PHILIPS

PAL-COLOUR PATTERN GENERATOR

PM 5508

(9449 055 080.1)

9499 490 04911 11/369/3/02/03/04

PHILIPS

Operating manual

PAL-COLOUR PATTERN GENERATOR

PM 5508

(9449 055 080.1)

9499 490 04911 11/369/3/02/03/04

Contents

List of figures

IMPORTANT

In correspondence concerning this instrument, please state the type-, serial- and instrument number as given on the identification plate at the rear of the instrument.

GENERAL

I. INTRODUCTION

The PHILIPS PAL-colour pattern generator PM 5508 is an all solid state, mains supplied instrument. It is intended for use when installing, fault-tracing and repairing colour TV sets operating according to the PAL systems G and I and black/white TV sets operating according to the 625 lines CCIR systems B, I, G and H. The PM 5508 is suited for use with colour-TV receivers of various principles, the circuits of which could differ in many ways, e.g. R - G - B control of the picture tube instead of control with (R-Y), (G-Y) and (B-Y) and Y, separation of luminance and chrominance signal in the video stage instead of with the aid of an additional I.F. chroma detector, etc.

Therefore the instrument is designed so that it produces ten test signals, by means of which the complete receiver performance can be checked by simply observing the patterns on the screen. A complete test will only take a few minutes. If during this test it is observed that the receiver requires realignment, the latter can easily and accurately be done with the aid of the generator signals. Re-adjustments of the delay-line circuit, the chroma-demodulators and the amplitude-ratio of the colour-difference signals can even be carried out by simply using the screen of the receiver as an indicator.

The instrument moreover has the following features:

— The RF output signal covers the VHF- and UHF ranges.

— Presetting of 4 channels in the VHF range and any 4 channels in the UHF range; instead of one VHF-channel, the IF vision carrier can be preset.

— RF output signal continuously adjustable and sufficiently high to supply several receivers simultaneously.

— Sound carrier can be switched on/off.

— Sound carrier can internally be modulated with 1 kHz.

— Burst amplitude continuously adjustable between 0 and 200%, fixed nominal position.

— Composite 1 Vp-p video signal externally available.

— "LINE-" and "FRAME SYNC." signals externally available for triggering purposes.

— Handy, small and light-weight instrument suited for workshop as well as mobile service.

II. TECHNICAL DATA

Properties expressed in numerical values with tolerances stated, are guaranteed by us. Numerical values without tolerance are intended for information purposes only and indicate the properties of an average instrument.

Vision carrier:

IF	38.9 MHz
Band I	55 . . . 70 MHz
Band III	173 . . . 225 MHz
Band IV/V	470 . . . 850 MHz

Push-buttons enable presetting of any 4 UHF channels and 4 VHF channels or 3 VHF channels and the vision IF carrier.

Spacing of vision and sound carriers:

PM 5508B: 6.0 MHz (CCIR system I; PAL system I)
PM 5508E: 5.5 MHz (CCIR systems B, G and H; PAL system G)
Frequency drift of sound subcarrier: ± 0.1% (10° . . . 40° C)

Video modulation:

Modulation	AM, negative
Residual carrier	15% at 100% white
Vision modulator	balanced diode type; max unbalance 5%
Differential phase	< 5°

Sound modulation:

Modulation	FM
Sweep	± 50 kHz
Distortion	< 3%
Internal modulation	1 kHz, sine wave
Modes of operation	— sound carrier off — unmodulated — modulated with 1 kHz

Encoding

System	PM 5508B: PAL-I PM 5508E: PAL-G
Subcarrier	4.433619 MHz
Frequency drift of subcarrier	± 20 Hz (10° . . . 40° C)
Burst width	approx. 10 cycles of subcarrier
Burst amplitude	"NOM" position: equal to sync. signal.
Burst phase	Adjustable: from approx. 0% to 200%. line sequential: 180° ± 45°
Burst position	5.6 μs after leading edge of line sync. pulses
Chroma modulators	balanced diode type
Chroma bandwidth	1.1 MHz (3dB)
Group delay precorrection of chroma signal	— 175 ns
Colour matrixing	Y = 0.30 R + 0.59 G + 0.11 B

Patterns

"CHECKERBOARD"	6 x 8 black/white squares, accurately centred.
"WHITE"	100% white signal with PAL-alternating burst.
"RED"	fully saturated red signal with PAL-alternating burst.
"GREYSCALE"	staircase signal with 8 identical steps.
"DOTS"	white dots; location corresponds to the intersections in the Irosshatch pattern.
"CROSSHATCH"	11 horizontal white lines; width: on line per field 15 vertical white lines; width: 200 ns. The horizontal and vertical white lines form black squares, accurately centred.

"DELAY" — 4 vertical bars:
146° : (G-Y) = 0,
180° : (R-Y) = 0,
90° : (B-Y) = 0
} luminance 40%
grey
NTSC encoded, however with PAL-alternating burst.

"PHASE" — same bars as "DELAY" with PAL-alternating burst.
However, upper part: PAL encoded with reduced saturation, and lower part: only chroma during the "positive" PAL-lines, where burstphase = 135°.

"MATRIX" — same bars as "DELAY" with PAL-alternating burst, however, completely PAL encoded.

"COLOUR BAR" — 75%-contrasted pilture. Upper part: colour bar signal with 8 vertical bars: white, yellow, cyan, green, magenta, red, blue and black. Lower part: white.

Bar	Relative luminance amplitude	Chroma phase	Relative chroma amplitude
White	0.75	—	—
Yellow	0.67	167°	± 0.33
Cyan	0.53	283°	± 0.47
Green	0.44	241°	± 0.44
Magenta	0.31	61°	± 0.44
Red	0.23	103°	± 0.47
Blue	0.08	347°	± 0.33
Black	0	—	—

Synchronisation and blanking

Line frequency — 15625 Hz ± 0.1%
Field sync. pulse — width 2.5 lines
(no inverted line pulses during field sync. pulse, no equalizing pulses, no interlacing)

Line sync. pulse	width	4.8 μs
	frontporch	1.9 μs
	blackporch	6.1 μs
Field blanking	24 lines	
Line blanking	12.8 μs	
Total field period	312 lines	
Active field period	288 lines	
Total line period	64 μs	
Active line period	51.2 μs	
Set-up between black level and blanking	5%	
Sync. to picture ratio	30 : 70	

Outputs

Socket "RF"

For UHF	20 mV *), if loaded with 75 Ω or 40 mV *), if loaded with 300 Ω (via matching transformer 75 Ω → 300 Ω) continuously adjustable
For VHF	15 mV *), if loaded with 75 Ω or 30 mV *), if loaded with 300 Ω (via matching transformer 75 Ω → 300 Ω) continuously adjustable
Output impedance	75 Ω
Amplitude ratio vision to sound carrier	4 : 1
Connector	BNC, female

Socket "VIDEO"

Voltage	1 Vp-p, if loaded with 75 Ω
Polarity	white positive — sync. negative
Output impedance	75 Ω
Connector	BNC, female

Sockets "SYNC."

Signal	optionally: — line frequency pulses — field frequency pulses to be selected with switch "SYNC."

*) RMS-value of the vision carrier during the peaks of the modulation envelope.

Amplitude	5 Vp-p, unloaded
Polarity	positive
Output impedance	10 kΩ
Connectors	4 mm banana sockets

Supply

Mains voltage	115 V or 230 V, ± 20%
Mains frequency	50—60 Hz
Power consumption	15 W at 220 V
Safety fuse	200 mA, delayed action type

Mechanical data

Dimensions	Modular cabinet
Height x width x depth	195 x 305 x 275 mm (width: 4 units)
Weight	6.1 kg

III. ACCESSORIES

1 Operating manual
1 Mains flex
1 RF cable with, only with PM 5508E, a matching transformer 75 Ω → 300 Ω

IV. DESCRIPTION OF THE BLOCK DIAGRAM

(See Fig. IV-1)

To obtain a constant ratio between line synchronising pulses, field synchronising pulses and the various patterns, the circuits of the instrument are controlled by a master oscillator. The frequency of this oscillator (312.5 kHz) is divided by means of a 2 : 1 divider in order to obtain the pulses "a", which control the horizontal information in the patterns. This divider is followed by another 2 : 1 divider and a 5 : 1 divider in order to obtain pulses of line frequency ("lb" and "ls").

Furthermore, the line frequency is successively divided by 2, by 4, by 3, and by 13 in order to obtain pulses having the field frequency ("fb" and "fs"). These dividers also supply pulses to control the vertical information in the patterns ("24 l", "312 l", from which are derived "~ b" and "96 l").
The luminance signal, the black/white patterns, the convergence patterns and the composite sychronising and blanking signal are generated on the basis of the afore mentioned horizontal and vertical control pulses.
These signals are added in the luminance-sync.-blanking adder and passed on, via the delay line, the video amplifier, where the composite luminance signal is added to the chrominance signal. The delay line (0.375 μs) compensates for the time delay which arises when the colour signals are encoded. The R, G, and B signals are generated in the colourbar generator. This generator is followed by a matrix, "adding" the R, G, and B signals in such a way that the correct Y, (R-Y), and (B-Y) signals are obtained. The step signal (Y') of the greyscale signal is also generated in this matrix.

The colour subcarrier signal is supplied by a crystal-controlled oscillator. The phase of the subcarrier to the (B-Y) modulator is shifted 90° in a phase shifting circuit, in order to obtain the correct quadrature of (R-Y) and (B-Y). In a PAL switching circuit the phase of the subcarrier to the (R-Y) modulator is inverted line sequentially, in order to obtain the PAL encoding. The PAL switching circuit can be cut out during the moments, that the generator has to produce an NTSC encoded signal (test signal "DELAY"). During this signal, however, the PAL switch actually operates briefly during the line backporch to produce the PAL-alternating burst. This is controlled by the "2 l' " pulses. The colour-diference signals and the burst keying pulses (the latter are derived from the "ls" pulses) are applied to the (R-Y) and (B-Y) modulators. These modulators are balanced modulators together supplying the chrominance signal in which the carrier wave has been suppressed. The chrominance signal is added to the luminance signal in the video amplifier.

The sound subcarrier is generated in a 5.5 MHz (6 MHz in the B-version) oscillator. Via a switch, this subcarrier can be frequency-modulated with 1 kHz by means of a modulator, operating according to the diode switching principle. This subcarrier oscillator itself can be switched off if desired.
In an adder stage the sound subcarrier is added to the composite video signal. From there it is applied to an RF modulator and, via an RF attenuator, to output socket "RF". The instrument is provided with an stabilised power supply with short-circuit protection circuit.

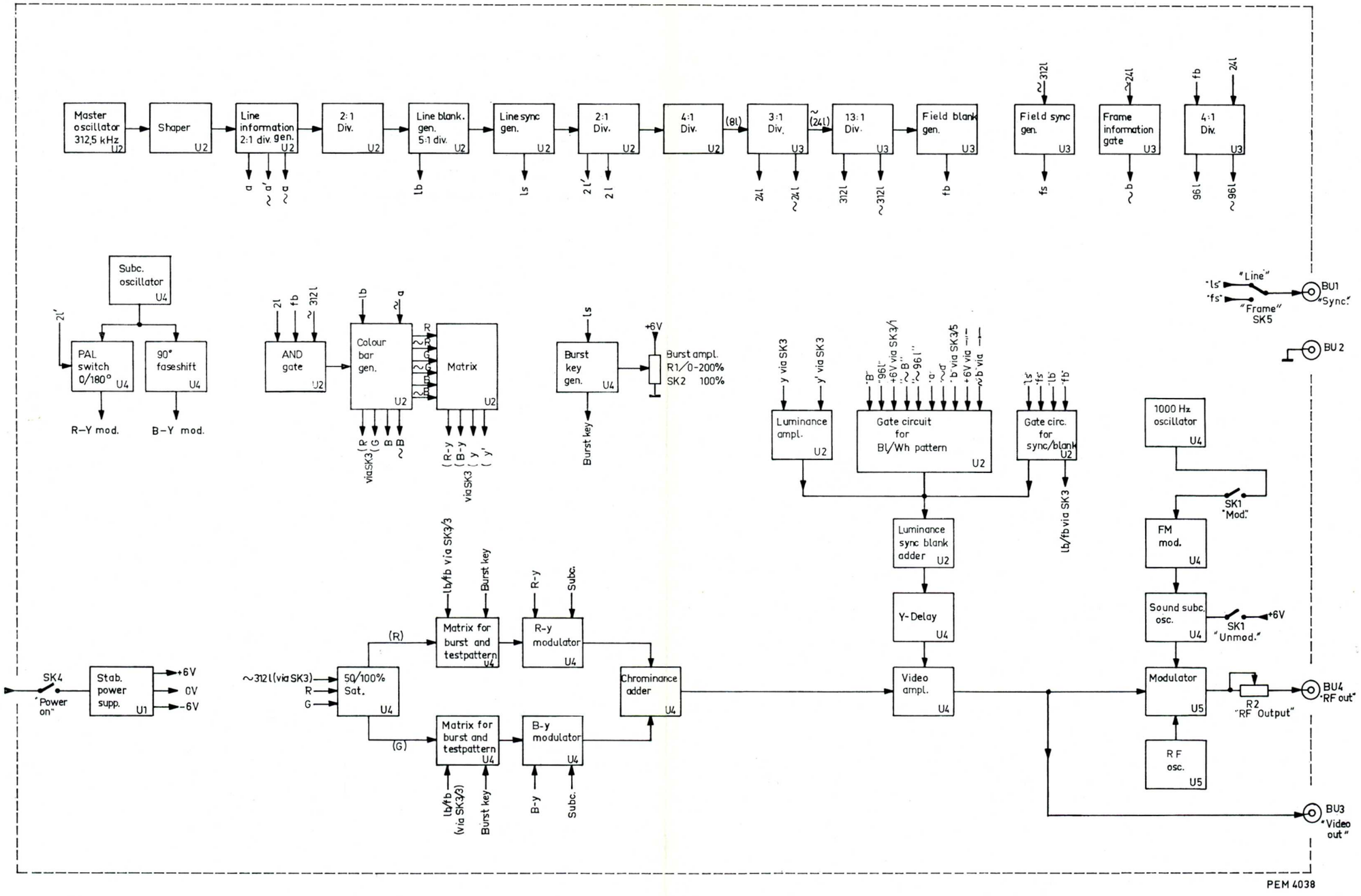

Fig. IV-1.
Block diagram

OPERATING INSTRUCTIONS

V. INSTALLATION

A. Adjusting to the local mains voltage

The instrument can be used with mains voltages of 115 V a.c. ± 20 % and 230 V a.c. ± 20 %.
If the instrument has to be adjusted to another mains voltage, resolder the connections to the primary windings of the supply transformer as shown in the sticker on the transformer.

To gain access to the supply transformer and fuse:
— Remove the bottom plate (two screws), the transformer-connections are then accessible.
— Remove the two screws holding the printed wiring unit which should then be hinged out.
— The fuse (200 mA, delayed) is then accessible.

B. Earthing

Earth the instrument in accordance with the local safety regulations. This can be done via the mains flex, as it is equipped with a plug with rim-earthing contacts, or via the earth-screw at the rear of the instrument. Not only the metal cabinet is then earthed but also the "common" of the circuit.
Avoid double earthing.

C. Connections

RF:
— Connect the generator to the mains by means of the mains flex supplied.
— Connect socket "RF" to the receiver to be checked by means of a RF cable and, if necessary, via the 75 Ω → 300 Ω matching transformer.
— The measuring set-up then is ready (see the section "OPERATION" on page 21).

VIDEO:
Circuits requiring an encoded colour video signal or a black/white video signal (e.g. monitors, decoders, video tape-recorders, etc.) should be connected to socket "VIDEO" by means of a coaxial 75 Ω cable. A positive video signal with an output impedance of 75 Ω can be taken from this socket. If loaded with 75 Ω, the output amplitude is 1 Vp-p.

SYNC.:
If an oscilloscope is to be triggered externally for some measurements, connect the sockets "SYNC." to the external trigger input of the oscilloscope.
Set switch "SYNC." to position "LINE" in case this triggering is to take place in the line sync.-pulse-rhythm and to position "FRAME" in case of triggering with field-sync. pulses. The polarity of the trigger pulses is positive.

VI. OPERATION

The following is a description of the procedure for tuning the generator to a colour receiver and for adjusting the "customer controls" of the colour receiver to their proper settings. It is obvious that this procedure probably cannot be completed if the receiver is defective.

— Make the connections as indicated in section "INSTALLATION", part C: "Connections-RF", page 19.

— Connect the colour receiver to the mains.

Warning

In most TV-receivers equipped with valves, the heaters are series connected; one pole of the mains is then connected direct to the chassis. Therefore, before measuring on the receiver, connect it to the mains via a separating transformer.

— Switch on the colour receiver.

— Switch on the generator (switch "POWER" to position "ON").
One of the channel scales will be illuminated, depending on whether a VHF- or an UHF-button is depressed.

— Turn control "BURST AMPL." fully anti-clockwise (switch to position "NOM", clicking sound!).

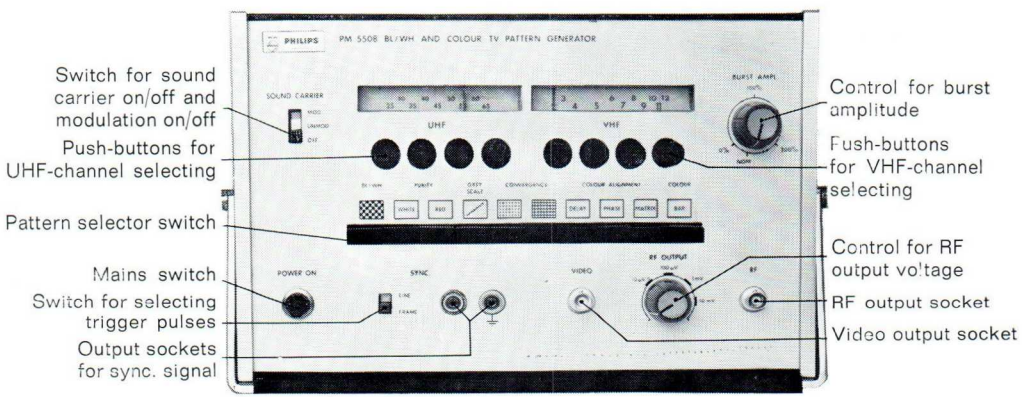

Fig. VI-1. Controls and sockets

— Set control "RF OUTPUT" to "10 mV".

— Depress switch "COLOUR BAR" and set switch "SOUND CARRIER" to position "MOD."
Note:
With the exception of the colour settings, the tuning, etc., of the black/white receiver to the generator is identical to the described procedure for colour receivers. In this case, however, use the "CHECKERBOARD"-pattern.

— Tune *) the generator to the channel to which the receiver is adjusted (the receiver should not be tuned to one of the local transmitters). As the generator produces a double sideband RF signal, be sure to tune to the correct sideband (the one that is highest in frequency), i.e. first set the generator to a channel thas is **lower** than the one to which the receiver is adjusted and then tune the generator to the receiver. The **first** sideband "encountered", is the correct one.
The receiver can also be tuned to the channel setting of the generator. In that case the receiver should first be set to a **higher** channel than the generator, etc.

— Carry out the fine tuning adjustments so that the picture on the receiver contains colour, while at the same time there is no "sound in the picture".

— Set the generator to the "GREYSCALE" pattern.

— Adjust controls "BRIGHTNESS" and "CONTRAST" of the receiver to obtain correct settings, i.e. the left vertical bar should be white and the right one should be black, while the bars in between should show six grey level steps increasing in darkness from left to right.

— Set the generator to the "COLOUR BAR" pattern.

— Adjust control "SATURATION" of the receiver to obtain the correct setting, i.e.: first turn it fully anticlockwise and increase the saturation until the green and the blue dots in the red bar just disappear.

— The "customer-controls" of the receiver then are properly adjusted.

*) The push-buttons for channel selecting can be pre-set to any channel within the range of the generator. To change a presetting, turn the button while it is depressed. The dial pointer will indicate the selected channel.

VII. APPLICATION

The generator supplies ten specially selected test signals for colour as well as for black/white. All these signals can be switched on by means of push-buttons, which are arranged for obtaining the signals in the optimum sequence for testing. First the basic black/white tests are made and then the special colour tests.

- The sections marked with a red dot are for colour-receivers only while the
- others, marked with a black dot, are for colour as well as for black/white receivers.

The description on the following pages is intended to give the user an impression of a checking procedure for receivers. At the same time an explanation of the colour patterns is given in small print.

CHECKING THE TUNER(S) OF THE RECEIVER

Due to a modification in the VHF tuner, the frequency limit at the beginning of Band I has been shifted so that the range around channel 2 (CCIR, system B) is replaced by the IF range common for TV receivers (around 38.9 MHz). The indication "2" on the VHF channel scale is therefore replaced by the indication "IF".
The user can now determine whether the incorrect functioning of the receiver is due to a defect in the channel selector.

Procedure

If, when following the procedure described in chapter VI "OPERATION", there is doubt whether the incorrect functioning of the receiver is due to a defect in the channel selector, proceed as follows:

1. Depress button "BL/WH" (checkerboard) and set switch "SOUND CARRIER" to position "UNMOD.".
2. Connect socket "RF" via a coaxial cable (without matching transformer) and an isolating capacitor, to the input of the first IF stage of the receiver. If necessary, temporarily unsolder the IF connection of this stage with the channel selector.
3. Tune the PM 5508 to the IF of the receiver, ensuring that the receiver is not overloaded (use control "RF OUTPUT" of the PM 5508).
4. If the receiver does operate properly yet, the defect will be located in the channel selector. We would like to emphasise that this IF signal of the PM 5508 *should not* be employed for any purpose other than described above.

A. **Pattern 1**
"CHECKERBOARD"

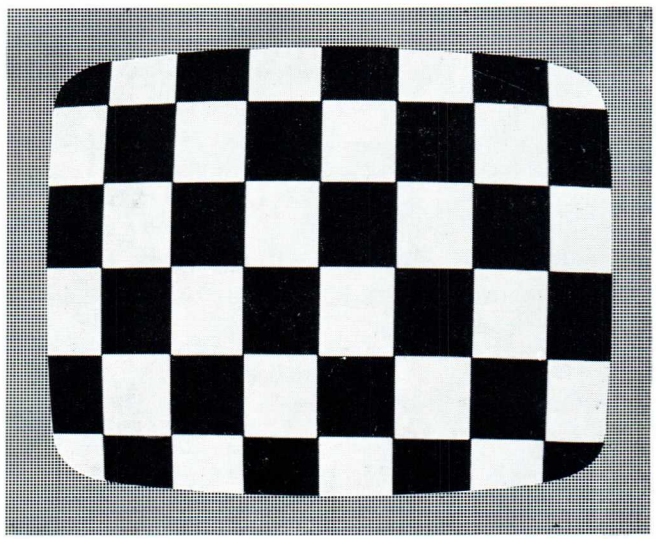

Fig. VII-1. "CHECKERBOARD"-pattern

1. ● Check for correct horizontal and vertical synchronisation.
2. ● Check for correct position of the picture (deflection yoke).
3. ● Check for correct horizontal and vertical amplitude of the deflection (picture height and -width; the "CHECKERBOARD"-pattern consists of 6 x 8 squares).

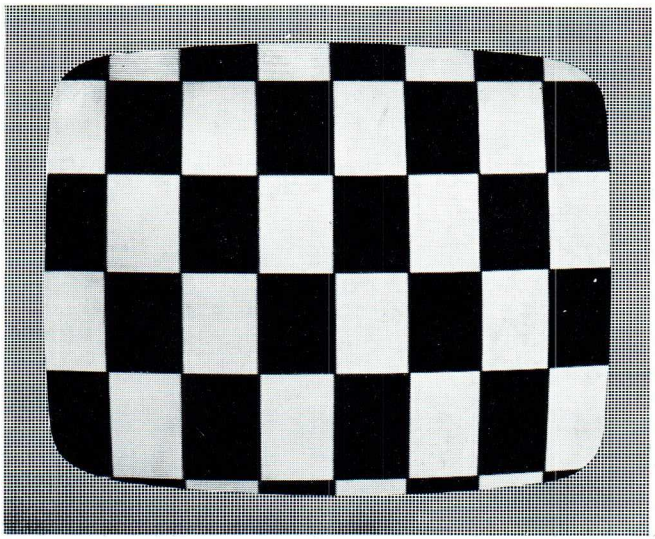

Fig. VII-2. Incorrect vertical amplitude and linearity

4. ● Check for correct horizontal and vertical linearity of the deflection Fig. VII-2 shows incorrect vertical amplitude and linearity.

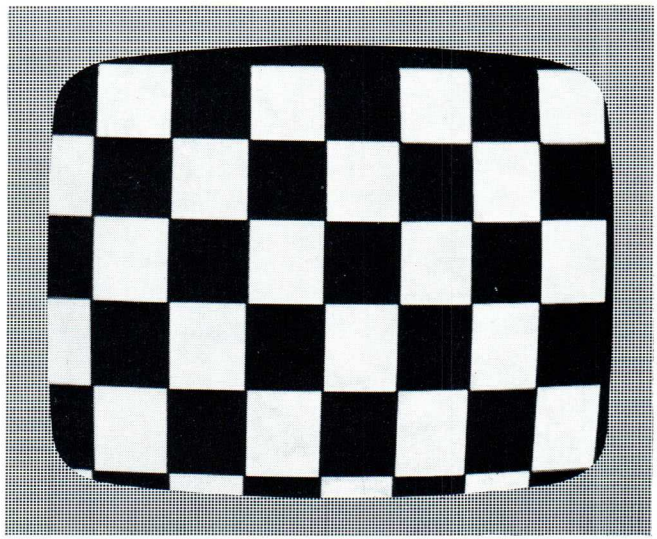

Fig. VII-3. Incorrect centring

5. ● Check for correct horizontal and vertical centring of the picture. Fig. VII-3 shows incorrect centring.

6. ● Check the bandwidth. The vertical black/white transitions should be sharp and not "double" (risetime and ringing resp.).
7. ● Check the step-function response. The vertical transitions should not show any overshoot.
8. ● Check for mains-hum interference in the synchronisation of the picture.
9. ● Check the sensitivity of the receiver by means of control "RF OUTPUT".
10. ● Check the suppression of the sound intercarrier. No "sound" should appear in the picture when switch "SOUND CARRIER" is set to position "UNMOD".
11. ● Check that there is no "l.f. sound in the picture" due to e.g. microphony or expressive power consumption of the sound output stage. This should be done with switch "SOUND CARRIER" in position "MOD".
12. ● Check the proper functioning of the sound section of the receiver, e.g. by operating switch "SOUND CARRIER".

B. **Pattern 2.**
"WHITE"

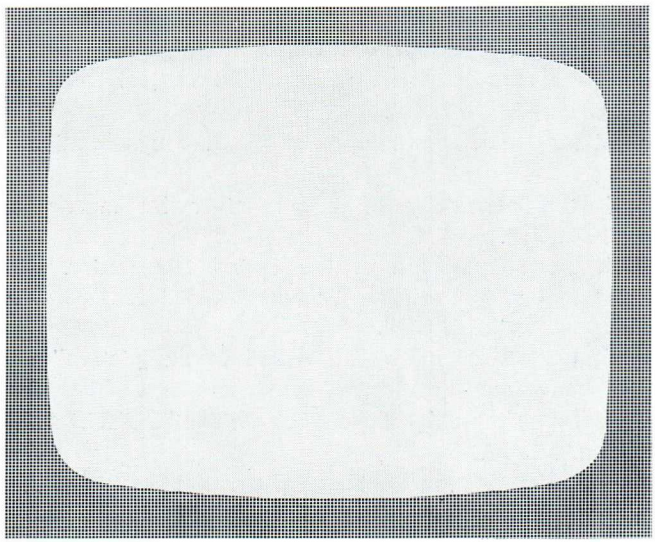

Fig. VII-4. "WHITE"-pattern

This pattern consists of a 100% white signal without chroma, but with PAL-alternating burst.

1. ● Check the picture for constant brightness over the entire screen (no hum, etc.).
2. ● Check the "white-C"-adjustment of the colour-picture tube (readjustment is required after e.g. replacement of the picture tube). This should be done with control "BURST AMPL" in position "NOM".
   Some colour receivers switch automatically from "black/white"-white to "colour"-white (standard White-C). This, the so-termed preferred-white adjustment, can be checked by setting control "BURST AMPL." from "0%" to "NOM" and back.
3. ● This pattern is also necessary to check and readjust the limiting of the beam-current of the colour picture tube. For details about this adjustment, refer to the Service Notes of the relevant receiver.

C. **Pattern 3.**
"RED"

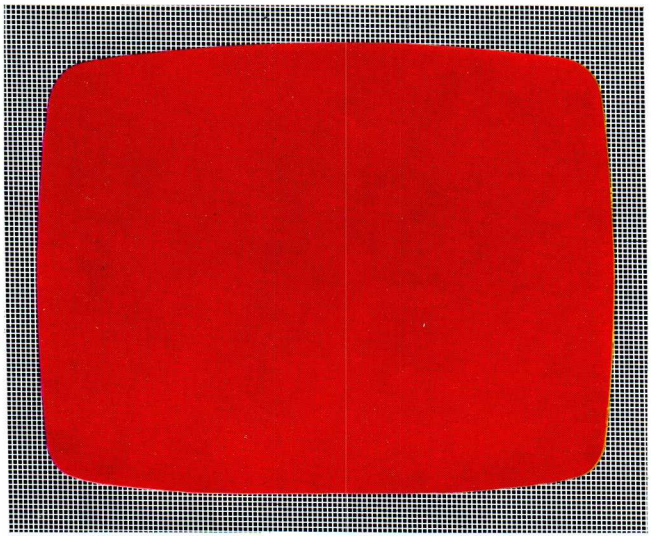

Fig. VII-5. "RED"-pattern

This pattern consists of a fully saturated red signal with PAL-alternating burst.

1. ● First set the brightness and saturation controls of the receiver clockwise and then turn them anti-clockwise until the blue and green dots disappear and only the red dots remain.

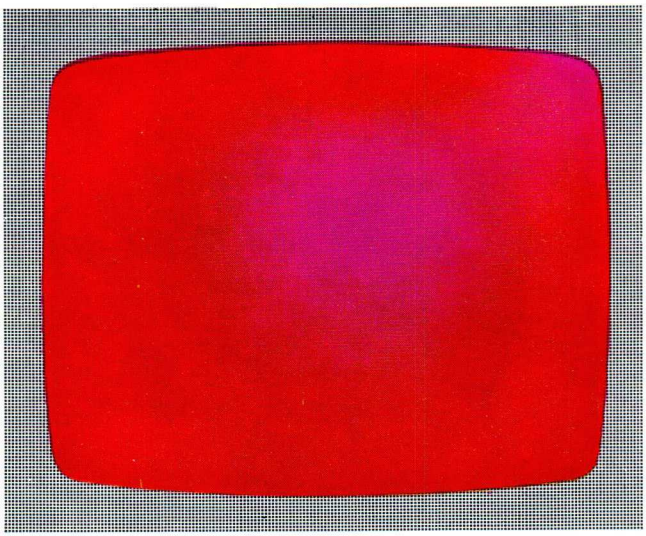

Fig. VII-6. Typical purity error

2. ● Check the purity of red (this pattern offers the adventage that the green and blue guns need not be switched off). Larger convergence errors may have an effect on this check. Fig. VII-6 shows a purity error.
3. ● This pattern can also be used to check whether a black/white receiver suffers from excessive interference due to the colour subcarrier.

D. **Pattern 4.**
"GREYSCALE"

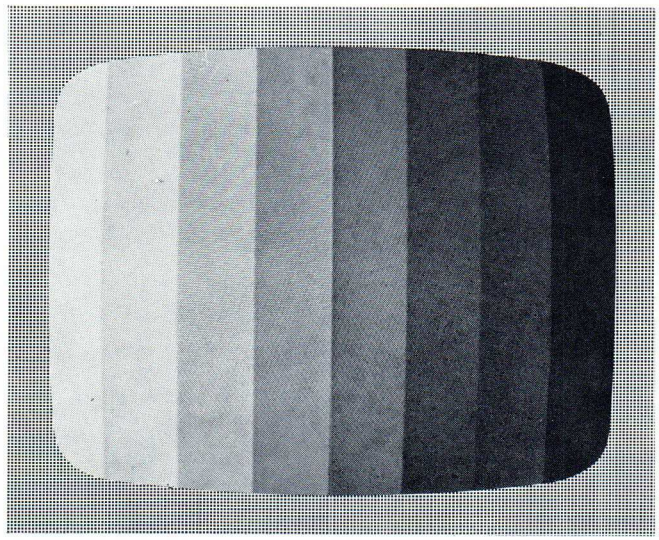

Fig. VII-7. "GREYSCALE"-pattern

This greyscale signal is a linear staircase signal. It has **not** been derived from the colour bar signal by removing its chroma-information.

1. ● Check the proper functioning and the range of the brightness and contrast controls of the receiver. In some receivers the black level is kept constant and is not effected by operation of the contrast while each of the 6 steps in between should show an equel increase of grey (from left to right).
2. ● Check the proper greyscale setting of the colour receiver. The various greybars should not contain any colour. (If the greyscale setting is not correct, the ratio between the beam current and the control grid curves of the three guns of the picture tube is not constant; re-adjust according to the instructions in the Service Notes of the relevant receiver).

3. ● The following check with this pattern requires the aid of the oscilloscope.
   Check the non-linearity of the video amplifier of the receiver with the contrast control at maximum. Check that each step of this grey-scale signal at the output of the video amplifier is equal. This can easily be measured by comparing it on the dual beam oscilloscope PHILIPS PM 3230 with the signal on socket "VIDEO".

E. **Pattern 5.**
"DOTS"

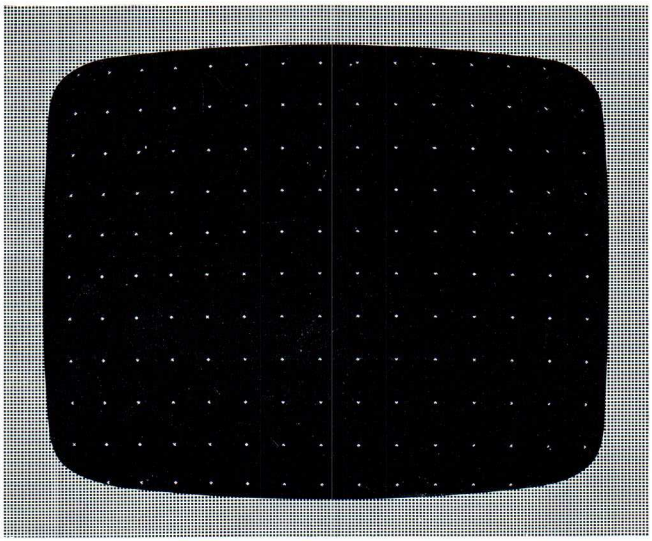

Fig. VII-8. "DOTS"-pattern

1. ● Check and, if necessary, re-adjust the static convergence in the centre of the screen at low ambient brightness. This should be done according to the instructions of the manufacturer of the receiver. Fig. VII-9 shows a detail of an incorrectly converged picture.