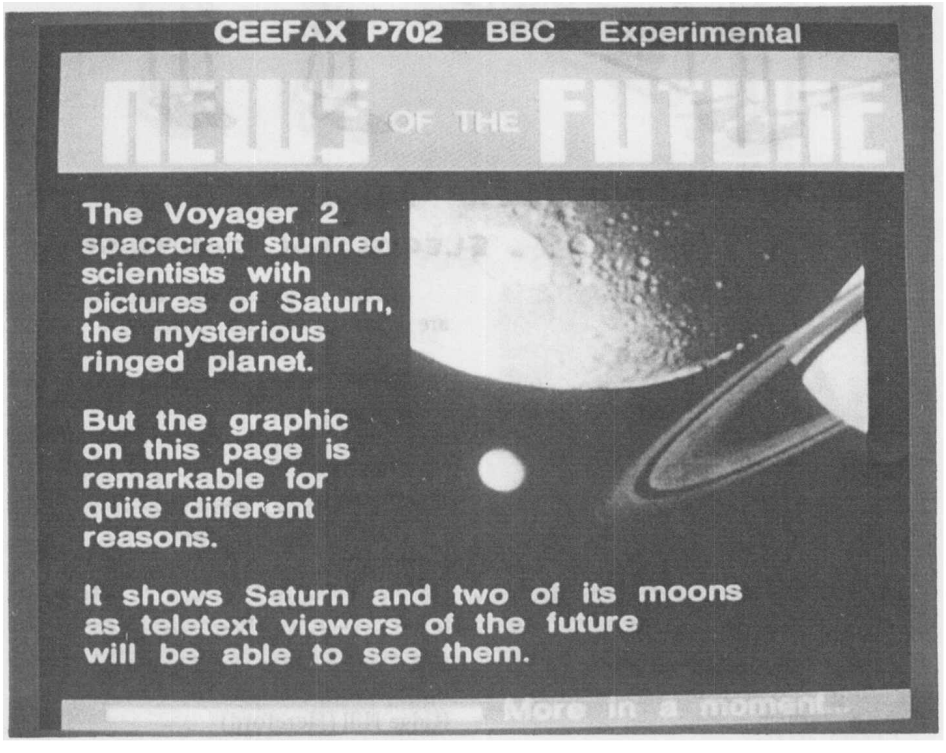
ENG INF

The Quarterly for BBC Engineering StaH



The BBC has made the first public broadcast of high quality still pictures by means of the UK Telctext system. The broadcast high-quality pictures and other enhancements were demonstrated to a technical committee of the European Broadcasting Union (EBU) on February lIth, and at a meeting of the Institution of Electrical Engineers (lEE) on March 8th. The UK teletext system has, for many years now, represented an efficient and rugged way of trans-mitting, receiving and decoding data for display on a television receiver. None of the efficiency or ruggedness is lost in the transmission of the enhancements.

The recent transmissions were the culmination of several years work by engineers from Special Projects Section at Research Department. The equipment used to generate the enhancements contained a teletext generator. a microcomputer system and a high-quality digital picture store. whose content was displayed on a screen. On the UK television standard (System 1) the store opcrates at thc CCIR recommended sampling rate of 13.5 MJ-Iz. with 8-bit Red, Green and Blue (RGB) samples, occupying some 1.2 M bytes of storage space. This represents an active picture size of 702 by 576 pixels, or picture elements, to fIll the television screen with the high-quality picture. For the experimental transmission, a montage of the startling pictures of Saturn taken from the Voyager 2 spacecraft was used to demonstrate the capability of the system. The picture was fed from a conventional 35 mm slide scanner into the digital picture store. After sampling at 13.5 MHz it was fed to a microcomputer and data generator that sorted the information into a form suitable for transmission. The special equipment was used temporarily to replace two of the conventional four line Ceefax signals on BBC 2 for the transmission.

The Voyager 2 picture was included in a series of pages that displayed an improved character font. The new character generator in the decoding equipment enabled the characters to be more easily read, with individual characters being weJI spaced

'continued on Page 3'

In *this* edition of *ENG* 'NF

Editorial

The recent announcement that the BBC is to be allowed to operate two satellite channels has been welcomed. Thus the BBC enters another era of broadcasting. As technology has improved, so have the services which the BBC has been able to offer its audience. None of these improvements would have been possible without the dedication and skill of BBC engineers.

For many years now BBC engineers have been investigating the problems to be found in the 12 GHz band, and seeking solutions. Some of the problems have been answered, others await international agreement.

Fifty years ago the BBC entered a new era when it moved its headquarters from Savoy Place to Broadcasting House. At that time the Press were quick to blame the BBC's high-power medium-wave transmitters for the series of wet summers that had been experienced. With the advent of satellites, how long before the Press make this accusation about satellite broadcasting?

Congratulations

Mr. Peter Rainger, Deputy Director of Engineering, has been elected a Fellow of the Royal Society for contributions to electronic techniques used in television. Our warmest congratulations to him.

Welcome

We welcome Keith Hunter from VT in Cardiff to our team of contributors. Keith has kindly agreed to supply Eng Inf with cartoons, and an example of his excellent work is published elsewhere on this page. We look forward to seeing some more of his cartoons in the future.

Alan Lafferty

Transmitters Opened

The following uhf tv relay stations have opened since January:

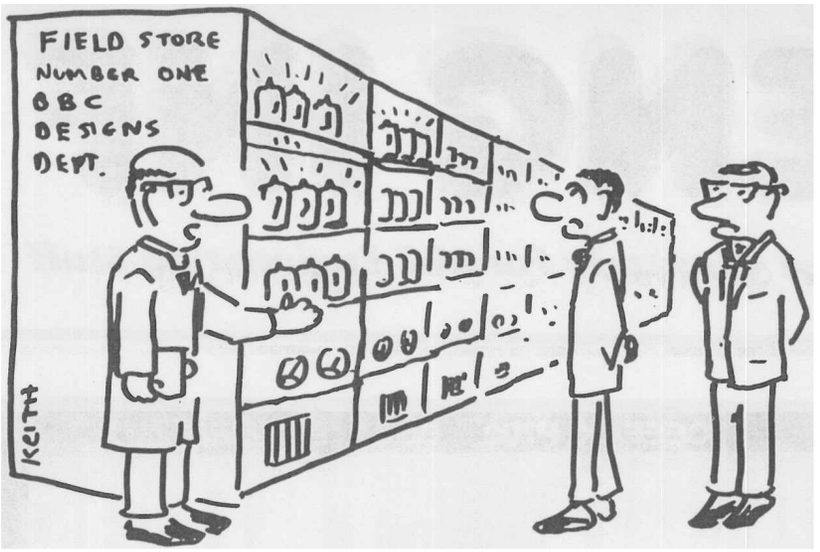
Ipstones Edge, Staffordshire
Romaldkirk, Co. Durham
Weaverthorpe, North Yorkshire
Wivenhoe Park, Essex
Newry South, Co. Down
Llanharan, Mid Glamorgan
St. Anthony-in-Roseland, Cornwall
Bretch Hill, Oxon
West Wycombe, Buckinghamshire
Coleford, Gloucestershire
Pinwherry, Strathclyde
Ballantrae, Strathclyde

Vhf Radio

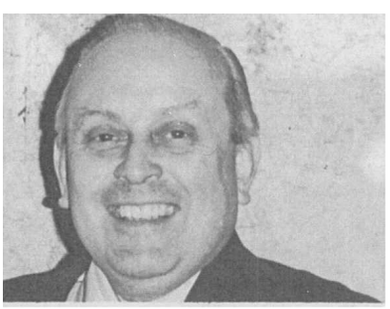
Wrotham - now mixed polarisation

Local Radio

Radio Guernsey - Rohais (mf only)
Radio Jersey - Trinity (mf only)



'THIS IS OUR NEW BAIRD 30 LINE TO PAL 625 ELECTRONIC CONVERTER'



Frank Be"isford, Assistant Head of Engineering Information Department, retired on 1st March after 25 *years' service.*

After serving in the Royal Navy from 1940 till 1946 *and in Government Communications until* 1956, *Frank joined the BBC as an Engineer in Broadcasting House. He moved to External Services in* 1958 *and became a Senior Maintenance Engineer at the Caversham monitoring station three years later.*

Frank is probably best known for his work in E.I.D. which he joined in 1964. His wide knowledge and enthusiasm ensured that the public, the retail trade, and the radio and television industry were all reliably informed about BBC engineering developments, particularly those affecting transmission or reception. There can be few representatives of the industry that have not heard his witty explanations of BBC policy from some platform or other.

Since he became A.H.E.I.D. three years ago Frank has represented the BBC in many negotiations with the Home Office on frequency planning and policy matters.

Phil Laven, the BBC's Senior Engineer in New York for the last three years, takes over as the new Assistant Head.

The following 405 line transmitters are expected to close as shown:

1983

BBC Transmitters - First Quarter
Bath (Avon)
Weymouth (Dorset)
Manningtree (Essex)
Wensleydale (N. Yorkshire)
Richmond (N. Yorkshire)
Weardale (Co. Durham)
Llangollen (Clwyd)
Newry (Co. Down)
Wenvoe Channel I3 (South Glamorgan)

IBA Transmitters - First Quarter
Bath (Avon)
Ridge Hill (Hereford)
S1. Hilary Channel 10 (South Glamorgan)

BBC Transmitters - Second Quarter
Bamstaple (N. Devon)
Thrumster (Caithness)
Orkney
Bressay (Shetland)
Grantown (Badenoch & Strathspey)
Kingussie (Badenoch & Strathspey)
Ammanford (Dyfed)
Kilvey Hill (Swansea)
Llanidloes (powys)

IBA Transmitters - Second Quarter
Huntshaw Cross (N. Devon)
Rumster Forest (Caithness)
Aviemore (Badenoch & Strathspey)

BBC Transmitters - Third Quarter
Douglas (Isle of Man)
Ballater (Kincardine & Deeside)
Toward (Argyll)
Lochgilphead (Argyll)
Rosneath (Dumbarton)
Millburn Muir (Dumbarton)

IBA Transmitters - Third Quarter
Richmond Hill (Isle of Man)
Whitehaven (Cumbria)
Rothesay (Argyll)
Rosneath (Dumbarton)

BBC Transmitters - Fourth Quarter
Lame (Co. Antrim)
Whitby (N. Yorkshire)

Electronic Stills Store *Evaluated*

An experimental prototype of an electronic store for still pictures was constructed for studio operation to enable pictures originated in electronic form to be stored and selected for transmission at the studio.

The need for such a stills store was identified some time ago. Traditionally, artwork and captions, etc., have been photographed and slides produced, and these have been broadcast using a studio slide scanner. More recently, however, direct electronic methods have become available for originating many of these signals. Extensive use is. now made 0 f electronic character generators and the BBC Broadcast Computer is also used in the generation of electronic pictures. With the advent of new electronic graphic drawing systems like 'Flair', it has become important that studios are provided with an all-electronic equivalent of the slide scanner.

The prototype studio store provides storage for 40 pictures. These can be selected for transmission either randomly, using a number keyboard, or in sequence using a single "CUT' button. 'MAIN' and 'PREVIEW' outputs are available so that, where sufficient monitoring facilities exist, the next picture can be previewed while a picture is 'on air'. Signals input to the store can be previewed before being recorded. Input and record operations overwrite previously stored information and are two button operations. The control keyboard contains numeric displays of the numbers of the pictures being output and can be operated remotely from the main equipment.

Signals are input and output in analogue RGB form and are processed and stored in digital YUV form using the new digital coding standard. The main signal storage is provided by one of the latest 8" Winchester magnetic disc drives which is completely sealed. Two digital semiconductor picture stores are used as buffer stores. Operation of the equipment is controlled by a Z80.based microprocessor which also provides picture processing for grabbing moving pictures.

Initial tests with the prototype studio store were most encouraging and showed that such a system could be readily incorporated into existing studios. Throughout last December and January, the prototype studio store was installed in the apparatus room of TC7 . It was established that the unit could provide an extremely valuable general studio facility. Studio cameras were used to enable still pictures of general studio activities or artwork to be stored. It was also found to be beneficial to store signals from the slide scanner so that the slide scanner mechanism was not required to change slides 'on air'. In the course of these tests, a brief demonstration recording was made showing how a weather map could be crudely animated by moving the weather symbols between successive pictures and replaying the pictures at three second intervals.

Further developments of the studio store are now in hand. It is intended to construct a second experimental prototype incorporating improvements and suggestions made during tests with the first. It is also hoped to develop a method of conveying pictures between stores using a removable cartridge. Eventually a design may be made for quantity production.

Adriiln Durey, Research Department, operates the control keyboard of the prototype studio store. A new picture has just been accessed and is *being output via the preview output. The main output* is *displayed on the right-hand monitor.*

"ENHANCED CEEFAX"

'continued from Page l'

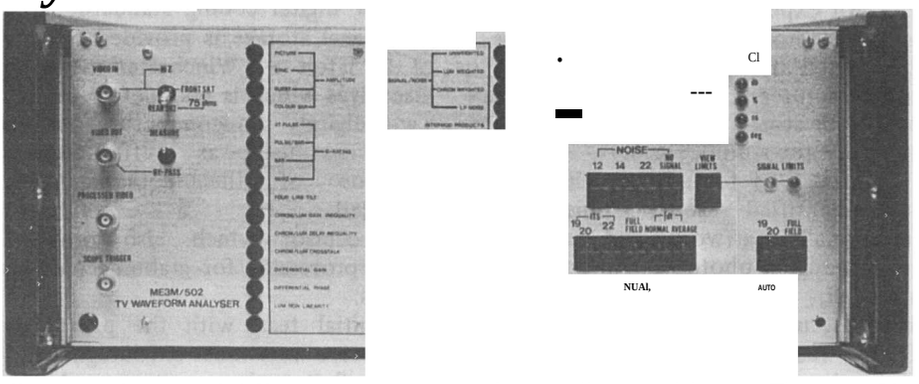
in the words.

Another innovation that was broadcast was "linked pages". In the present Ceefax system there are often pages where the content has some relevance to another page in the magazine. Viewers wishing to retrieve the additional pages need to re-select the page number and wait for the magazine to cycle round until they receive them. Using "linked pages" the Ceefax Editor would decide which pages were associated with each other, and would add extra information to link them together. In the enhanced decoder the pages would be stored and instantly displayed when the relevant linked page number was selected. For example, the news index on page 201 on BBC 2 could be linked to background information, news headlines, and complete news stories which the viewer could retrieve at the touch of a button without waiting for the magazine to cycle round.

For some time now the Ceefax Unit have been transmitting teletext software in conjunction with Brighton Polytechnic and several schools to see if it is possible to transmit computer programs by means of Ceefax, which could be directly loaded into a microcomputer memory. With the advent of the BBC Microcomputer, and using the teletext adaptor that will become available later this year, it will be possible to use the Ceefax service as a source of software for the computer system. It has been shown that using prototype equipment it is possible to download programs into the BBC Microcomputer, without the need to copy the program and then re-enter it via the computer keyboard. As well as being able to download teletext software, the teletext option associated with the BBC Microcomputer will also respond to the "linked pages" which are now being transmitted.

Most of the enhancements to the Ceefax system require additional memory in the receiver decoder, and it is not likely that the full range of enhancements will become available until later in the decade. All of the enhancements are compatible with existing decoders. For example, viewers selecting the pages carrying the picture information will currently receive the text without decoding the picture information. The characters are displayed in the existing format. When the enhancements are transmitted as part of the service it is likely that the editor will nIl in the gaps where the picture would have been by a simple graphic so that the viewer is not left with a blank screen.

TV Waveform *Analyser*



Engineering Designs Department have recently completed the development of the automatic TV waveform analyser (ME3/S02). The design is seen as a replacement for several separate items of existing test equipment including automatic ITS monitoring equipment which is at present in service at transmitter stations.

Both traditional analogue and modern microcomputer techniques have been blended to produce an instrument with sufficient flexibility to accommodate new measurement requirements by changing microcomputer software.

The new equipment is able to make precision measurements on either full field test signals or the insertion test signal carried during the field blanking interval, and has the capability of providing up to thirty independent requirements. The measurements include amplitude, noise, linear and non-linear waveform distortions, intermodulation interference and transmitter modulation depth.

The analyser can be used either in a manual or automatic mode. The manual mode enables an operator to make measurements of a single parameter, whereas the automatic mode allows a selection of different measurements to be made in sequence using either ITS or full field test waveforms. If the BBC test waveform generator, type GE4M/S61, is used to provide the test signals then the analyser is able to identify the particular test waveform and set itself so as to make the appropriate measurement. Intelligent operation can be further enhanced if a control line is available from the analyser back to the GE4M/S61 waveform generator. Under these conditions the analyser can remotely control the generator to produce the waveform necessary for any given measurement.

The results of any measurement are continuously compared against a set of internally stored limits. There are 32 fully independent sets of lin1its stored within the microcomputer memory, each set consisting of upper and lower red, and upper and lower amber for each of the 30 measurement parameters. This is provided to give in a single instrument the capability of providing monitoring at any position in the whole of the BBC distribution network.

Full remote control is possible with the analyser and a BCD output of the readings is provided for logging purposes or telemetry.

The analyser is mounted in a 4U high bay width chassis and will be available in both portable and rack mounting forms.

Broadcasting House: New Studios

ACED contractors have completed the demolition work at the rear of **BH** London and are now halfway through the construction of a 2-floor extension above the roof of the Concert Hall gallery. It will be the first addition to **BH** since 'The Extension' was built. This work is part of an SCPD-led project to provide new facilities for News and Current Affairs.

Work first began in February 1981 when a fiffi1 of specialist contractors demolished the old boiler-house chimney using a 2 foot diameter, hydraulically-driven, diamond-tipped circular saw. Bearing in mind that the chimney consists of one foot thick very pebbly concrete with reinforcing rods every six inches in both directions, lateral and vertical, the process was remarkably quiet. Although Studio 3B and the Concert Hall were put out of action, the disturbance to the rest of the building was minimal.

The main building contract began in June, with the demolition of the rear wall of **BH** itself. This was to allow for the addition of the new steel-framed structure. The extra space within this structure will house a replacement News Intake Recording area and some offices. This will make building available for use as three new News and Current Affair studios, with 'Mixer' Studio 3B being rebuilt at the same time. This new studio, together with the new 3K, 4C and SA Studios, will be equipped with the general purpose range of control desks.

Desks from all three suppliers of general purpose desks, Audix, Calrec and Neve, will be included in the development. Calrec have been awarded a contract for a 32-channel, 3 group 14 outside source Mark 3A desk for 3B as well as for the Technical Operator's position that goes with these desks. Studio 4C will also have a Technical Operator's position: Neve will provide a Mark 4, 24-channel desk in Studio SA, which will be a discussion studio. Audix will supply a 12-channel Mark 4A for Studio 3K. This desk is capable of one-man operation and will act as a back-up studio/recording area to Studio 3B. A smaller back-up area for Studio 4D will be equipped with a Glen Sound GSNT.l console. The general purpose desk Mark 3, 3A and 4A are developments from the basic general purpose design. They are the result of close co-operation between Radio 0 & M's Technical Consultative Committee and SCPD's Radio Studio Unit. SCPD's Broadcast Systems Unit A are to provide studio control panels which will interface with the new microprocessor-controlled solid-state source selection system. This system will feature plain language entry, and display sources by means of a keyboard and alphanumeric LED displays. Unit A will also be installing a Pye M100 intercom system to replace the existing News Production intercom. The old system is an Ericsson crossbar type, which is already overloaded.

News and Current Affairs studios tend by their nature to have a profusion of intercoms, telephones, picture monitors, printers and other peripheral equipment. With the growing importance of Ceefax and vidiprint, these and other data communications systems are under consideration for the new area. As the areas are all fairly compact care has to be taken when new equipment is brought into the studios. For this reason extra planning meetings have been set up between ACED, and the News and Current Affairs, the user department, to try and integrate as much of the extra equipment as possible into the interior design of the new

The first of the new studios will be in service early in 1983.

EXTENDED PAL CODING for *SATELLITES*

The quality of present-day television pictures is limited by the available transmission bandwidth and by the capabilities of currently available display tubes. There is no very immediate sign of any large bright higher definition display device to take over from the shadow mask Cathode Ray tube, but many workers are in the field and we can expect some development during the next few years.

Assuming, then, that a better display becomes available what possibilities are there for wider bandwidth transmissions to match? Both Satellite Broadcasting and optical fibre cable distribution offer wider bandwidth and Research Department has been considering how these could best be exploited. A key factor in any new transmission system must be compatibility, whereby existing receivers could continue to work with new-standard signals, although new receivers would be necessary to derive full benefit. For at least the early years of satellite or optical fibre cable services it would be required that existing receivers continue to be usable, with appropriate converters. The introduction of any non-compatible system could require many years for international agreement and new receiver development and hence seriously delay the establishment of satellite broadcasting in this country.

The present-day VI< 5.5 MHz video transmission bandwid th is adequate for 625-line monochrome pictures. The limitations become apparent when the colour signals must be squeezed in with the monochrome. Ingenious though the PAL coding system may be, it is impossible to avoid some mutual interference between monochrome (luminance) and colour components. These interferences show themselves as luminance appearing in chrominance channels (cross colour) giving rise to flashes of false colour on striped suits for example; and chrominance signals appearing in the luminance channel give spurious dot patterns. To reduce these effects to acceptable levels, signals in the region of the colour sub-carrier (4.43 MHz) are attenuated, usually resulting in loss of all signal frequencies from about 4 MHz up to the 5.5 MHz band limit. So the majority of colour receivers roll-off about 4 MHz and show little fine detail whilst still suffering from some degree of cross colour aberrations.

A new proposal involves fIltering-off high frequency components above 3.5 MHz. This gives a very slight reduction in picture defiriTtion, scarcely noticeable on present-day display-tubes, but virtually removes all possibility of interference between luminance and chrominance components so that cross colour effects disappear.

In a wider-bandwid th satellite or optical fibre channel there is room to transmit the filtered-off high frequency luminance components separately. The high frequencies (3.5 MHz upwards) are shifted in frequency to a higher band (8 MHz upwards) and transmitted together with the original low frequencies and chrominance signals. The upper limit of the separated high frequencies could extend above the 5.5 MHz equivalent bandwidth of the present transmission channel.

A new receiver, specially designed for this wide bandwidth transmission system, would shift the transmitted high frequencies back to their original values (3.5 MHz upwards) and hence display a much-enhanced degree of fine picture detail. The new receiver would of course also be free from cross colour effects, since the high frequencies would be re-inserted after colour decoding had taken place.

Research Department have demonstrated experimental coders and decoders working on this principle and has passed extended bandwidth signals, with associated digital sound channels, through an RF link simulating a satellite channel. Results were very satisfactory and showed also that the proposed system is entirely compatible with continuing use of present-day receivers.

"PHOTOGRAPHIC EXAMPLES"
Page 6 and 7

EQUIPMENT DEPARTMENT:Automatic Testing

The Equipment Department Test Laboratory is now using automatic methods to test a range of audio amplifiers, power supplies and oscillators, using equipment based on a general purpose interface connection system.

For some years the use of automatic testing has been closely watched, but available systems were generally specialised and intended for high-volume production. Some ten or so years ago Hewlett Packard developed a standard interface bus system which allows test instruments to communicate and exchange data with each other under the control of a stored test program. This system was adopted as American standard, IEEE-488, and later as International Standard IEC-625. However, it was not until the low cost microprocessor came on the scene that a wide range of data-controlled instruments were produced and made the system attractive.

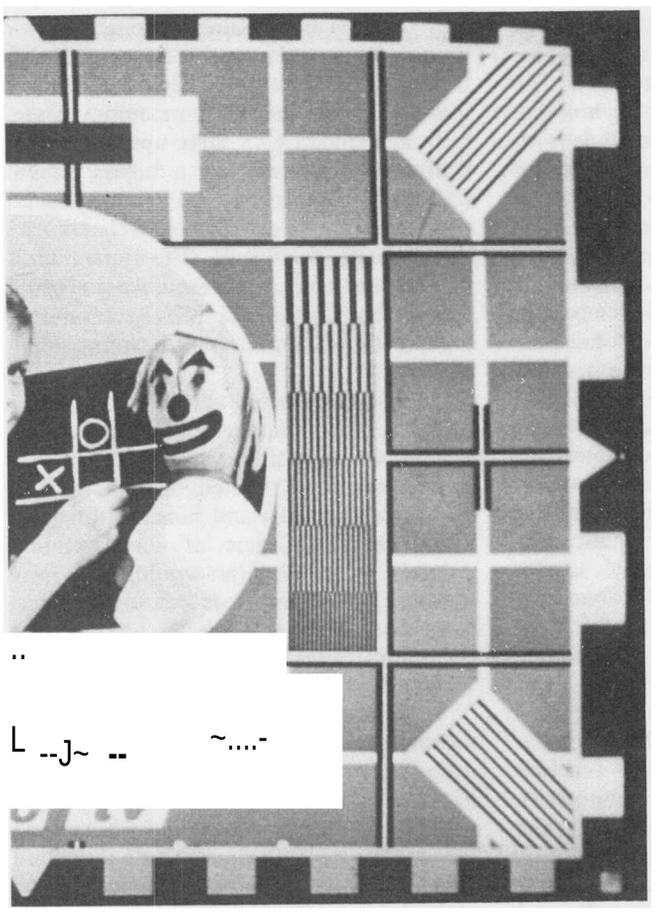
The General Purpose Interface Bus (GPIB), the generally used name for the system, has 16 lines, eight for data, and eight for interface communication management. Three of these management lines are used for "handshaking" a technique which co-ordinates the transfer of non-synchronous data. A microcomputer acts as Controller, and this commands and receives data from the other instruments on the bus. Each instrument has its own address and can either be a "talker", a "listenp,r", or both (talkers provide information to the bus, listeners receive information).

The system was first used in Equipment Department to test synthesised oscillators for the "Silver Streak" UHF transposer, where it was required to make a large number of measurements to ensure the unit was operating correctly. A desk top microcomputer (HP85) controlled a device to originate logic signals which set the oscillator to the channels in Band 4 and 5, and a modulation analyser made four different types of measurement on each channel.

More recently the same basic system has been used for testing audio amplifiers. The desk top micro-computer controls an audio test set to originate measure signals, a digital multimeter to measure resistance and d.c. volts and current. A switching matrix configures the test set up for each test. Measurements are made of various circuit resistances, gain, frequency response, noise, distortion etc. The cost of writing the program was saved on the first batch of amplifiers tested.

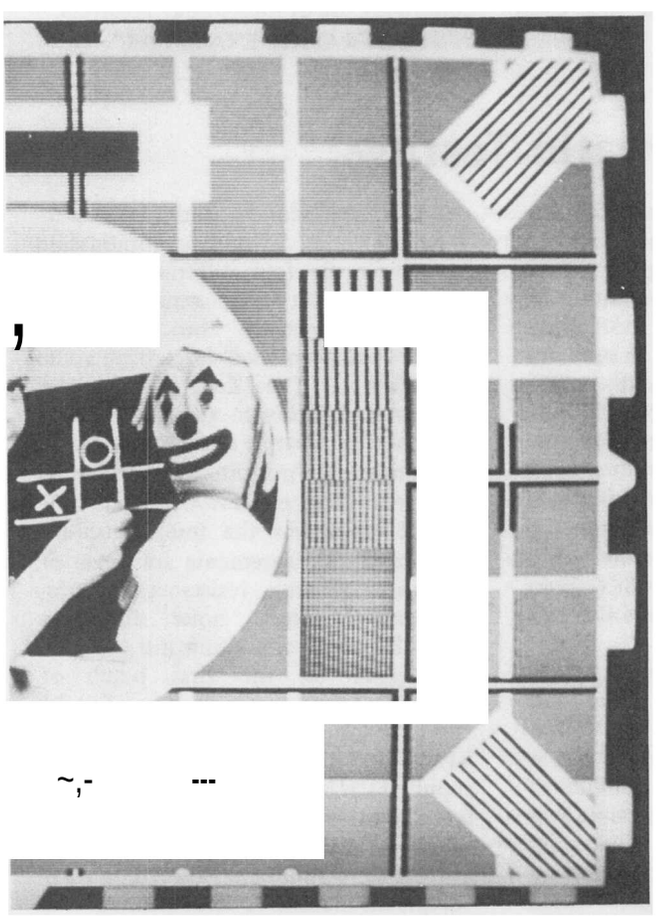
At the present time a permanent automatic test system for power suppliers is being assembled. The techniques will be adopted for an increasing range of units as the system is developed, resulting in lower costs for equipment made in Avenue House.

CONVENTIONAL PAL



The uncoded picture

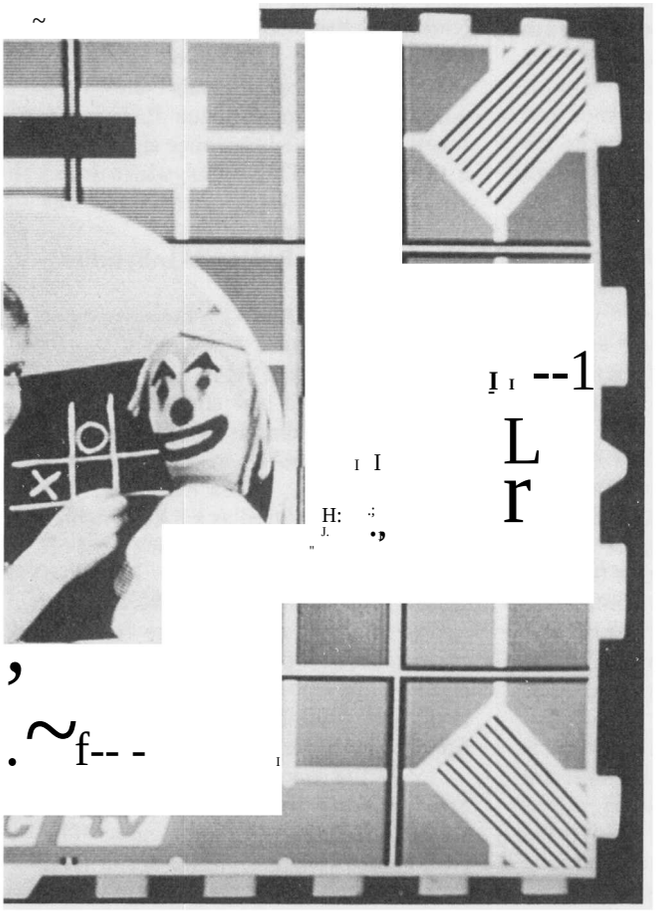
Test Card F direct from the slide scanner without any form of PAL coding.



Test Card F via Conventional PAL coder and decoder

The spurious patterns on the diagonal bars at the corners of the picture and on the resolution gratings to the right of the clown are caused by crosscolour - the PAL decoder wrongly interprets fine detail in the picture as colour information because both are transmitted in the same frequency band. The next-to-bottom resolution grating is removed by the notch filter in the decoder.

EXTENDED pAL



Extended PAL - Test Card F as seen with a conventional PAL decoder

Current television receivers are not capable of displaying the full resolution of pictures transmitted by the PAL system. This is because of bandwidth restrictions in the receiver's circuitry and lack of resolution in present-day display tubes. But current receivers do reproduce the spurious coloured patterns known as crosscolour caused by the colour decoder wrongly interpreting fine detail in the picture as colour information. Thus the owners of current receivers would lose little if the fine detail which cause crosscolour is removed; in fact they would gain because crosscolour would be eliminated. This photograph of a Test Card taken from a high-quality picture monitor shows both the reduction of crosscolour and the loss of fine detail; but tests have shown that on a domestic receiver the paramount effect is the reduction of crosscolour.

Test Card F via Extended PAL coder and decoder

In the Extended PAL system the fine detail is transmitted in a separate frequency band from the colour information. Thus there can be no crosstalk between the two signals; there are therefore no spurious patterns on the diagonal bars at the corners of the picture or on the resolution bars to the right of the clown. Furthermore no notch mter is needed in the Extended PAL decoder. Thus the fidelity of the picture is maintained up to the highest resolution.