit boards are only made use of when standard clocks are obtained in various demodulators from corresponding modulators.

Another type of method is to make use of earth station standards to provide clocks associated with all demodulators. In this type of case, there is no need for transmission clock printed circuit boards. Clock distribution functions substitute for reception clock printed circuit boards.

4. Official business cut over printed circuit boards taking

official business voice, data, and back alarms and connecting them to spare equipment. In order to reduce as much as possible equipment spare parts, use is made here of plug in type relays to make hardware set ups conform to requirements associated with earth station operating personnel.

4.5 Intermediate Frequency Parallel Circuit/Shunt Boards

Certain three way mixed parallel circuit devices are installed on a terminal board, acting as intermediate frequency parallel circuit/shunt terminal board. There are respectively 4 parallel circuit device units, and the two parallel circuit "sets" are capable of satisfying maximum requirements associated with 9 modulation units or demodulation units and 4 frequency convertors. Spare part equipment set ups make actually provided hardware capable of satisfying requirements associated with various earth station operating personnel.

4.6 Remote Control and Monitoring Computers

At a central location--through remote control and monitoring systems that can be selected at will--distant terminal operating control is carried out with respect to what may be large numbers of modulators and demodulators as well as spare groups (that is, parameter adjustment). It is normally not used in spare cut over.

The core of the systems in question is a specialized table model computer. One series link RS485 trunk line connects it to modulator/demodulator equipment. One trunk line, at 1200 meter distances, is capable of connecting a maximum of 32 pieces of equipment. With the use of additional computer ports, it is possible to provide expanded capabilities.

The foundation of designs is that the configuration of equipment be able to take text forms and display them on video frequency display units (VDU)--just like a series of screens or pages. Through keyboards, operating personnel select the needed pages or operations. Display pages are as follows.

Summary Pages	They display the general configuration of various spare groups. Appended pages are selected from here.
Control Bench Boards	This page can control 1:N spare control bench boards. Carrier wave paths are implemented by spare control bench boards selected from those normally under automatic control. However, the control of various bench boards can be replaced by operating personnel. This page also displays current paths to select in association with various spare groups.
Modulator Bench Boards	This page monitors all modulator bench boards, displaying warning states,

frequencies, electrical levels, and noise abatement adjustments. These parameters are also capable of being controled by operating personnel.

Demodulator Bench Boards: This page is extremely similar to modulator pages. However, it is only capable of controling frequency, monitoring erroneous code rates, and back alarms. /8

Erroneous Code Rate Statistics: Erroneous code keying rates obtained from forward error correction decryption devices go through analysis to obtain the keying usability rates associated with various carrier waves. The page is displayed from the statistics in question. Fig.4 is one sample page for demodulator spare groups.

Erroneous Code Rate Statistics — 11 September 1988 11:22

Group 5 — Period from 1 August 1988 00:00 to 31 August 23:59

Demodulator	Channel	Average Erroneous Code Rate	Error Free Seconds (%)	Erroneous Code Seconds (%)	Severe Erroneous Code (%)	Erroneous Code Minutes (%)	No Way to Use (%)
1	1022	1.OE-9	99.99	0.01	0.00	0.00	0.00
2	1023	2.3E-9	98.75	1.21	0.02	0.57	0.02
3	1024	5.7E-6	90.12	7.33	1.42	5.57	11.60
4	1397	1.OE-9	93.45	6.78	9.12	3.45	6.78
5	1522	4.7E-5	71.23	14.56	7.89	10.12	3.45
6	4760	2.7E-7	90.98	7.65	4.32	1.09	8.76
7	4870	7.4E-7	89.09	8.76	5.43	3.21	1.09
8	4980	1.3E-9	99.99	0.01	0.01	0.02	0.03

Single Item Selections:

S: General System Status M: Modulator Status B: Incident Record E: Erroneous Code Rate Statistics

C: Set Status D: Demodulator Status P: Printer Statistics F: Text Shift X: Delete

Fig.4 Erroneous Code Rate Statistic Screen Example

Edit Function It controls system configuration, precisely specifying parameters (for example, all bench board trunk line

recognition parameters). It is also capable of using rolling displays to redisplay file records. Controling automatic file print parameters is also set out on this page.

5. CONCLUSIONS

This type of new generation modulator and demodulator equipment is specially designed for INTELSAT IDR services under a 8448kb/s data rate. It has already been proven that this type of relay telephone application puts forward requirements not only in such areas as transmission equipment itself, but such ancillary areas as 1:N spare functions, remote control and monitoring computers, and so on.

P3801 equipment was independently financed and produced by the Marconi Company. Even though designs were primarily intended for application to IDR, it is estimated, however, that their unique flexibility will make the equipment appropriate for use in a number of other markets.

REFERENCES

[1] INTELSAT Earth Station Standards, Document IESS-308 (Rev. 4): "Performance characteristics for intermediate data rate (IDR) digital carriers", Dec. 1987.

[2] M. Robusto, "The development of intermediate data rate (IDR) digital transmission performance characteristics", Int. J. Satell. Commun., 6, 369-389 (1988)--this issve.

[3] INTELSAT Earth Station Standards, Document IESS-309 (Rev. 1): "QPSK/FDMA performence characteristics for INTELSAT business services (IBS)", Dec. 1986.

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NAIC-ID(RS)T-0127-96.3 /9

THE DEVELOPMENT OF CHINESE SATELLITE COMMUNICATIONS

Wang Duanxiang

Translatiion of "Wo Guo Wei Xing Tong Xing De Fa Zhan"; pp 9-11

This article describes the advantages and shortcomings associated with the use of satellite communications in China. It introduces communications satellites launched by China as well as INTELSAT and Japanese communications satellites. It summarizes the status of Chinese satellite communications. Finally, it puts forward three points of view with regard to Chinese satellite communications--development of the Chinese satellite communications industry must conform to the national situation, open up the Ku wave band as early as possible, and, in conjunction with that, management opinions are put forward.

1. CHARACTERISTICS OF SATELLITE COMMUNICATIONS

Characteristics associated with satellite communications are suitable to communications associated with areas where the population is dispersed. In forty nine percent of the national territory of China, each square kilometer does not contain ten inhabitants. Moreover, Chinese islands in the Southern Sea are, by contrast, scattered over approximately a million square kilometers of sea surface. With regard to these areas, satellite communications are one type advantageous communications form.

Satellite communications and other radio propogation communications forms are the same. Their coverage areas will be several tens of thousands of times larger than medium wave or ultra short wave broadcasting. They will be much more stable than results for short wave broadcast. They are capable of being used in television broacasting and are able to achieve very stable, clear images. Moreover, they will not produce detestable double image phenomena.

Looked at in long range terms, satellites are also a good method of mobile communications. At the present time, they are already used a great deal in communications with and positioning of vessels on the high seas. In conjunction with this, utilization has already spread to the aviation area. Moreover, they are also in the midst of developing uses in communications associated with large model land vehicles.

With regard to long range communications, satellites also have a clear advantage--that is, equipment is fast and maintenence is convenient. For instance, as far as communications and television broadcasts between Beijing, Urumqi, and Lhasa are concerned, satellites are then the most economical method with the fastest equipment.

Comparing satellite communications and other communications methods, they also have disadvantages. They must have satellites in space. On the ground, they must also have surface stations with huge antennas. When making use of satellites for telephone calls, there is a 0.514 second delay round trip. This makes people feel very ill at ease. Because satellite positions can only be in space above the equator, in areas above 76.4° north latitude, it is, therefore, not possible to make use of them. As a result, in the case of the Great Wall station which China has set up at the South Pole, it is only possible to make use of short wave to communicate with Beijing.

Because satellites can only be placed in circular orbits above the equator 42230 kilometers from the center of the earth, their positions are very limited. For this reason, it is necessary to treasure the limited resources of this satellite position.

2 COMMUNICATIONS SATELLITES LAUNCHED BY CHINA

In April 1984, China launched its first geosynchronous communications satellite. This satellite had two transmiters all together. The tranmission power was 8 watts. Omindirectional effective radiated power EIRP was 23.4dBW. Use was made of the C wave band. In February 1986, China launched its second geosynchronous communications satellite. Due to advances in the antennas, a change was made from circular beams to elliptical beams in accordance with the topography of China. This caused the EIRP to rise to 34.5dBW.

In May and December 1988, China respectively launched two communications satellites. The number of transmiters had increased to 4. The output power of each transmiter rose to 10W.

Satellite EIRP increased to 36dBW.

On 4 February 1990, China again launched a fifth communications satellite. In conjunction with this, it was decided to send the Asia No.1 satellite into space early this year.

3. INTELSAT AND JAPANESE COMMUNICATIONS SATELLITE PROJECTS

Reference to the development of international satellite communications organizations as well as the current status and development projects associated with Japanese communications satellites is beneficial with respect to the development of Chinese satellite communications.

Table 1 sets out the development of the INTELSAT satellite series. It can be seen that there are two clear tendencies. One is toward the development of large capacity. From INTELSAT I to VI, communications capacity increased approximately 100 fold. Satellite electric power source powers increased 50 fold. Weight increased 45 fold. Another tendency is increases in efficiencies. Using the same 1000 transmission circuits for calculations--comparing the No.I satellite to the No.IV satellite--launch weight was reduced to 1/13.2 of the No.I satellite. Electric power source power was reduced to 1/11.9. The parts used were reduced to 1/12.8. /10

Table 2 sets out three types of satellites which Japan made use of in the era 1970-1990. Japanese satellite communications projects were very grand. They make direct use of Ka wave band (20GHz/30GHz). Preparations were made to launch communications satellites in the 2 ton weight range in the 1990's. In conjunction with this, plans were made to realize--in the early period of the next century--large scale communications platforms synchronous with the spin of the earth.

Table 1 INTELSAT Satellites

	INTELSAT Satellites							
	I	II	III	IV	IVA	V	VA	VI
Number	1	3	5	7	5	8	6	(5)
Weight (kg)	39	86	152	732	793	1037	1100	1780
Power (W)	46	85	131	454	525	1200	1300	2300
Transmiter No.	2	1	2	12	20	29	34	46
Communications Capacity (Circuit No.)	240	240	1500	4000	6000	12000	15000	30000
Antenna Beam No.	1	1	1	3	3	7	8	10
No. of Parts Used (Thousands)	1.5	5	7	17	19	54	56	70
Launch Date	1965	1967	1968	1971	1975	1980	1985	1989

Table 2 Japanese Communications Satellite Indices

Model	CS-1		CS-2		CS-3	
Weight (kg)	350		350		550	
Position (Long.)	135°E		132°E (CS-2A) 136°E (CS-2B)		132°E (CS-3A) 136°E (CS-3B)	
Project Life	3 years		5 years		7 years	
Transmiters	2(C wave band)	6(Ka wave band)	2(C wave band)	6(Ka wave band)	2(C wave band)	10(Ka wave band)*
Bandwidth(MHz)	200	200	180	130	180	100
EIRP(dBW)	29.5	37	29.5	37	31	38.7

*Add additional 50% reserve.

4. STATUS OF CHINESE SATELLITE COMMUNICATIONS

The development of Chinese satellite communications shows itself in particular in the areas of broadcast and small diameter antenna earth stations.

Chinese satellite television surface receiving stations are estimated to have already developed to around eleven thousand. These play a very great role in universal education, wiping out illiteracy, and improving the quality of the people. Banking systems are just in the midst of being equiped with satellite communications networks. This is a typical example of the utilization of VSAT. They make use of 9.6kb/s. This type of slow speed data transmission has this year been opened up to 200 small stations. 350 small stations, taking Beijing as their center, will be fully hooked in by next year.

5. IDEAS WITH REGARD TO THE DEVELOPMENT OF CHINESE SATELLITE COMMUNICATIONS

First of all, the development of Chinese satellite commucations enterprises must conform to the national situation of China. Our satellite communications technology is approximately twenty years behind INTELSAT. It is hoped to catch up ten years at the end of this century. As far as satellites which China launches from now on are concerned, 20-30 transmiters should be appropriate. The antenna beams which are made use of are also capable of being reduced to a beam covering the whole area and three point beams (west, southeast, northeast). We are

not able to develop on a scale in accordance with Japanese ideas. However, we must stress experimental work.

China should, as early as possible, open up the Ku frequency band. In the area of broadcast reception, receiving stations associated with C frequency band 6 meter antennas--if changed to the use of the Ku frequency band--are then capable of reducing antennas to diameters of 2.6 meters, but obtaining the same reception results. This is capable of making antenna weights reduce to 1/12.2--making the cost of receiving stations shrink to 1/3.7.

In the area of the management of satellite communications enterprises, system programs must give consideration to the "coordination of heaven and earth". Management must achieve conversion to enterprise, avoiding "messing together" and "the old supplies in kind system". Satellite communications services and utilization must, in all cases, have a set of detailed technical standards. Moreover, they must--following along with the passage of time--supplement new items. Their role is to make use, to the maximum extent possible, of satellite capabilities, and, in conjunction with that, serve communicators over a broad range. (Editor in Charge: Liang Zhaotian)

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-TELECOMMUNICATIONS TRENDS-

JAPANESE SATELLITE TO BE FITTED WITH MULTIPLE BEAM ANTENNA SYSTEM

Yan Yi

Translation of "Dian Xin Dong Tai Ri Ben Wei Xing Jiang Pei Bei Duo Bo Shu Tian Xian Xi Tong"; p 13

Japan Telegraph and Telephone Company (NTT) has already completed manufacturing tasks associated with antenna systems, transmiters, and on board satellite switching equipment of the Japanese engineering test satellite ETS VI, set to be launched in 1992.

The ETS VI satellite will be fitted with multiple beam antenna systems. This new technology will be capable of use in developing satellite mobile communications. Due to shrinking beam widths, multiple beam antenna system single beam radio frequency powers, therefore, increase. The NTT Company proudly asserts that powers associated with the ETS VI satellite are capable of being 30 times higher than the powers associated with ordinary antenna systems.

The antenna systems in question will operate in the Ka frequency band (30GHz up line, 20GHz down line) and the S frequency band (2.6GHz up line, 2.5GHz down line).

As far as the antenna systems in question are concerned, if they are used in mobile communications, it is then possible to use small model rod shaped antennas to receive signals. However, with satellite mobile communications systems which are not like Inmarsat, it is necessary to use parabolic receiving antennas with diameters of 1.2 meters. As a result, multiple beam antenna system technology will let small model vessels and vehicles even more easily make use of satellite mobile communications services.

ETS VI satellite antenna systems have an antenna reflector with a diameter of 3.5 meters. This reflector is 9 times larger than reflectors on any communications satellite which Japan uses at the present time. In order to withstand the extreme temperature fluctuations in outer space and guarantee beam precision, antenna reflector surfaces have a thin layer of carbon

filament reinforced plastic. Moreover, reflectors use carbon fiber reinforced plastic wood movable rack supports.

13 Ka frequency band beams associated with antenna systems will cover all of Japan. The width of each beam is reduced to be 0.3°. It is necessary to make beams reach this type of width accurately. Directional precision must be controled within 0.015° (ordinary system accuracies only require 0.1°). The NTT Company has already developed a type of control system which is able to guarantee this precision.

5 S frequency band beams will cover all of Japan and a 200 nautical mile economic maritime area.

Translated from Communications Systems Worldwide, Sept, 1989, p 54.

--MICROWAVE DEVICES--

PROGRESS IN THE DEVELOPMENT OF SUBMINIATURE SINGLE CHIP MICROWAVE INTEGRATED CIRCUITS

Translation of "Chao Xiao Xing Dan Pian Wei Bo Ji Cheng Dian Lu Kai Fa Jin Zhan"; pp 14-17

--Objectives: Miniaturization of Communications Equipment and Conversion to Low Costs

1. DEVELOPMENT BACKGROUND ASSOCIATED WITH NEW MODEL STRUCTURES FOR SINGLE CHIP MICROWAVE INTEGRATED CIRCUITS

Recently--using as a beginning 12GHz satellite broadcasting to start with immediately--as far as the operations of the Japanese Telegraph and Telephone Company (NTT) are concerned, they seem to be looking at such areas as submillimeter wave satellite communications (20GHz and 30GHz), user wireless communications (21GHz and 26GHz), and so on. Utilization of frequencies above 10GHz are just in the midst of thriving. With regard to influences created by these requirements, there will of course be an expanded range of applications for wireless communications. As a result, people urgently hope for the use of single chip microwave integrated circuits (MMIC) to assemble into radio transceivers.

In 1987, NTT reseach institutes had already successfully developed MMIC associated with satellite relay uses. In conjunction with this, they were scheduled to be fitted into the experimental technology satellite ETS-VI launched in 1992. The volume and weight of this MMIC repeater were only one sixth those of mixed integrated circuit repeaters (transistors, resistors, capacitors, and so on, assembled on an aluminum oxide substrate)

which had been made use of on practical satellites (CS-3) and so on in the past. Through this work, NTT established design technology associated with the microband structure MMIC.

At the present time--taking the U.S. as the leader, and including Japan in--MMIC research is just in the midst of being in the ascendant. However, most of those the use of which is opted for are all this type of microband structure. As far as the shortcomings of microband structures are concerned--besides normal GaAs FET working processes--it is also necessary to grind substrates and work passage apertures. Industrial production processes are complicated. As a result, rates of product finishing are low.

With regard to the new concept of single surface MMIC which was conceived by the research institutes described above, it is capable of resolving the shortcomings discussed previously. Moreover, chip surface area can be greatly reduced. With the help of this type of new model device, it is possible to hope that the volumes of various types of radio communications equipment can be reduced in a big way. Costs will also be more economical.

This article will explain the structure and characteristics associated with single surface MMIC--presenting examples of applications. It will also introduce submillimeter wave band single surface MMIC which are actually manufactured.

2. STRUCTURE AND CHARACTERISTICS ASSOCIATED WITH SINGLE SURFACE MMIC

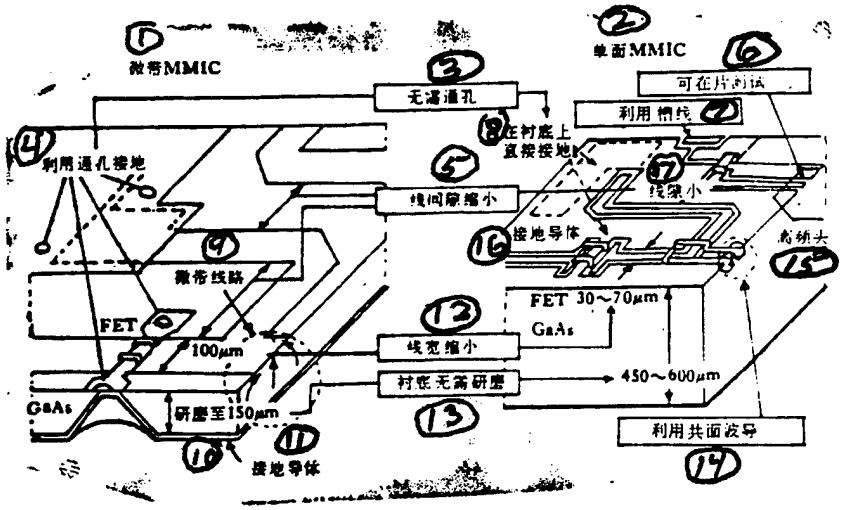
Single surface MMIC make use of suspended wiring technology to take coplanar wave guides and troughs as well as concentrated constant circuit components (FET, diodes, resistors, capacitors, inductors) and gather them all together to make a type of new concept in microwave integrated circuits on the same GaAs base surface.

In the past, microband circuitry signal lines which were used were on the obverse of bases, but grounding conductors were on the reverse of bases. When use is made of coplanar wave guides and troughs to act as the principal transmission lines, signal lines and grounding conductors are, by contrast, both on the fronts of bases. When active devices such as FET and so on are used, there is a need to cause one terminal to be grounded. In microband model MMIC, large scale working must be carried out--that is, holes must be made in substrates in order to facilitate mutual connections to conductors on the back.

Characteristic impedances associated with microband circuits are determined by base thickness and signal line width. In order to reduce signal line width, it is necessary to take bases and grind them thin. However, due to causes associated with such areas as operating convenience, bases must be not thinner than around 150μm. At this time, speaking in regard to commonly used 50Ω circuits, the widths are approximately 100μm.

Conversely, as far as single surface MMIC coplanar wave guide circuits are concerned, their characteristic impedances are dependent on the ratio of trough gap width between signal lines and grounding conductors as well as signal line widths. There is no relatiionship to the widths associated with the 50Ω circuitry described above and base thicknesses. It is possible, through altering signal line widths and trough widths, to make free determinations. As a result, circuit widths can be reduced to 30μm. Besides that, it is necessary to have grounding conductors between coplanar wave guide circuits and adjacent lines. Even if the intervals between adjacent lines are smaller than those associated with microband circuitry, there will still not be the appearance of mutual interference. Because of these causes--making use of coplanar wave guide single surface MMIC--it is possible for mounting desities to be relatively higher than for microband structure MMIC. It is possible to realize miniaturization (see details in Fig.1). /15

Table 1 Structure and Characteristics of Single Surface MMIC



Key: (1) Microband MMIC (2) Single Surface MMIC (3) No Need (Illegible) for Passage Aperture (4) Making Use of Passage Apertures for Grounding (5) Interval Between Lines Reduced (6) Test Measurements Can Be Done on Chip (7) Use Made of Troughs (8) Directly Grounded to Base (9) Microband Circuitry (10) Ground to 150μm (11) Grounding Conductor (12) Line Width Reduced (13) No Need for Base Grinding (14) Utilization of Coplanar Wave Guides (15) High Frequency Head (Illegible) (16) Grounding Conductor (17) Small Line Gap

Besides this, microband circuitry and coplanar wave guides are both unbalanced structures. However, troughs are still balanced structures. Making use of this point, it is possible to realize signal phase differences of 180 in a simple manner. With regard to this problem, it is necessary to discuss it in detail in the electric circuit technology below.

3. CIRCUIT TECHNOLOGY ASSOCIATED WITH SINGLE SURFACE MMIC

Designs associated with single surface MMIC are not able to be added into use "as is", with ready made software on the market, in the way that microband MMIC are. In order to introduce circuit designs, there is a need to understand microwave frequency band characteristics from direct current to over 30GHz for the three parts--transmission lines (coplanar wave guides and troughs), electric circuit components (FET, diodes, resistors, helical inductances, capacitors, and so on), structural elements (suspended lines, line curvature items, branching items), and so forth. As a result, at the outset, it is then necessary to develop these basic components. It is also necessary to do repeated test measurements of these components, accumulating data. At the present time, accumulated data and design software supplied on the market are taken and woven together. It is already possible to design various types of circuits. Their precisions are the same as those associated with microband MMIC.

In single surface MMIC's, newly conceived circuit technologies and FET operating conditions as well as results associated with piggy back structures make it possible to cause circuit volumes to shrink in a big way. At the present time--using frequency multipliers as an example--we introduce circuit technologies associated with the features of single surface MMIC.

Frequency multipliers are a type of electric circuit which takes input signal frequencies and increases them a certain whole number of times after which they are outputed again. In order to realize this objective, it is necessary to make use of FET nonlinearity characteristics associated with voltages and currents. What is called nonlinearity refers to--for example, input voltage amplitude values increasing two fold, but output current amplitudes not increasing two fold--this type of special characteristic. Because of this, when input wave forms go through nonlinear FET, distortions will be produced. In output wave forms--besides having the basic wave components of inputs--there are also components associated with 2 fold, 3 fold,..., n fold of the base frequency. 2 fold frequency multipliers are nothing else than the establishment of methods to extract in highly efficient ways 2 fold multiple components from among output frequencies--at the same time, suppressing the basic wave components, causing them to have no way to be outputed.

To be able to suppress basic wave components within very wide frequency band ranges and also to be able, in a highly efficient manner, to output 2 fold frequency components, electrical circuits opt for the use of balanced circuits associated with balanced-unbalanced (that is, balun) convertors. The convertors in question possess functions associated with forming 180° phase difference signals. When signals associated

with phase differences of 180° are inputed, respectively, toward two nonlinear FET's, basic wave components, between the two FET's, still maintain 180° phase differences (opposite phases). But, 2 fold frequency components are, however, changed into the same phase (phase difference is 0°). As a result, if one takes the outputs of the two FET's and connects them in parallel, two base wave components are, by contrast, opposite in phase and combine to cancel each other out. There is no output. Conversely, 2 fold frequency components, however, combine, due to the same phases, and appear in association with output terminals which only have this frequency component.

However, in microband circuitry, when manufacturing balanced-unbalanced convertors, it is necessary to take 1/4 wave length lines and passage apertures and combine them together. 1/4 wave lengths associated with 6GHz reach over 4mm on GaAs bases. This convertor component alone must then occupy an area of approximately 4mmx2mm, making the surface areas associated with MMIC's very large. Conversely, in single surface MMIC, taking coplanar wave guides and turning them into trough mode convertors, they are, in themselves, equivalent to balanced-unbalanced convertors. Mode convertors only take coplanar wave guides, troughs, and suspended lines and combine them together. Therefore, so long as there is around 0.5mm square, it is then possible to have enough to make them (see Fig.2). As a result, balanced frequency multipliers are capable of greatly reducing volumes because of single surface MMIC (see Fig.2 and Fig.3). /16

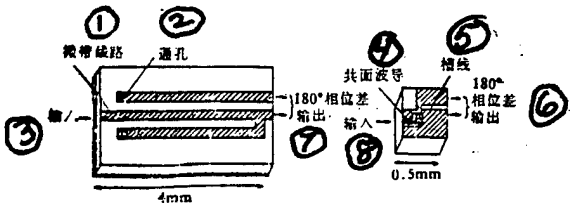


Fig. 2 Single Surface MMIC Cause Miniaturization of Balanced-Unbalanced Convertors (Left: Microband Model Right: Single Surface Model)

Key: (1) Microband Circuitry (2) Passage Aperture (3) Input (4) Coplanar Wave Guide (5) Trough (6) 180° Phase Difference Outputs (7) 180° Phase Difference Outputs (8) Input

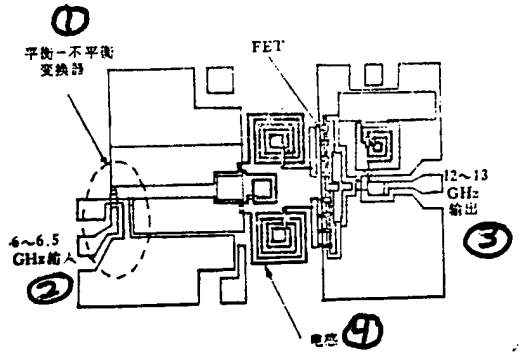


Fig.3 6GHz/12GHz Frequency Multiplier (Single Chip Dimensions 1.5mm x 1.0mm)

Key: (1) Balanced-Unbalanced Convertor (2) 6-6.5GHz Input (3) 12-13GHz Output (4) Inductance

4. SINGLE SURFACE MMIC USED IN SUBMILLIMETER WAVE WIRELESS COMMUNICATIONS EQUIPMENT

As far as the single surface MMIC structures which NTT research institutes made use of are concerned, they successfully designed, and, in conjunction with that, manufactured all the component circuitry required in association with submillimeter wave wireless communication system high frequency parts. This success made comparatively large contributions toward the establishment of single surface circuitry design technology and perfecting a step further GaAs integrated circuit manufacturing technology. Taking single surface MMIC and sealing them up, direct connections between various chips are then capable of constructing transceiver modules. Using 26GHz receivers as an example, volumes, using single surface MMIC for manufacturing, can be greatly reduced as compared to the use of microband MMIC manufacturing. The former is only about one fifth of the latter (Fig.4).

With regard to this receiver module, as far as the oscillation system of the device in question is concerned, it possesses frequency stability characteristics which are the same as crystal oscillators, and is, at the same time, capable of switching over received frequencies. With respect to receivers that are made use of at the present time, a great many opt for the use of dielectric resonance devices in order to stabilize oscillation frequencies associated with the devices in question. As a result, corresponding to each different reception frequency, there is then a need to have different equipment. Through opting for the use of single surface MMIC to construct synthesized type reception modules, there is a possibility of using ultra miniaturized square chips to provide an interchangeable receiver (Fig.5). The role of this receiver module lies in taking high frequency 26GHz signals, which are difficult to handle, and transforming them into medium frequency signals under 1GHz which can be processed by such cheap components as silicon transistors, large scale silicon integrated circuits, and so on.

5. LARGE SCALE MINIATURIZATION OF WIRELESS COMMUNICATIONS SYSTEMS AND EXPECTATIONS FROM NOW ON

Up to the present time, MMIC still remain at the level of realizing 1-2 types of functions on each chip. Objectives associated with research from now on are to improve degrees of integration and, finally, to actualize the integration of entire receivers on one chip. In order to realize this objective, it

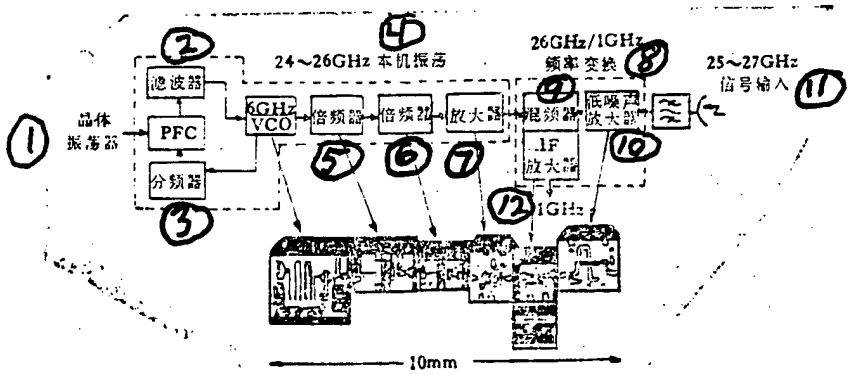


Fig.4 Single Surface MMIC Cause Receiver Module Miniaturization

Key: (1) Crystal Oscillator (2) Wave Filter Device (3) Frequency Divider (4) 24-26GHz Oscillation of Devices in Question (5) Frequency Multiplier (6) Frequency Multiplier (7) Amplifier (8) Frequency Conversion (9) Frequency Mixer (10) Low Noise Amplifier (11) Signal Input (12) (Illegible)F Amplifer

/17

is not only necessary to miniaturize circuits. There is also a need to set up good, accurate compound function circuit design methods as well as establishing semiconductor manufacturing techniques associated with relatively high product completion rates.

As far as single surface MMIC strutures are concerned, in the areas of both circuit miniaturization and improving product completion rates, they are far superior to microband MMIC. If it is possible to reresearch good, accurate circuit design methods, it is then possible to fully realize the objective of taking complete transceivers and integrating them on a single unit. /17

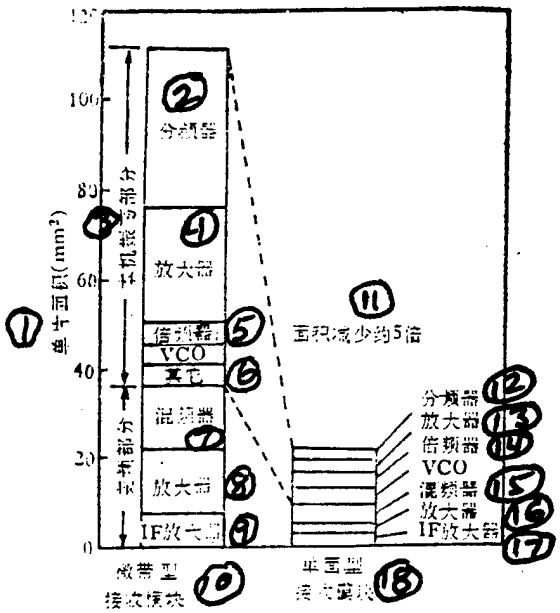


Fig.5 Composition of Submillimeter Wave Receiver Modules and Single Surface MMIC Chips

Key: (1) Single Chip Surface Area (2) Frequency Divider (3) Oscillation Components of Basic Devices (4) Amplifier (5) Frequency Multiplier (6) Other (7) Frequency Mixer (8) Amplifier (9) IF Amplifier (10) Microband Model Receiver Module (11) Surface Area Reduced Approximately 5 Fold (12) Frequency Divider (13) Amplifier (14) Frequency Multiplier (15) Frequency Mixer (illegible) (16) IF Amplifier (17) Single Surface Model Receiver Module

Following along with further development of single surface MMIC from now on, the appearance of microwave and millimeter wave portable types of mobile communications devices is completely to be expected.

--TELECOMMUNICATIONS TRENDS--

BRAZILIAN SATELLITE COMMUNICATIONS TECHNOLOGY

Yan Yi

Translation of "Ba Xi De Wei Xing Tong Xin Ji Shu"; p 17

Brazil's satellite communications network began operations in 1975. At that time, use was made of leased INTELSAT transmiters. However, beginning in 1988, systems associated with the state run Brazilian telecommunications company (Telebras) were making use of their own Brazilian telecommunications satellites--Brasilsat--all the time. Primary and reserve Brasilsat satellites were capable of providing a total of 48 transmiters. Each transmiter has a band width of 36MHz.

From the beginning, the key points associated with Brazilian satellite communications projects have lain in nothing else than the development of earth station systems and satellite link circuit design technology. The objective is the need--in accordance with the technological capabilities of the nation in question--to improve the domestic networks, and, in conjunction with that, reduce the import of needed equipment. For this reason, the Brazilian telecommunications company research and development center (CPqD) has taken capabilites and concentrated them in developing various types of devices and equipment used by television and telephone ground stations.

Television and voice signal transmission and reception use Kasaigelun (phonetic) antennas (3 meter, 4.5 meter, 6 meter, and 10 meter) which were developed very rapidly. Manufacturing technology has been transfered to manufacturing firms in the country in question. At the present time, relevent domestic plants and the Brazilian telecommunications company research and development center are just in the midst of developing other types of antennas.

Besides this, the center in question is already in test production of a series of 4GHz frequency band low noise amplifiers. Relevent 100°K and 80°K (equivalent noise temperature) technologies have been transfered to industrial circles. 6GHz high power amplifier systems have already been developed successfully. At the present time, firms in the country in question have already manufactured 100 watt amplifiers making use of traveling wave tubes as well as 10W and 5W amplifiers making use of gallium aresenide field effect transistors and thin film mixed circuit techniques.

Currently, in the Brazilian market place, there are a good number of pieces of equipment which are manufactured relying on the technical capabilities of the country in question. There are

those that use high capacity telephone circuits (FDM), those that use small capacity SCPC, and also those used in single television receiving stations.

The Brazilian telecommunications company research and development center has developed design software programs associated with analog satellite links which the company in question uses at the present time. Besides this, development has also been done--together with university research personnel--on software programs associated with digital satellite link design uses.

At the moment, the short term target associated with Brazilian satellite communications projects is the exploitation of scarce circuits by TDMA systems. It is possible to directly link up with user data terminals. In conjunction with this, distribution is provided according to need--point to point and point to multiple point services. On site test projects were carried out in 1988.

According to separate reports, the Brazilian telecommunications company research and development center is carrying out specialized research on 11-14GHz frequency band devices and wireless electric wave broadcast technologies in order to facilitate--in the not too distant future--development of a second generation of Brazilian domestic satellites.

Extracted from IEEE Communications Magazine, Sept, 1989, p.37 (Yan Yi).

--MOBILE COMMUNICATIONS--

NATIONAL PAGING SYSTEM OF FINLAND

Tapani Nevanpaa

Translation of "Fen Lan Quan Guo Xun Hu Xi Tong"; pp 18-21

This article has an eye toward the self-diagnostic characteristics and wireless synchronicity associated with Finland's paging network. Finland's paging network covers over 95% of the area of the whole country. Since the opening of paging services in 1985, they have played an important role in strengthening the public telephone network. It is possible to carry out paging through any ordinary telephone, calling to paged persons anywhere inside the country.

The paging network is a wireless synchronous one. In this network, various base stations use the same frequencies for sending telephone calls. The purpose of this type of design concept lies in utilizing as effectively as possible the limited capacity of a wireless frequency channel. Besides Finland, the paging networks of Austria, Switzerland, Sweden, and Tokyo also make use of this type of wireless synchronous method.

Finland's paging services are a type of individual paging service managed by PTL-Tele company. It already covers the majority of the area of Finland. At the present time, this network has 320 base stations. Reception areas include all the most densely populated areas of southern Finland. There are approximately 25000 people who use paging services. Among these, the majority are people carrying out emergency tasks and engaged in maintenance and service type work or people engaged in business management.

Paging telephone calls are capable--through any ordinary telephone receiver--of being dialed up. Moreover, in any area of

the country, use is made in all cases of the same type of paging receiver and the same connection codes. Paging switchboards receive paging telephone calls. In conjunction with this, the 320 transmiters aiding the paging net will send the paging telephone call in question to the paging receiver in accordance with requirements. This sending process is completed within 2 minutes after dialing.

1. SERVICES

Finland's paging system is capable of supplying 5 types of different paging services such as audible signals, visual signals, leaving messages (short, simple notifications), group calls, group alarms, and so on. Paging systems themselves include a small model pocket size receiver.

This service opts for the use of CCIR No.1 wireless paging code--also designated as POCSAG code. Transmission speeds in wireless frequency channels are 512 bits/second. It is possible to grow to 1200 bits/second. The latter speed is still not necessary in Finland. However, corresponding paging services in Sweden recently expanded and, indeed, made use of this type of relatively high speed.

2. PAGING NET STRUCTURE

Paging services are connected to the public telephone network. The paging network includes 3 functional components--paging switchboards, transmiter net, and paging receivers. The maximum user capacity associated with this service is 100000.

Paging switchboards include paging terminals (PT), voice recognition systems (VRS), and paging net units (PNU). The synchronous methods which paging makes use of as well as transmission net equipment and its software have already been developed and manufactured successfully by Finland's Tecnomen Oy company.

3. SELF-DIAGNOSIS

One of the most important characteristics of paging networks lies in their being able to carry out autodiagnosis of abstract network communications configurations and concrete network electronic equipment. Internal self-diagnostic software operates continuously. With regard to each equipment element in paging networks, it is standard in all cases. Each time assets are capable of providing autodiagnosis optinally, this software then begins to operate. /19

As far as setting up paging network autodiagnosis is concerned, it causes equipment one level up in network systems to be monitoring operations of equipment one level below from start to finish. Through specifying that lower level equipment in network systems must report its operating status to higher level equipment makes this type of monitoring relatively convenient.

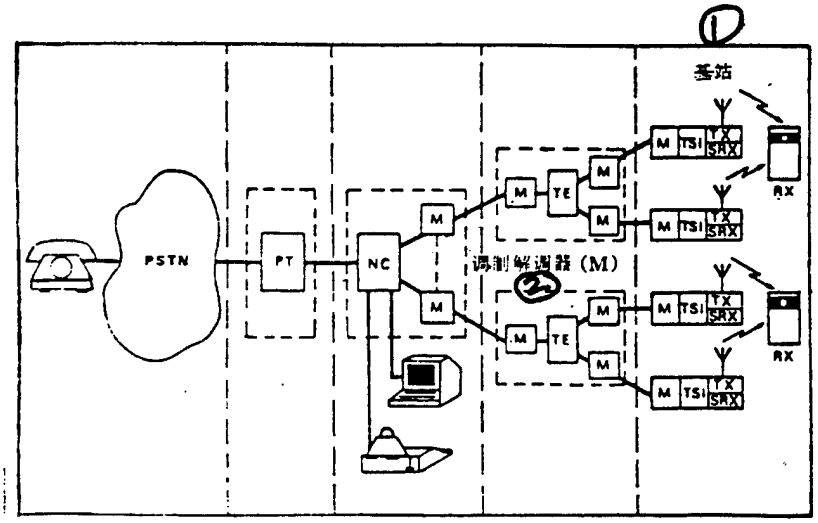


Fig.1 Line and Block Chart for Finland's National Paging System

Key: (1) Base Station (2) Modulator Demodulator (M) PSTN: Public Switching Telephone Network NC: Network Controller TSI: Transmitter Site Input TX/SRX: Dual Use Transceiver PT: Paging Terminal TE: Transmission Expander M: Modulator Demodulator RX: Paging Receiver

Reports are of two types--progress reports as well as reports of normal operating conditions sent at fixed times, and malfunction and error reports sent as necessary pursuant to autodiagnostic checks and abnormal configurations. It is possible for operating personnel to make reactions to reports received on video frequency displays, sending out commands for the corresponding measures selected. However, self-diagnostic processes will normally select automatically the necessary actions. Paging net status is clearly displayed on video frequency screens. As a result, operating personnel very easily determine necessary measures.

In verification data sent in association with subordinate equipment, configuration reports and warning reports are taken and delivered to upper level equipment in the network. Because it is necessary to send a verification of the frame structure of the data obtained as conforming with the SDLC agreements, therefore, using the methods above saves time and is capable of increasing paging capacity. Moreover, any configuration requests which are entered into video frequency displays by operating personnel can immediately give rise to connections with the newest formated data which paging network elements have already acquired. This means that it will be much faster for operating personnel to see responses to status requests on video frequency displays than to opt for the use of other methods.

Among a number of status reports and malfunction reports which are normally displayed on video frequency display devices, there are such ones as equipment placed in main use configurations, equipment placed in blockage configurations, communications errors, communications malfunctions, dual function transceiver errors, as well as dual use transceiver malfunctions, and so on. Among verification data is included the third data byte associated with codes reserved for use with these warning codes and configuration codes. As a result, the whole network is capable of having 256 types of different configuration codes. The significance of each type of code is stipulated beforehand. They are the same from beginning to end. Origin points have no relationship to the codes (that is, the network section to which the first byte in verification data refers).

4. SYNCHRONICITY

As far as paging codes which paging terminals receive from paging network elements are concerned--using paging message forms (each paging message string has a maximum of 32 paging requests)--they are sent to transmission expanders (TE). The latter also

take these messages and send them to base station transmiter site inputs (TSI). Once these messages reach the input in question, they are in all cases broken out, and, in conjunction with this, the paging code is taken and converted into standard POCSAG code.

16 of this type of code character and one synchronicity code character (no relationship to wireless synchronicity) form a group. They are sent from base station wireless dual use transceivers in order to facilitate user paging receiver acquisition, and, in conjunction with that, decoded. If paging code is inadequate to form a group of complete POCSAG code, the blank positions in the group in question must use specially designed free code fillers. /20

In paging networks where base station density is relatively great, wireless transmission methods have problems to them in and of themselves. What creates these problems is that any given user paging device is capable of simultaneously receiving the same message from a good number of base stations.

As a result, user paging receivers are capable of erroneously taking the sum of certain base station messages to be the paging message to receive. Moreover, the more asynchronous the phases are between message components received from different base stations, the more unreliable the message accuracy then is. Wireless transmissions associated with base stations that are close to each other are synchronous, causing the various message components to be almost without phase difference. It is then possible to avoid this problem.

5. CHARACTERISTICS

Paging network elements control synchronicity activation and needed programs. Paging net elements are fitted with the data above acting as network set up parameters. Time intervals needed between various iterations of successive wireless synchronicity, the beacons of all the other base stations within "hearing range" of various base stations, as well as their distances (degree of accuracy is 1 kilometer) also have provided manually designated characteristics associated with synchronicity activators selected for use optinally. If synchronicity activators use manual designations, then the automatic synchronicity designations described above are, by contrast, not implemented.

Paging network units--based on data associated with "hearing distances"--determine whether or not it is possible to opt for the use of original wireless communications lines between base stations--taking the entire domestic network to act as one area for carrying out synchronicity. If it is not possible to do this, paging network elements, by contrast, specify independent

areas (that is, separated areas). The interiors of independent areas can be synchronous. However, it is not continuous to other areas. The smallest independent areas are only capable of having one base station. There is no connection with any other base station.

Seen from the angle of user paging receivers, these independent area operations not being synchronous will not give rise to actual problems on the boundaries between independent areas. As a result, for purposes of synchronicity, it is possible to assign operations inside paging networks associated with each independent area as independent of other areas. This is also nothing else than to say that the whole network can have a good number of synchronicity activators--one for each area.

The main objective of synchronicity processes is a need to make signals leaving adjacent base station antennas reach synchronicity at high degrees of accuracy. Because we are only speaking in terms of user paging receivers, this is the only related factor. As a result--due to phase error measurements and dual use transceiver time delay compensation, in reality, synchronicity processes which base stations carry out are far more complicated than is imagined.

One of the basic principles associated with synchronicity methods is to measure factors influencing the accuracy of synchronicity processes in transmiters and the synchronous receivers associated with various base stations--for instance, the rise time periods, fall time periods, as well as static time periods associated with step jump effects, and so on. The absolute values of these error producing factors are respectively different for each base station. Moreover, what seems to be even more disadvantageous is that these absolute values constantly change as functions of time and the main environmental factors, causing--in the area of the precisions required in synchronicity processes--long term stability characteristics to be not too good. However, in the short term (for example, intervals between synchronicity periods), they are really comparatively stable. The significance of this with regard to the time intervals selected for successive measurements of these factors as well as making compensation for them is very great.

These measurements and compensations are suited to improving the performance of wireless electronic hardware in apparent terms. The reason is that--in the area of requirements specified in association with synchronicity--these hardware characteristics are certainly not high. There is no need for any periodic manual adjustments with regard to hardware or to make calibrations of exchange spares during maintenance processes. These operations are all completely automatically. Synchronicity processes will function normally from beginning to end.

Tests and measurements carried out on site clearly show that

this type of synchronicity method is capable of achieving precisions this high, with the result that the error amounts produced are almost completely created by speed differences between the various base station constant temperature quartz clocks. This type of speed differnce--in interval time periods associated with successive synchronicity periods will accumulate.

6. SPEEDS

Aided through paging network communications lines, approximate time period synchronicity is carried out. In conjunction with this, synchronicity commands are taken and sent into paging networks--using designed synchronicity processes to make synchronicity periods begin. These design processes are capable of being simultaneously carried out in normal wireless paging transmissions implemented by base stations. However, the processes in question are time consuming and increase capacity burdens on central processing units. Therefore, they are not repeated in every instance.

The processes described above are only repeated when a certain type of change is given rise to by networks within intervals associated with the preceding synchronicity period--for example, the creation of equipment start up or blockage, set up alterations, and so on. Finland's national paging system is comparatively large. In this system, synchronicity commands which are sent toward the paging net require 10 seconds more or less and only then is it possible to transmist them to the entire net. This is a most unsatisfactory condition with regard to lines, speaking in terms of broadcast conditions being bad. These processes are also capable of beginning before base stations have completed one iteration and are just in the midst of transmiting routine wireless paging. Buffers associated with transmiter on site input sections are capable of taking pagings of telephones which need to be sent and holding them for approximately 40 seconds.

7. TARGETS /21

Problems given rise to by phase error have already had research done on them under laboratory conditions. These experiments clearly show that--in the worst situations--when the conditions described below go into effect, messages received from two separated transmiters will be subject to interference. These conditions are that two independent radio signal strengths in the vicinity of receivers are different from each other by less than 3dB and the minimum phase difference between data signals associated with the two transmiters is 1/4 bit.

In actuality, when receivers are positioned just within the

area associated with the two transmiters' transmission overlap, the first condition will then be satisfied. In the area of synchronicity, when the primary factor associated with the attenuation of the two transmited signals lies in distance (free propogation attenuation), it is easy to have the appearance of the worst case. Giving consideration to such factors as output powers which are made use of, frequencies which are used, as well as actual signal to noise ratios, and so on, it is possible to estimate that--under the worst conditions--this 3dB overlap area includes a width of 3 kilometers.

There should be synchronicity between transmiters in order to facilitate making data signal phase errors leaving antennas not exceed ±239 microseconds with regard to conventionally "correct" phases (propogation time delays in overlap areas are in an approximately ±5 microsecond range). If one is then speaking in terms of reception interference, transmiters which are far from each other do not need to be synchronous.

Option is made for the use of the same frequencies as those used in transmission of routine paging messages in order to complete wireless synchronicity processes. As a result, each time wireless synchronicity processes hold wireless circuits for that purpose, capacities associated with transmission use for routine paging then diminish. It is possible to reduce to a minimum this type of side effect by opting for the use of the two types of methods below: (1) taking wireless synchronicity requirements and reducing them to a minimum, that is, taking time intervals associated with successive wireless synchronicity periods and increasing them to a maximum; (2) carrying out each iteration of successive wireless synchronicity as rapidly as possible.

In this area, actual targets must take the influences of wireless synchronicity processes with regard to overall paging net processing capabilities and limit them to under 5%.

Synchronicity also requires this type of implementation--that is, user paging receivers do not take wireless synchronicity signals and mistake them for paging message reception.

Signal networks, in and of themselves, have no special requirements with regard to wireless synchronicity. Arrangements are made of paging network signal processes to make paging messages sent by dual use transceivers have to reach the buffers of transmiter on site input sections within the appropriate time period of 5-10 seconds before wireless transmission begins.

In this way, even if paging messages may be resent due to communications malfunctions or modulator demodulator lines being bad, it will still not influence wireless synchronicity operations. [[2880]]

--INFORMATION WAVE--

Translation of "Xin Xi Bo"; p 21

- Japan's Seiko Watch Company and a U.S. San Francisco telecommunications company have cooperated and, this year, are marketing a wristwatch model pager. This type of wristwatch model pager has both wristwatch time keeping functions and pager paging functions. The price is $350 U.S. a unit. At the present time, only the U.S. has frequency modulation subcarriers to implement satellite paging services. However, it will not be long before other nations bring out similar services. Therefore, the outlook for wristwatch model paging devices is very good. Next year, they will enter the European and Southeast Asian markets.

- The ancient form of amusement of international chess has already crossed into the 21st century ahead of human kind. Recently, the U.K. has put out an entertainment type of telecommunications service called "the chess pal electronic mailbox". Chess enthusiasts can make use of British Telecom's common user graphics and text transmission and display net to indulge their chess addiction in front of a television screen. It is not only possible to understand various matches of the chess forum. It is, moreover, possible to understand from it the situations of many chess friends, to look for an appropriate opponent to play chess, and it is even possible to participate in "the chess pals electronic mailbox" and each year's "chess pals electronic chess tournament". Using this type of method to play chess is faster, more reliable, and more economical than the past method of chess by mail.

- The Japanese Postal Department has already set up two research teams to develop a new generation of portable type telephone set. This type of phone is only as large as a pocket pager, but possesses the functions of ordinary telephones. It is projected for practical use in 1995. Development objectives are the set up of "Microcells" with diameters of around 500 meters,

making use of the same frequencies. The phones are digital ones.

They are small and light. Sending power is small. They use small batteries. They operate in the submicrowave frequency band. They are not only capable of transmiting voice. They are, moreover, also capable of transmiting data, facsimile, and stationary images.

- A 7 meter long, specially equiped truck associated with the intenational maritime satellite organization (INMARSAT) toured 14 countries of the Middle East this spring, making demonstrations of the newest technology associated with mobile satellite communications--including two types of mobile satellite communications, maritime and land. The Middle East area is vast.

Moreover, the original land communications foundations are weak--very suitable for the development of satellite communications. INMARSAT shows two types of technology--A standard and C standard. Relevent personages in the Middle East were very interested in this series of demonstrations. Relevent areas are still under consideration for "lifting of bans", letting the Middle East region be able to smoothly develop mobile satellite communications.

--TELECOMMUNICATIONS SWITCHING TECHNOLOGY--

RING REQUIREMENTS FOR NONSWITCHED LOADS

Richard E. Pavelka

Translation of "Fei Jiao Huan Fu Zai De Zhen Ling"; pp 22-26

This article illucidates how hold over ringing, signal tone, and RTC equipment using digital technology and pulse width modulation technology as its foundation operates for today's digital switchboards.

1. FORWARD

One only needs to bring up old equipment--lumped type ringing, signal tones, and RTC signal equipment--and it will then be in everyone's good graces again. Telephone companies discovered that the embedded type ringers associated with most of today's digital switching systems do not have the strength to provide various types of tone flow for many specialized hold over simulation service circuits.

In most telephone exchange buildings, digital switching systems have almost (certainly not completely) replaced all analog circuits. However, types of hold or nonswitched equipment such as switching circuits outside exchanges, bidirectional dedicated line circuits, long line dial circuits, as well as test measurement units still need to remain. The reason is that, in digital switchboards, the functions described above are not provided or duplicated. These circuits normally need ringing currents and/or the on and off associated with the use of combinations of dial tones and signals, but these cannot be

obtained from digital switchboards.

Below are described the most commonly seen hold over load signals. In conjunction with that, an example is presented to explain modernized hold ringing, dial tones, and RTC signal equipment which takes as its foundation digital technology as well as pulse width modulation (PWM) technology. This type of equipment is capable of expanding in order to satisfy required increases in output capacity. Moreover, increases in output capacity were often difficult to foresee before the introduction into use of the equipment in question.

When old style magnetic types of telephone systems with self-contained batteries began to introduce manual systems with common power sources, various telephone exchanges then equiped themselves with equipment associated with lumped type ringing, dial tones, and RTC signal sources. Common battery manual systems also gradually were replaced by mechanical switching. First of all, they were step by step systems. After that, they were crossbar systems, and, again, the new generation is electronic simulation switching systems (ESS). In every case, these systems all had a common function as lumped type RTS signal source equipment associated with the two types of switched and nonswitched loads.

Following along with the introduction of digital switching, in a good number of situations, lumped type RTC equipment had already been replaced by a number of small model ringers embedded in the interior of switchboards. The number of user lines which the ringers in question served was limited. Moreover, there was no excess capacity which was capable of providing such types of utilizations as two way dedicated line circuits, long line dialing circuits, switching circuits outside the exchange, far terminal test measurement circuits, sectretarial answering service circuits, or carrier wave signal banks.

These digital switchoards synthesize various types of calling process tones (dialing, ringing, busy). This not only eliminates hardware signal tone source equipment. It, moreover, also eliminates nonswitched load tone sources.

The technical term "hold over ringing" has already turned into a synonym for all nonswitched load RTC requirements. As a result, it is hoped that all new digital exchanges (main exchanges and distant terminal exchanges) will in all cases be fitted with hold over ringing equipment in order to drive nonswitched loads.

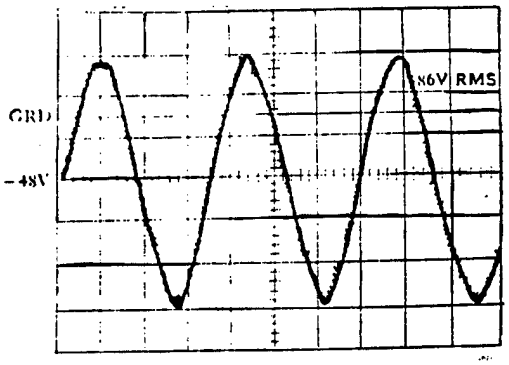
2. RTC EXPLANATION

2.1 -AC/DC Audible Components

Hold over ringing signals for which option is most widely made include continuous 86Vrms, 20Hz sine waves (AC) added to telephone exchange -48V battery (DC). With regard to the addition to this complex wave form (440+480)Hz of audible components (mixed electric level approximately 3.8Vrms), Fig.1 draws out the -AC/DC audible components involved.

20Hz AC components in actuality drive user telephone ringers (or bells). Normally, the ringers in question are connected in series with approximately 0.45uF matching capacitors. Series components are in fixed connections between the a and b lines associated with user circuits. Due to the blocking functions of capacitors, when bells ring, the DC component normally does not play a role. When users pick up telephones to answer, clip spring contact points close, making a user line loop connected to the relatively low internal resistance of the telephone. At this time, DC components follow this type of pick up configuration and flow into user line circuits. This type of configuration is detected by operational amplifiers associated with relays or electrical resistance shunts series connected to the inside of telephone exchanges and circuits, thereby cutting off ringing signals. After ringing signals are eliminated from user lines, the call circuit is then completed between the calling terminal and the called terminal. Because of this, the two users can then talk. /23

Fig.1 -AC/DC Audible Ringing Wave Form



Previous types of electromechanical switchboards had one small 0.02-0.04uF capacitor. From audible ringing currents flowing toward the called user (-AC/DC audible component) use is made of point contacts back to the sending caller side. Impedence associated with this type of capacitor is high enough to be able to block 20Hz ringing currents. It cuts out audible tone components. In conjunction with this, they are taken and sent back to the calling user, showing that the called user's line is just ringing. This type of capacitance tone signal matching technology was in wide spread application throughout the Bell system as early as before the middle 1960's. In conjunction with this, 1 ESS was brought in. It was not only electromechanical types of switching systems in cities. Moreover, a good number of other nonswitched dedicated service circuits of such types as two way private lines also opted for the use of this type of feedback audible ringing (or ring back) tone method. All Bell system standard ringing equipment made in this stage provided, in every case, "audible ringing" as standard service. As a result, in reality, it was not possible to obtain ringing currents that did not have ringing tones.

This means that, in a good number of currently existing telephone exchanges, it is possible to have conditions where nonswitched simulative dedicated service circuits are installed. Moreover, most of these circuits have capacitance matching systems associated with the sending back of audible ringing tones toward sending terminals. Even if today's digital switchboards have plenty of ringing capacity they can use, a good number of circuits among these circuits are certainly not able to make correct use of nonaudible 20Hz signals--much less have plenty of capacity. They are not capable of going through restored 1 ESS or 2 ESS ringing equipment to play their roles. The reason is that these pieces of equipment are only able to provide nonaudible ringing and do not have the needed -AC/DC audible signals. In order to determine whether or not all nonswitched circuits in large buildings will operate together with nonaudible ringing, the carrying out of an exhaustive study is time consuming and without benefit. Moreover, no matter how fully one analyzes, there will always be errors. Therefore, the conclusion arrived at is to provide hold over RTC equipment containing in it

-AC/DC AUD to resolve this type of requirement.

2.2 105V± Ringing Sources

The second type of ringing source which is needed by hold over signals is continuous 105V rms and 20Hz sine wave (no DC component). The return terminal grounding of this ringing source

--- is expressed by the use of a "+" sign. Among these, 105V± ringing sources provide telephone ringers to act as audible alarm bells inside telephone exchanges as well as for the uses associated with ring backs on relay line bus connections as well as miscellaneous test measurement circuits. This output usage very rarely exceeds 10%-15% of the capacity already built into hold over RTC equipment.

2.3 +AC/DC Audible Components

Sometimes there is a need for hold over RTC equipment to supply a third type of ringer source. It is a superposition on a high voltage positive terminal (negative ground)--that is, on a ±48V DC component--a continuous 86V rms 20Hz sine wave (AC). In certain telephone exchanges, this type of signal source is capable of being designated as SUP+AUD or simplified to become SUP+. +AC/DC audible signals supply distant terminal test measurement circuits, long line dialing circuits, and four other circuits selected by users and superposed on the user's line. Telephone instruments associated with these lines have added to them special types of devices of the same catagories as dual diodes (among them, one is a Qina [phonetic] diode) or early vaccuum tubes. These dual diodes or vaccuum tubes act as polarization sensitive switches connected in series with ringers on one side of circuits (one terminal is grounded). Two of the four user ringers make the a line go to ground. The other two, by contrast, make the b line go to ground. Within any set, two diodes or vaccuum tubes are connected to each other in accordance with mutually opposite polarities. -AC/DC AUD or ±AC/DC AUD are brought to bear going through between the a line or b line sides and ground. It is then possible to select for activation any one of the four ringers, and the remaining three will all not ring.

During digitization processes, the four user circuits on the same line just rapidly disappear. However, any telephone exchange will still have a few of this type of line, requiring option for the use of +AC/DC AUD in order to carry out test measurements. /24

2.4 Signal Tone Outputs

Different from the audible components associated with -AC/DC audible signals in hold over RTC equipment, the need for dial tones is not nearly so clear as for the successive ringing signals described above. However, in the end, it is reasonable to consider dialing tones, ringing tones (separate from 20Hz), and busy signals as all being switched load functions. Moreover, they are provided by digital switchboards using various types of methods. In that case, why do we still need to be concerned

about providing these signal tones through hold over RTC equipment?

There are a number of nonswitched dedicated service circuits which require individual and multiple calling process tones in order to indicate the statuses of various types of circuits or test measurements.

For example: There are a number of telephone exchanges which possess one dedicated service element used in order to check the pulse accuracies produced in user telephone instrument rotary dials. Inspection and repair personnel first dial an entry code. After heaing a confirmation tone, they then dial zero. Calculations are subsequently carried out with regard to this, and, in conjunction with it, standard comparisons are made with regard to 10 pulses each second. Assuming that the dialing pulses are within acceptable limits, this test measurement circuit then sends back a dial tone. If the pulse speed is excessively slow, it then sends back a 60 iterations/minute (IPM) busy signal. If the pulse speed is too fast, it then sends back a 120 IPM overflow signal.

Answering systems in apartment house rooms require dial tones. Various systems carrying out relay line distribution and miscellaneous test measurements can require dial tones. There are a number of old alarm transmission circuits which perhaps require on and off audible ringing tones. These circuits take standard calling process tones and send them from security offices where no person is on duty to security offices with people on duty in order to indicate various types of alarm statuses.

Due to the fact that nonswitched load signal tone requirements show quite large differences from one exchange to another exchange, and they are, moreover, difficult to predict, the ideal solution plan is, therefore, to provide 4 precise types of call process tones (dial tone, audible ring, high, and busy) in all the various pieces of hold over RTC equipment with absolutely no exceptions--particularly when hardware costs and space requirements are not excessive. Just as -AC/DC audible components are not able to be acquired from digital switchboards, in that way, call process tones used to supply the outside are also not able to be acquired from digital switchboards.

2.5 RTC Signal Outputs

At the same time that the successive ringing signals described above satisfy most hold over RTC requirements, there still exist other hold over loads (despite the fact that they are extremely few). This then requires RTC signal or period on and off signals. To put it simply, these signals include interrupted ringing, make and break tones, and on and off grounding. Fig.2 shows typical RTC timing.

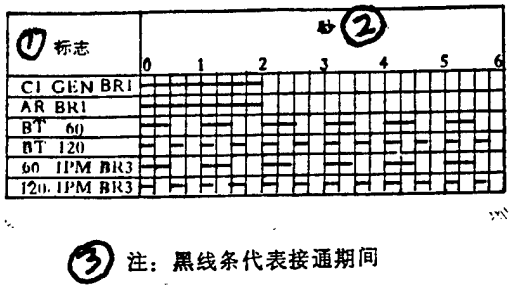


Fig.2 RTC Signal Timing

Key: (1) Index (2) Second (3) Note: Black Lines Represent Contact Periods.

Below are relatively detailed explanations of various types of signals.

- CODE 1 GEN BR1/ or RI BR1 is a -AC/DC AUD signal formed in accordance with a 2 second connect 4 second cut off nodal pattern. In 4 second cut off periods or static periods, -48V is

applied to outputs in order to provide interrupted ringing currents to user loops.

- AR BR1 is an exact audible ringing tone (440+480Hz) in line with the nodal pattern associated with CODE1 GEN BR1. This type of signal is completely away from -AC/DC AUD signal sources.

It supplies hold over load circuits with RTC audible ringing tones. The circuits in question require this ringing tone to be separated from 20Hz ringing tone signals.

-BT60 and BT120 are precise low tone signals (480+620Hz). Nodal patterns are, respectively, 0.5 second break (used with distant terminal test measurement circuits) and 0.25 second contact with 0.25 second break. Bus relay lines or any special type of service circuit requiring 120 IPM (fast) busy signals will also require BT120.

-As far as 60 IDM BR3 and 120 IPM BR3 are concerned, the nodal patterns are consistent with those of BT60 and BT120. These special outputs are only formed by make-break grounding. They are used as distant terminal test measurement circuits, maintenance circuits, alarm clocks, as well as simulation test measurement and warning circuit indicator light illuminations or subordinate relay drive signals.

3. HOLD OVER SIGNAL DESIGN TARGETS

Up to the present time, determination has already been made of various types of ringing, signal tones, and RTC signals required by hold over signals. Experience verifies that almost all hold over signal requirements as well as interchangability objective substitution requirements can, in all cases, be satisfied through the conditons set out below: /25

-AC/DC audible components
-105V±
-+AC/DC audible components
-dial tones (350+440Hz)
-audible ringing tones (440+480Hz)
-high tones (480Hz)
-low tones (480+620Hz)
-make-break ringing (CODE 1 GEN BRI)
-make-break ringing tones (AR BRI)
-busy signals (BT 60)
-overflow signals (BT 120)
-60 IPM (grounding pulse)
-120 IPM (grounding pulse).

In order to simplify hold over RTC equipment types, it is necessary--as much as possible--to limit most of the numbers selected for service to 1 or 2 items. Discussions with telephone company engineers brought to light a number of selections which feel a debt to past designs. Speaking even more frankly, there

was certainly no exact understanding of the actual requirements of concrete installations with regard to which items to select for use. Because of this, each type of item selected for service was then arranged in order form blanks.

In order to be a help in supplying more economical standardized products--besides limiting numbers selected for service--hold over RTC equipment should also include the capabilites below.

-For the sake of reliability, all signal generation and RTC formation functions must have dual back ups. Moreover, there is a need to monitor all outputs associated with these pieces of both main and back up equipment. When monitors detect the disappearance of any output, they then automatically change over to hot standbys.

For the sake of facilitating expansion, to begin with, 20Hz ring generator capacities should initially be 50VA, and, on site, then should be able to rise to 100VA.

-Various types of signal tones must conform to rigorous signal tone programs associated with the Bell-U.S. combined telephone association (Fig.3).

-There is a need to provide light emiting diodes (LED) for diagnostic and alarm uses, in order to simplify maintenance, and, in conjunction with that, make repair times as short as possible.

-Option should be made for the use of modularized plug-in type structures in order to facilitate maintenance and future expansion.

-Primary and secondary alarm outputs should be mutually compatible with currently existing office alarm systems.

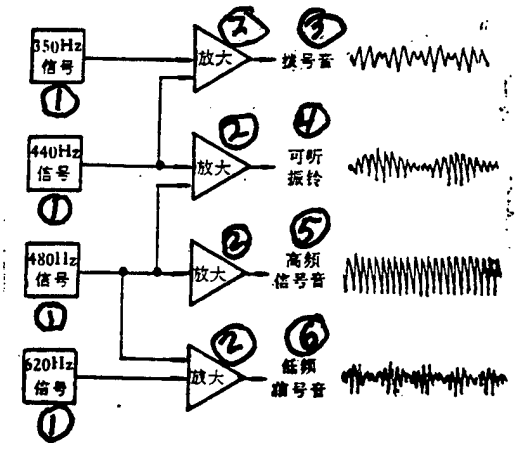


Fig.3 Rigorous Signal Tone Plan (1) Signal (2) Amplification (3) Dial Tone (4) Audible Ring (5) High Frequency Signal Tone (6) Low Frequency Signal Tone

4. COMPREHENSIVE EXPLANATION

Fig.4 draws out the line and block chart associated with hold over RTC signal source equipment systems manufactured to satisfy the design targets described above. Besides ring generators, distribution fuses, 105±V isolating transformers, and a few odds and ends, all circuits are, in every case, sealed into plug-in type printed circuit boards. These circuit boards or circuit elements are then installed in single casings. In conjunction with this, there are mutual connections with printed back boards. These back boards cause manually done wiring to be almost totally eliminated from the areas in question.

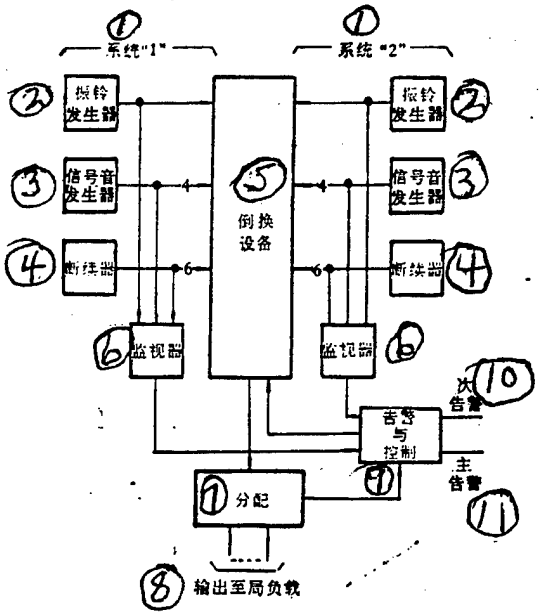


Fig.4 System Line and Block Chart

Key: (1) System (2) Ring Generator (3) Signal Tone Generator (4) Make-Break Device (5) Monitor (6) Monitor (7) Distribution (8) Output Loadto Exchange (9) Alarm and Control (10) Secondary Alarm (11) Main Alarm

For the sake of reliability, ring generators, signal tone generators, make-break devices, and system monitors are all backed up units. All outputs are converted into one set. Substitution breakers for the system as a whole are contained in the same case, associated with plug-in mount type printed circuit boards. System input and output distribution fuses are mounted

in all cases in the common user fuse panel associated with parts of systems that do not reveal electrical charges, in order to reduce to a minimum operating personnel being made subject to injuries associated with electric shocks. /26

-In order to make 20Hz sine wave ring signals, option is made for the use of 50VA PWM convertors in order to optimally satisfy requirements associated with voltage regulation, efficiencies, and low harmonic wave distortion. Another 50VA generator set is capable of being connected in parallel with the first in order to supply capacities reaching as high as 100VA.

-Signal tone generators are composed of digital frequency generators which drive 4 one piece IC power amplifiers. Respective individual amplifiers separately provide 1 type among 4 types of calling process tones.

-Make and break devices are composed of digital IC RTC signal or timing signal generators as well six driving mercury make-break switches. They supply various types of RTC signal ouputs associated with speeds of 10, 60, and 120 IPM.

-Monitors are divided into two parts. One part opts for the use of IC comparators in order to check uninterrupted outputs from signal tone amplifiers and continuous outputs associated with -AC/DC AUD ringing. Assuming that ring generator outputs fall below predetermined thresholds or any signal tone output electric level falls more than 3dB, then, an exterior alarm is introduced. In conjunction with this, office loads are changed over to the reserve side of signal source equipment. Grounding pulse monitors and make-break signal tone monitors are similar in type. No matter whether it is ground pulse outputs disappearing, RTC slow downs, or changes into continuous signals, in all cases, the external alarms described above are introduced, and, in conjunction with that, there is a change over to the reserve side. As far as make-break operation on the two sides of equipment (main and reserve) is concerned, malfunction monitoring is simultaneously carried out in an uninterrupted way with regard to all outputs from these two sides. If malfunctions are discovered in association with the reserve side--even if they are definitely not connected to a load--it is still necessary to introduce secondary alarms in order to arouse the attention of maintenance personnel before the problem influences services.

-Under system control, ring generators, signal tone generators, and change over breakers associated with make-break devices will take 1 or 2 side equipment outputs and connect them to output distribution fuses and terminals.

5. CONCLUSIONS

Despite the fact that advanced digital switching systems have as characteristics signal tones and RTC signals associated with their own internal digitized formation as well as very numerous embeded type ring generators--thereby causing municipal switchboards to abolish the traditional lumped type RTC signal source equipment--speaking in regard to special types of analog

service circuits, however, there still continues to be a need for hold over ringing equipment in order to produce normal RTC functions.

In the several years just past--in the same way as there has been a conversion from magnet types to common battery types--in reality, various new digital exchanges (whether they are large exchanges or small distant terminal offices) have still taken lumped type RTC equipment with which they are furnished and used it in association with hold over nonswitched loads.

-NEW PRODUCTS-

REAL TIME LASER DISC VIDEORECORDERS

Lyu Guisen

Translation of "Shi Shi Ji Guang Pan Lu Xiang Ji"; p 26

The KDD Company and the Vanguard Electronics Technology Company have cooperated and successfully produced for the first time a kind of real time analog type videorecorder associated with erasing images and recording (retaking) images using laser disc methods to provide high quality moving imagery.

At the present time, magnetic tape videorecorders are in wide spread use in order to record and play back. On the other hand, laser disc players provide, by contrast, comparatively clear imagery. They are, moreover, capable of withstanding many years of use. Operation is also convenient. However, most of these types of products are only capable of being used to play back.

In the area of broadcast equipment, there are also a number of digital type laser disc videorecorders which are capable of being used to make digital type records of imagery. Because of the fact that, as far as one side of a 30cm laser disc is concerned, it only records 5 minutes worth of imagery, its uses are very limited.

Laser disc videorecorders which have been newly and successfully developed opt for the use of analog types of video recording. One side of a video disc is capable of recording or playing back 30 minutes of high quality moving imagery. It is possible to believe that they possess a high degree of commercial product applicability.

Beside this, this type of new system also has a good number of the functions which the magnetic tape videorecorders of the past possessed--for example, (1) high speed random entry functions. Using this function, it is possible, within an average time period of 0.2 seconds, to instantaneously locate image tracks. (2) They are convenient for videorecorder disc fast forward. They are also convenient for on screen image shot advancement.

Before, as far as recording and editing moving imagery was concerned, it was only possible to carry it out on magnetic tape videorecorders. Due to the new videorecorders described above, it is possible to carry out these two operations on high quality laser videorecorder discs. It is predicted that specialized departments and other departments will all very rapidly make wide spread applications.

REFERENCE

Selected from KDD Telecom News, No.11, 1989, p5.

NAIC-ID(RS)T-0127-96.13 /27

NEW STRUCTURE FOR DIGITAL SWITCHING NETWORK

A. Jajszczyk

Translation of "Shu Zi Jie Xian Wang Xin Jie Gou"; pp 27-29

This article puts forward design methods associated with cost effective single stage pulse code modulation (PCM) switching networks composed of digital switching matrices. In a good many situations, this single stage switching network is more regular than the current switching network structures which are now familiar. Moreover, they include relatively few components. The single stage switching networks that are put forward are also capable of use with submodules associated with multiple stage switching networks.

1. INTRODUCTION

Applications of standard digital switching matrices (DSM) are one type of trend in today's design of digital switching networks. This type of matrix--on the same circuit chip (that is, the same printed circuit board) has both time switching and space switching. In a digital switching network, information can be transmited from any channel entering in toward a PCM link circuit to any channel out toward a PCM link circuit. In order to obtain switching networks with capacities larger than single matrix capacities, we can take switching matrices put together by various types of methods to form a switching network.

The simplest method is mutual parallel connections of assisting digital switching matrices. The networks which are obtained include [L/n]2 matrices. Here, L is the total number in each network of links in toward PCM and links out away from PCM. n is the capacity of one digital switching network. The symbol [x] stands for the smallest whole number equal to or greater than x. It has already been reported that there is a type of switching network [2] which includes a relatively small number of elements with regard to certain L and n values. However, this

type of switching network--between its digital switching matrices--has wiring which is comparatively complicated and irregular. Another method, by contrast, opts for the use of multiple stage structures. In this article, we put forward a number of methods to achieve single stage switching networks and multiple stage switching networks. These switching networks are cost effective with regard to certain L's and n's and possess characteristics associated with connection regularity between components.

2. SINGLE STAGE SWITCHING NETWORKS

Basic single stage switching networks without blockage can be arrived at using the procedural steps set out below.

(1) Take k links entering toward PCM and k links going out toward PCM and connect them, respectively, to L/k input terminal and output terminal switching matrices (L=2n-k, k is capable of eliminating as much as possible u, u≤n).

(2) Take the u-k input terminals and output terminals remaining in association with each digital switching matrix and connect them up to the incoming and outgoing PCM links associated with follow on digital switching matrices--one given matrix terminal (that is, input terminal or output terminal) connected to one PCM link. When the given matrix arrives at the last matrix and there is already a connection, take the subsequent terminal and connect it up to the first matrix, and so on, and so forth.

The costs of networks obtained (using matrix numbers for purposes of representation) are C=L/k. The steps described above are capable of being used in small capacity switching networks. Fig.1 is a switching network (that is, L=5) composed of 5 3x3 digital switching matrices. We must pay attention to the fact that it is not possible to arrive at one L=5. In conjunction with this, option is made for the use of ordinary multiple stage nonblocked switching networks associated with 3x3 switching elements.

In order to compose a single stage network with a capacity larger than 2n-1, we are able to take several networks which are obtained using the methods described above and combine them together. In this type of situation, i-1 order networks are taken to act as a switching device. Applying the procedural steps described above, it is possible to obtain i order networks. If ki is able to eliminate as much as possible Li, it is then possible to opt for the use of this type of method. Here, ki is the number of PCM links associated with i-1 order networks. These links are capable of acting as i order network terminals. Li is the total number of terminals associated with i order networks. The capacities of networks obtained are Li=2Li-1 - ki, and costs are Ci = Ci-1 (Li/ki). Test consideration is given to an L=9 network composed of 4x4 digital wiring matrices. The capacity of first order networks obtained with the use of the procedural steps described above is L1=6, and C1=3. On this

network, use is again made of the procedural steps described above. We are then able to obtain networks associated with results of L2=9 and C2=9--as shown in Fig.2. /28

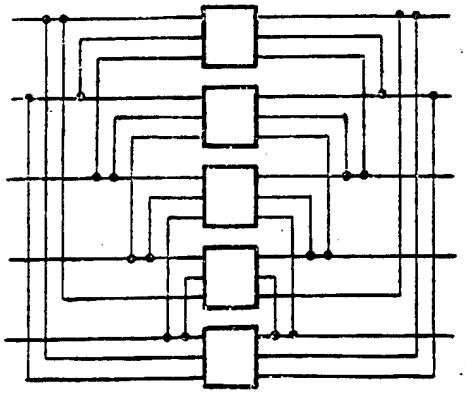


Fig.1 Single Stage Switching Network (L=5, n=3)

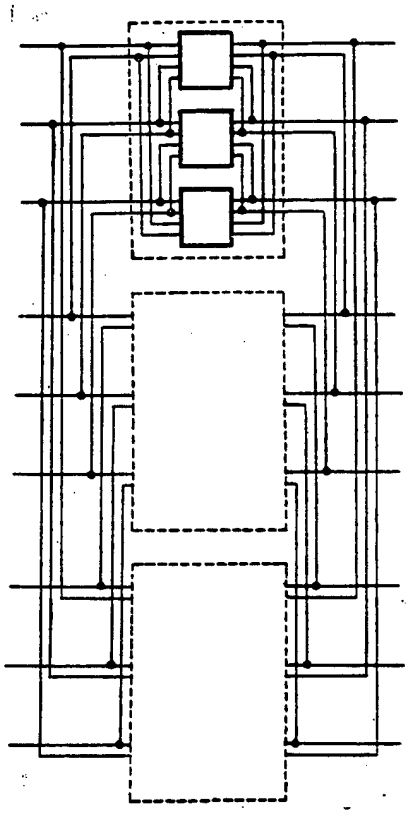


Fig.2 2 Order Single Stage Switching Network

3. MULTIPLE STAGE SWITCHING NETWORKS

Following along with increases in capacity, the numbers of digital switching matrices required by single stage switching networks has also rapidly increased. As a result, option is made for the use of multiple stage switching networks. The most popular solution method is to opt for the use of 3 stage networks similar to those put forward by Clos to act as basic structures. Normally this uses full 3 stage networks to replace methods associated with each intermediate stage switching network in (s-2) stage networks and arrive at a general s stage network. The maximum capacities of this type of network are closely related to stage numbers. In order to overcome this type of correlation, and, in conjunction with that, save on the number of switching matrices, different network structures are put forward. In this type of situation, basic structures are also composed of 3 stage networks. However, in order to obtain relatively large capacities, one stage nonblocked switching networks are used to replace switching devices in one stage or multiple stage networks. We can take this type of method and the single stage switching networks put forward in this article and combine them together. As an example, we consider a network with a capacity of 48 PCM links--as shown in Fig.3. This network is composed of 3 stages, including 48 switching matrices. Conventional networks possessing the same kind of combined properties (that is, networks that can be combined anew) include 64 matrices. In conjunction with this, there is an arrangement to form 5 stages.

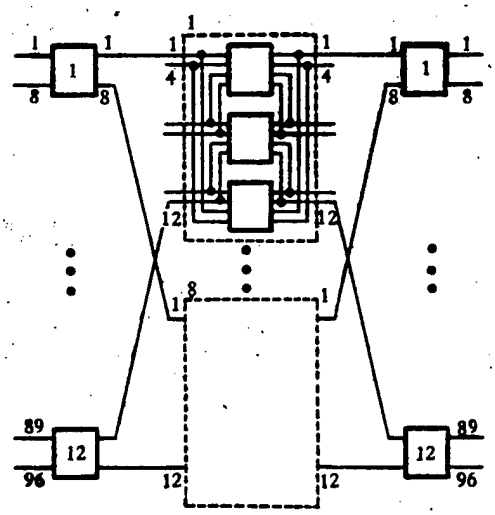


Fig.3 Three Stage Switching Network

4. CONCLUSIONS

In a good number of examples of practical uses, the switching networks which this article puts forward have a smaller number of components than those used at the present time. The procedural steps described are also useful with regard to band width switching--in particular, with regard to switching networks with small capacities.

REFERENCES

[1] JAJSZCZYK, A.: "Design of switching networks composed of uniform time-space elements". Proc. 11th int. teletraffic congress, Kyoto, 1985(North-Holland, Amsterdam, 1985), pp. 1061～1068.

[2] JAJSZCZYK, A.: "Cost-effective digital Switching network", Electron. Lett, 1985, 21, pp. 909～910.

[3] JAJSZCZYK, A.: "Novel architecture for a digital switching network", ibid., 1984, 20, p. 683.

[4] CLOS, C.: "A study of non-blocking switching networks", Bell Syst. Tech. J., 1953, 32, pp. 406～424.

[5] JAJSZCZYK, A: "On nonblcking switching networks composed of digital symmetrisal matrices" IEEE Trans., 1983, COM-31, pp, 2～9.

-TELECOMMUNICATIONS TRENDS-

PORTABLE TELEPHONE INSTRUMENT ELECTRIC POWER SOURCES CATCH FIRE

Lyu Guisen

Translation of "Dian Xin Dong Tai Ke Xie Shi Dian Hua Ji Dian Yuan Qi Huo"; p 29

A portable telephone instrument of the Japan Telegraph and Telephone Company gave rise to smoke emissions during utilization processes. In conjunction with that, an accident associated with the burning of a user was initiated by this. As a result, the company in question decided to stop using this type of portable telephone instrument. In conjunction with that, nickel-cadmium batteries were used to replace the lithium batteries free of charge.

The company in question is still investigating the causes of this accident. However, as far as case type electric power sources in portable telephone instruments catching fire is concerned, this point seems to be clear. This case type electric power source system included a battery and corresponding circuitry. The possibility was very great of defects existing in the lithium batteries that were used. It was therefore decided to temporarily stop use of lithium batteries. In conjunction with this, they will be recalled. This type of lithium battery--which is not up to specifications--is manufactured in Canada.

The advantage of lithium batteries is that, after going through one iteration of charging, telephone instruments are then capable of carrying out a good number of calls. As a result, their applications are in the midst of a rapid increase.

Selected from KDD Telecom News, No.9, 1989, p.3

-NEW EQUIPMENT-

MULTILINGUAL PAGERS

Chang Weiguo

Translation of "Xin She Bei Duo Yu Xun Hu Ji"; p 29

Hong Kong's Kantone Paging Company has successfully developed a multilingual pager which is capable of displaying Roman characters and Chinese characters. This type of pager device--in the written Chinese mode--is capable of displaying 32 lines of independent information. The maximum length for each message is 39 characters. In the Roman writing mode, the maximum length of each message is 79 characters. Besides this, it is also possible to handle Arabic characters. This device opts for the use of PQCSAG encryption methods. Operating frequency band is 138MHz-174MHz.

Translated from Communications International, Dec. 1989, p.26

-NEW PRODUCTS-

NEW MODEL SEMICONDUCTOR ULTRA HIGH FREQUENCY DEVICES USED IN ASSOCIATION WITH DIRECT BROADCAST SATELLITE RECEIVERS

Yan Yi

Translation of "Xin Chan Pin Zhi Bo Wei Xing Jie Shou Ji Yong De Xin Xing Ban Dao Ti Chao Gao Pin Qi Jian"; p 29

The U.S. Hughes Company put forward a type of new model high electron migration transistor (HEMT) semiconductor device associated with clearly improved ultra high frequency amplification characteristics. This type of device makes application of a type of new material series associated with high electron migration transistors developed by the Hughes Company. Option is made for a layered composite manufacture associated with gallium-indium-arsenic compounds, aluminum-indium-arsenic compounds, and indium-phosphorous compounds. As far as opting for the use of this type of device is concerned, amplifier noise electric levels are greatly reduced. Ultra high frequency characteristics are very good. As a result, it is possible to produce direct broadcast satellite receiver systems associated with antennas having diameters smaller than 3 English feet. Other potential uses for this type of new device lie in high speed radar signal processing digital circuits and high power millimeter wave circuits.

Translated from Communications International, Vol.16, No.10, Oct.1989, p.2 .

SUCCESSFUL TEST MANUFACTURE OF WX-22 MODEL CORDLESS TELEPHONES IN FUJIAN

Ying Bihu

Translation of "WX-22 Xing Wu Sheng Dian Hua Ji Zai Fu Jian Shi Zhi Cheng Gong"; p 29

Going through 2 years of repeated measurements and tests, a type of multiple function full duplex cordless telephone instrument called the WX-22 is just about to come out. This new product--the development of which was undertaken by the Fujian Province, Quanzhou City, Beifeng Radio Plant--combines the functions of wire and wireless telephone devices as well interphones in one package. The mother set and hand sets are all capable of independently dialing telephones outside or receiving telephone calls coming from outside. They are also capable of being used as separate frequency duplex interphones. The instruments in question can be used with AC or DC. If a power outage is experienced, the mother set takes on the role of an ordinary telephone. When there is external connection to a DC power source, all functions are then restored. The communication range of the instruments in question is great. Counter interference characteristics are strong. Security characteristics are good. They are compatible with dual tone frequency dialing, pulse dialing, and non pick up calls, as well possessing multiple functions such as luminous displays, and so on. The designs of these instruments are completely in conformance with postal and telecommunications departmental standards associated with connections. At the present time, they have already entered into the final testing phase. It will not be long until batch production will be organized, and they will be introduced onto the market as fast as possible.

NAIC-ID(RS)T-0127-96.18 /30

-TELECOMMUNICATIONS NETWORKS-

TRENDS WITHIN PUBLIC TELECOMMUNICATIONS DIGITAL NETWORKS

B. Svedberg

Translation of "Gong Yong Dian Xin Shu Zi Wang Fa Zhan Fang Xiang"; pp 30-32

At the present time, the management companies associated with most public networks face a type of situation which is nothing else than a number of users which is not great (commercial users) soliciting the greater part of the business and most of the income. However, at the same time, a comparatively large part of the investment associated with telecommunications networks must still be put into local networks in order to respond to needs associated with connecting to users in a vast number of residential homes.

One of the most pressing problems associated with telecommunications management companies is nothing else than the need to satisfy the requirements of commercial users. This means that there is a need to adapt to new business requirements which always constantly develop. The market clearly shows that effective communications are more important by the day as a prerequisite condition for successful commercial firms.

In a number of areas--for example, banks and tourism businesses--telecommunications are indispensable in the whole of operations. In other businesses, new telecommunications services will also lay the foundation of good opportunities for new enterprises which need to be opened up.

However, at the same time as satisfying the needs of commercial circles, network operating companies must also increase the area of services with regard to residential users. The needs of the latter are generally ordinary telephone services at the lowest charges possible.

In this way, the requirement which is put forward is to have methods of operating in order to attract new business users and also not to influence current business.

As a result, what is needed is to decide on gradual changes to support networks. It is not development plans associated with huge changes.

1. NETWORK DEVELOPMENT TRENDS

At the present time, development associated with telecommunications network technologies takes as its characteristics the areas of rapid digitization and expanded fiber optics applications.

Digitization means improving network signal command capacities. This is also capable of taking intelligent service functions and switchboards and separating them. In conjunction with this, allocation is made of various types of services in order to acquire optimum efficiencies in the areas of implementation and management.

As far as a gradual expansion of fiber optics in various parts of networks is concerned, this then creates an opportunity to provide relatively high band widths for users in an economical manner.

Besides this, networks are also opened up with regard to business providers adding value. As a result, residential users and commercial users are able to rapidly (illegible) opt for the use of a great many new businesses.

2. BAND WIDTH ALLOCATION AND USER NET MODERNIZATION

Today's need to increase band width primarily comes from commercial circles. It is estimated that, in the future, residential clients will have particular need for cultural and entertainment program services--for example, high definition television (HDTV).

At the present time, high band width services are mostly managed within commercial departments. However, more and more new businesses are opting for their use by new service providers and widely distributed service businesses (for example, travel

businesses). This means that services between different companies will develop in the same way.

People should also remember that data associated with the amount of business are often dependent on technology and costs associated with public networks. Opting for the use of digital networks will produce comparatively large capacities having relatively low costs.

The allocation of comparatively large band widths in association with public networks is capable of using forms of gradual development for completion (See Fig.1).

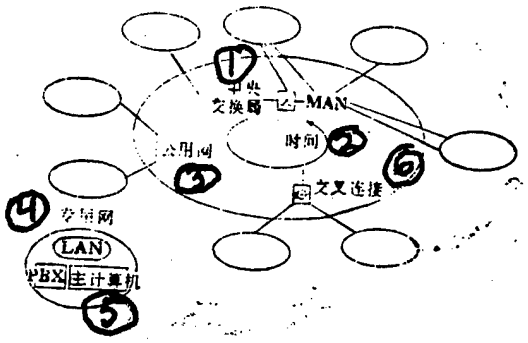


Fig. 1 Band Width Allocation

Key: (1) Central Switching Exchange (2) Time (3) Public Network (4) Specialized Network (5) Main Computer (6) Cross Connection

The first step is already being implemented. This speaks in terms of main computers connected together by leased lines and requiring the use of capacities reaching 2Mb/s or local networks (LAN). /31

As far as the second step is concerned, the methods described above associated with the use of digital cross connections (DCC) to make connections among various dispersed structures provide it, and metal wire connections are not used. In this way, option is made for the use of modernized operational safeguard systems, and it is possible to shorten transmission times and reduce labor costs.

With regard to the third step, it is possible to make option for the use of services which already switch multiple megabytes and are provided by public municipal area networks (MAN). The feasibility of this item of technology in public networks is just in the midst of being discussed--in particular problems associated with such areas as security, operations, and maintenance, as well as differentiating users and networks in an environment of multiple users.

Because of this, it is very possible to use asynchronous transmission modes (ATM) and wide band and narrow band switchboards to take dedicated MAN (possibly also public MAN) and connect them together in order to provide services, which already switch multiple megabytes, on the scope of the whole nation--thereby entering into the B-ISDN phase.

Due to network development associated with this type of step by step implementation, public networks opt for the use of such technologies as DCC, MAN, ATM, and so on, to support wide band communications. At the same time as this, communications which already switch Nx64kb/s will also be provided--acting as a type of strengthened narrow band ISDN service. Besides this, due to the including of such types of entertainment services as high definition television, wide band B-ISDN communications will also be developed.

Speaking in terms of local area networks, the first fiber optic lines are used in high density areas. As far as opting for the use of fiber optics is concerned--with the aid of currently existing conduits--it is possible to cause clear increases in the processing capabilities associated with local area network services. In conjunction with this, it is possible to satisfy the requirements of commercial users with regard to comparatively high band width, which are growing by the day.

Fiber optic technology is, first of all, used between central switching exchanges and distant terminal modules connecting equipment at user locations (see Fig.2). These local

connections opt for the use of copper wire or optical fiber, depending on requirements with regard to band width.

As a result, the foundation of network modernization lies in local area networks. The beginnings of modernization will lie first of all in areas of dense population associated with obsolete old analog equipment or appear in areas where the proportion of commercial users is high and there is demand for increased band widths.

Because of this, in these areas--with the aid of superposed technologies--it is possible to take digital bases and use them in order to make modernizations of areas associated with low user densities. This involves making use of superposed commercial users and the allocation of distant terminal modular digital connections, taking commercial users associated with other areas and connecting them to digital networks. In this way, distant terminal modules cause commercial users to be capable of making use of new services--for example, using 64kb/s and even higher speeds to transmit business data, and so on. This is also capable of causing terminal users to begin making use of digital telephones along with advanced telecommunications services.

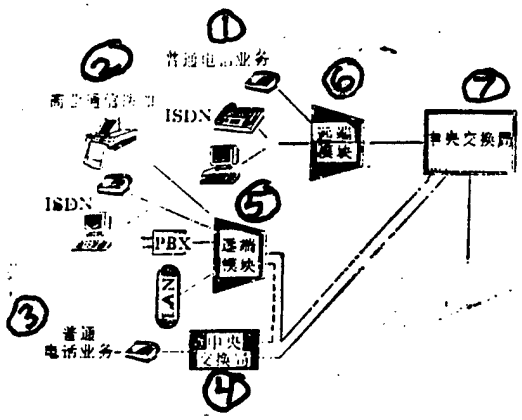


Fig.2 User Network Modernization

Key: (1) Ordinary Telephone Service (2) High Business Communications (illegible) (3) Ordinary Telephone Service (4) Central Switching Exchange (5) Distant Terminal Module (6) Distant Terminal Module (7) Central Switching Exchange

3. INTELLIGENT FUNCTION NETWORKS

Speaking in terms of speed and band width applications, network digitization and opting for the use of fiber optics means introducing even more services and operations with even higher cost effectiveness.

For example, the application of superposition technology brings into play these advantages. With regard to a number of basic network characteristics (for instance, number design) comparatively high requirements are presented. Besides traditional telephone call circuit selection and billing, original number designs were difficult to put to other uses. As a result, it is necessary to opt for the use of a new concept--intelligent function networks.

When networks introduce intelligence, there is then the possibility--in accordance with actual needs and requirements--of opening up more new services.

In order to supply new services, networks must formulate new means--that is, means of taking network intelligence and separating it from the various switching nodes. As far as realizing this point is concerned, it is possible--through such new types of nodal points as those opting for the use of service control points (SCP) in networks as well as combined service switching and control points (SSCP) operated by service management systems (SMS), and so on, (see Fig.3). With regard to the use of this type of method, it is conducive to opting for the use of new services. In networks, there is no necessity to rewire all the switching equipment or reprogram.

At the present time, the services most often discussed are general continuous numbers and mobile telephone numbers. These services are supplied by making use of such functions in networks as common circuit signal commands as well as data bases, and so on. First of all, data bases are of a pan national character, making use of lumping to put out a number of services. Following along with inceases in use, the services will be allocated to various nodal points close to users. /32

Mobile communications then realize a relatively good distribution of services to nodal points close to the locations of frequent users.

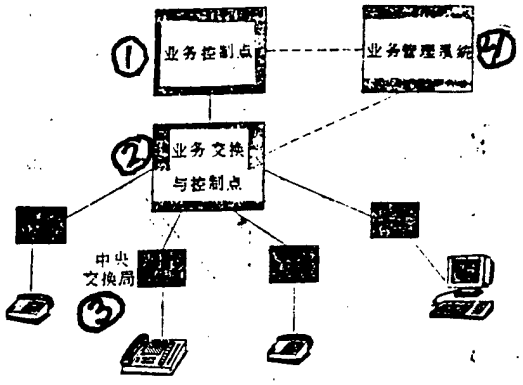


Fig.3 Local Service Dispatch Center Key: (1) Service Control Point (2) Service Switching and Control Point (3) Central Switching Exchange (4) Service Management System (Illegible)

In mobile communications, what number directories and numbers involve is mobile (voice) terminals as well as their users, but they are not actually network terminal port numbers. Networks and mobile terminals/users maintain contact. In conjunction with this, two data bases are updated--home location register (HLR) and visit location register (VLR) (see Fig.4).

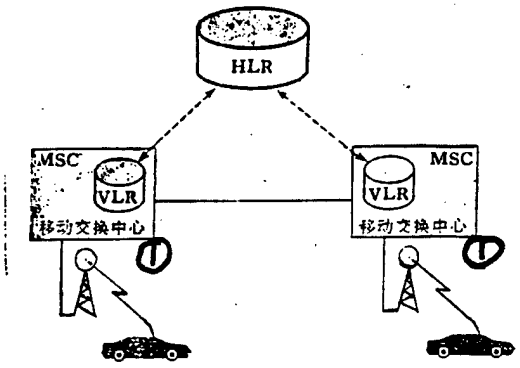


Fig.4 Mobility Provided by Distributed Data Base Management (CEPT/GSM Specifications)

Key: (1) Mobile Switching Center

Data bases and their management are regulated by the European postal and telecommunications management organization federation (CEPT) mobile communications special working team (GSM) for small area cellular networks. However, use is also possible in public telephone networks of a 2 line range in order to supply general and individual telephone numbers.

Examples of mobile communications clearly show the necessity of providing various types of distributive services by distributed data bases and management support. They also point out--in environments associated with intelligent network structures--the possibility of these switched nodal point mechanisms.

4. CONCLUSIONS

Telecommunications networks of the future will come to be set up on the basis of requirements associated with new services--first of all, on the basis of requirements associated with commercial circles, and, finally, also on the basis of requirements associated with residential users.

These requirements have "hard" characteristics (for example, increasing band width) and "soft" characteristics (for example, telephone at will--that is, mobility). These requirements develop as functions of time, meaning that services must opt for their use gradually.

At the same time, charges associated with the penetration of these services into the residential user market must be as low as possible.

Future digital networks should be able to use controlable methods to gradually make reactions to these requirements. Due to the involvement of indeterminant factors, it is not possible to accurately forsee which type of service is needed at what time.

Networks must use dynamic methods to allocate a number of means in order to facilitate being able to open up various types of services at necessary times. The realization of means required by this point includes changing over to the paths associated with high band width equipment as well as intelligent network structures.

-ADVANCE NOTICE OF THE MAIN ITEMS IN NEXT ISSUE

-Forward Error Correction Technology Suitable for Use with INTELSAT IDR Carrier Waves

-Practical Use of Earth Station Flat Panel Recieving Antennas

-Problems Discovered in Detection Associated with Program Controled User Switchboards

-One Type of Multiple Area Cordless Telephone System

SUZHOU NO.1 WIRE ELECTRONICS PLANT

[FIG.]

SOPHO-S PROGRAM CONTROLLED DIGITAL USER SWITCHBOARD CAPACITY 20-20000 LINES

The Suzhou No.1 Wire Electronics Plant is the factory designated as the national point for the introduction of production of the Dutch Phillips Company's SOPHO-S program controlled digital user switchboard. The system in question is a type of combined switching and transmission system associated with language, documents, data, and imagery. It is not only capable of use in currently existing analog networks. It is also capable of use with integrated service digital networks (ISDN) of the future. It is a type which coordinates with open styles of office automation system.

The plant in question is one of the earliest factories in China to specialize in the production of crossbar system automatic telephone switchboards--possessing abundant experience and product design capabilities associated with the manufacture of various types of municipal voice, agricultural voice, and user crossbar switchboards. Many types of products have gloriously achieved the designation of top quality electronics industry product.

PLANT ADDRESS: SUZHOU, XUJIANG ROAD NO.51, TEL. 331461, TELEGRAPHIC ADDRESS: 2539, POSTAL CODE: 215004

WCB100 TEST MEASUREMENT FREQUENCY CONVERTOR SERIES

WCB100 test measurement frequency convertor series includes WCB164 model test measurement repeaters, WCB161 model test measurement upper frequency convertors, and WCB141 model test measurement lower frequency convertors. As far as its analog satellite repeaters are concerned, they are used in satellite communications earth station internal equipment open loop or closed loop adjustment surveys. It is an indispensable instrument set associated with earth station maintenance and satellite communications equipment production plant adjustment surveys.

Characteristics:

() Do not go through satellites. Internal station equipment is capable of autoloop test measurements.

() Wide bands.

WCB164 MODEL TEST MEASUREMENT REPEATER

Main Uses:

Used in radio frequency closed loop test measurements associated with transceiver equipment inside 4/6GHz system satellite communications stations.

Main Technical Characteristics:

Input frequency range: 5925-6425MHz
Input electric level: 0dBm (maximum)
Input impedance: 50Ω(L16-50K)
Local oscillator frequency stability: ±2x10-6d
Output frequency range: 3700-4200MHz
Output impedance: 50Ω(L16-50K)
6/4GHz transfer losses: ≤15dB
6/4GHz transfer loss fluctuation: ≤0.5dBp-p(fo±18MHz)
Three stage mutual adjustment result: ≤-53dBm (when two carrier waves which are respectively -13dBm are inputed).

WCB161 MODEL TEST MEASUREMENT UPPER FREQUENCY CONVERTOR

Main Uses:

To realize open loop adjustment surveying of characteristics associated with satellite communications earth station down link equipment.

Main Technical Characteristics:

Intermediate frequency input characteristics:
- frequency 70±18MHz
- electric level ≤0dBm
- impedance 75Ω(Q9-75K)
- attenuation 0-20dB stepped

Radio frequency output characteristics:

frequency 3700-4200MHz
electric level -17 - -40dBm
impedance 50Ω(L16-50K)
Intermediate frequency to radio frequency transfer loss: ≤17dB
Intermediate frequency to radio frequency amplitude frequency characteristics: ≤0.5dBp-p/36MHz
Intermediate frequency to radio frequency time delay characteristics: ≤3ns/36MHz

WCB141 MODEL TEST MEASUREMENT LOWER FREQUENCY CONVERTOR

Main Uses:
To realize open loop adjustment surveying of characteristics associated with satellite communications earth station up link equipment.

Main Technical Characteristics:
Radio frequency input characteristics:
frequency range 5925-6425MHz
electric level 0dBm (medium setting AGC)
impedance 50Ω(L16-50K)
Intermediate frequency output characteristics:
frequency 70±18MHz
maximum electric level 0dBm
impedance 75Ω(Q9-75K)
Radio frequency to intermediate frequency gain: 20±2dB
Radio frequency to intermediate frequency amplitude frequency characteristics: ≤0.5dBp-p/36MHz)

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Single surface single chip microwave integrated circuits (MMIC) have, in all cases, the advantage compared to microband single chip microwave intergrated circuits in the area of circuit miniaturization and the area of improving rates of product formation. If it is possible to study again electrical circuit design methods associated with good precisions, it is, then, possible to fully realize the objective of taking entire transceivers and integrating them on one chip. Following along with the development of single surface single chip microwave integrated circuits from now on, the appearance of microwave and millimeter wave portable type radio communications devices in which volumes are small, weights are light, and prices are cheap can be fully anticipated.

--Taken from "Progress in the Development of Subminiature Single Chip Microwave Integrated Circuits"

April 1990 Edition (Overall No.226)

Satellite Communications

Microwave Devices

Mobile Communications

Telecommunications Switching Technology

Telecommunications Networks

* * *

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