APPLICATION NOTE

Measurements on S-VHS and RGB Signals with Video Measurement System R&S VSA and Video Analyzer R&S UAF

Products:

Video Analyzer R&S UAF
Video Measurement System R&S VSA
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Measurements on RGB and S-VHS Signals with Video Measurement System R&S VSA and Video Analyzer R&S UAF

1 Introduction
The R&S VSA and R&S UAF video analyzers have been designed for measurements on CCV signals. Under certain conditions, they can also be used for measuring the primary colour components RGB and TV signals in the S-VHS format. Since the signals available at the SCART connectors of set-top boxes (STBs) and DVD players often use these formats, these measurements are more important than ever in the production of STBs and also for DVD players in digital TV.

2 Requirements
The signals demodulated and decoded by STBs or generated by DVD players have to meet certain requirements when the primary colour components RGB are to be measured. It is known that a monochrome signal is obtained when the red, green and blue colour components of identical amplitude are added. Conversely, it can be said that the red, green and blue colour components obtained from a monochrome signal have the same waveform. For the measurements, this means that test line CCIR18 - the multiburst which is only a monochrome signal - carries the multiburst on all three components after the RGB components have been separated. The same applies to the sinx/x and black-line signals, the white reference bar, the 2T pulse and the 5-step staircase in test line CCIR17.

These are the main signals required for automatic measurements with the R&S VSA and R&S UAF video analyzers.
Appropriate test signals are needed to meet these requirements. If the output signals of an STB are to be measured, the transport streams (TS) stored on the hard disk of the R&S DVG or R&S DVRG are used. All previously described signals are stored on the hard disks. The R&S SFQ modulates the MPEG2-coded transport streams according to DTV standards; the STB demodulates and decodes the RF signals and forwards the RGB signals to the SCART connector. If the STB is equipped with a common interface (CI), the desired TS can also be directly applied to the MPEG2 decoder of the STB. Possible error sources for demodulation in the front end of the STB can thus be avoided.

3 Measurements in S-VHS Format

Requirements are different in the case of the Y/C system (Y = brightness or luminance and C = colour information or chrominance), which is also called SVHS. The video analyzer input linked to the Y component ensures synchronization or, if an additional output is available for the composite sync signal, the composite sync signal should also in this case allow the Gen Lock function to be used.

S-VHS signals can be measured in three ways.

3.1 First Measurement Method:

The Y and C components are passively added via the two loopthrough filter inputs of the R&S VSA. The video analyzer therefore "sees" a CCVS at the selected input and measures all relevant parameters including the group delay in the 20T pulse of test line CCIR17. The parameters "differential gain" and "differential phase" produced when the Y and C signals are added do not exist in the chrominance channel per definition, since the colour information is transmitted at a constant DC level of 0 V, and these parameters are therefore not evaluated.

Another requirement to be met by the DVD player or the STB to be tested is sufficient return loss at the two Y and C outputs. Required is an $\alpha > 34$ dB in the range from DC to 5 MHz. Assuming the worst case, i.e. the impedance of the Y output is 2% (corresp. to 34 dB) higher than the nominal 75 $\Omega$, and that of the C output is 2% below 75 $\Omega$, the following is obtained for the luminance signal:

S-VHS format of 100/0/75/0 colour bar

Luminance Y

Chrominance C

A professional set of test DVDs - as is now offered by Rohde & Schwarz - is required for measuring a DVD player. On these DVDs, too, all necessary signals are available in highest coding quality. Signals of top quality are essential for professional video measurements with the R&S UAF or R&S VSA.
The signal to the video analyzer is attenuated at the voltage divider with the ratio \( V = \frac{0.98}{1.02 + 0.98} = 0.49 \). Since the nominal value is 0.5, the luminance level is 2% too low.

Correspondingly, the chrominance level is 2% too high.

If these maximum tolerances can be accepted in production, addition is the simplest way to measure S-VHS signals. In production, every second that extends the production process should be avoided, however. The measurement should therefore be as short as possible. For the VideoMeasurement System R&S VSA, this means that the main parameters of a group have to be chosen for the measurement, as any increase of parameters would extend the measurement time.

3.2 Typical R&S VSA Configuration for Measuring S-VHS Signals

Parameters to be measured with the R&S UAF or R&S VSA at the S-VHS output:

- CCIR17 Luminance bar amplitude
- Tilt
- Luminance nonlinearity
- Delay between luminance and chrominance at 20T pulse
- CCIR18 Amplitude frequency response of multiburst
- Black line S/N ratio
- Full field Burst amplitude
- Sync amplitude

When measurements are performed with the R&S VSA, amplitude and group-delay frequency response are of course measured with the optimal \( \sin x/x \) signal.

Since the Video Measurement System R&S VSA measures time and frequency as well, the following parameters can be evaluated:

- Line period
- Line jitter
- Colour subcarrier frequency

While a fixed set of parameters is measured with the R&S UAF in the test lines used, single parameters of a parameter group can be selected in the R&S VSA. A list of parameters is therefore available for the CODEC43 test pattern which is stored in the R&S DVG, R&S DVRG and also on the R&S Test DVDs.
3.3 Second Measurement Method:

The Video Analyzer R&S UAF is particularly suitable for automatic measurements of test lines in the S-VHS standard. Not only can the three loopthrough filter inputs A, B and C be selected in the INPUT SELECT menu but inputs A and B can also be added in the R&S UAF. The return loss is in this case no longer a function of the source impedance of the Y and C components of the instruments to be tested, but is determined by the highly accurate 75Ω terminations at the loopthrough filters.

The terminations supplied with the R&S UAF and the R&S VSA have an ohmic resistance of ±0.1% for a return loss of >50 dB up to 20 MHz. These values do not have a measurable influence on the signal quality.

Internally, the video analyzer "sees" a CCVS signal and measures all parameters including the group delay of the 20T pulse in test line CCIR17. The parameters "differential gain" and "differential phase" produced when the Y and C signals are added do not exist in the chrominance channel per definition, as the colour information is transmitted at a constant DC level of 0 V. An evaluation is therefore not useful.
This configuration is set on the R&S UAF under TEST LINES after pressing the SETUP key.

<table>
<thead>
<tr>
<th>SETUP / TESTLINES CCIR</th>
</tr>
</thead>
<tbody>
<tr>
<td>TESTSIG</td>
</tr>
<tr>
<td>CCIR 17</td>
</tr>
<tr>
<td>CCIR 18</td>
</tr>
<tr>
<td>CCIR 330</td>
</tr>
<tr>
<td>CCIR331</td>
</tr>
</tbody>
</table>

STD | ABORT | MODE 1 | EXIT

Fig. 11. Configuration of R&S UAF for measuring S-VHS signals

Very narrow tolerances can be achieved in production with this measurement method. The accuracy only depends on the tolerances of terminations and of the video analyzers. Here the Video Analyzer R&S UAF performs measurements of highest precision.

### 3.4 Third Measurement Method:

The Y and C components are applied to two different video analyzer inputs. Both loopthrough inputs are terminated into 75 Ω. Each signal component is separately measured. Since the R&S VSA has four loopthrough filter inputs, two inputs are available for other tasks. The composite sync signal for analyzer synchronization can be applied to one of these inputs, the other input is used for automatic CCVS measurements.

Using a separate input to measure each signal component is an accurate method because the associated terminations have a very small tolerance of 0.1%. The artificial differential gain and differential phase parameters are not produced either. These measurements therefore allow for a more accurate representation of the S-VHS video signal.

Fig. 12. Test setup for measuring DVD players in S-VHS format with R&S VSA
The delay between the luminance and chrominance signal cannot be measured however. The first measurement could be a solution in this case because this parameter is not affected by the return loss.

Since this method requires that the Y and C components be measured one after the other, the high precision of the S-VHS measurement is at the expense of the measurement time which is twice as long.

4 Measurements in RGB Format

The signals required for automatic measurements of the analog outputs of STBs in RGB format with R&S VSA or R&S UAF are provided by the test setup below. The CCVS SCART output can, of course, also be measured.

![Test setup for measuring STBs in RGB format with R&S VSA](image)

A much simpler test setup can be used for measuring the outputs of DVD players because the test signals can in this case be taken from the R&S Test DVDs. As already mentioned, the test DVDs contain signals of highest coding quality so that digital and analog signal processing in the DVD player under test can be accurately measured.
The DTV Recorder Generator R&S DVRG or the MPEG2 Measurement Generator R&S DVG are connected to the ASI (asynchronous serial interface) of the TV Test Transmitter R&S SFQ by means of a 75 Ω coaxial cable for transmitting the MPEG2 transport stream Codec43. The more favourably priced TV Test Transmitter R&S SFL may be used instead of the R&S SFQ.

The TV test transmitter modulates data in line with DVB, ATSC or ISDB standards. The STB for the selected standard demodulates, decodes and converts the data to the analog RGB and also to the CCVS format. The DVD player with the R&S Test DVDs supply the RGB test signals with the high accuracy required for measuring the signal quality of a DVD player. The analog signals are analyzed by the Video Measurement System R&S VSA. The Video Analyzer R&S UAF may be used instead. For this purpose connect the Red component to input A, the Green component to input B and the Blue component to input C of the video analyzer and don't forget to terminate the loop through input filters with 75 Ω.

As can be seen from the next section, the amplitude frequency response and group-delay measurement with sinx/x and the parameter measurement on an STB or DVD player in the time domain cannot be performed with the Video Analyzer R&S UAF. Parameters in the time domain are true design parameters and the sinx/x measurement is replaced by the multiburst measurement in the R&S UAF. Because of the high measurement speed and the possibility to measure all major parameters, the Video Analyzer R&S UAF is the ideal instrument for use in production.

4.1 Measuring the RGB Components

The Codec43 transport stream contains all signal elements required for the measurement. All there is to do is to select the line number containing the required signal elements in the Video Measurement System R&S VSA or Video Analyzer R&S UAF and to start the measurement.

<table>
<thead>
<tr>
<th>Test signal</th>
<th>Line ranges</th>
<th>Test line to be selected in the R&amp;S UAF/VSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red area</td>
<td>24 - 30</td>
<td>27</td>
</tr>
<tr>
<td>CCIR 17</td>
<td>31 - 38</td>
<td>34</td>
</tr>
<tr>
<td>Sawtooth</td>
<td>39 - 46</td>
<td>42</td>
</tr>
<tr>
<td>Black line</td>
<td>47 - 58</td>
<td>50</td>
</tr>
<tr>
<td>Multiburst</td>
<td>277 - 286</td>
<td>595</td>
</tr>
<tr>
<td>Sinx/x</td>
<td>287 - 294</td>
<td>603</td>
</tr>
<tr>
<td>CCIR 330</td>
<td>295 - 302</td>
<td>611</td>
</tr>
<tr>
<td>Colour bar</td>
<td>303 - 310</td>
<td>623</td>
</tr>
</tbody>
</table>

Table 1 Lines of Codec43 test pattern

All major parameters of the RGB components can be measured with the lines defined above.
• Luminance bar amplitude measured at white bar in CCIR17
  Measuring instrument: R&S UAF or R&S VSA

• Amplitude frequency response, 0.5 to 5.8 MHz measured with CCIR18
  Measuring instrument: R&S UAF or R&S VSA

• Amplitude frequency response, 0.2 to 6 MHz measured with sinx/x
  Measuring instrument: R&S VSA

• Group delay, 0.2 to 6 MHz measured with sinx/x
  Measuring instrument: R&S VSA

• 2T pulse parameters measured at 2T pulse in CCIR17
  Measuring instrument: R&S UAF or R&S VSA

• Luminance nonlinearity measured with 5-step staircase in CCIR17
  Measuring instrument: R&S UAF or R&S VSA

• Tilt of white reference bar measured at white bar in CCIR17
  Measuring instrument: R&S UAF or R&S VSA

• Noise measured in black line
  Measuring instrument: R&S UAF or R&S VSA

• Sync pulse amplitude measured in full-field signal of green channel
  Measuring instrument: R&S UAF or R&S VSA

The following parameters can only be measured with the R&S VSA at the green component which nominally contains the sync pulse.

• Sync pulse width
• Line period
• Field period
• Line jitter

These four parameters characterize the time behaviour of signal generation in the STB or the DVD player. Normally, they are to be considered design parameters. In production, they should nevertheless be monitored by means of sample measurements.

All video parameters concerning the colour subcarrier of the CCVS are irrelevant and should not be measured at the RGB components level. As with video parameter measurements in the S-VHS system, a fixed set of parameters is defined in the R&S UAF for the test lines used. In the R&S VSA, however, the desired parameters of a parameter group can be individually selected. A list of parameters is therefore available for RGB measurements when the CODEC43 test pattern is used.

Since the terminations have narrow tolerances, each signal component is measured with the highest accuracy. The high measurement accuracy is however at the expense of the measurement time, which is three times as long because the R, G and B components have to be measured one after the other.

The RGB parameters can also be measured automatically via the controller function of the R&S VSA when the R&S BASIC program VSA-RGB1.bas is used. The program is available on the R&S homepage as an appendix to this Application Note. A printout of the program is attached as Appendix 1. Once initialized, the R&S VSA requires only slightly more than two seconds for measuring a primary colour component. The CODEC43 test pattern is again used as the test signal.
4.2. Time Offset between the Primary Colours RGB

If a time offset occurs between the three primary colour components, the edges of individual picture items are multicoloured. A time difference is caused, for instance, through analog filtering of the RGB data after D/A conversion when the three filters have different delays, or during digital signal processing when different processes are performed in the three signal paths.

It is therefore important that the delay differences are measured with high resolution. In the Video Measurement System R&S VSA, the 2T pulse of test line CCIR17 is used to determine the time positions of the RGB components in the range ± 500 ns with an accuracy of <5 ns.

For this measurement, select the 3-window display in the Scope mode and choose the "Simultan" mode. Select display of line 34 using the Line softkey. This diagram contains test line CCIR17, and 26 µs after the rising edge of the sync pulse, the 2T pulse.

The measured 2T pulse follows 26.046 µs after the 50% value of the sync pulse leading edge. This time diagram cannot be displayed with the highest resolution and the nominal value of 26.0 µs is not displayed. The diagram does not show the time offset to the reference component carrying the sync pulse. For an accurate offset measurement, set the horizontal axis to 100 ns/div using the MOVE/EXPAND function keys and the spinwheel on the R&S VSA front panel. After correct adjustment, only the 2T pulses of test line CCIR17 in RGB format are shown in the three displays.

Fig. 19. CCIR17 in Scope mode: red component (top) green component with sync pulse (center) blue component (bottom)

Fig. 20 Horizontally expanded simultan diagram of Fig. 19

Select Pulse for Cursor 1 (width about 2 µs) and Level for Cursor 2 (width 0 µs). To simplify operation, select simultaneous transfer of cursor settings to all three displays by selecting All Displays in the Cursor pulldown menu.

Fig. 21 Cursor settings for measuring the time offset between R - G and G - B

Shift the Pulse cursor to the center of the 2T reference pulse of the green component, which is displayed in the center window for input C. Shift the Level cursor until 0.000 µs is displayed as the time difference C2-C1 for the green component.

The R&S VSA now automatically measures the difference between the time centers of the 2T pulses of the red and blue components relative to the time center of the 2T pulse of the green component.
The R&S VSA calculates the time centers of the 2T pulses from the time positions of the 50% amplitude of the rising and the falling 2T pulse edges. The time centers of the 2T pulses are in the middle between the time positions of the 50% amplitudes.

This example shows that the red component of input B is delayed by 26 ns against the green component. The level is 688.7 mV which is about 1.5% too low. However, these distortions in the time and level domain are not visible on the screen.

The blue component is clearly too late and its level is too low. On the TV screen, this delay is shown by vertical white lines which have yellowish/reddish shadows at the front and a blue aftershadow. The blue component is measured. It has a delay of 236 ns against the green component and a level of only 550.9 mV, which is 21% too low.

The time offset measurement can also be performed automatically with the aid of the controller function of the R&S VSA when the R&S BASIC program RGBZeit.bas is used. The program is available on the R&S homepage as an Appendix to this Application Note. A hardcopy of the program is enclosed as Appendix 2. Once initialized, the R&S VSA requires hardly more than one second for measuring the time differences of the red and blue components to the green reference component. The CODEC43 test pattern with test signal CCIR17 in line 34 is again used as the test signal.

4.3 Signal Interfaces on STBs and DVD Players

4.3.1 S-VHS Connector

Standard S-VHS male and female connectors are provided with 4 contacts for ground and Y component (chrominance) in one housing. They are normally referred to as Hosiden connectors.

Video analyzers are equipped with coaxial 75 Ω BNC connectors. To ensure a reliable connection to the measuring instrument, we therefore recommend to adapt the above connector to BNC for luminance and chrominance. Adapters for Hosiden connectors to two coaxial 75 Ω BNC connectors are not commercial. Customers must create their own adapters.

4.3.2 SCART Connector

SCART is the abbreviation of "Syndicat des Constructeurs d'Appareils Radiorécepteurs et Téléviseurs". SCART connectors are commonly used as video and audio interfaces on STBs, DVD players and other video and audio consumer units. The SCART interface is defined by standards EN 50 049 or IEC 933.

Table 2 shows the most common contact assignment but the standard allows for three other pin configurations which are not described here.
1 Audio, right, off
2 Audio, right, on
3 Audio, left / mono off
4 Audio, ground
5 Blue, ground
6 Audio, left / mono on
7 Blue
8 Input/output switching voltage
9 Green, ground
10 Not used
11 Green
12 Not used
13 Red, ground
14 Not used
15 Red
16 Blanking signal, 1 = blanking
17 CCVS, ground
18 Ground, blanking signal
19 CCVS off
20 CCVS on
21 Shielding

Table 2  Most common contact assignment of SCART connector

Here, too, the following applies:

Video analyzers are equipped with coaxial 75 Ω BNC connectors. To ensure reliable connections to the measuring instrument, we recommend to adapt the SCART connector to BNC for the three primary colours RGB and the S-VHS and CCVS signals.
Adapters from SCART to coaxial 75 Ω BNC connectors for the video signals are not commercial. Adaptation is normally via standard Cinch connectors and then commercial Cinch - BNC adapters are used.
Standard SCART cables for audio signals are also available with Cinch connectors which can then be adapted to BNC as described above.

5 Conclusion

Analog measurements are not obsolete. As long as digital video signals have to be D/A-converted for display on the - still commonly used - analog screen, the analog outputs of the involved instruments have to be checked to make sure that the required quality parameters are complied with. In production, where not one second of test time can be wasted, the fast Video Analyzer R&S UAF is the optimum solution to check compliance with required quality criteria.
If comprehensive measurements are to be performed, the flexible Video Measurement System R&S VSA with its great variety of measurement functions is the right choice. This system can also be used as an IEC 625/IEEE488-bus controller for final production test systems without any other facilities being required.
6 Configuration of VSA for running a Basic program

- Change VSA to controller mode:
  - press **hardkey CONTROLLER**
  - select **MAPPING ENTER**
  - DISPLAY
    - select Front Panel **DOS**
    - select ext. Monitor **DOS**
  - KEYBOARD
    - select Keyboard **ext. Monitor ENTER**
- press **two times ESC hardkey**
- DOS Mode is selected **C:\>**
- type in **C:\> cd RS-BASIC ENTER**
- type in **C:\ RS-BASIC>BASIC ENTER** (change to R&S Basic)

- **insert disk** with Basic programs **VSA_RGB1.BAS** and **RGBTIME1.BAS** into slot of VSA
  - type in **ALOAD"A:VSA_RGB1.BAS" ENTER**
- program **VSA_RGB1.BAS** is loaded into VSA
  - type in **SAVE"VSA_RGB1.BAS" ENTER**
- program **VSA_RGB1.BAS** is stored in VSA

- type in **ALOAD"A: RGBTIME1.BAS" ENTER**
- program **RGBTIME1.BAS** is loaded into VSA
  - type in **SAVE" RGBTIME1.BAS" ENTER**
  - program **RGBTIME1.BAS** is stored in VSA

- type in **LOAD"VSA_RGB1.BAS" ENTER RUN**
  - the RGB measurements are executed

- to call a new program type in **delete all ENTER**

- type in **LOAD"RGBTIME1.BAS" ENTER RUN**
  - the timing measurements between (R and G) and (B and G) are executed

STOP program **CRTL / BREAK**
back to BASIC **F8**
RUN **F2**
LOAD **F5**
SAVE **F6**
back to DOS **bye**
Appendix 1

VSA_RGB1.bas
Measurement of video parameters of RGB components using R&S VSA

10 SET 1,3: MOVE 350,300: AREA 410,90: SET 2,15
15 PRINT "[2J Please wait..."
20 Vsa=20: IEC TIME 8000
22 IEC OUT Vsa,"*RST"
23 IEC TERM 10: IEC TIME 8000
25 IEC OUT Vsa,"conf:meas:ref:sel:all off;*wai"
30 IEC OUT Vsa,"calc:aver:meas:count 0;*wai"
35 REM PRINT "Measurement with initialization of VSA ? yes/no"
40 REM INPUT X$: IF X$="yes" THEN 100 ELSE 190
100 PRINT "VSA Initialisation in Progress..."
105 IEC OUT Vsa,"conf:meas:gro:sel:all CLEAR;*wai"
110 IEC OUT Vsa,"conf:meas:gro:sel LBAA,ON;*wai"
115 IEC OUT Vsa,"conf:meas:gro:sel SAA,ON;*wai"
120 IEC OUT Vsa,"conf:meas:gro:sel TILT,ON;*wai"
125 IEC OUT Vsa,"conf:meas:gro:sel LNL,ON;*wai"
130 IEC OUT Vsa,"conf:meas:gro:sel SXAP,ON;*wai"
135 IEC OUT Vsa,"conf:meas:gro:sel SXAN,ON;*wai"
140 IEC OUT Vsa,"conf:meas:gro:sel SXGP,ON;*wai"
145 IEC OUT Vsa,"conf:meas:gro:sel SXGN,ON;*wai"
150 IEC OUT Vsa,"conf:meas:gro:sel LP,ON;*wai"
155 IEC OUT Vsa,"conf:meas:gro:sel LP,ON;*wai"
160 IEC OUT Vsa,"conf:meas:gro:sel LNLB,ON;*wai"
165 IEC OUT Vsa,"CONF:MEAS:TSIG:LINE T17C,34,TSIN,603,TSYN,17,TQU,50"
170 IEC OUT Vsa,"rout:ssel B;*wai"
175 IEC OUT Vsa,"STAT:VSAS LME;*wai"
180 IEC OUT Vsa,"conf:meas:gro sel;*wai"
190 PRINT "[2J"
195 REM first build up the measurement display
196 GOSUB 1000
200 IEC OUT Vsa,"rout:meas:isel A;*wai"
205 IEC OUT Vsa,"read:meas:par? LBAA;*wai"
210 IEC IN Vsa,X$: Alba=VAL(X$): IF Alba=0 THEN 205
220 IEC IN Vsa,X$: Atilt=VAL(X$)
225 IEC OUT Vsa,"read:meas:par? LNL;*wai"
230 IEC IN Vsa,X$: Alnl=VAL(X$)
235 IEC OUT Vsa,"read:meas:par? SXAP;*wai"
240 IEC IN Vsa,X$: Asxap=VAL(X$)
245 IEC OUT Vsa,"read:meas:par? SXAN;*wai"
250 IEC IN Vsa,X$: Asxan=VAL(X$)
255 IEC OUT Vsa,"read:meas:par? SXGP;*wai"
260 IEC IN Vsa,X$: Asxgp=VAL(X$)
265 IEC OUT Vsa,"read:meas:par? SXGN;*wai"
270 IEC IN Vsa,X$: Asxgn=VAL(X$)
275 IEC OUT Vsa,"read:meas:par? LNL;*wai"
280 IEC IN Vsa,X$: Alnlb=VAL(X$)
300 PRINT "[10:45H":USING "####.#";1000*Alba
305 PRINT "[12:45H":USING "##.#";100*Atilt
310 PRINT "[13:45H":USING "##.#";100*Alnl
315 PRINT " [14;45H USING "##.##"; Asxap
320 PRINT " [15;45H USING "##.##"; Asxan
325 PRINT " [16;45H USING "###.###"; 1E9*A sxgp
330 PRINT " [17;45H USING "###.###"; 1E9*As xgn
335 PRINT " [18;45H USING "##.##"; Alnlb
340 SET 1,3: MOVE 350,280: AREA 410,60: SET 2,155
400 IEC OUT Vsa,"rout:meas:isel B;"wai"
402 IEC OUT Vsa,"read:meas:par? LBAA;"wai"
404 IEC IN Vsa,X$: Blba=VAL(X$): IF Blba=0 THEN 402
406 IEC OUT Vsa,"read:meas:par? SAA"
408 IEC IN Vsa,X$: Bsaa=VAL(X$)
410 IEC OUT Vsa,"read:meas:par? TILT;"wai
412 IEC IN Vsa,X$: Btilt=VAL(X$)
414 IEC OUT Vsa,"read:meas:par? LNL;"wai
416 IEC IN Vsa,X$: Blnl=VAL(X$)
418 IEC OUT Vsa,"read:meas:par? SXAP;"wai"
420 IEC IN Vsa,X$: Bsxap=VAL(X$)
422 IEC OUT Vsa,"read:meas:par? SXAN;"wai"
424 IEC IN Vsa,X$: Bsxan=VAL(X$)
426 IEC OUT Vsa,"read:meas:par? SXGP;"wai"
428 IEC IN Vsa,X$: Bsxgp=VAL(X$)
430 IEC OUT Vsa,"read:meas:par? SXGN;"wai"
432 IEC IN Vsa,X$: Bsxgn=VAL(X$)
434 IEC OUT Vsa,"read:meas:par? LNLB;"wai"
436 IEC IN Vsa,X$: Blnlb=VAL(X$)
438 IEC OUT Vsa,"read:meas:par? LP"*
440 IEC OUT Vsa,X$: Blp=VAL(X$)
442 IEC OUT Vsa,"read:meas:par? LJPP"*
444 IEC IN Vsa,X$: Bljpp=VAL(X$)
500 PRINT " [10;55H USING "####.#"; 1000*Blba
502 PRINT " [11;55H USING "####.#"; 1000*Bsaa
505 PRINT " [12;55H USING "##.##"; 100*Btilt
510 PRINT " [13;55H USING "##.##"; 100*Blnl
515 PRINT " [14;55H USING "###.##"; Bsxap
520 PRINT " [15;55H USING "###.##"; Bsxan
525 PRINT " [16;55H USING "###.##"; 1E9*Bsxgp
530 PRINT " [17;55H USING "###.##"; 1E9*Bsxgn
535 PRINT " [18;55H USING "##.##"; Blnlp
540 PRINT " [19;55H USING "##.##"; 1E6*Blp
545 PRINT " [20;55H USING "####"; 1E9*Bljpp
600 IEC OUT Vsa,"rout:meas:isel C;"wai"
605 IEC OUT Vsa,"read:meas:par? LBAA;"wai"
610 IEC IN Vsa,X$: Ciba=VAL(X$): IF Ciba=0 THEN 605
615 IEC OUT Vsa,"read:meas:par? TILT;"wai"
620 IEC IN Vsa,X$: Ctilt=VAL(X$)
625 IEC OUT Vsa,"read:meas:par? LNL;"wai"
630 IEC IN Vsa,X$: Chnl=VAL(X$)
635 IEC OUT Vsa,"read:meas:par? SXAP;"wai"
640 IEC IN Vsa,X$: Csxap=VAL(X$)
645 IEC OUT Vsa,"read:meas:par? SXAN;"wai"
650 IEC IN Vsa,X$: Csxan=VAL(X$)
655 IEC OUT Vsa,"read:meas:par? SXGP;"wai"
660 IEC IN Vsa,X$: Csxgp=VAL(X$)
665 IEC OUT Vsa,"read:meas:par? SXGN;"wai"
670 IEC IN Vsa,X$: Csxgn=VAL(X$)
675 IEC OUT Vsa,"read:meas:par? LNLB;"wai"
680 IEC IN Vsa,X$: Clnlb=VAL(X$)
700 PRINT "[10;65H";USING年上半年*.#";100*Clba
705 PRINT "[12;65H";USING.*#*.;100*Ctilt
710 PRINT "[13;65H";USING.*#*.;100*Clnl
715 PRINT "[14;65H";USING.*##*;Csxap
720 PRINT "[15;65H";USING.*##*;Csxan
725 PRINT "[16;65H";USING.*##*;1E9*Csxgp
730 PRINT "[17;65H";USING.*###*;1E9*Csxgn
735 PRINT "[18;65H";USING.*##*;Clnlb
740 GOTO 200
750 STOP
1000 REM print screen
1010 SET 2,3: MOVE 35,340: LABEL "R",2
1020 SET 2,4: MOVE 60,340: LABEL "G",2
1030 SET 2,9: MOVE 85,340: LABEL "B",2: SET 2,15
1040 MOVE 115,335: LABEL "Component Measurement with VSA",1
1050 PRINT "[97m"
1060 PRINT "[8;10HParameter";TAB(42);"Red";TAB(52);"Green";TAB(62);"Blue"
1070 PRINT "[97m"
1080 SET 1,3: MOVE 348,280: AREA 424,55: SET 2,15
1090 SET 1,4: MOVE 425,280: AREA 504,55: SET 2,15
1100 SET 1,9: MOVE 505,280: AREA 580,55: SET 2,15
1110 MOVE 348,280: DRAW 50,280: DRAW 50,55: DRAW 348,55
1120 PRINT "[10;10Hlum Bar Ampl (abs) mV"
1130 PRINT "[11;10HSync Ampl (abs) mV"
1140 PRINT "[12;10Htilt %/bar"
1150 PRINT "[13;10Hlum NL %"n
1160 PRINT "[14;10HSin x/x Amplitude pos dB/grat"
1170 PRINT "[15;10HSin x/x Amplitude neg dB/grat"
1180 PRINT "[16;10HSin x/x Group Delay pos ns/grat"
1190 PRINT "[17;10HSin x/x Group Delay neg ns/grat"
1200 PRINT "[18;10Hlum Noise Lumw (bar) dB/bar"
1210 PRINT "[19;10HLine Period us"
1220 PRINT "[20;10HLine Jitter pp ns"
1230 RETURN

= ESC
Appendix 2

RGBTIME1.bas
Measurement of time offset using the R&S BASIC program.

10 PRINT " [2J"
15 MOVE 160,370
20 SET 1,3: LABEL "Time positions",1
22 MOVE 0,340
25 SET 1,3: LABEL " of RGB components measured with VSA",1
30 PRINT " [6;15HTest signal CODEC43 with CCIR17 in line 34"
35 PRINT " [8;0HGreen component with sync pulse is time reference"
40 PRINT "Connections at VSA:"
45 PRINT "Red at input A, Green at input B, Blue at input C"
50 Vsa=20: IEC TERM 10: IEC TIME 4000: V=0.01
55 IEC OUT Vsa,"sens:scop:filt1 off"
60 IEC OUT Vsa,"sens:scop:filt2 off"
65 IEC OUT Vsa,"sens:scop:filt3 off"
70 REM F is "READY" switch, D is "dot" switch
75 F=0: D=0
80 PRINT
85 REM PRINT "Measurement with VSA initialization ? yes / no"
90 REM INPUT X$: IF X$="yes" THEN 130 ELSE 390
95 PRINT "VSA initialization in progress..."
100 IEC OUT Vsa,"STAT:VSAS SCOP"
105 IEC OUT Vsa,"ROUT:SCOP:ISEL1 A"
110 IEC OUT Vsa,"ROUT:SCOP:ISEL3 C"
115 IEC OUT Vsa,"ROUT:SCOP:ISEL3 C"
120 IEC OUT Vsa,"ROUT:SSEL B"
125 IEC OUT Vsa,"DISP:MODE TRIP,ON"
130 IEC OUT Vsa,"DISP:WIND1:TRAC:X:LPOS 34,26us,1.5us"
135 IEC OUT Vsa,"DISP:WIND1:TRAC:Y:BOTT -0.1V:TOP 1.1V"
140 IEC OUT Vsa,"DISP:WIND3:TRAC:X:LPOS 34,26us,1.5us"
145 IEC OUT Vsa,"DISP:WIND3:TRAC:Y:BOTT -0.1V:TOP 1.1V"
155 IEC OUT Vsa,"CONF:SCOP:TRAC1:CURS2:X:LPOS 34,26us,1.5us"
165 IEC OUT Vsa,"CONF:SCOP:TRAC3:CURS2:X:LPOS 34,26us,1.5us"
175 IEC OUT Vsa,"CONF:SCOP:TRAC3:CURS2:X:LPOS 34,26us,1.5us"
180 IEC OUT Vsa,"CONF:SCOP:TRAC3:CURS2:X:LPOS 34,26us,1.5us"
185 IEC OUT Vsa,"CONF:SCOP:CURS1:TYPE LEV"
190 IEC OUT Vsa,"CONF:SCOP:CURS1:X:LPOS 34,26us,0us"
195 IEC OUT Vsa,"CONF:SCOP:CURS1:X:LPOS 34,26us,0us"
200 IEC OUT Vsa,"CONF:SCOP:CURS1:TYPE LEV"
205 IEC OUT Vsa,"CONF:SCOP:CURS1:X:LPOS 34,26us,0us"
210 PRINT " Time measurement in progress..."
215 T=26
220 IEC OUT Vsa,"CALC:AVER:SCOP:COUN 8"
225 IEC OUT Vsa,"ROUT:SCOP:ISEL B"
245 IEC OUT Vsa,"CONF:SCOP:TRAC2:CURS2:X:LPOS 34,"+STR$(T)+"us,0us"
250 IEC OUT Vsa,"CONF:SCOP:TRAC2:CURS2:X:LPOS 34,26us,2.0us"
255 REM measure the cursor timing difference
265 IEC IN Vsa,X$
270 IF D=1 THEN 490
485 PRINT ";
490 GOSUB 620
500 IF F=1 THEN 740
510 GOSUB 550
520 GOTO 470
530 REM Cursor shift
540 VS=LEFT$(RS,1)
550 IF VS="-" THEN 590
560 T=T+V: GOTO 600
570 T=T-V
580 IEC OUT Vsa,"CONF:SCOP:TRAC1:CURS1:X:LPOS 34,"+STR$(T)+"us,0.0us"
590 RETURN
600 REM Separation of level/time difference
610 RETURN
620 A=LEN(X$)
630 IF A=25 THEN B=12: C=12
640 IF A=27 THEN B=13: C=13
650 IF A=26 THEN K$=MID$(X$,13,1)
660 IF K$="," THEN B=12: C=13 ELSE B=13: C=12
670 RETURN IF A=25 THEN C=12
680 L$=LEFT$(X$,B)
690 R$=RIGHT$(X$,C)
700 IEC OUT Vsa,"ROUT:SCOP:ISEL A"
720 IEC IN Vsa,X$: GOSUB 620
725 IF ABS(Z)<0.5E-9 THEN F=1
730 RETURN IF ABS(Z)>1E-8 THEN V=0.01 ELSE V=0.001
735 IF ABS(Z)>1E-7 THEN V=0.1
740 RETURN
750 PRINT " Time offset between Red and Green components"
760 IEC OUT Vsa,"ROUT:SCOP:ISEL C"
780 IEC IN Vsa,X$: GOSUB 620
790 PRINT " Time offset between Blue and Green components"
800 IEC OUT Vsa,"ROUT:SCOP:ISEL B"
820 IEC IN Vsa,X$: GOSUB 620
830 PRINT " Using ";VAL(R$)*1E9;" ns"
835 PRINT " 
840 IEC OUT Vsa,"ROUT:SCOP:ISEL B": D=1: F=0: GOTO 470
845 STOP
850 END

Additional Information


Please send any comments or suggestions about this Application Note to: Broadcasting-TM-Applications@rohde-schwarz.com.