Service Manual

Tektronix

TSG 90 PATHFINDER™
NTSC Signal Generator

070-8706-01

Warning
The servicing instructions are for use by qualified personnel only. To avoid personal injury, do not perform any servicing unless you are qualified to do so. Refer to all safety summaries prior to performing service.

Specifications

Introduction

The material in this section is organized into two main groupings: the specification tables and the supporting figures. The specification tables include:

- NTSC general signal characteristics and test signal specifications.
- Signal level specifications.
- Power supply, physical, and environmental specifications.

The supporting figures (waveform diagrams and related data) follow the specification tables.

Reference Documentation

The following documents were used as references in the preparation of this specification:

Product Classification Environmental Test Summary, 13 June 1977; Tektronix Standard 062-2853-00

Electromagnetic Compatibility Environmental Test, 31 March 1977; Tektronix Standard 062-2866-00

Recommendations and reports of the CCIR, 1978; Transmission of Sound Broadcasting and Television Signals Over Long Distances (CMTT)

IEEE Standard Dictionary of Electrical Terms, Second Edition (1977); IEEE Standard 100-1977

Safety Standard for Electrical and Electronic Test, Measuring Controlling and Related Equipment, February 1988; ANSI/ISA-S82.01

International Electrotechnical Commission Standard “Safety Requirements for Electronic Measuring Apparatus;” IEC 348

Canadian Standards Association Electrical Standard for Electrical and Electronic Measuring and Testing Equipment; CAN/CSA C22.2 No. 231

Standard for Electrical and Electronic Measuring and Testing Equipment, Second Edition, July 21, 1980

Performance Conditions

The Performance Requirements are valid within the environmental limits shown in Table 1–7 if the instrument is calibrated in an ambient temperature of 23° C, after a warm-up time of 20 minutes.

Safety Standards

The following safety standards apply to the TSG 90:

- ANSI/ISA-S82.01
- IEC 348
- CAN/CSA C22.2 No. 231
- UL 1244

***NOTE**. Shielded cables were used in the certification of this instrument; therefore, shielded cables are recommended to be used when operating. (EC 92)*

Specification Tables

Table 1–1: General Video Test Signal Characteristics

Characteristic	Performance Requirements	Supplemental Information
Luminance Amplitude Accuracy	± 1% of 714.3 mV (100 ± 1 IRE)	
Chrominance-to-Luminance Gain	± 2% of 714.3 mV (100 ± 2 IRE)	1% typical.
Blanking Level	0 V ± 50 mV	
Rise Time Accuracy	± 10%	Except where otherwise specified
Burst Amplitude	285.7 mV (40 IRE) ± 2%	
Sync Amplitude	285.7 mV (40 IRE) ± 2%	
Sync Rise Time	140 ns ± 20 ns	
Output Impedance		75 Ω
Return Loss		≥ 36 dB at 4.2 MHz
Subcarrier Stability	3.579545 MHz ± 10 Hz	Over a temperature range of 0 to +45 °C. Annual adjustment required.
Signal-to-Noise Ratio		≥ 60 dB; Signal passed through a continuous random noise measurement low pass filter, F_c=5 MHz.
Chrominance-to-Luminance Delay	≤ 15 ns	10 ns typical. Measured with the NTC7 Composite signal.
SCH Phase	0° ± 5°	
Frequency Response	Flat within ± 2% to 4.2 MHz	
Field Tilt	≤ 0.5%	
Line Tilt	≤ 0.5%	
5-Step Linearity Error	≤ 1%	Relative step matching.
Differential Gain	≤ 1%	
Differential Phase	≤ 1°	
2T Pulse K-Factor	≤ 0.5%	Ringing ≤ 1.5% peak.
Luminance Rise Time	Digitally derived	250 ns ± 25 ns, except where otherwise specified.
Chrominance Rise Time	Digitally derived	400 ns ± 40 ns, except where otherwise specified.
Burst Rise Time	Digitally derived	400 ns ± 40 ns
Line Timing	Digitally derived	See Figures 1–1 through 1–16
Front Porch Duration	Digitally derived	1.5 µs ± 0.1 µs
Line Blanking Interval	Digitally derived	10.9 µs ± 0.2 µs; measured at the 20 IRE point of active video.
Breezeway Duration	Digitally derived	600 ns ± 100 ns
Line Sync Duration	Digitally derived	4.7 µs ± 100 ns (at half-amplitude)
Vertical Serration Duration	Digitally derived	4.7 µs ± 100 ns (at half-amplitude)
Equalizing Pulse Duration	Digitally derived	2.3 µs ± 100 ns (at half-amplitude)
Burst Delay from Sync Duration	Digitally derived	 5.308 µs ±35 ns (19 cycles of subcarrier) 2.51 µs ± 0.1 µs (9 cycles of subcarrier)

Table 1–2: Video Test Signals

Characteristic	Performance Information		
SMPTE Bars	See Figure 1–1		
Rise Times			
Luminance	140 ns ± 25 ns		
Chrominance			
–I	250 ns ± 25 ns		
Q	833 ns ± 80 ns		
Field Timing			
Color Bars	Lines 21–182; See Figure 1–1a		
Reverse Blue Bars	Lines 183–202; See Figure 1–1b		
IYQB	Lines 203–262; See Figure 1–1c		
	Luminance Amplitude (Pedestal, mV)	Subcarrier Amplitude (peak–to–peak, mV)	Subcarrier Phase (degrees)
White	549.1	00.0	00.0
Yellow	492.6	443.3	167.1
Cyan	400.9	626.6	283.5
Green	344.5	585.2	240.7
Magenta	258.2	585.2	60.7
Red	201.7	626.6	103.5
Blue	110.1	443.3	347.1
–I	53.6	285.7	303.0
Q	53.6	285.7	33.0
75% Color Bars	Full Field Color Bars; 75% Amplitude, 7.5% Setup with a 100 IRE White Flag. See Figure 1–2.		
SNG Color Bars (Opt J only)			
SNB021565 & above			
Lines 21 – 163	30 IRE Flat Field		
Lines 164 – 198	Color Bars of 0 Setup SMPTE Color Bars		
Lines 199 – 209	IYQB of 0 Setup SMPTE Color Bars		
Lines 210 – 162	30 IRE Flat Field		
Red Field	See Figure 1–3		
Luminance Pedestal	201.74 mV (28.3 IRE)		
Chrominance Amplitude	626.66 mV_{p-p} (87.8 IRE)		
Chrominance Phase	103.5°		
(SIN X)/X	See Figure 1–4		
Spectrum	–3 dB at 4.75 MHz		
5-Step Staircase	See Figure 1–5		
Amplitude	714.3 mV (100 IRE)		
0 IRE Flat Field (STD only)	See Figure 1–6; 0 mV, no burst		
50 IRE Flat Field	See Figure 1–7		
Amplitude	357.2 mV		
Black Burst	See Figure 1–8		
Amplitude	53.57 mV (7.5 IRE)		

Table 1–2: (Cont.)Video Test Signals

Characteristic	Performance Information
Field Square Wave	See Figure 1–9
Field Timing	
Lines (White)	Lines 70–213
Lines at Blanking	All remaining active lines
Amplitude	714.3 mV (100 IRE)
Multiburst	See Figure 1–10
Amplitudes	
White Reference Bar	500 mV (70 IRE)
Packets	428.6 $mV_{p\text{-}p}$ (60 IRE), Equal width packets
Pedestal	285.7 mV (40 IRE)
Burst Frequencies	0.5, 1.0, 2.0, 3.0, 3.58, and 4.2 MHz
Packet Rise Time	
0.5 MHz	140 ns typical (sine-squared shaped packets)
All Other Packets	400 ns typical (sine-squared shaped packets)
Convergence	See Figure 1–11
Amplitude	549.3 mV (76.9 IRE)
Pattern	Crosshatch: 14 horizontal lines and 17 vertical lines per field
Pulse HAD	225 ns ± 25 ns
NTC7 Composite	See Figure 1–12
Bar	
Amplitude	714.3 mV (100 IRE)
Rise Time	125 ns ± 25 ns
2T Pulse	
Amplitude	714.3 mV (100 IRE)
HAD	250 ns ± 25 ns
Modulated Sin^2 Pulse	
Phase	60.8° ± 1°
Amplitude	714.3 mV (100 IRE), measured at peak amplitude
HAD	1.563 µs ± 150 ns
Modulate 5-Step Staircase	
Luminance	642.9 mV (90 IRE)
Chrominance	285.7 mV (40 IRE)
NTC7 Combination	See Figure 1–13
Multiburst	
Amplitudes	
White Bar	714.3 mV (100 IRE)
Packets	357.2 $mV_{p\text{-}p}$ (50 IRE)
Pedestal	357.2 mV (50 IRE)
Burst Frequencies	0.5, 1.0, 2.0, 3.0, 3.58, and 4.2 MHz
Packet Rise Times	
0.5 and 1.0 MHz	140 ns typical (sine-squared shaped packets)

Table 1–2: (Cont.)Video Test Signals

Characteristic	Performance Information
All Other Packets	400 ns typical (sine-squared shaped packets)
Modulated Pedestal	
Pedestal Amplitude	357.2 mV (50 IRE)
Chrominance Amplitudes	142.9 mV (20 IRE), 285.7 mV (40 IRE), and 571.4 mV (80 IRE)
Phase	90°
Rise Time	400 ns ± 40 ns
FCC Composite	See Figure 1–14
Bar	
Amplitude	714.3 mV (100 IRE)
Rise Time	250 ns ± 25 ns
2T Pulse	
Amplitude	714.3 mV (100 IRE)
HAD	250 ns ± 25 ns
Modulated Sin^2 Pulse	
Phase	60.8° ± 1°
Amplitude	714.3 mV (100 IRE)
HAD	1.563 µs ± 150 ns
Modulate 5-Step Staircase	
Luminance	571.4 mV (80 IRE)
Chrominance	285.7 mV (40 IRE)
Rise Time	375 ns ± 37.5 ns
Matrix	See Figure 1–15
Safe Area	See Figure 1–16
Amplitude	549.1 mV (76.9 IRE)
Safe Title	
Horizontal Bar	Lines 45 and 238
Vertical Timing	14.925 and 56.525 µs
Safe Action	
Horizontal Bar	Lines 33 and 250
Vertical Timing	12.325 and 59.125 µs

Table 1–3: Character Identification

Characteristic	Information
Number of Characters Displayed	Two lines of up to 16 characters per line
Display Position	Movable over the Safe Action area of the field. The first line may also be displayed in the Vertical Blanking Interval.
Character Amplitude	Black: 53.6 mV (7.5 IRE) White: 642.9 mV (90 IRE)

Table 1–4: Audio Tone

Characteristic	Performance Requirements	Supplemental Information
Amplitude	0, +4, or +8 dBu into 600 Ω	
Amplitude Accuracy	± 0.25 dBu	
Frequency		50, 63, 125, 250, and 400 Hz; 1, 2, 4, 8, 10, 12.5, 16, and 20 kHz; Sweep
Frequency Accuracy		± 0.5 Hz
Sweep		1 kHz for 5 seconds, followed by 0.5 seconds at each of the following frequencies: 50, 63, 80, 100, 125, 160, 200, 250, 315, 400, 500, 630, and 800 Hz; then 1, 1.25, 1.6, 2, 2.5, 3.15, 4, 5, 6.3, 8, 10, 12.4, 16, and 20 kHz.
Distortion (THD)	≤ 1% (20 kHz bandwidth)	≤ 0.4% typical
Audio ID “click” (click ON)	Channel 1, 1 click Channel 2, 2 clicks	Channel click outputs are offset for positive channel identification.

Table 1–5: Power Supply

Characteristic	Performance Requirements	Supplemental Information
DC Input Range	9 to 15 Vdc	
Supply Accuracy		+5 V ±250 mV, –5 V ±250 mV
Hum		Typical: 25 mV_{p-p}
Noise		≤ 50 mV (5 MHz bandwidth)
Fuse		1 A fast blow, 32 V min
Power Limit without adapter with adapter		 2.25 W 4.0 W
Power Consumption Audio and Back light off Audio and Back light on		Typical: 1.25 W 1.44 W

Table 1–6: Physical Characteristics

Characteristic	Performance Information
Height	5.6 cm (2.2 in)
Width	9.1 cm (3.6 in)
Depth	19.1 cm (7.5 in)
Net Weight TSG 90 TSG 90 with battery pack	 0.48 kg (1.06 lb) 0.68 kg (1.5 lb)
Shipping Weight (with AC adapter)	1.50 kg (3.31 lb)

Table 1–7: Environmental Characteristics

Characteristic	Performance Information
Temperature	
Operating	0° C to +50° C (32 to +122° F)
Storage	–30° C to +65° C (–22 to +149° F), excluding batteries
Altitude	
Operating (battery)	to 15,000 feet (4572 m)
Operating (with AC adapter)	to 14,000 feet (4267 m)
Storage	to 50,000 feet (15420 m)
Transportation	Meets the requirements of NTSB Test Procedure 1A, Category II (24 inch drop)

Waveform Illustrations

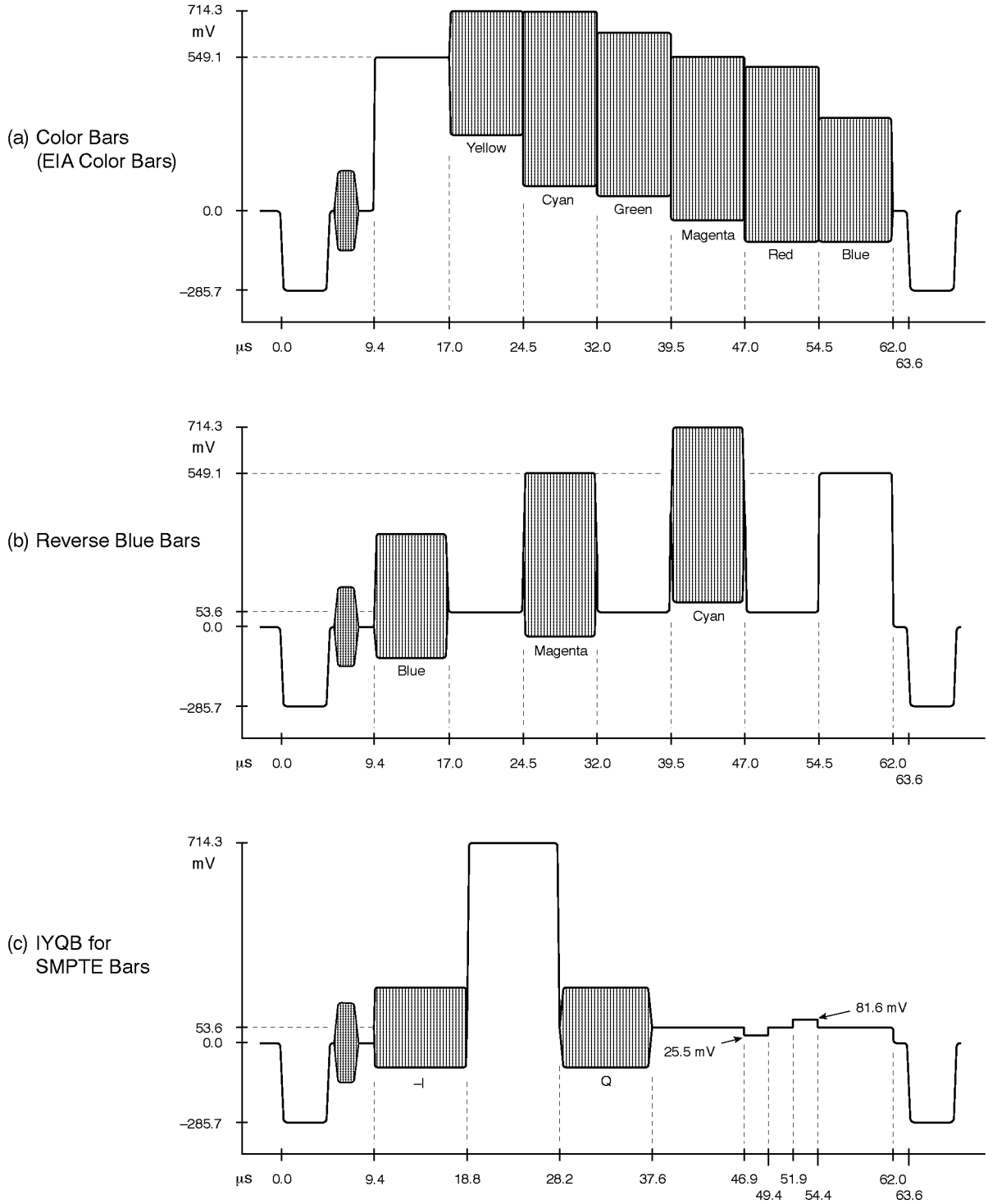


Figure 1–1: SMPTE Color Bar Components

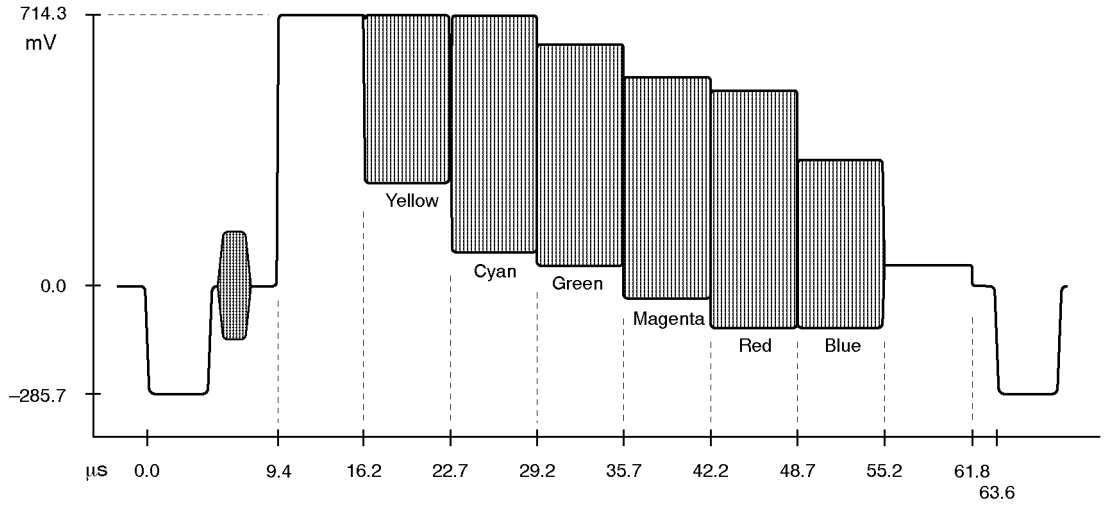


Figure 1–2: 75% Color Bars

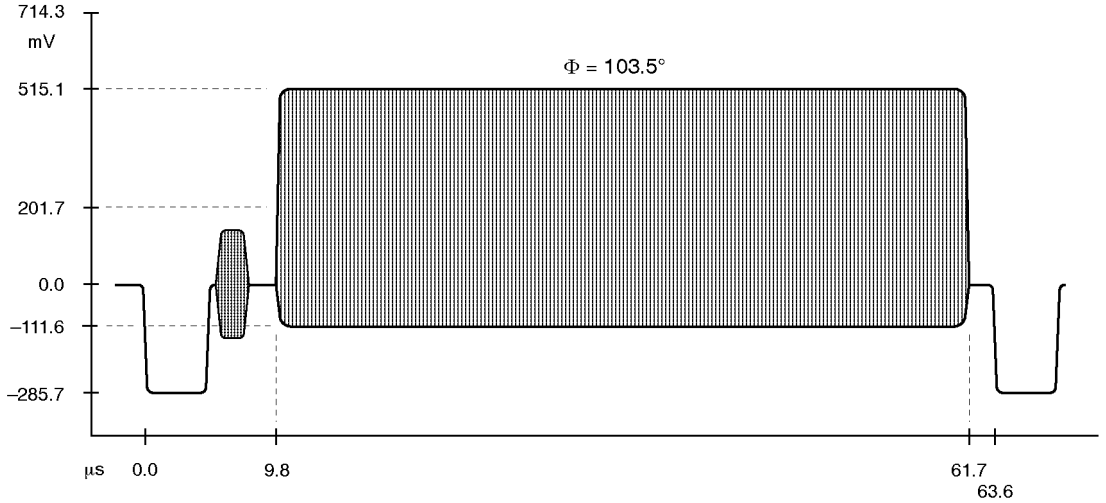


Figure 1–3: Red Field

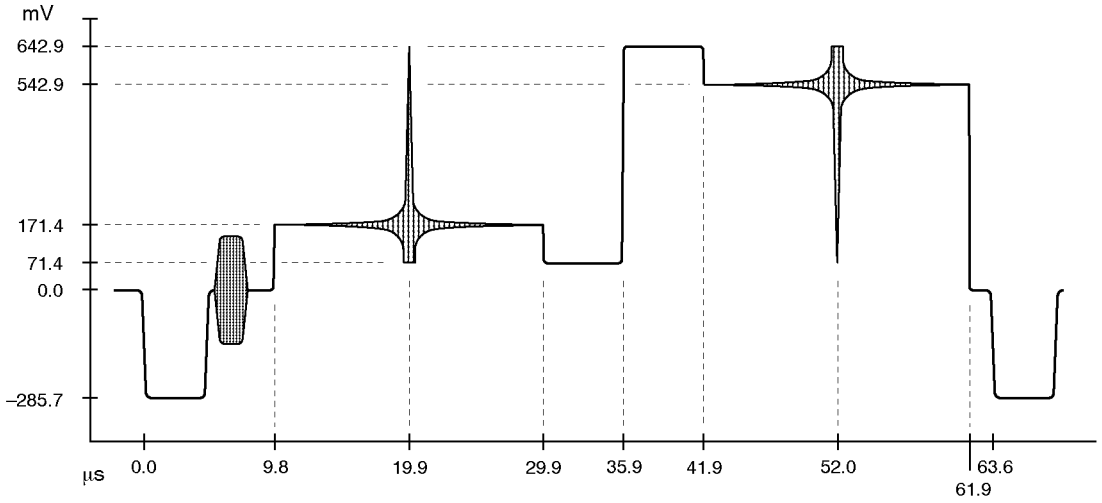


Figure 1–4: SIN(X)/X

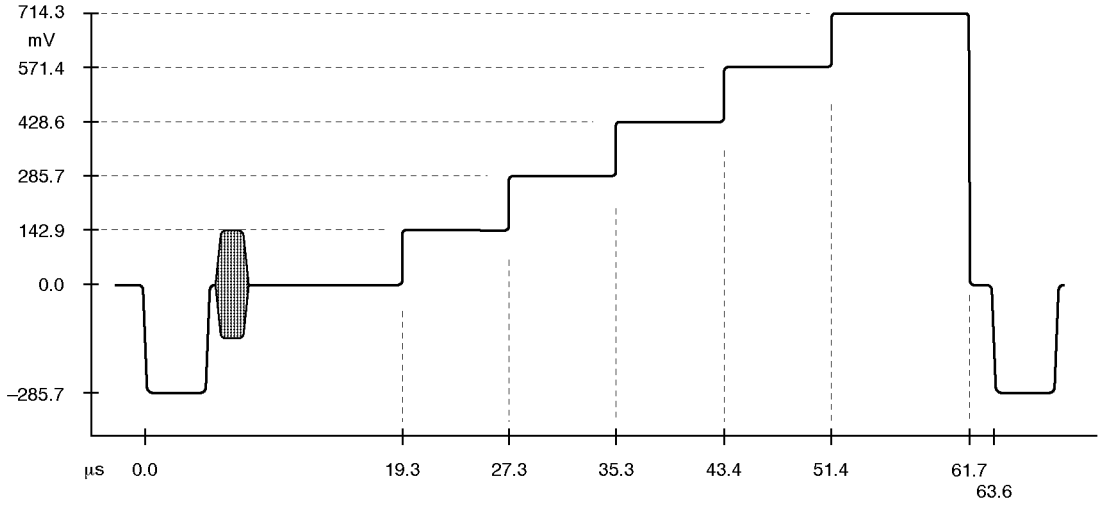


Figure 1–5: 5-Step Staircase (Gray Scale)

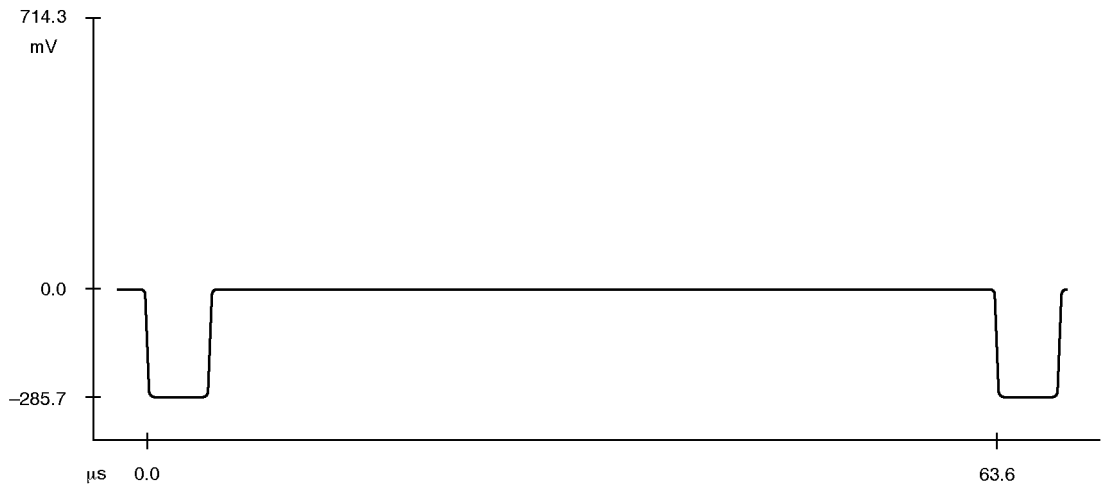


Figure 1–6: 0 IRE Flat Field

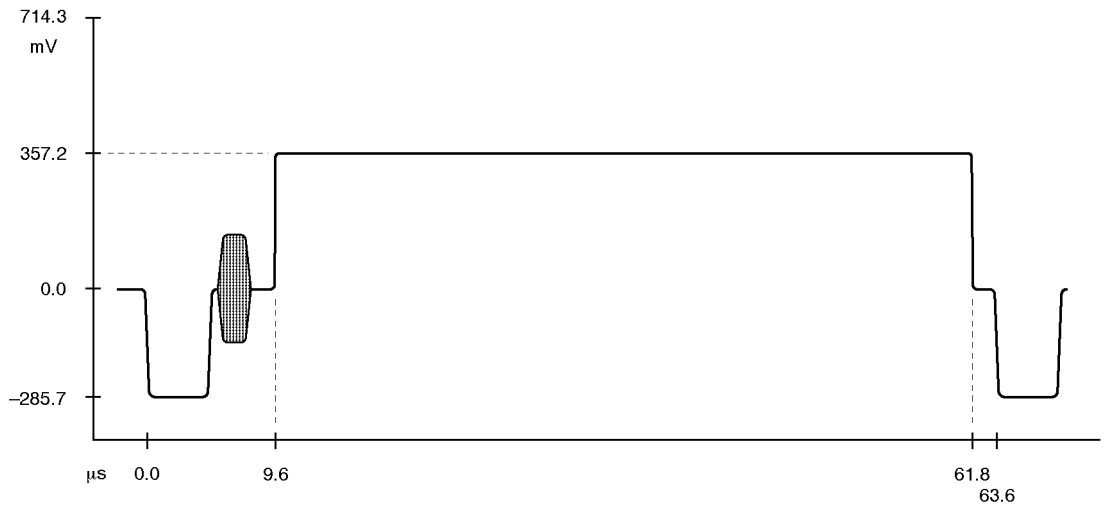


Figure 1–7: 50 IRE Flat Field

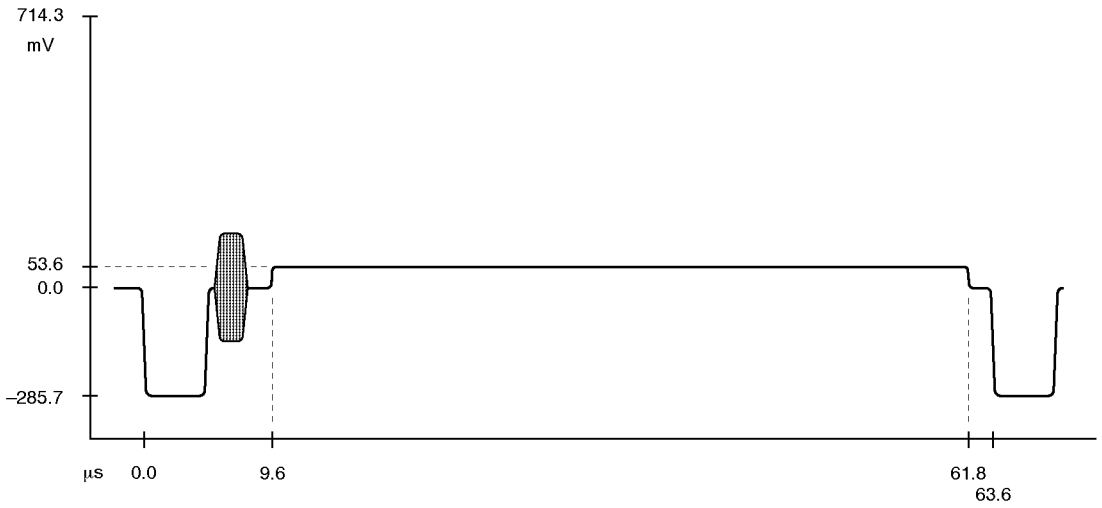


Figure 1–8: Black Burst

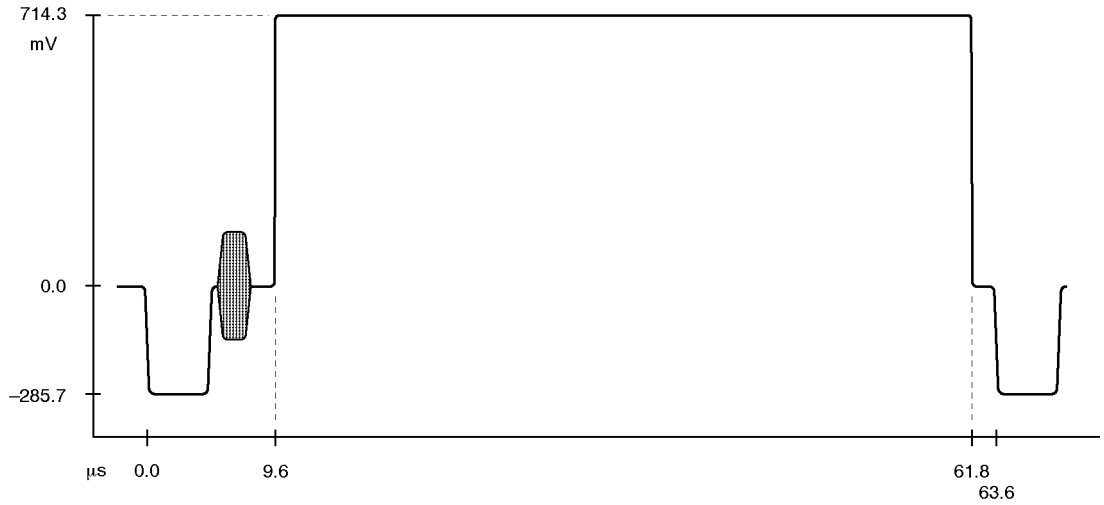


Figure 1–9: Field Square Wave

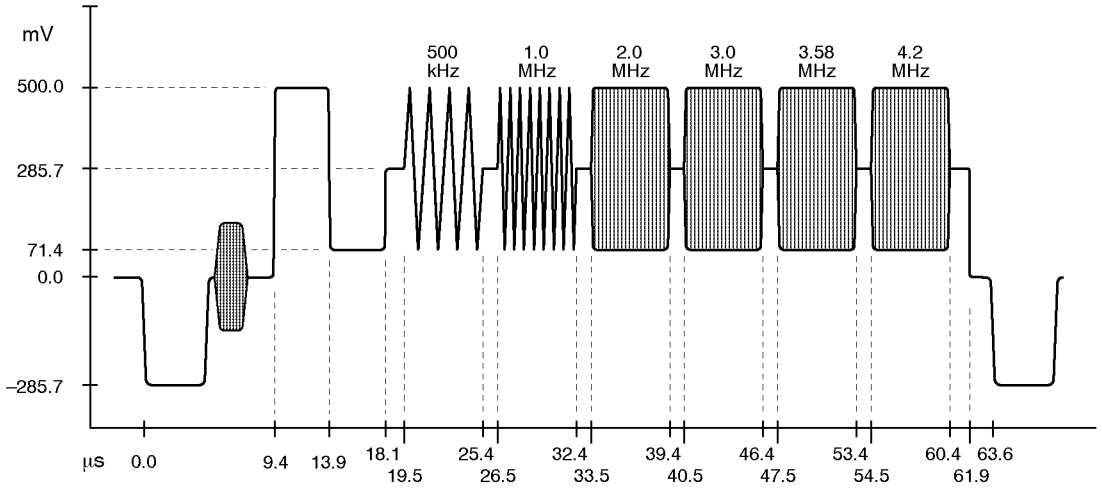


Figure 1–10: Multiburst

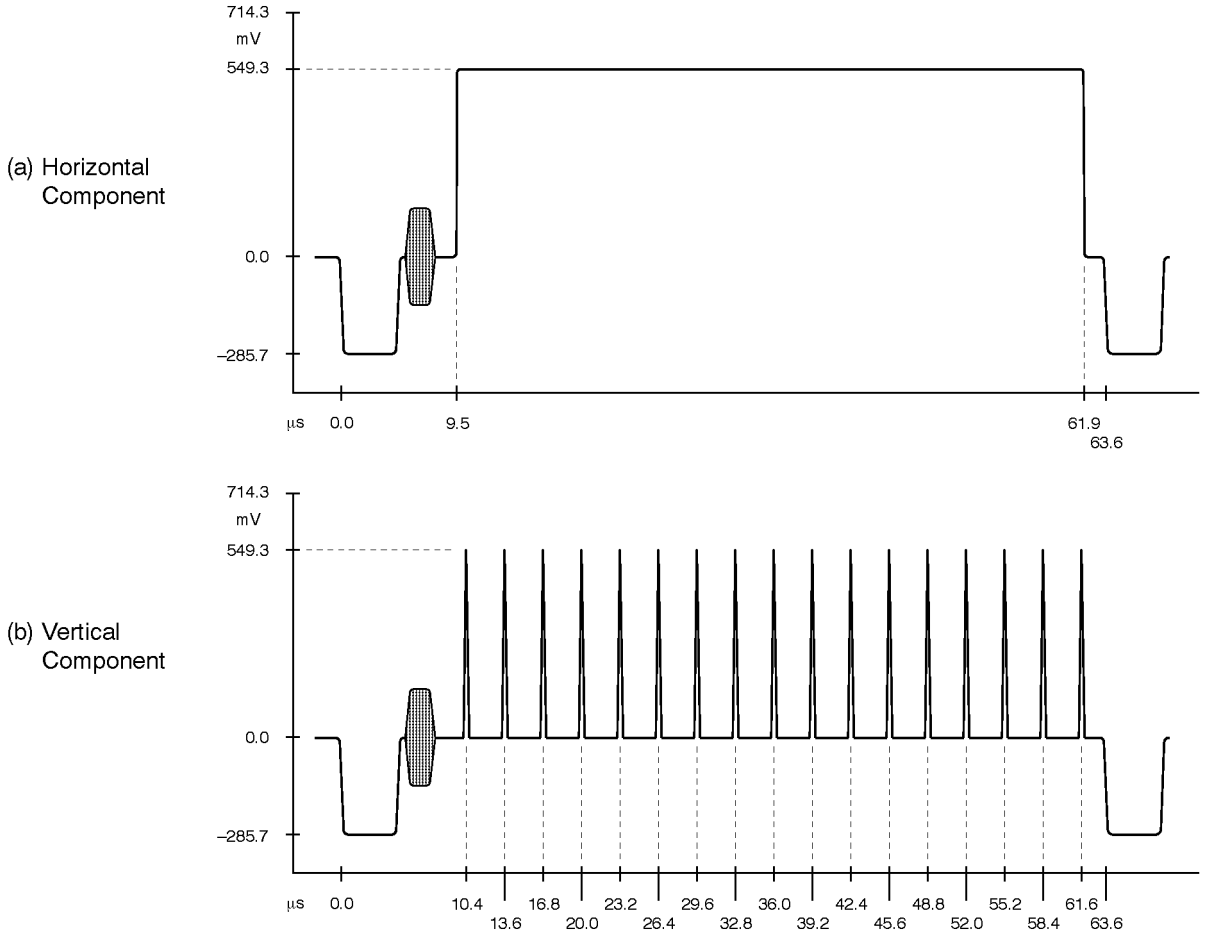


Figure 1–11: Convergence Components

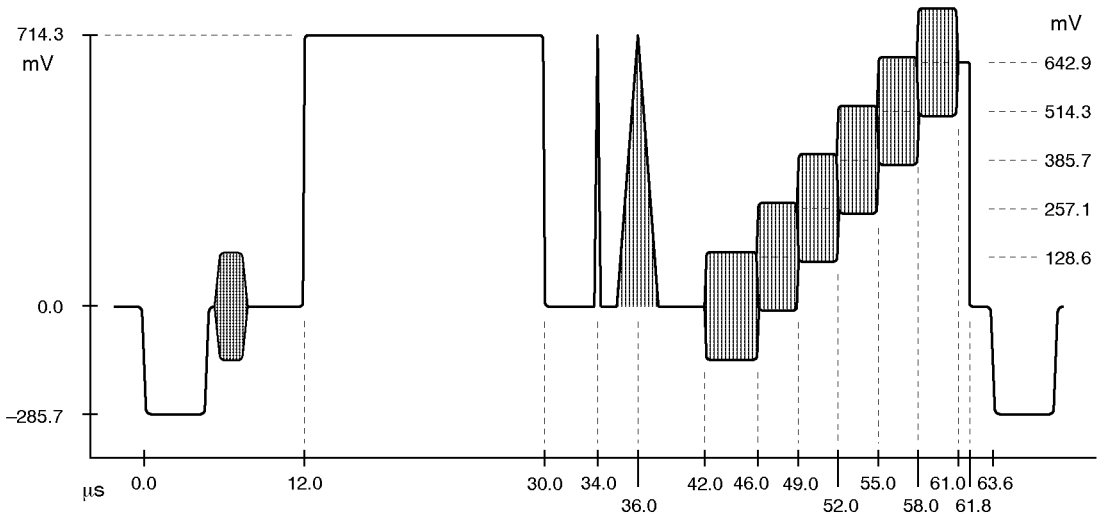


Figure 1–12: NTC7 Composite

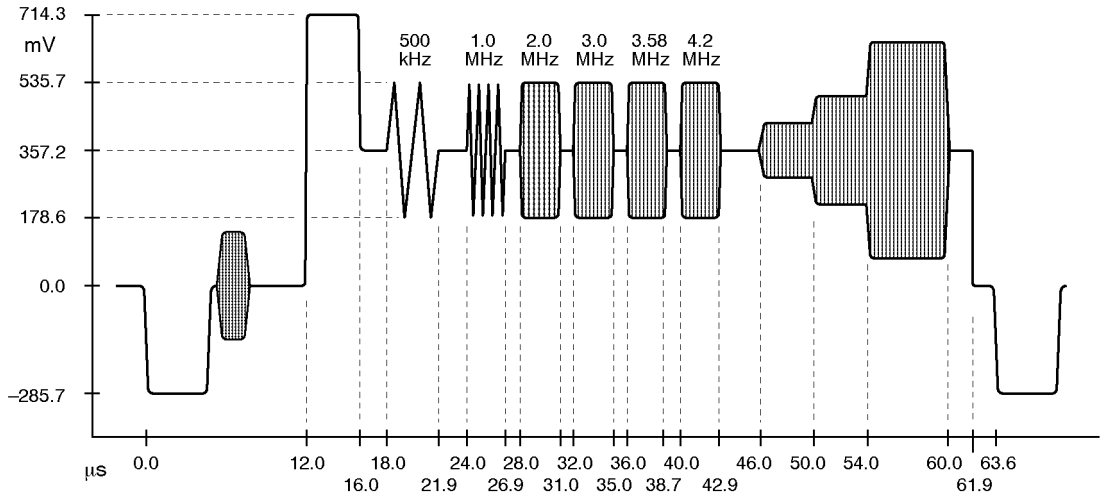


Figure 1–13: NTC7 Combination

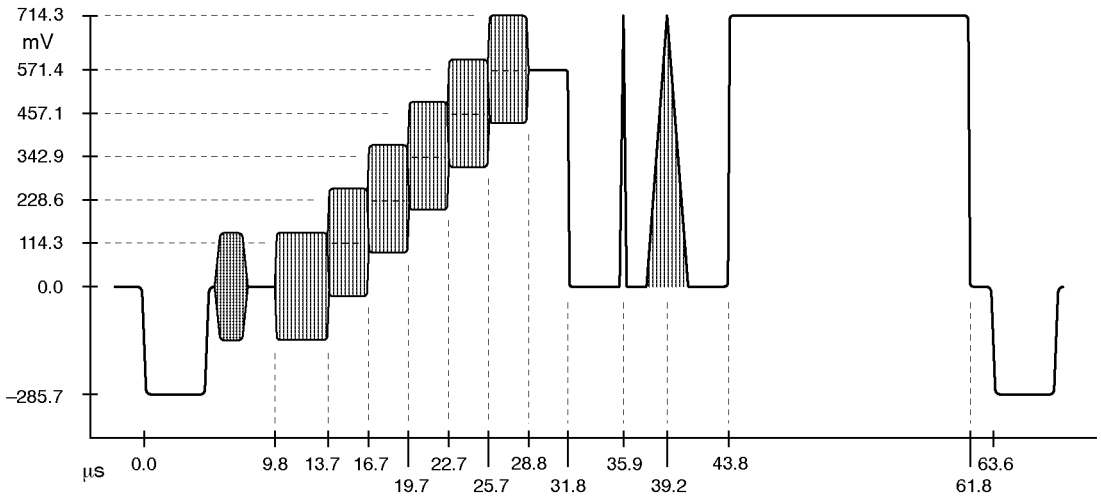


Figure 1–14: FCC Composite

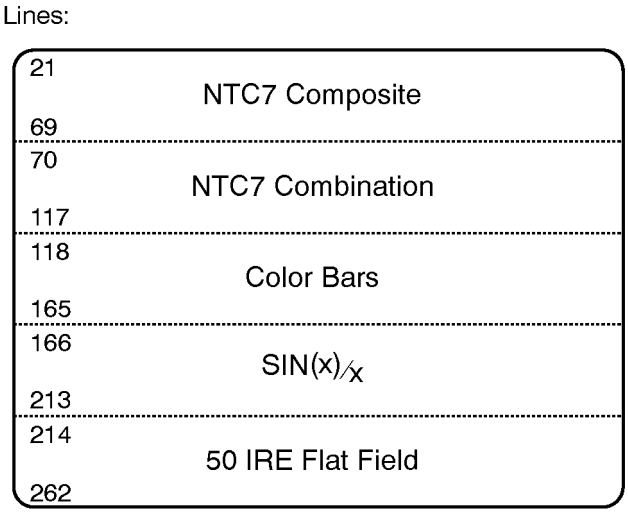
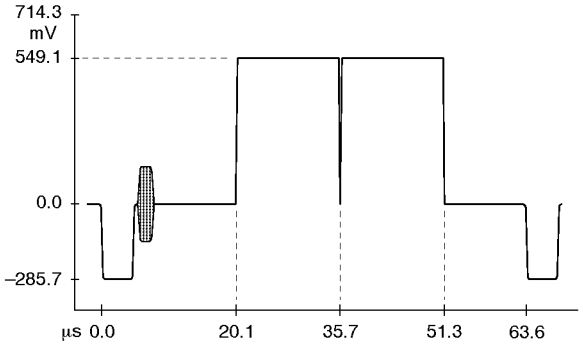
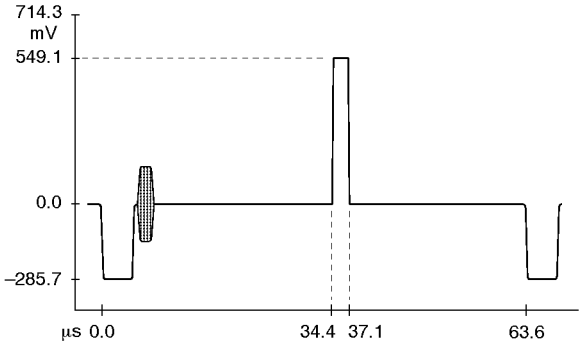


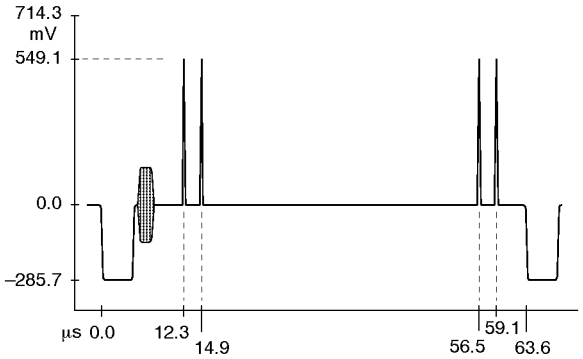
Figure 1–15: Matrix



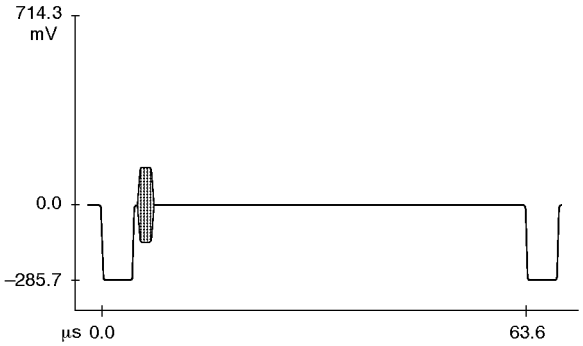
Lines 33, 45, 238, and 250



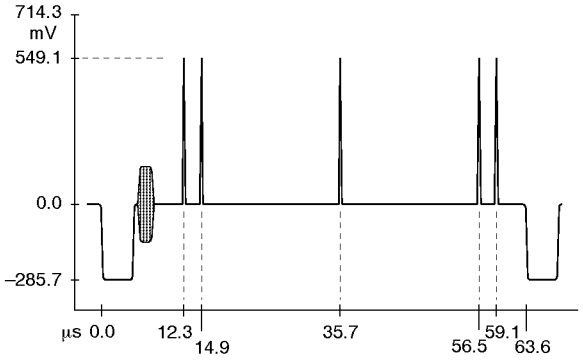
Line 141



Lines 69–132 and 149–213



All remaining lines



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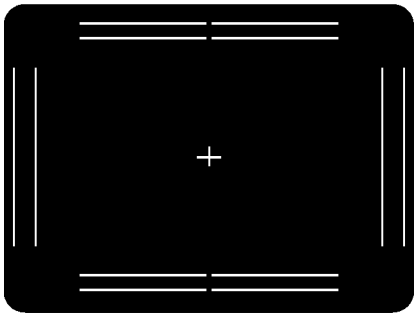

Safe Area display

Figure 1–16: Safe Area