SM01

3G-SDI/HD-SDI/SDI

Video Pattern Generator

User Manual

Revision 0.1
5th March 2022

Revisions

Date	Revisions	Version
05-03-2022	First draft.	0.1

Contents

Figures

1. Introduction

SM01 is a serial digital interface (SDI) video pattern generator supporting 525i, 625i and 19 high-definition video standards. The standards supported are:

525i
625i
720p/23.98Hz
720p/24Hz
720p/25Hz
720p/29.97Hz
720p/30Hz
720p/50Hz
720p/59.97Hz
720p/60Hz
1080p/23.98Hz
1080p/24Hz
1080p/25Hz
1080p/29.97Hz
1080p/30Hz
1080i/50Hz
1080i/59.94Hz
1080i/60Hz
1080p/50Hz
1080p/59.97Hz
1080p/60Hz

Patterns available are:

525i
75% colour bars
100% colour bars
SMPTE colour bars
N7CMPF
N7CMBF
FCCMB
Y/C frequency sweep
Limit ramp
Pedestal
Zone plate

625i
75% colour bars
100% colour bars
75% bars + red
CCIR17
CCIR18
CCIR330
CCIR331
Limit ramp
50% flat field
Zone plate

HD
75% colour bars
100% colour bars
SMPTE colour bars
Black
Grey
White
Red
Green
Blue
Limit ramp
5-step staircase
2T30TPB
Multi-burst
15MHz sweep
30MHz sweep
Crosshatch
Pathological
Matrix
Zone plate

SM01 is powered by a universal input power supply, or it can operate more than four hours standalone with its internal rechargeable batteries.

2. Controls and Connections

The top view of the SM01 module is shown in Figure 1.

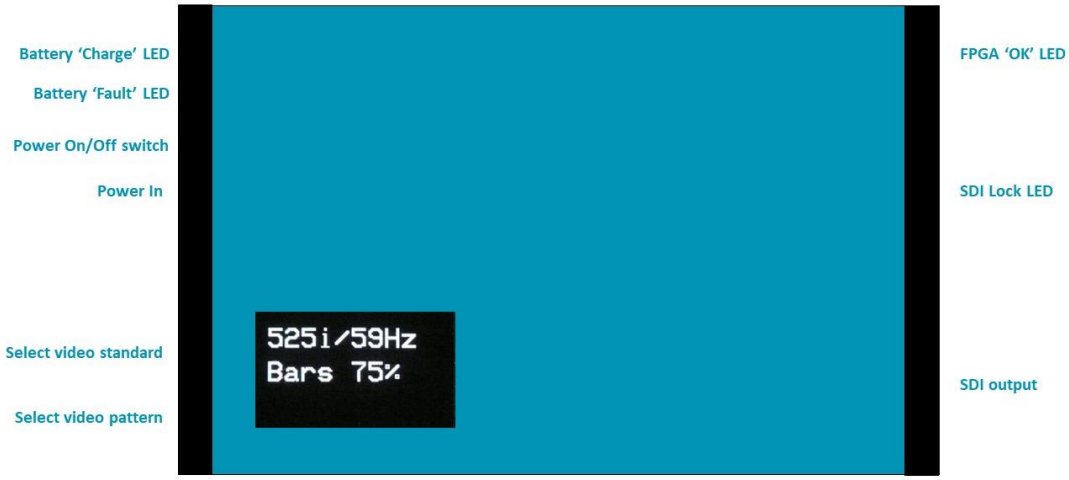


Figure 1 SM01 module connections.

The AC-DC converter connects to the 'Power In' left-hand jack. The SM01 input is protected against reverse polarity and out of range inputs with a resettable fuse. The converter supplied with the SM01 is a model TE10A0503F01 manufactured by SL Power Electronics Corp., providing 5VDC at 2A and accepting AC inputs from 100-240VAC. Connect the supplied power cord (appropriate to your country) to the AC-DC converter and output DC of the converter to the **Power In** input jack of the SM01.

A full specification for the supplied AC-DC converter may be found in Appendix A.
The SM01 will also operate for more than four hours using its rechargeable NiMH batteries (depending on the standard selected).

The serial digital interface (3G-/HD-/SDI) output is connected to the '**SDI Output**' BNC. The SDI output conforms to the SMPTE-259M/SMPTE-292M/SMPTE-425M specification. The SDI output specification is detailed in Chapter 5.

3. Quick Start Guide

Switch On and Control

Switch on the SM01 using the left-hand toggle switch (down for **ON**, up for **OFF**). The **FPGA OK** LED should light (indicating the FPGA has been configured correctly) and the **SDI LOCK** LED should also light (indicating the SDI PLL has locked and the output is valid).

To change the video standard, push the **Select Video Standard** pushbutton. The standards will sequence through the following 21 standards (indicated on the OLED display):

525i/59.94Hz (default)
625i/50Hz
720p/23.98Hz
720p/24Hz
720p/25Hz
720p/29.97Hz
720p/30Hz
720p/50Hz
720p/59.94Hz
720p/60Hz
1080p/23.98Hz
1080p/24Hz
1080p/25Hz
1080p/29.97Hz
1080p/30Hz
1080i/50Hz
1080i/59.94Hz
1080i/60Hz
1035i/29.97Hz
1035i/30Hz
1080p/50Hz
1080p/59.94Hz
1080p/60Hz

To change the video test pattern, push the **Select Video Pattern** pushbutton. The patterns selected will be different depending on the standard selected. The patterns will sequence through the following selections (indicated on the OLED display):

525i standard:
75% colour bars
100% colour bars
SMPTE colour bars
N7CMPF
N7CMBF
FCCMB
Y/C frequency sweep
Limit ramp
Pedestal
Zone plate

625i standard
75% colour bars
100% colour bars

75% bars + red
CCIR17
CCIR18
CCIR330
CCIR331
Ramp
50% flat field
Zone plate

HD standards:
75% Colour bars
100% Colour bars
SMPTE Colour bars
Black field
Grey field
White field
Red field
Green field
Blue field
Modulated ramp.
Modulated 5-step staircase
2T, 30T pulse bar
30MHz/15MHz multiburst
15MHz/7.5MHz sweep
30MHz/15MHz sweep
Crosshatch
SDI pathological
Matrix
Zone plate

A description of each pattern and its function can be found in Chapter 4.

It is possible to continue to use the SM01 whilst the batteries charge. The batteries take approximately 1 hour to charge from fully empty. While charging the **Charge** LED will light.

The **Fault** LED will light if the battery monitor detects an error condition, which usually indicates the batteries need to be changed (See Appendix C).

4. SM01 Patterns

Below is a detailed description of each of the SM01 patterns.

525i/625i test patterns

75% Colour bars (525i and 625i)

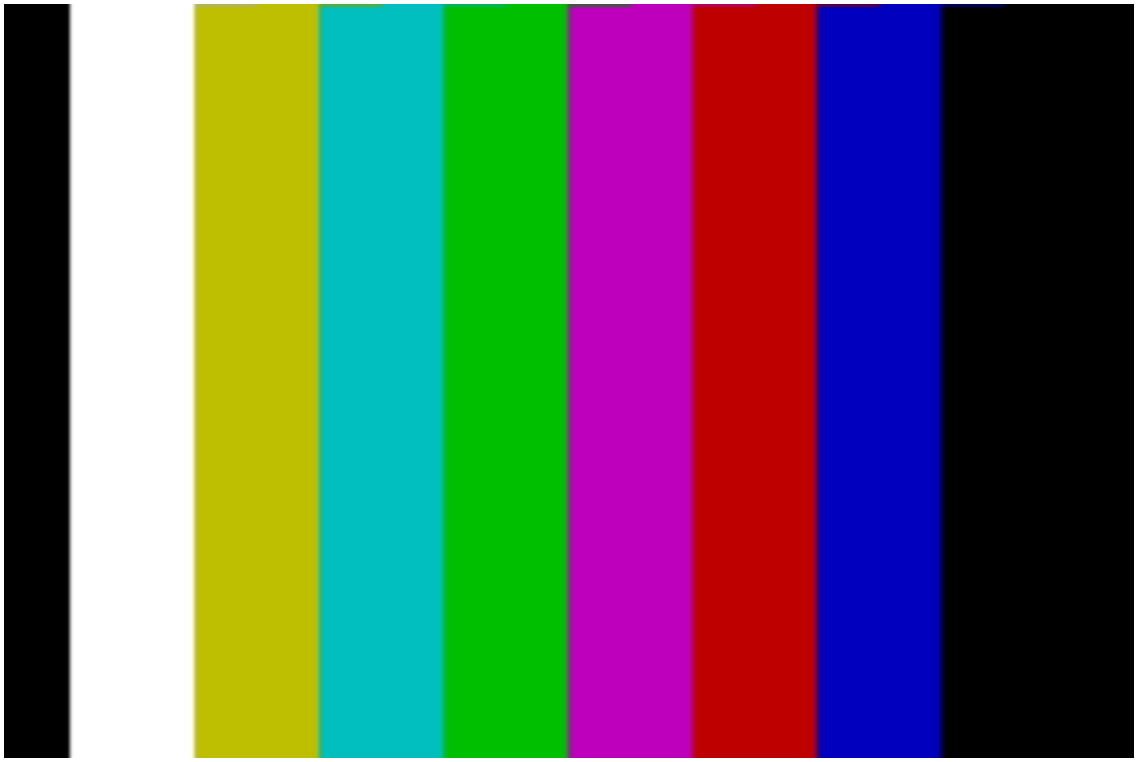


Figure 2 75% SD colour bars.

75% colour bars are used for measuring insertion gain, chroma level and chroma gain and for monitor alignment.

100% Colour bars (525i and 625i)

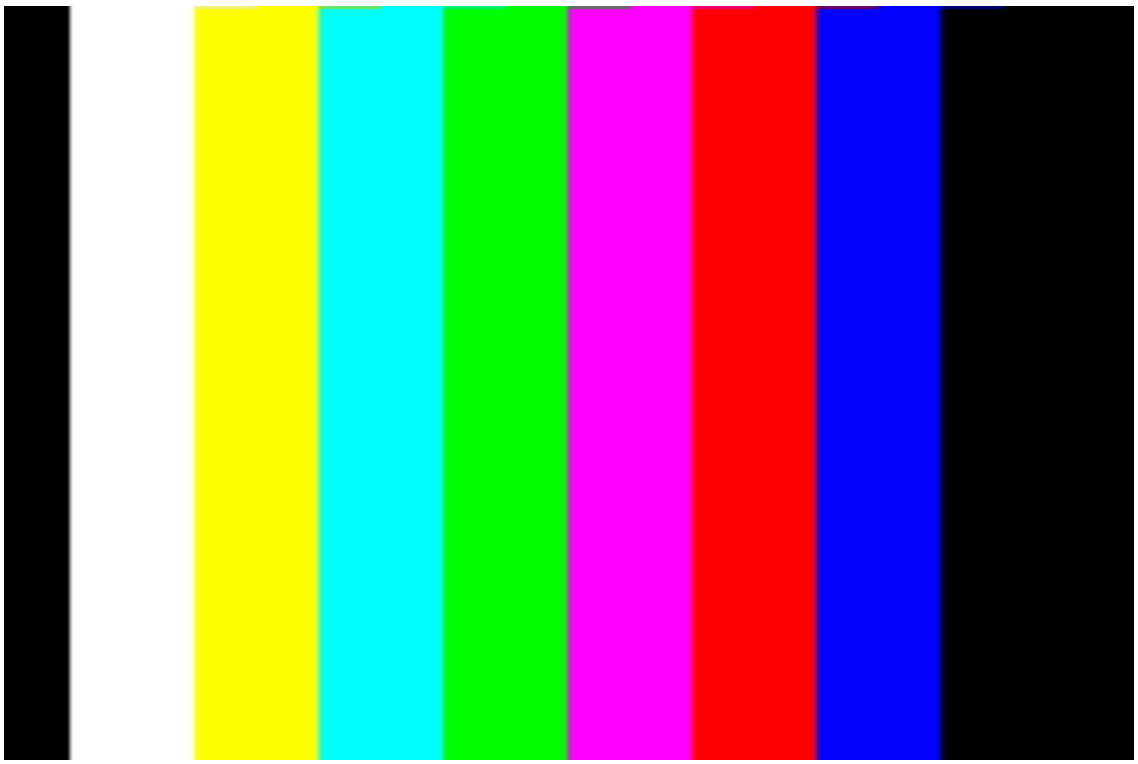


Figure 3 SD SMPTE Colour Bars.

100% colour bars are used for measuring insertion gain, chroma level and chroma gain and for monitor alignment. The colour bar sequence is white, yellow, cyan, green, magenta, red, blue and black.

SMPTE Colour bars (525i only)

67% of the SMPTE colour bar waveform comprises 75% colour bars; white, yellow, cyan, green, magenta, red and blue. Below this and comprising 8% of the frame, is a sequence of blue, black, magenta, black, cyan, black, white bars. The function of these bars is to set monitor chroma gain and phase – the red and green monitor outputs are switched off and the monitor hue (chroma phase) is adjusted to equalize the cyan/magneta and magenta/cyan vertical transitions. The chroma saturation is then used to equalize the transition between white/blue vertical transition.

The bottom 25% of the SMPTE pattern is, from left to right, -I, white, Q, black and pluge.
The pluge (±4 IRE bars) is used to set up the monitor black level; the whiter than black bar should be visible, the blacker than black bar should not. The –I and Q elements of the SMPTE pattern are no longer used.

N7CMPF (NTC-7 Composite – 525i only)

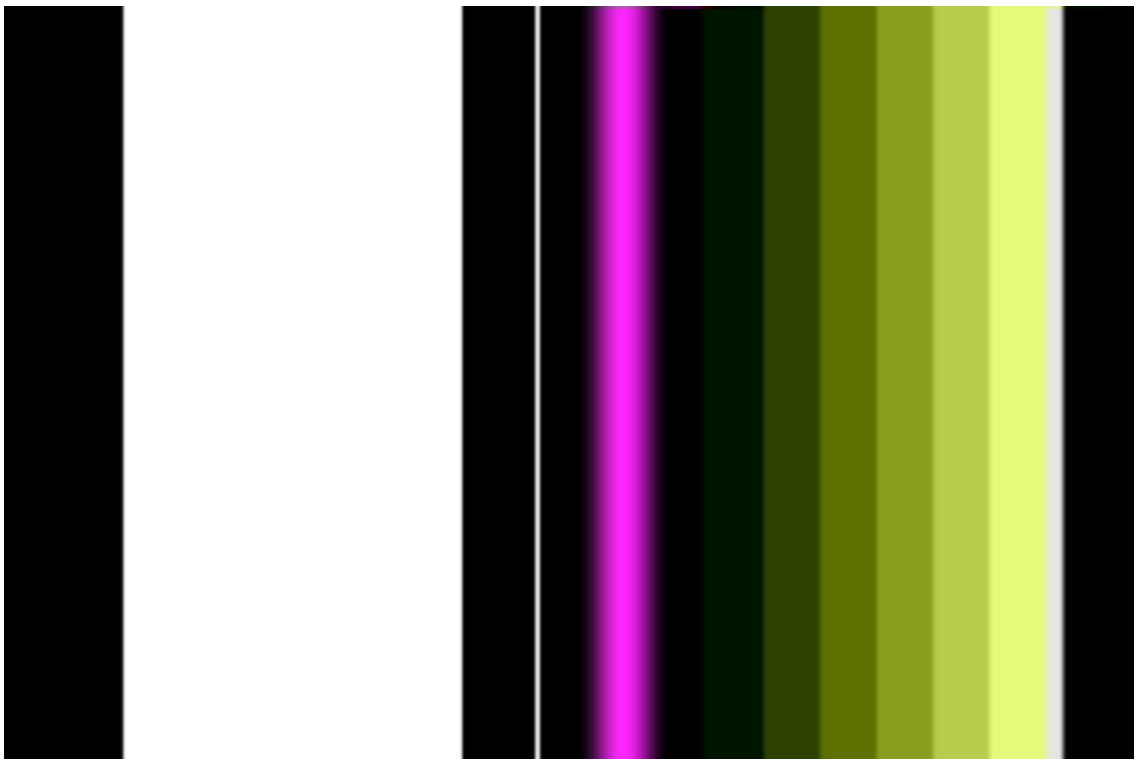


Figure 4 N7CMPF test pattern.

The NTC-7 pattern consists of a 100% white bar, 2T pulse, 12.5T chrominance pulse and a 5-step modulated staircase.

The 2T pulse is used for measuring distortion in the system group delay (the delay vs. frequency response of system).

N7CMBF (525i only)

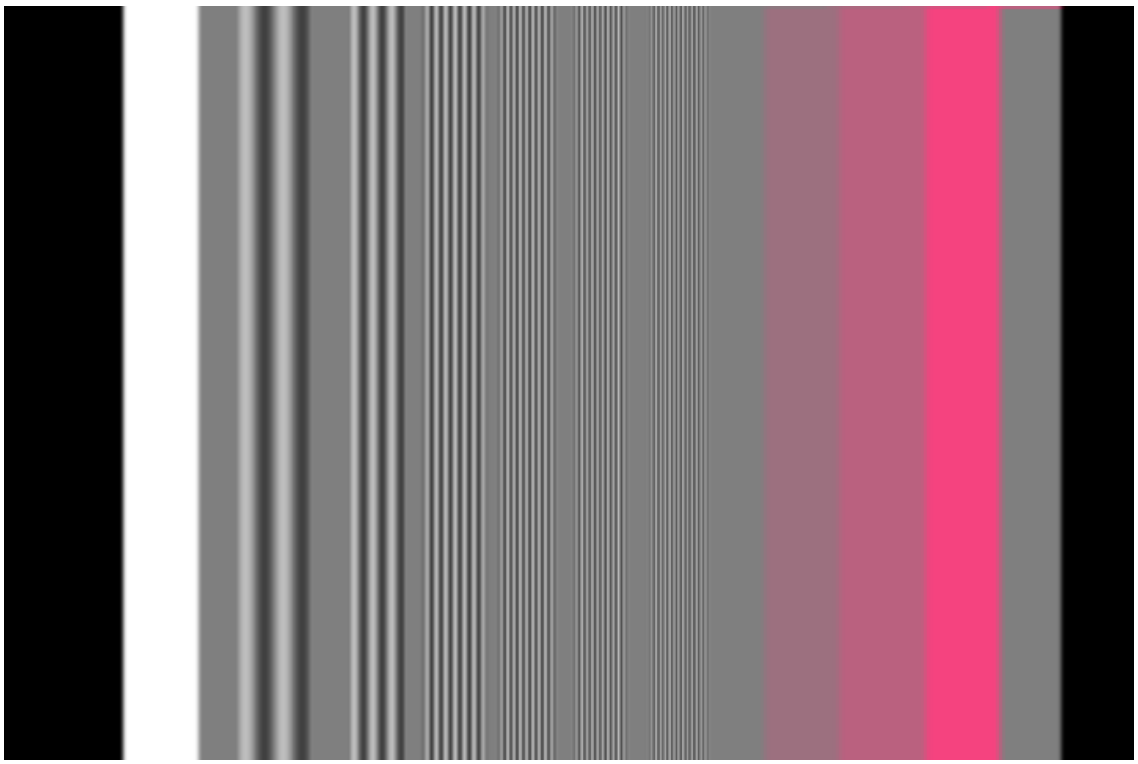


Figure 5 N7CMBF test image.

The NTC-7 Combination pattern consists of a white bar at 100 IRE, 6 multiburst packets of 50 IRE amplitude on a 50 IRE pedestal (at 0.5MHz, 1.0MHz, 2.0MHz, 3.0MHz, 3.58MHz and 4.2MHz) and a 20,40 and 80 IRE amplitude modulated chrominance on a 50 IRE pedestal.

FCC-MB (525i only)

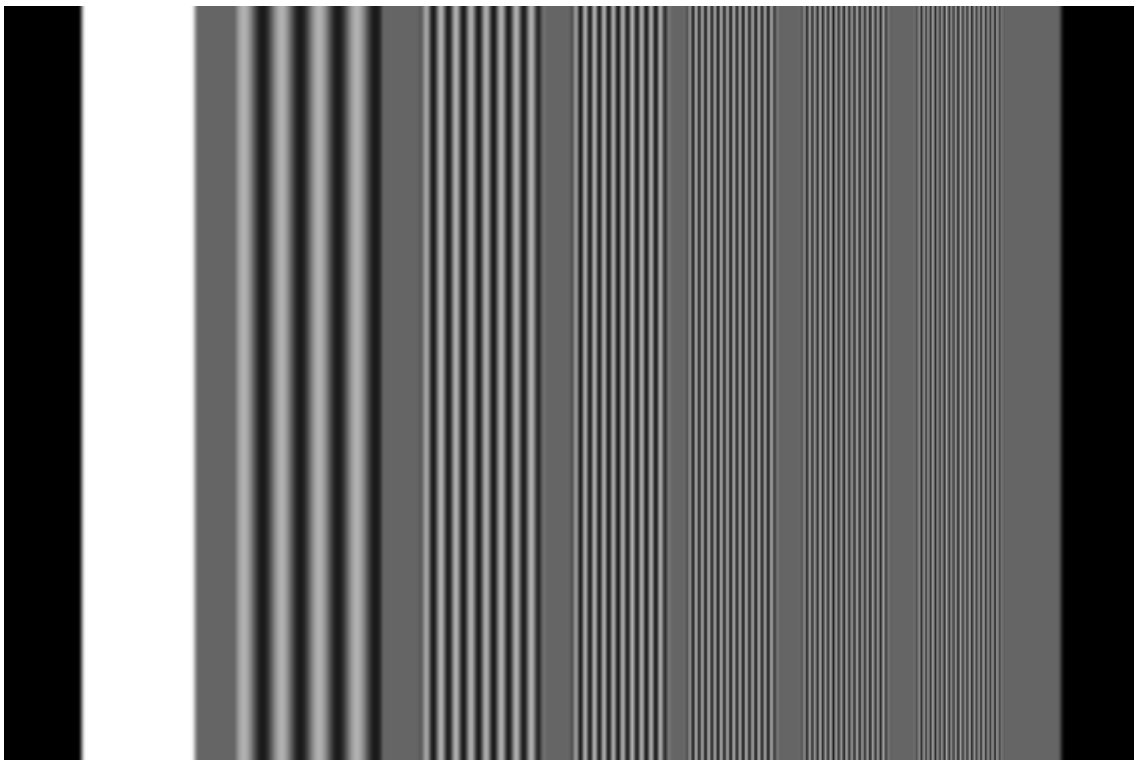


Figure 6 FCC-MB test image.

The FCCMB test signal is a pulse reference followed by six frequency packets at 0.5MHz, 1.25MHz, 2.0MHz, 3.0MHz, 3.579545MHz and 4.1MHz.

Frequency Sweep (525i and 625i)

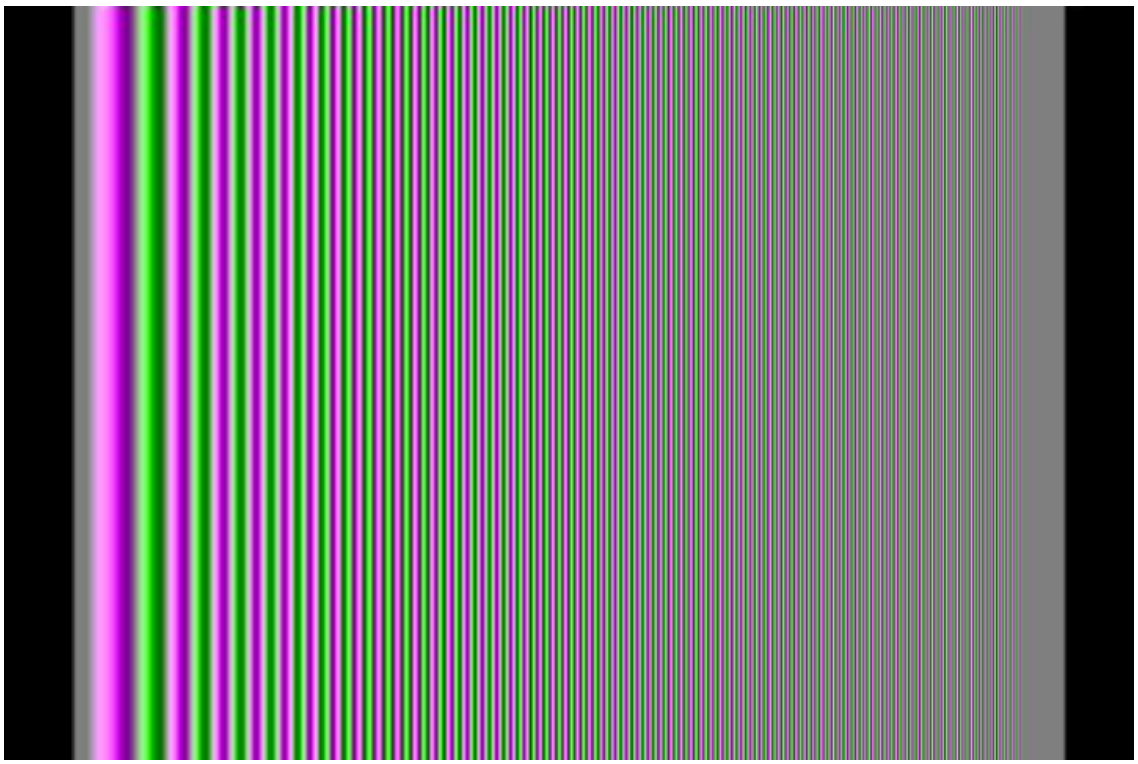


Figure 7 Frequency sweep test image.

Sweep is a swept frequency waveform used for testing the system frequency response.
For PAL/NTSC the frequency range is 0.25MHz to 5.75MHz for luma and 0.125MHz to 2.75MHz for chroma.

Limit Ramp (525i only)

Figure 8 Limit ramp test image.

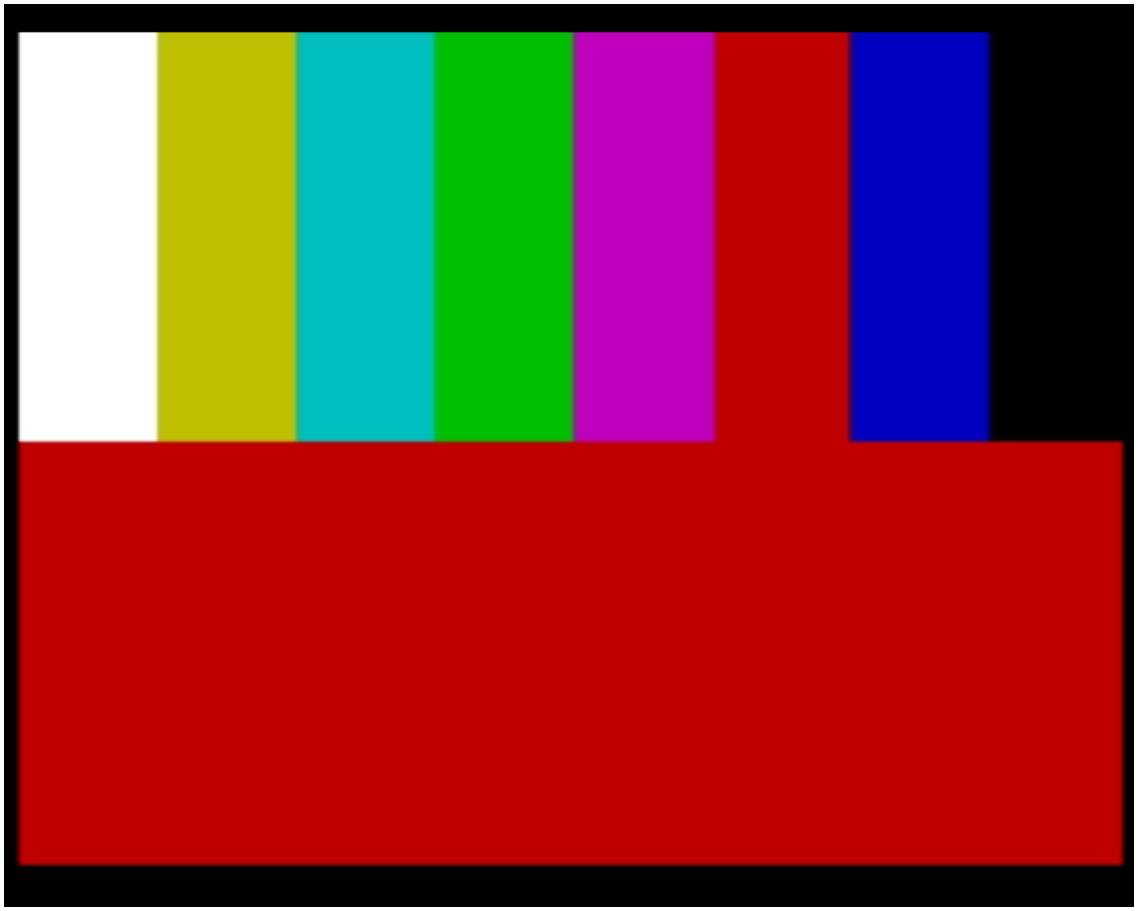
The limit ramp is a linear luma and chroma ramp, incrementing from 64_{10} to 940_{10} across the active picture area. It may be used for noise measurements and linearity tests.

Pedestal (525i) / 50% flat field (625i)

Figure 9 Pedestal and 50% full frame test image.

Pedestal is a full frame 50 IRE (NTSC) or 350mV (50%, PAL) video signal that may be used for noise measurements.

75% Colour bars + Red (625i only)



The top half of this pattern is 75% colour bars, as described above. The bottom half is a 75% saturation red field.

CCIR17 (625i only)

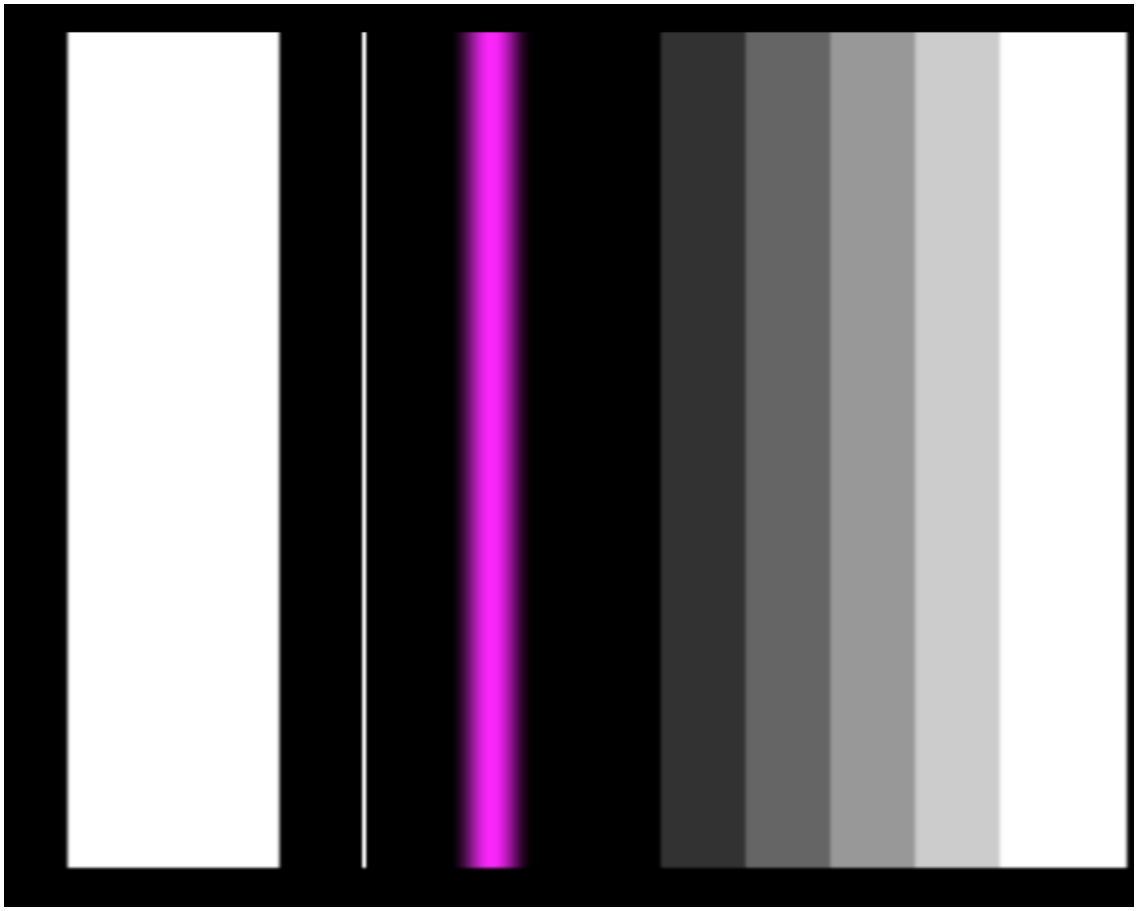


Figure 10 CCIR 17 Test Image.

The CCIR17 pattern consists of a 100% reference luminance bar followed by 2T and 20T pulses and a 5 step luminance staircase. The pattern may be used for the measurement of K-factor, luma/chroma gain/delay and luminance linearity.

The CCIR17 signal is also inserted on line 17 of the output signal by enabling 'VITSOn' in the Setup menu, (default is on).

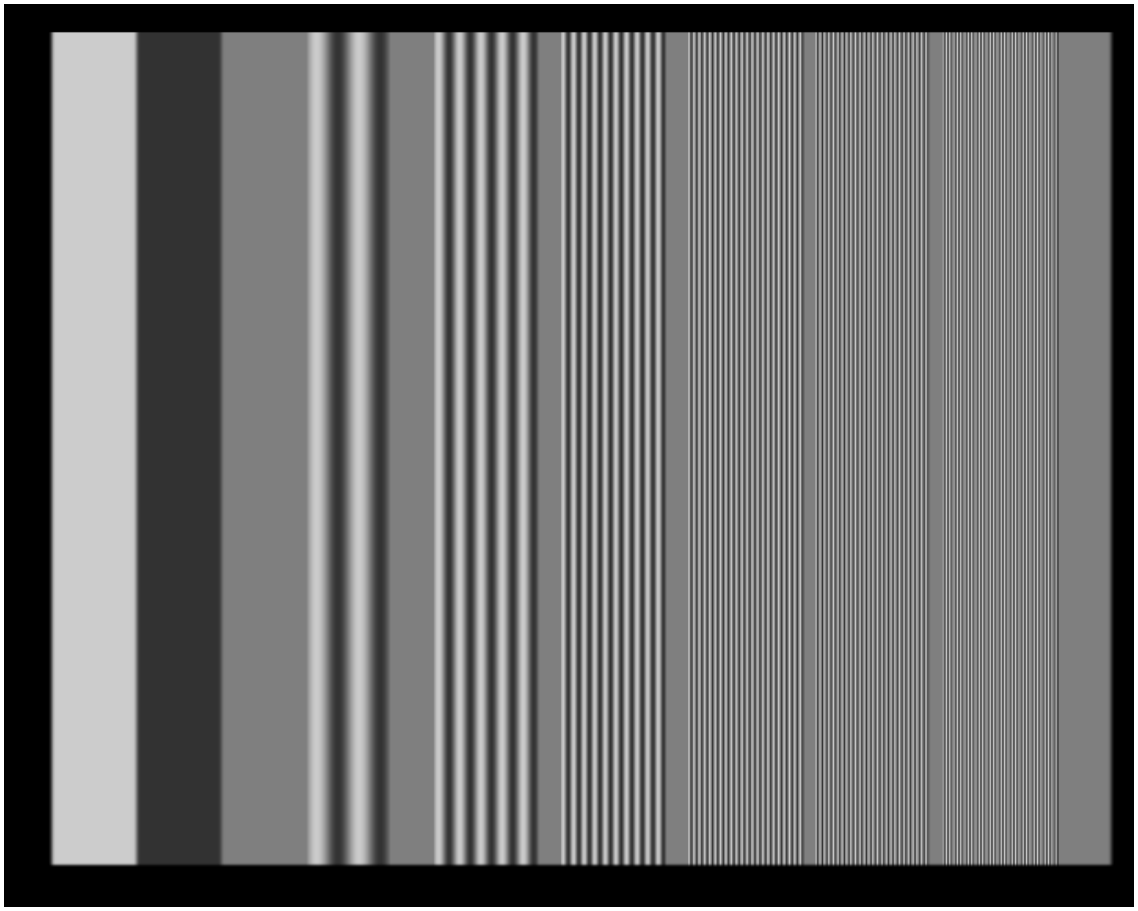


Figure 11 CCIR18 test image.

The CCIR18 pattern is a standard VITS, (Vertical Interval Test Signal), pattern consisting of a luminance reference bar followed by 6 multi-burst packets at 0.5MHz, 1.0MHz, 2.0MHz, 3.0MHz, 4.8MHz and 5.8MHz of 60% amplitude on a 50% pedestal.

The CCIR18 signal is inserted on line 18 of the output signal by enabling 'VITSOn' in the Setup menu, (default is on).

CCIR330

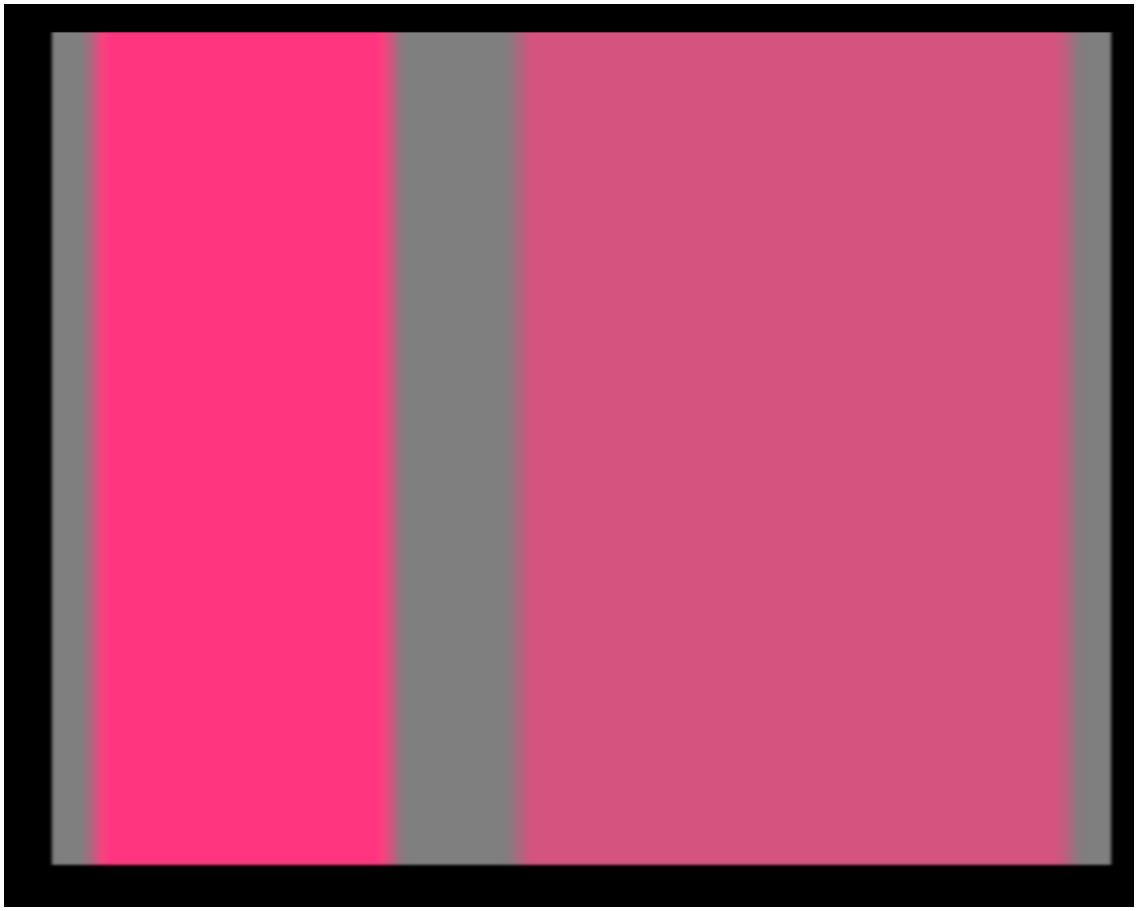


Figure 12 CCIR330 test image.

The CCIR331 signal is used to measure chroma amplitude and phase errors as well as luma/chroma intermodulation. It is a vertical interval test signal (VITS) and is inserted on line 331 of the output signal by enabling 'VITSOn' in the Setup menu, (default is on).

Ramp (PAL only)

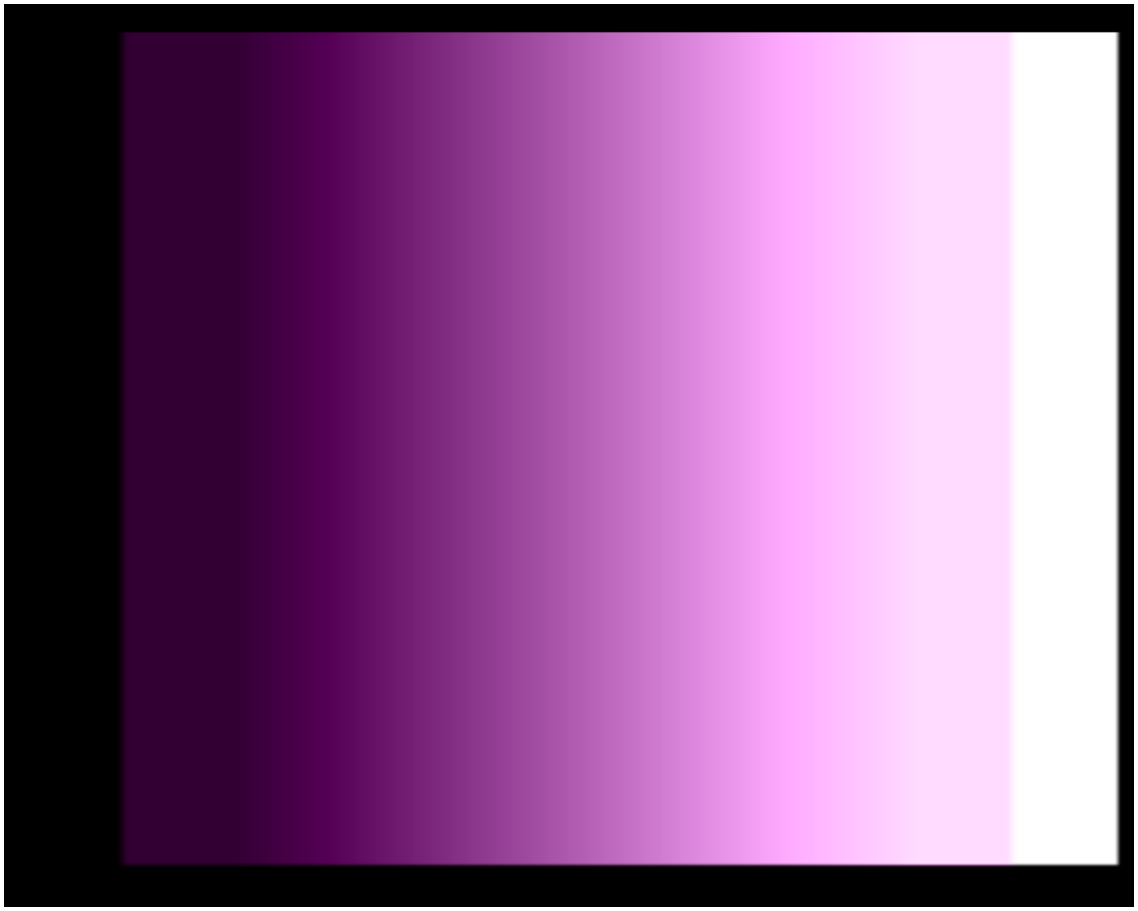


Figure 13 Ramp test image.

HD/aCVi Patterns

75% Colour bars

75% colour bars are used for measuring insertion gain, chroma level and chroma gain and for monitor alignment. The SM01 generates full frame 75% saturated colour bars with a 100% white bar reference. The colour bar sequence is white, yellow, cyan, green, magenta, red, blue and black.

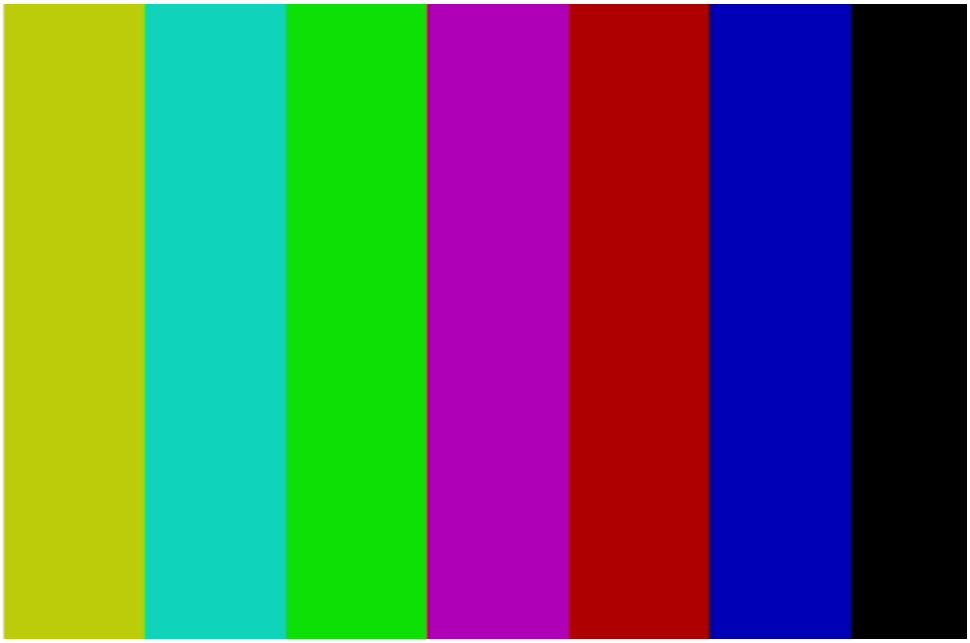


Figure 14 75% colour bar waveform.

100% Colour bars

100% colour bars are used for measuring insertion gain, chroma level and chroma gain and for monitor alignment. The SM01 generates full frame 100% saturated colour bars with a 100% white bar reference. The colour bar sequence is white, yellow, cyan, green, magenta, red, blue and black.

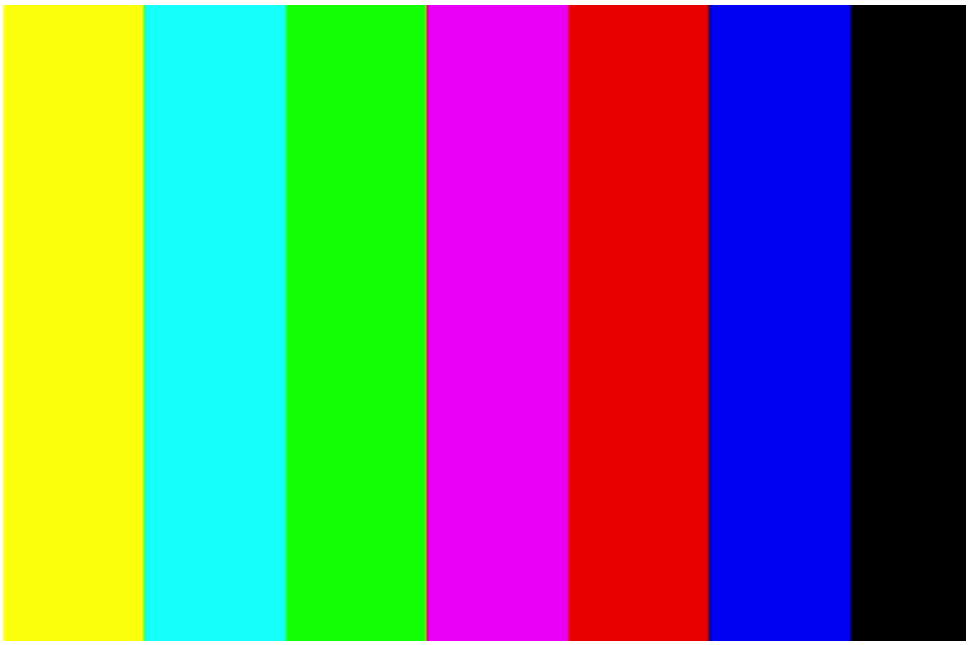


Figure 15 100% colour bars.

SMPTE Colour bars

67% of the SMPTE colour bar waveform comprises 75% colour bars; white, yellow, cyan, green, magenta, red and blue. Below this and comprising 8% of the frame, is a sequence of blue, black,

magenta, black, cyan, black, white bars. The bars are used to set the monitor colour saturation and contrast. Below this is a below black 'pluge' which is used to set the monitor black level.

Figure 16 SMPTE Colour bars.

Black

Black is a full frame 0mV luma only video signal that may be used for noise measurements.

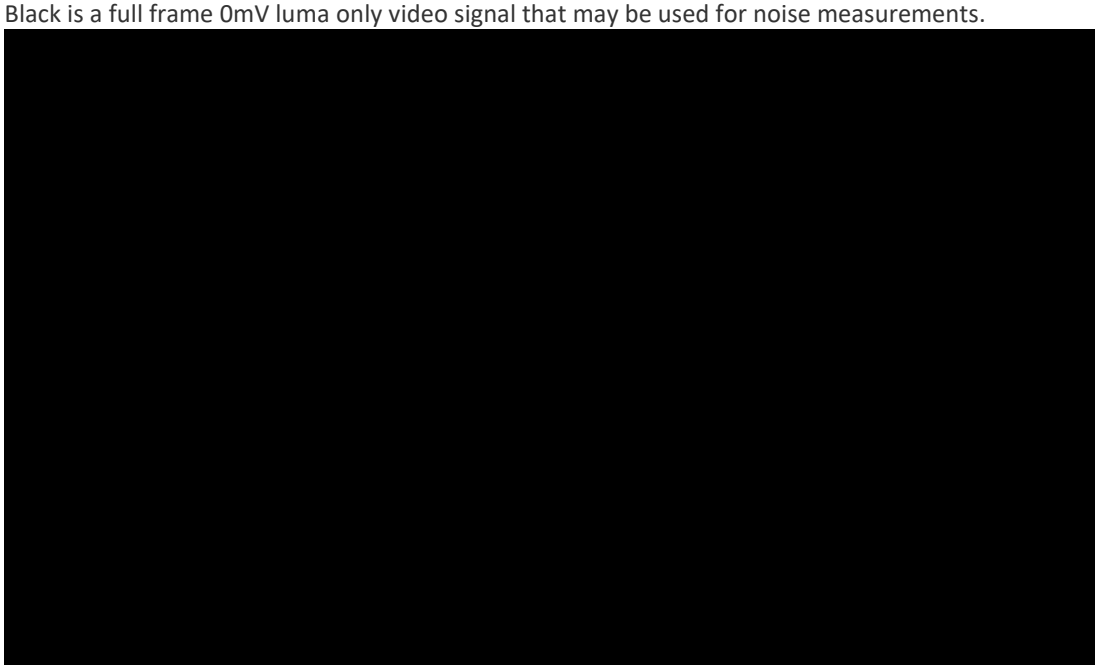


Figure 17 Black flat field.

50% Grey

Pedestal is a full frame 350mV luma only video signal that may be used for noise measurements.

Figure 18 Grey flat field.

White

White is a full frame 700mV luma only video signal that may be used for noise measurements or for finding AC coupling or clamping issues.

Figure 19 White flat field.

Red

Red is a full frame 75% saturated red video signal.

Figure 20 Red flat field.

Green

Green is a full frame 75% saturated green video signal.

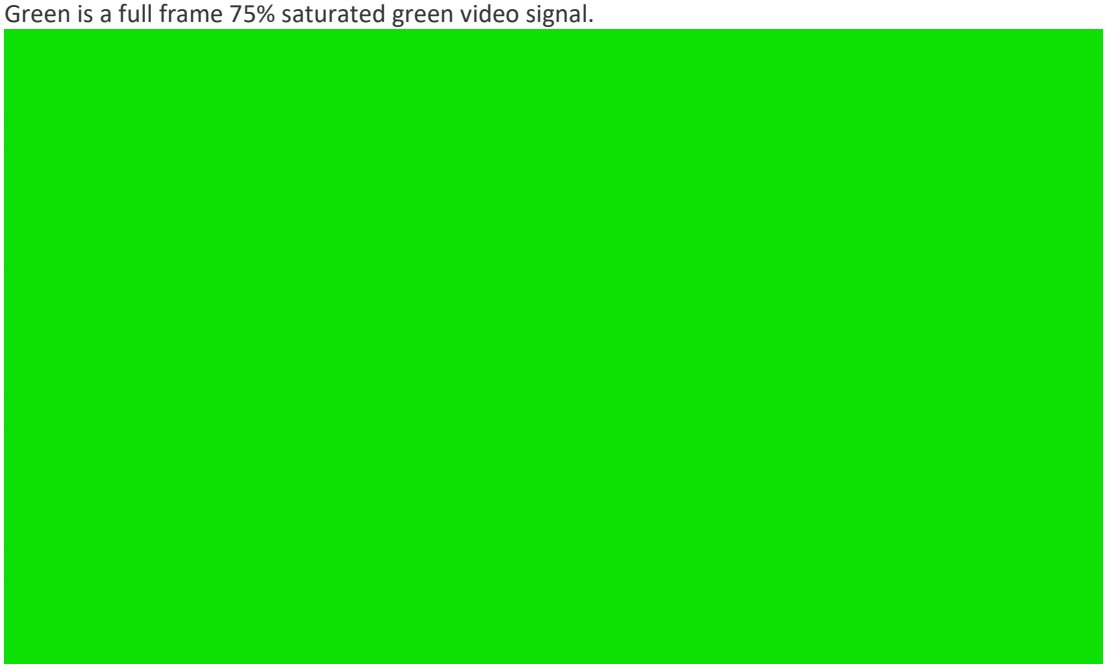


Figure 21 Green flat field.

Blue

Blue is a full frame 75% saturated blue video signal.

Figure 22 Blue flat field.

Ramp

This waveform is a linear modulated ramp and may be used to measure linearity or signal to noise ratio.

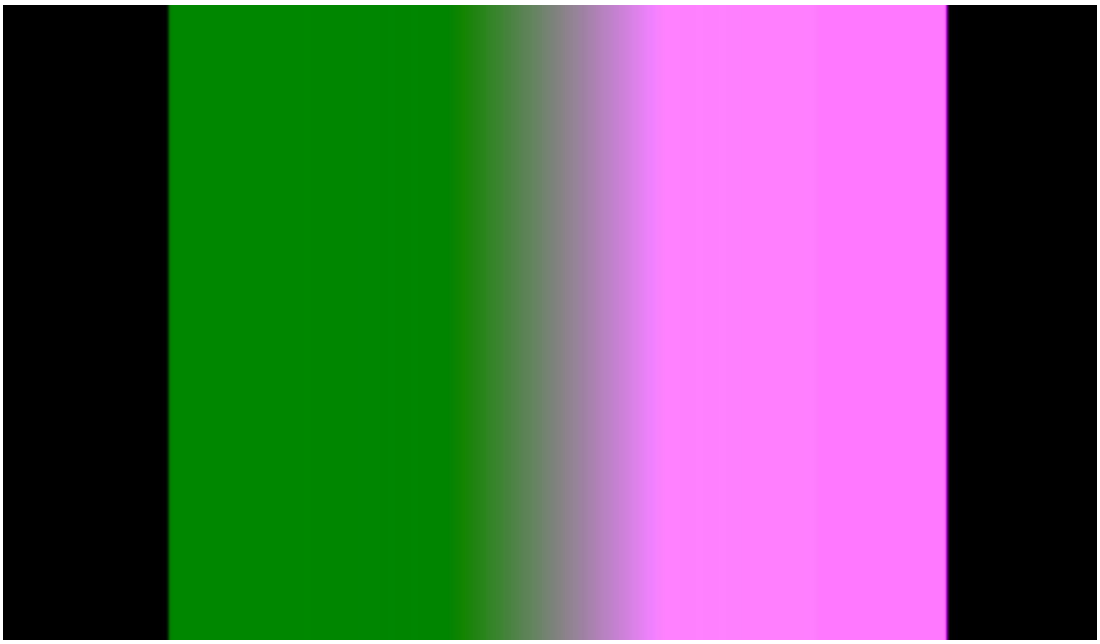


Figure 23 Modulated ramp.

5-step staircase

This waveform is five, equal amplitude, steps of luma and chroma and may be used to measure linearity.

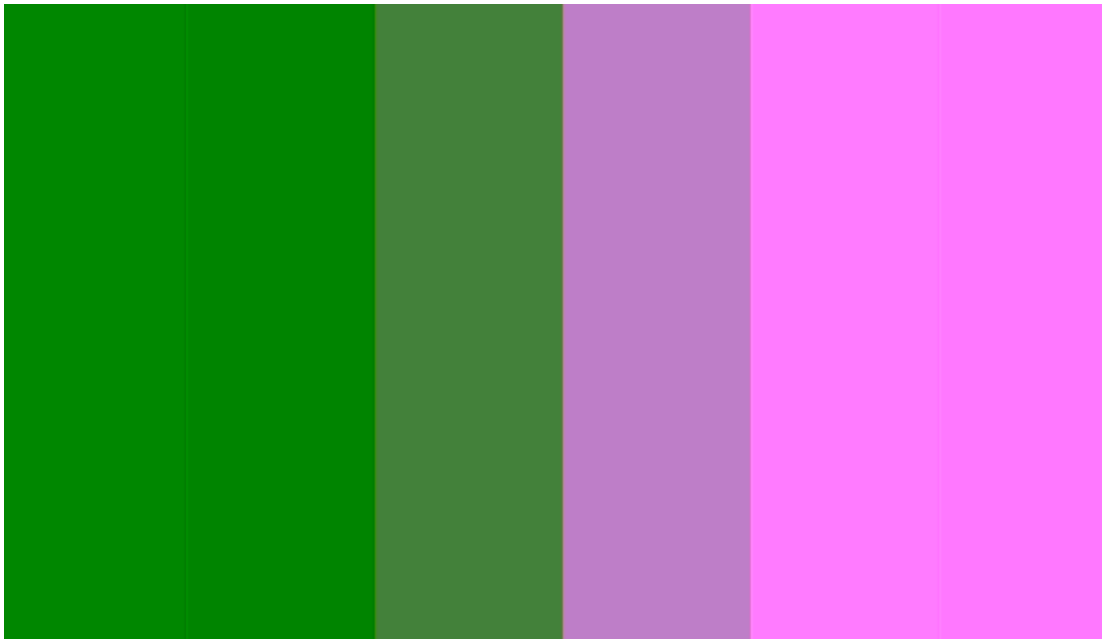


Figure 24 5-step modulated staircase.

2T30T

This waveform is a pulse/bar waveform consisting of a 2T wide pulse, a 12.5T wide pulse, a 30T wide pulse and a white bar. This test signal is used to measure the pulse response of the video path where ringing of pulses, or asymmetry indicate possible problems. 2T is the minimum pulse width permissible in the HD video stream.

Figure 25 2T, 30T pulse bar.

Multiburst

The Multiburst waveform is used to measure frequency response. It consists of a reference amplitude bar and six packets of 5MHz, 10MHz, 15MHz, 20MHz, 25MHz and 30MHz for the luma channel and 2.5MHz, 5MHz, 7.5MHz, 10MHz, 12.5MHz and 15MHz for the chroma channels.

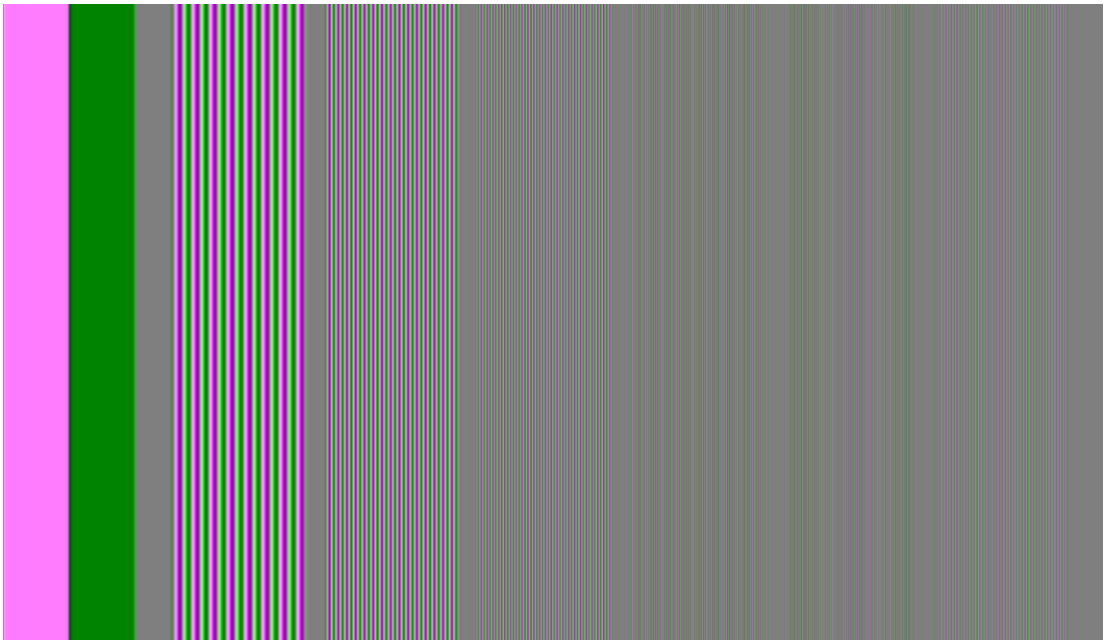


Figure 26 Multiburst.

15MHz sweep.

This waveform is a 1MHz to 15MHz frequency sweep for the luma channel, and a 0.5MHz to 7.5MHz frequency sweep for the chroma channels.

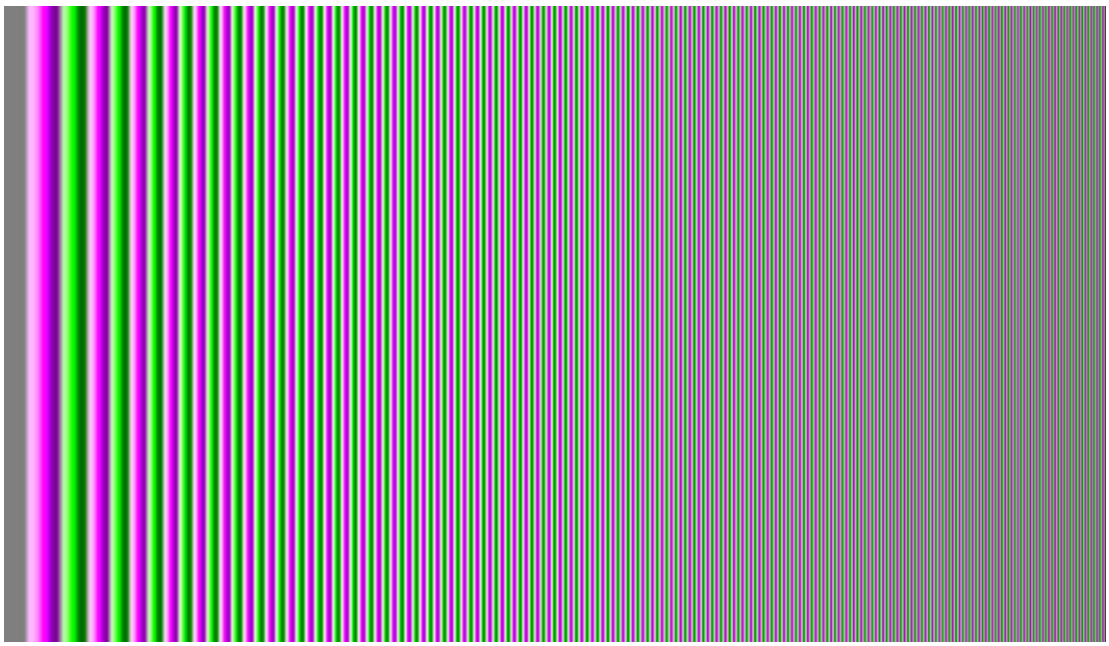


Figure 27 15MHz frequency sweep.

30MHz sweep

This waveform is a 1MHz to 30MHz frequency sweep for the luma channel, and a 0.5MHz to 15MHz frequency sweep for the chroma channels. These frequencies are the limits of the SMPTE-296M specification for HD video.
At the bottom of the waveform are 5 markers which indicate the 5MHz,10MHz,15MHz, 20MHz and 25MHz frequencies for luma and the 2.5MHz, 5MHz, 7.5MHz, 10MHz and 12.5MHz frequencies for chroma.

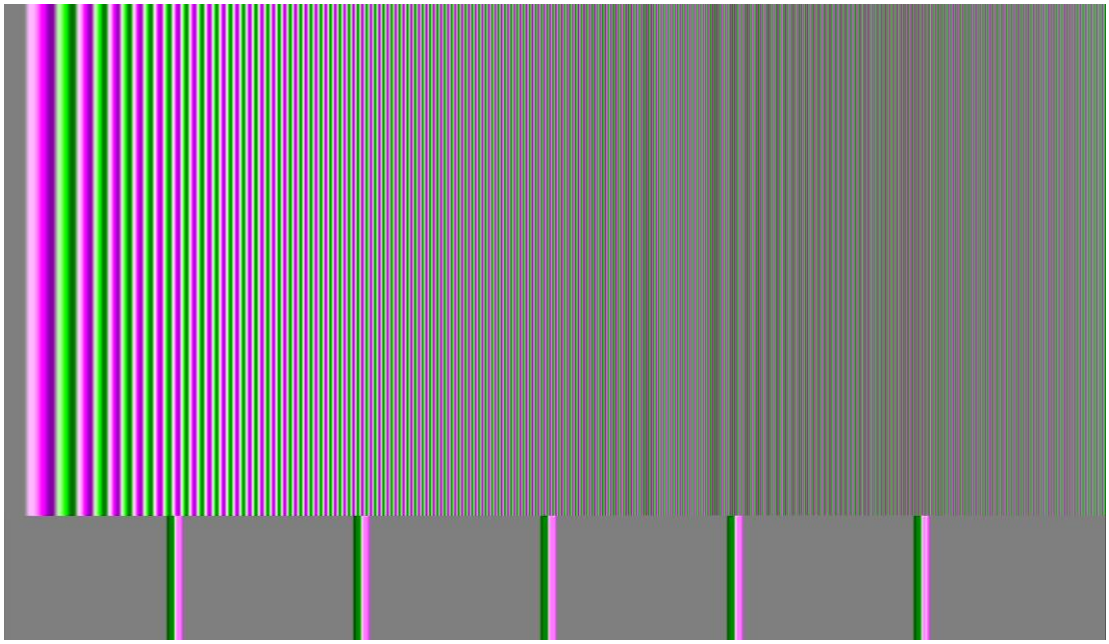


Figure 28 30MHz frequency sweep.

Crosshatch

The crosshatch pattern is a grid of 23 x 11 (1080 line) or 21 x 11 (720 line) lines which may be used for monitor alignment and positioning.

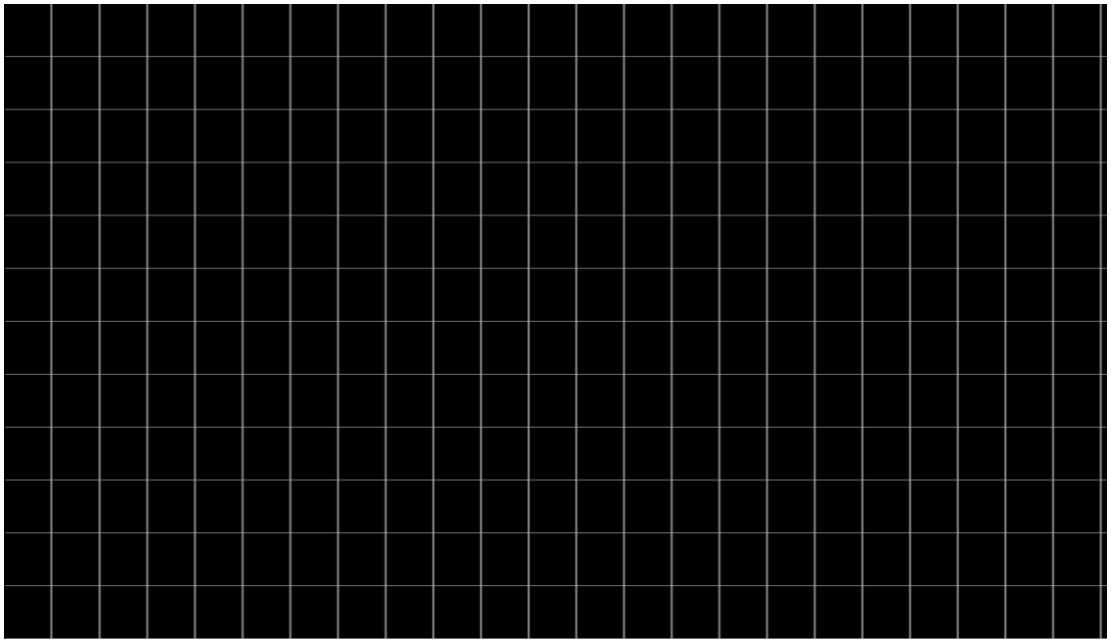


Figure 29 Crosshatch.

Pathological

The SDI PLL test signal is intended to test the SDI input receiver.

The top half consists of a repetitive active line pattern of values Y=198h and C=300h. After scrambling this results in either 19 ‘ones’ followed by one ‘zero’ or 19 ‘zeros’ followed by one ‘one’. This output stresses the equalizer because of its low frequency content.

The bottom half consists of a repetitive active line pattern of values Y=110h and C=200h. This results in an output with 20 ‘zeros’ followed by 20 ‘ones’. This bit pattern tests the receiver PLL because of the low transition frequency of edges in the data.

Figure 30 SDI Pathological.

Matrix

The matrix test signal comprises five equally spaced patterns in one combination test signal that permits a single test signal analysis of a video component or system. The five signals are: 75% colour bars, 5 step modulated staircase, 2T/20T pulse and bar, luma multi-burst and modulated ramp.

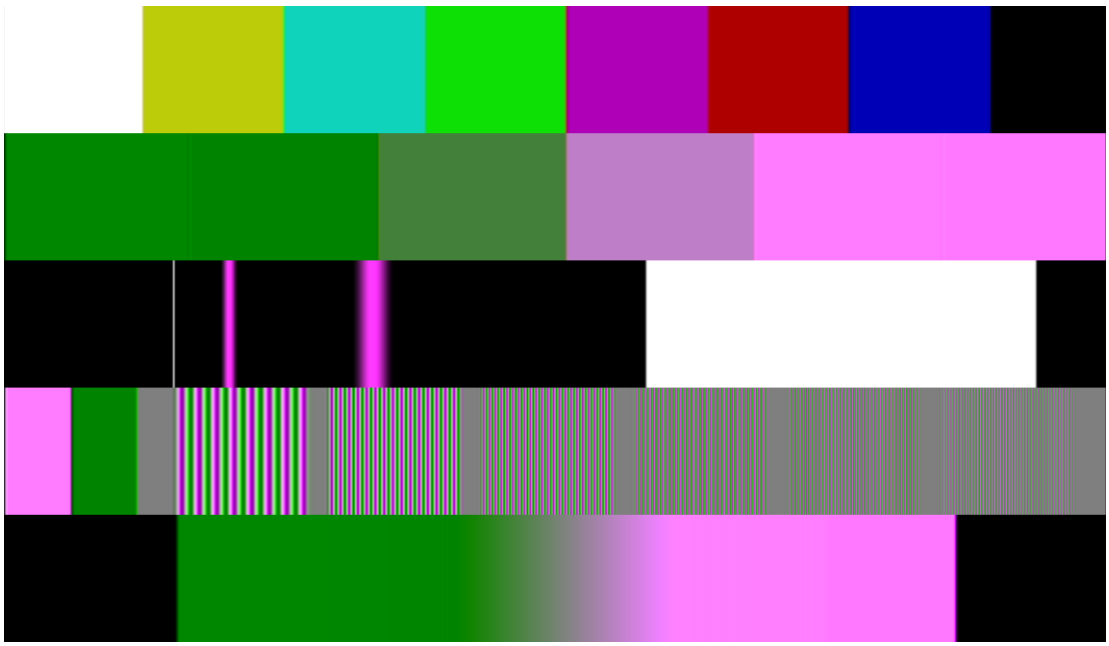


Figure 31 Matrix.

Zone Plate

The zone plate is a two-dimensional linear frequency sweep with the highest frequencies at the edges of the image. It can be used to measure the horizontal and vertical frequency response of system. Attenuation on the left and right edges of the image show low pass filtering of the image; attenuation of the top and bottom of the image show vertical filtering, perhaps line to line averaging or issues with a scaler or de-interlacer.
The zone plate is very useful for designing and testing composite analogue video decoders, including the new HD composite standards (see Figure 20).

The zone plate's use is not just restricted to analogue video decoding. Any video processing, SD or HD, which manipulates the image spatially and/or temporally can be tested to breaking point with the zone plate: such processing includes video standards conversion, de-interlacing and scaling.

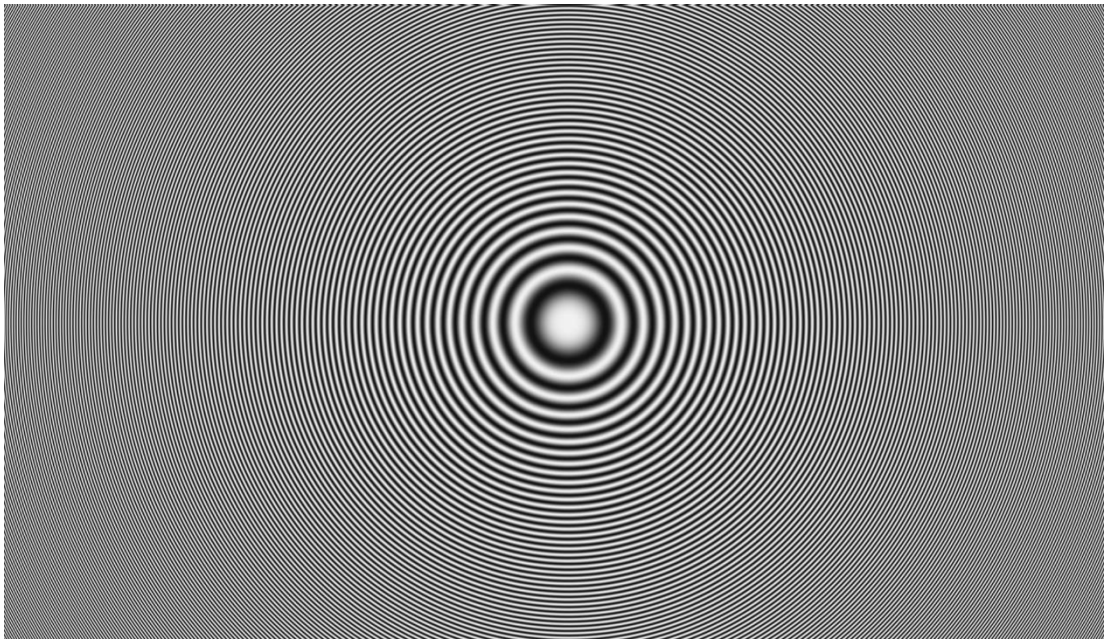


Figure 32 Zone plate.

5. SDI Output

The SDI output measurements, (measured using a Tektronix WFM700M), are shown in Figures 33 to 36.

Figure 33 SDI output 525i line format measurement

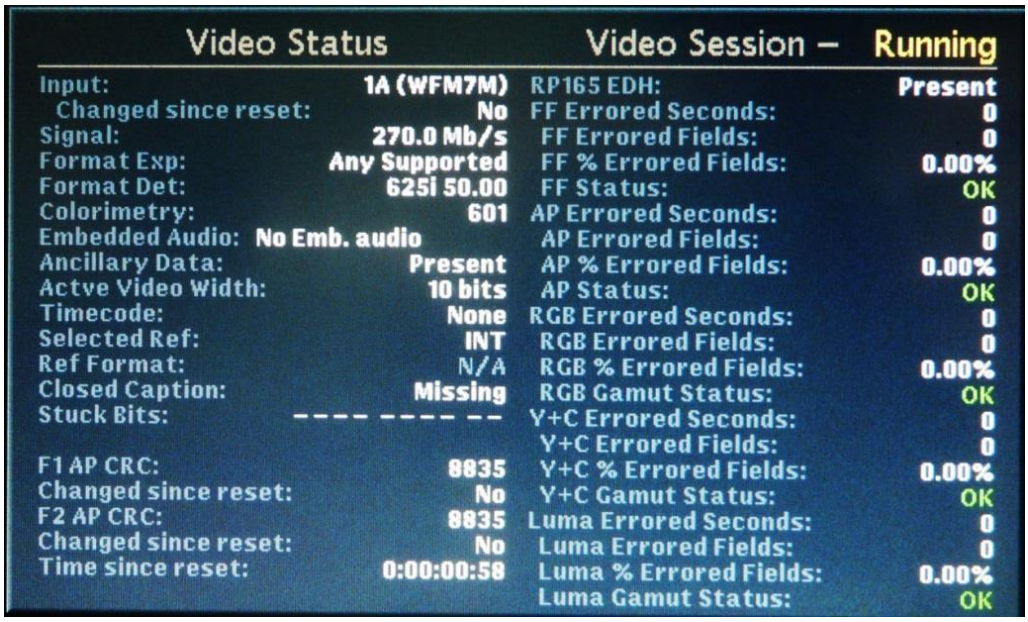


Figure 34 SDI output 625i line format measurement

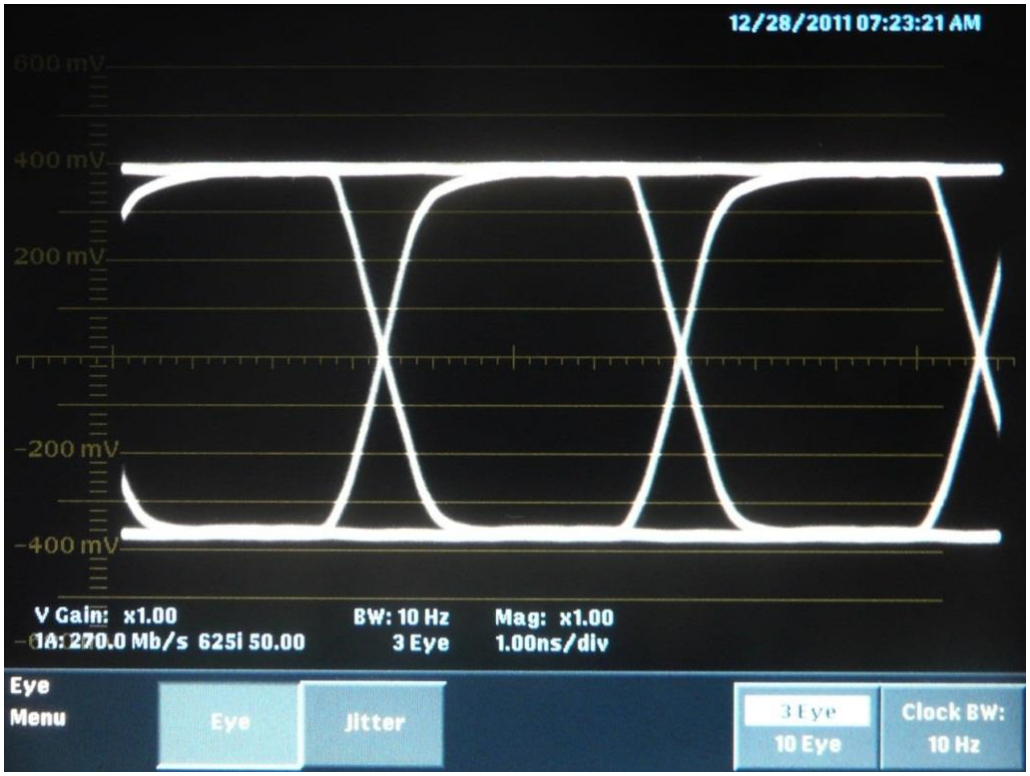


Figure 35 SDI output 625i line eye pattern

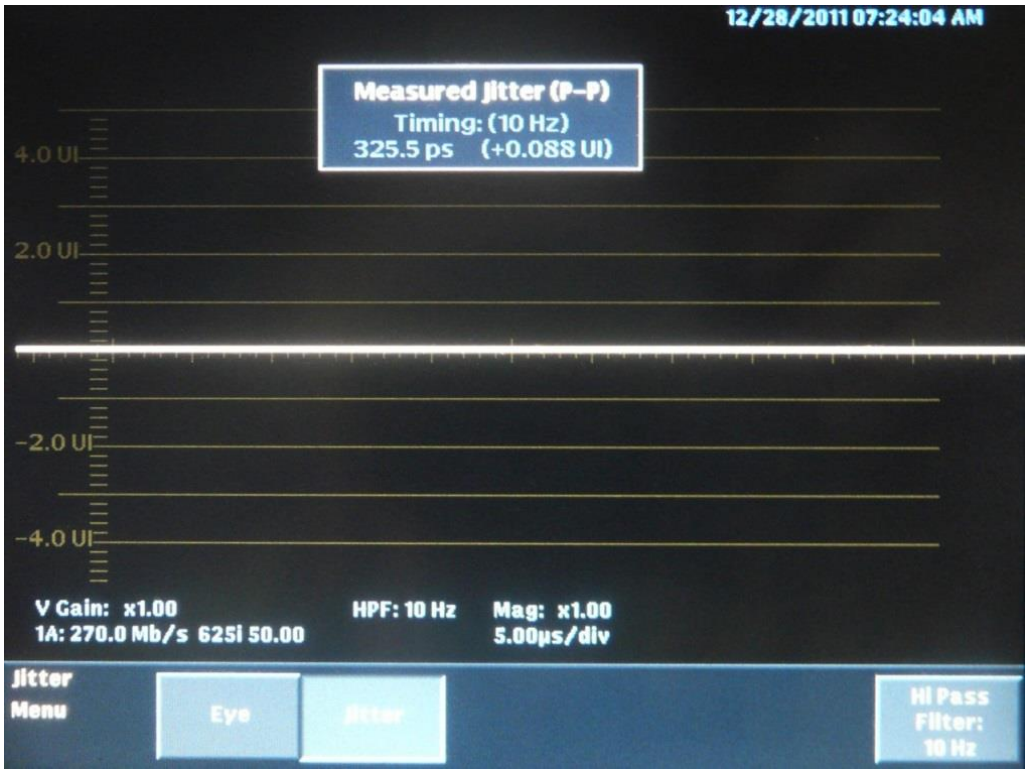


Figure 36 SDI output 625i line jitter measurement.

Appendix A: Power supply specification

The AC-DC converter supplied with the SM01 is a model TE10A0503F01 from SL Power Electronics. It accepts all AC inputs from 90-264VAC and provides a 5V, 2A DC output for the SM01. The detailed specification is shown below.

SL POWER ELECTRONICS

TE10 Family 10W~12W Single Output External Power Industrial Grade

Industrial

FEATURES AND BENEFITS

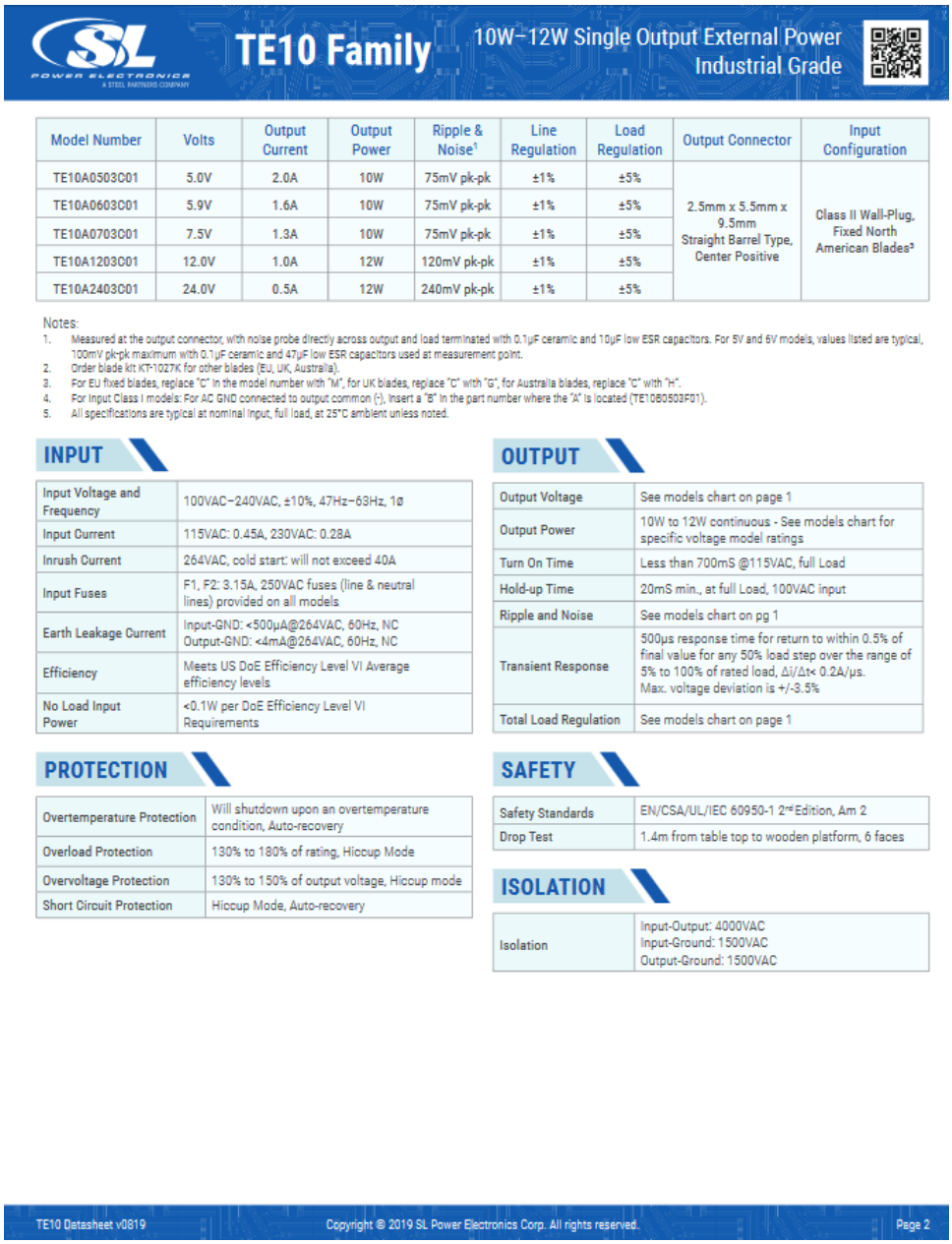
Universal Input 90VAC~264VAC Input Range Desktop and Wall-Plug Versions	Meets "Heavy Industrial" Levels of EN61000 EMC Requirements
Up to 12W of AC-DC Power	>10 Year E-Cap Life
IP22 Rated Enclosure	>1,000,000 Hours MTBF
Approved to EN/IEC/UL60950-1 2nd Edition, Am.2	3 Year Warranty
Meets EN55022/CISPR22, FCC Part 15.109 Class B Conducted & Radiated Emissions, with 6db Margin	Meets DoE Efficiency Level VI Requirements No Load Input Power Average Efficiency

RoHS CE LPS VI AULT LEVEL VI EFFICIENCY ERP & DMC

MODEL SELECTION

Model Number	Volts	Output Current	Output Power	Ripple & Noise[1]	Line Regulation	Load Regulation	Output Connector	Input Configuration
TE10A0503F01	5.0V	2.0A	10W	75mV pk-pk	±1%	±5%	2.5mm x 5.5mm x 9.5mm Straight Barrel Type, Center Positive	Class I Desktop, IEC60320 C14 Receptacle
TE10A0603F01	5.9V	1.6A	10W	75mV pk-pk	±1%	±5%		
TE10A0703F01	7.5V	1.3A	10W	75mV pk-pk	±1%	±5%		
TE10A1203F01	12.0V	1.0A	12W	120mV pk-pk	±1%	±5%		
TE10A2403F01	24.0V	0.5A	12W	240mV pk-pk	±1%	±5%		
TE10A0503N01	5.0V	2.0A	10W	75mV pk-pk	±1%	±5%	2.5mm x 5.5mm x 9.5mm Straight Barrel Type, Center Positive	Class II Desktop, IEC60320 C8 Receptacle
TE10A0603N01	5.9V	1.6A	10W	75mV pk-pk	±1%	±5%		
TE10A0703N01	7.5V	1.3A	10W	75mV pk-pk	±1%	±5%		
TE10A1203N01	12.0V	1.0A	12W	120mV pk-pk	±1%	±5%		
TE10A2403N01	24.0V	0.5A	12W	240mV pk-pk	±1%	±5%		
TE10A0503Q01	5.0V	2.0A	10W	75mV pk-pk	±1%	±5%	2.5mm x 5.5mm x 9.5mm Straight Barrel Type, Center Positive	Class II Desktop, IEC60320 C18 Receptacle
TE10A0603Q01	5.9V	1.6A	10W	75mV pk-pk	±1%	±5%		
TE10A0703Q01	7.5V	1.3A	10W	75mV pk-pk	±1%	±5%		
TE10A1203Q01	12.0V	1.0A	12W	120mV pk-pk	±1%	±5%		
TE10A2403Q01	24.0V	0.5A	12W	240mV pk-pk	±1%	±5%		
TE10A0503B01	5.0V	2.0A	10W	75mV pk-pk	±1%	±5%	2.5mm x 5.5mm x 9.5mm Straight Barrel Type, Center Positive	Class II Wall-Plug, Interchangeable Blades (North American Blade included)[2]
TE10A0603B01	5.9V	1.6A	10W	75mV pk-pk	±1%	±5%		
TE10A0703B01	7.5V	1.3A	10W	75mV pk-pk	±1%	±5%		
TE10A1203B01	12.0V	1.0A	12W	120mV pk-pk	±1%	±5%		
TE10A2403B01	24.0V	0.5A	12W	240mV pk-pk	±1%	±5%		

Figure 37 Power supply specification - page 1.



SL POWER ELECTRONICS
A STEEL PARTNERS COMPANY

TE10 Family

10W–12W Single Output External Power
Industrial Grade

Model Number	Volts	Output Current	Output Power	Ripple & Noise[1]	Line Regulation	Load Regulation	Output Connector	Input Configuration
TE10A0503C01	5.0V	2.0A	10W	75mV pk-pk	±1%	±5%	2.5mm x 5.5mm x 9.5mm Straight Barrel Type, Center Positive	Class II Wall-Plug, Fixed North American Blades[3]
TE10A0603C01	5.9V	1.6A	10W	75mV pk-pk	±1%	±5%		
TE10A0703C01	7.5V	1.3A	10W	75mV pk-pk	±1%	±5%		
TE10A1203C01	12.0V	1.0A	12W	120mV pk-pk	±1%	±5%		
TE10A2403C01	24.0V	0.5A	12W	240mV pk-pk	±1%	±5%		

Notes:
1. Measured at the output connector, with noise probe directly across output and load terminated with 0.1µF ceramic and 10µF low ESR capacitors. For 5V and 6V models, values listed are typical, 100mV pk-pk maximum with 0.1µF ceramic and 47µF low ESR capacitors used at measurement point.
2. Order blade kit KT-1027K for other blades (EU, UK, Australia).
3. For EU fixed blades, replace "C" in the model number with "M", for UK blades, replace "C" with "G", for Australia blades, replace "C" with "H".
4. For Input Class I models: For AC GND connected to output common (-), insert a "B" in the part number where the "A" is located (TE10B0503F01).
5. All specifications are typical at nominal input, full load, at 25°C ambient unless noted.

INPUT

Input Voltage and Frequency	100VAC–240VAC, ±10%, 47Hz–63Hz, 1Ø
Input Current	115VAC: 0.45A, 230VAC: 0.28A
Inrush Current	264VAC, cold start: will not exceed 40A
Input Fuses	F1, F2: 3.15A, 250VAC fuses (line & neutral lines) provided on all models
Earth Leakage Current	Input-GND: <500µA@264VAC, 60Hz, NC Output-GND: <4mA@264VAC, 60Hz, NC
Efficiency	Meets US DoE Efficiency Level VI Average efficiency levels
No Load Input Power	<0.1W per DoE Efficiency Level VI Requirements

OUTPUT

Output Voltage	See models chart on page 1
Output Power	10W to 12W continuous - See models chart for specific voltage model ratings
Turn On Time	Less than 700mS @115VAC, full Load
Hold-up Time	20mS min., at full Load, 100VAC input
Ripple and Noise	See models chart on pg 1
Transient Response	500µs response time for return to within 0.5% of final value for any 50% load step over the range of 5% to 100% of rated load, Δi/Δt< 0.2A/µs. Max. voltage deviation is +/-3.5%
Total Load Regulation	See models chart on page 1

PROTECTION

Overtemperature Protection	Will shutdown upon an overtemperature condition, Auto-recovery
Overload Protection	130% to 180% of rating, Hiccup Mode
Overvoltage Protection	130% to 150% of output voltage, Hiccup mode
Short Circuit Protection	Hiccup Mode, Auto-recovery

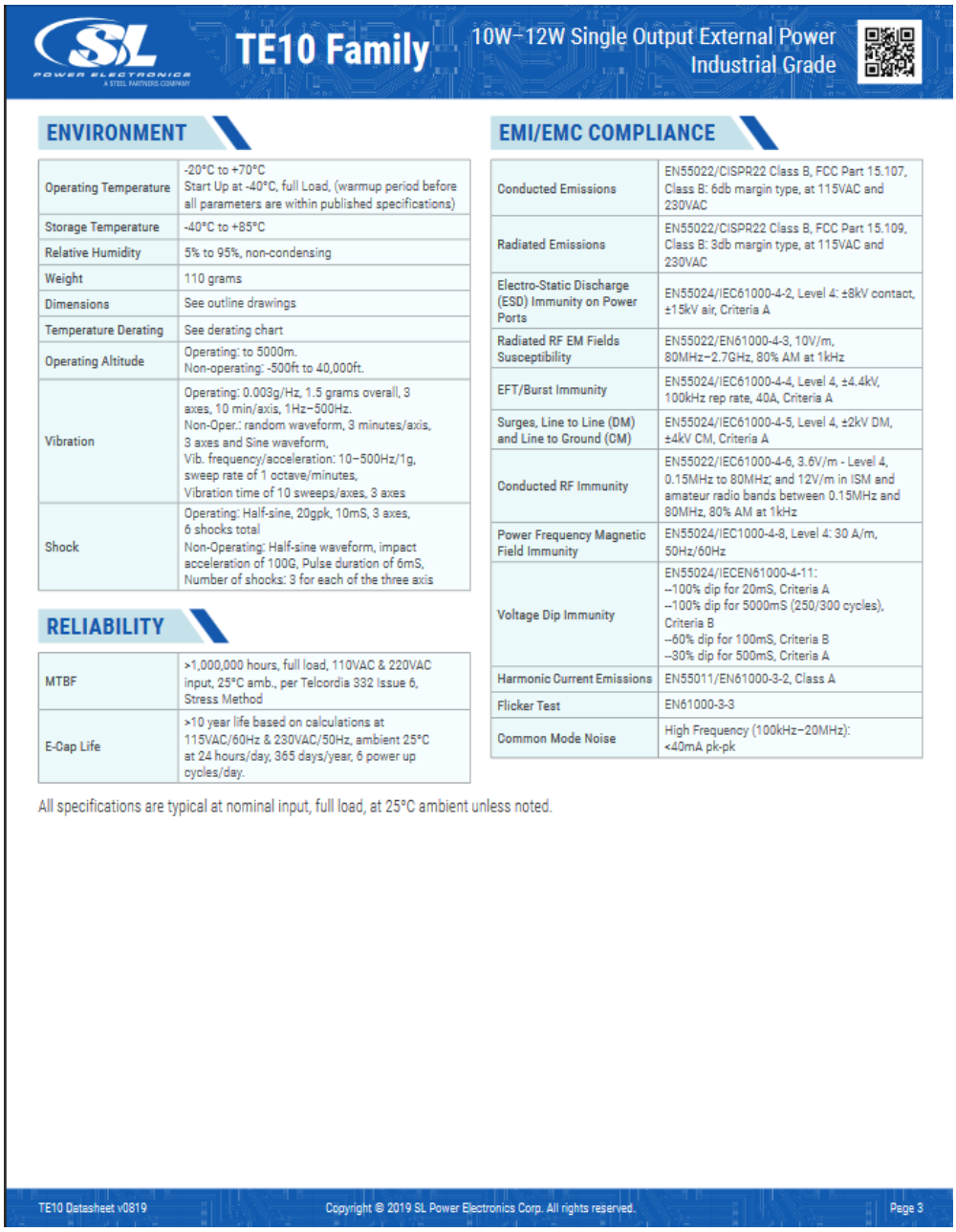
SAFETY

Safety Standards	EN/CSA/UL/IEC 60950-1 2nd Edition, Am 2
Drop Test	1.4m from table top to wooden platform, 6 faces

ISOLATION

Isolation	Input-Output: 4000VAC Input-Ground: 1500VAC Output-Ground: 1500VAC

Figure 38 Power supply specification - page 2.



TE10 Family

10W–12W Single Output External Power
Industrial Grade

ENVIRONMENT

Operating Temperature	-20°C to +70°C Start Up at -40°C, full Load, (warmup period before all parameters are within published specifications)
Storage Temperature	-40°C to +85°C
Relative Humidity	5% to 95%, non-condensing
Weight	110 grams
Dimensions	See outline drawings
Temperature Derating	See derating chart
Operating Altitude	Operating: to 5000m. Non-operating: -500ft to 40,000ft.
Vibration	Operating: 0.003g/Hz, 1.5 grams overall, 3 axes, 10 min/axis, 1Hz–500Hz. Non-Oper.: random waveform, 3 minutes/axis, 3 axes and Sine waveform, Vib. frequency/acceleration: 10–500Hz/1g, sweep rate of 1 octave/minutes, Vibration time of 10 sweeps/axes, 3 axes
Shock	Operating: Half-sine, 20gpk, 10mS, 3 axes, 6 shocks total Non-Operating: Half-sine waveform, impact acceleration of 100G, Pulse duration of 6mS, Number of shocks: 3 for each of the three axis

RELIABILITY

MTBF	>1,000,000 hours, full load, 110VAC & 220VAC input, 25°C amb., per Telcordia 332 Issue 6, Stress Method
E-Cap Life	>10 year life based on calculations at 115VAC/60Hz & 230VAC/50Hz, ambient 25°C at 24 hours/day, 365 days/year, 6 power up cycles/day.

EMI/EMC COMPLIANCE

Conducted Emissions	EN55022/CISPR22 Class B, FCC Part 15.107, Class B: 6db margin type, at 115VAC and 230VAC
Radiated Emissions	EN55022/CISPR22 Class B, FCC Part 15.109, Class B: 3db margin type, at 115VAC and 230VAC
Electro-Static Discharge (ESD) Immunity on Power Ports	EN55024/IEC61000-4-2, Level 4: ±8kV contact, ±15kV air, Criteria A
Radiated RF EM Fields Susceptibility	EN55022/EN61000-4-3, 10V/m, 80MHz–2.7GHz, 80% AM at 1kHz
EFT/Burst Immunity	EN55024/IEC61000-4-4, Level 4, ±4.4kV, 100kHz rep rate, 40A, Criteria A
Surges, Line to Line (DM) and Line to Ground (CM)	EN55024/IEC61000-4-5, Level 4, ±2kV DM, ±4kV CM, Criteria A
Conducted RF Immunity	EN55022/IEC61000-4-6, 3.6V/m - Level 4, 0.15MHz to 80MHz; and 12V/m in ISM and amateur radio bands between 0.15MHz and 80MHz, 80% AM at 1kHz
Power Frequency Magnetic Field Immunity	EN55024/IEC1000-4-8, Level 4: 30 A/m, 50Hz/60Hz
Voltage Dip Immunity	EN55024/IECEN61000-4-11: –100% dip for 20mS, Criteria A –100% dip for 5000mS (250/300 cycles), Criteria B –60% dip for 100mS, Criteria B –30% dip for 500mS, Criteria A
Harmonic Current Emissions	EN55011/EN61000-3-2, Class A
Flicker Test	EN61000-3-3
Common Mode Noise	High Frequency (100kHz–20MHz): <40mA pk-pk

All specifications are typical at nominal input, full load, at 25°C ambient unless noted.

Figure 39 Power supply specification - page 3.

Appendix B: SM01 Schematics

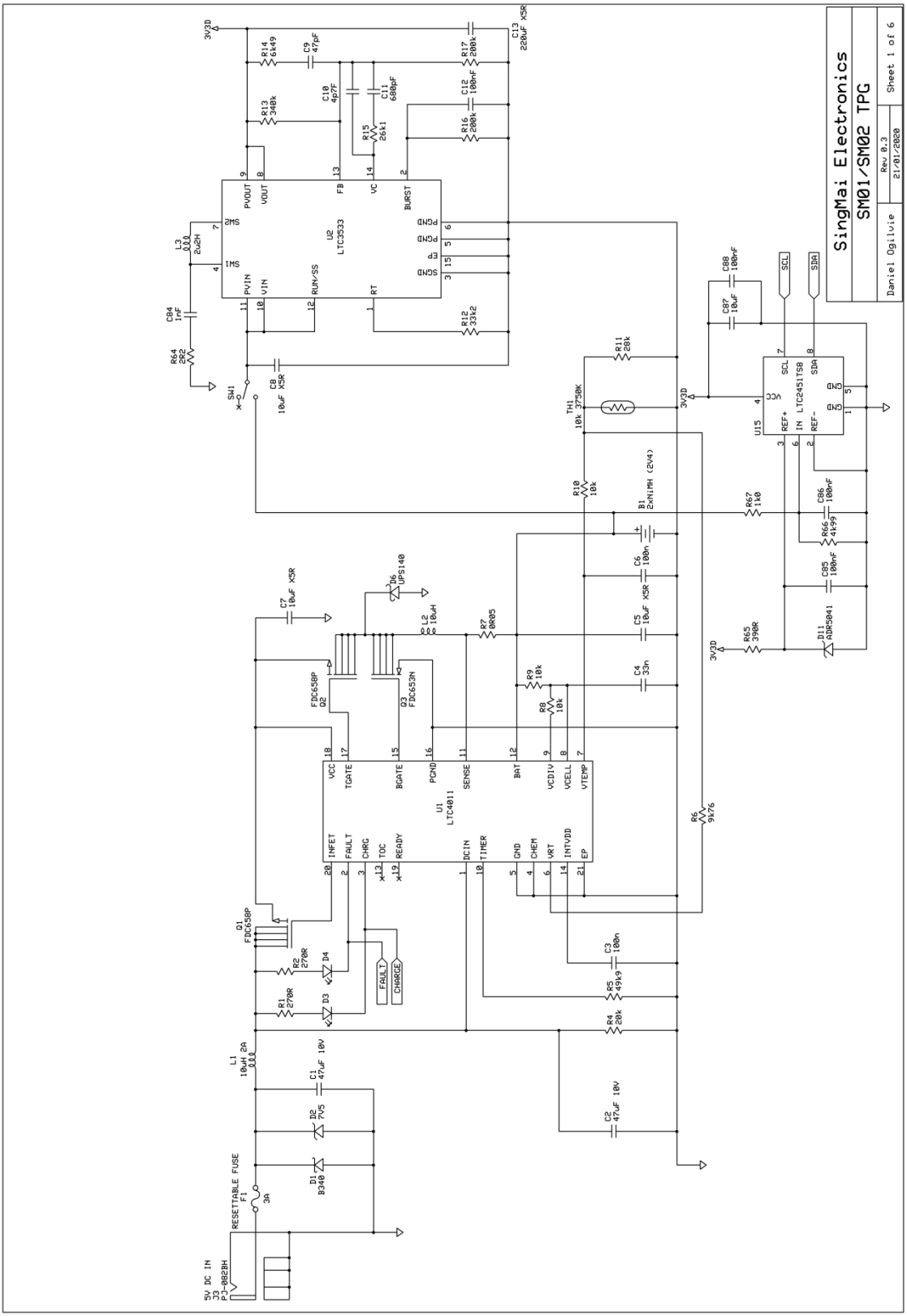


Figure 40 SM01 Schematics Sheet 1 – Battery control.

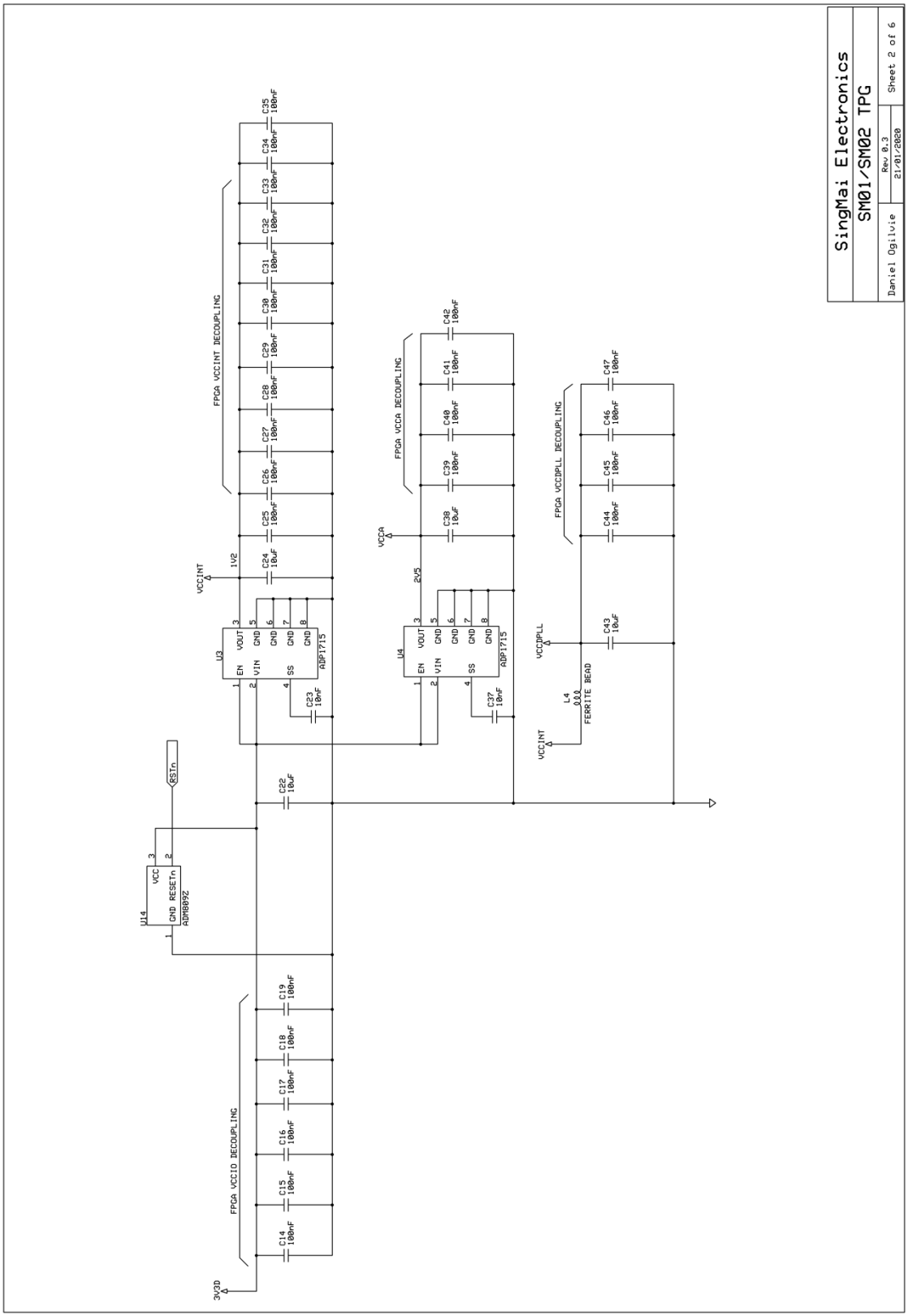


Figure 41 SM01 Schematics Sheet 2 Power supplies.

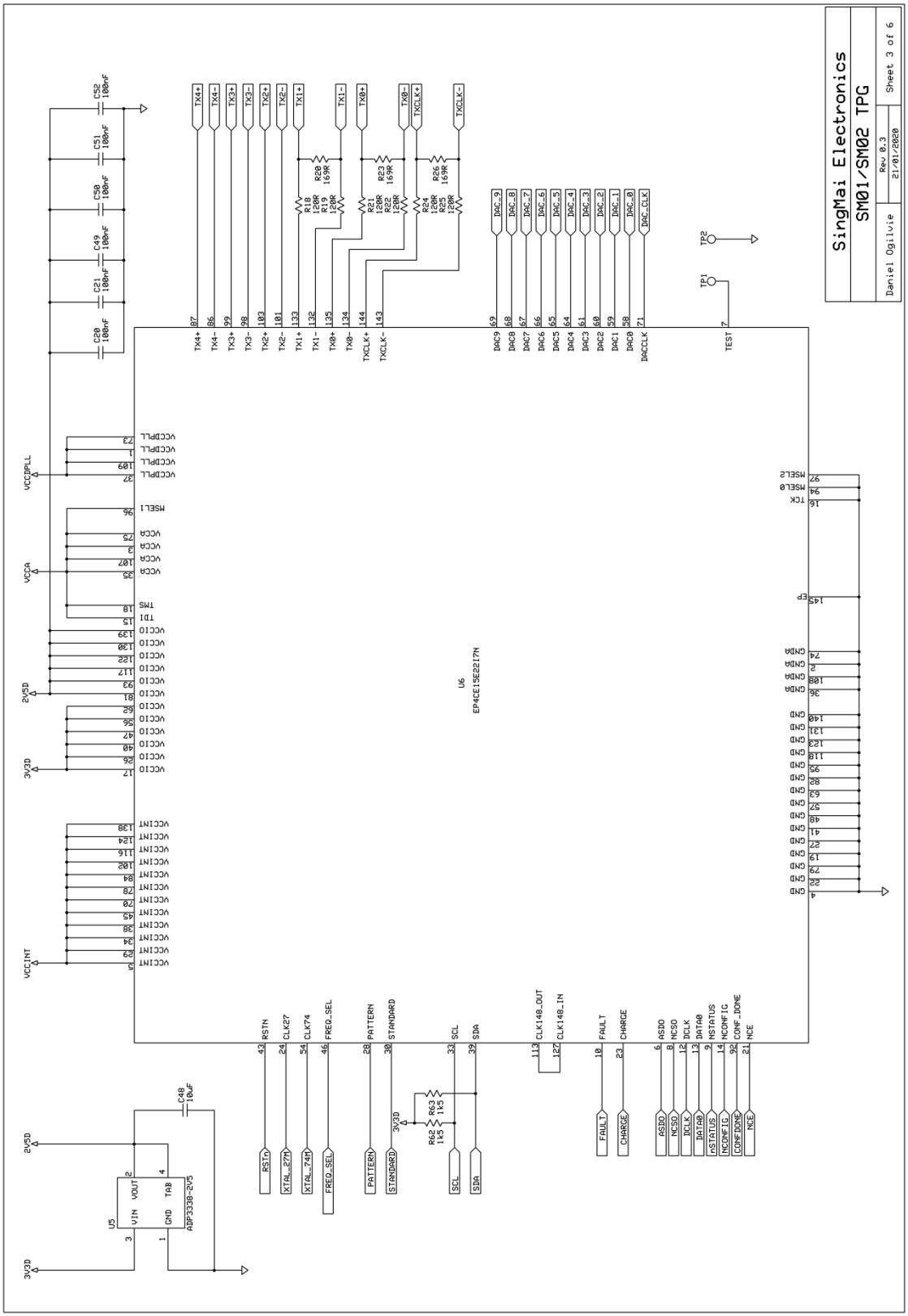


Figure 42 SM01 Schematics Sheet 3 - FPGA.

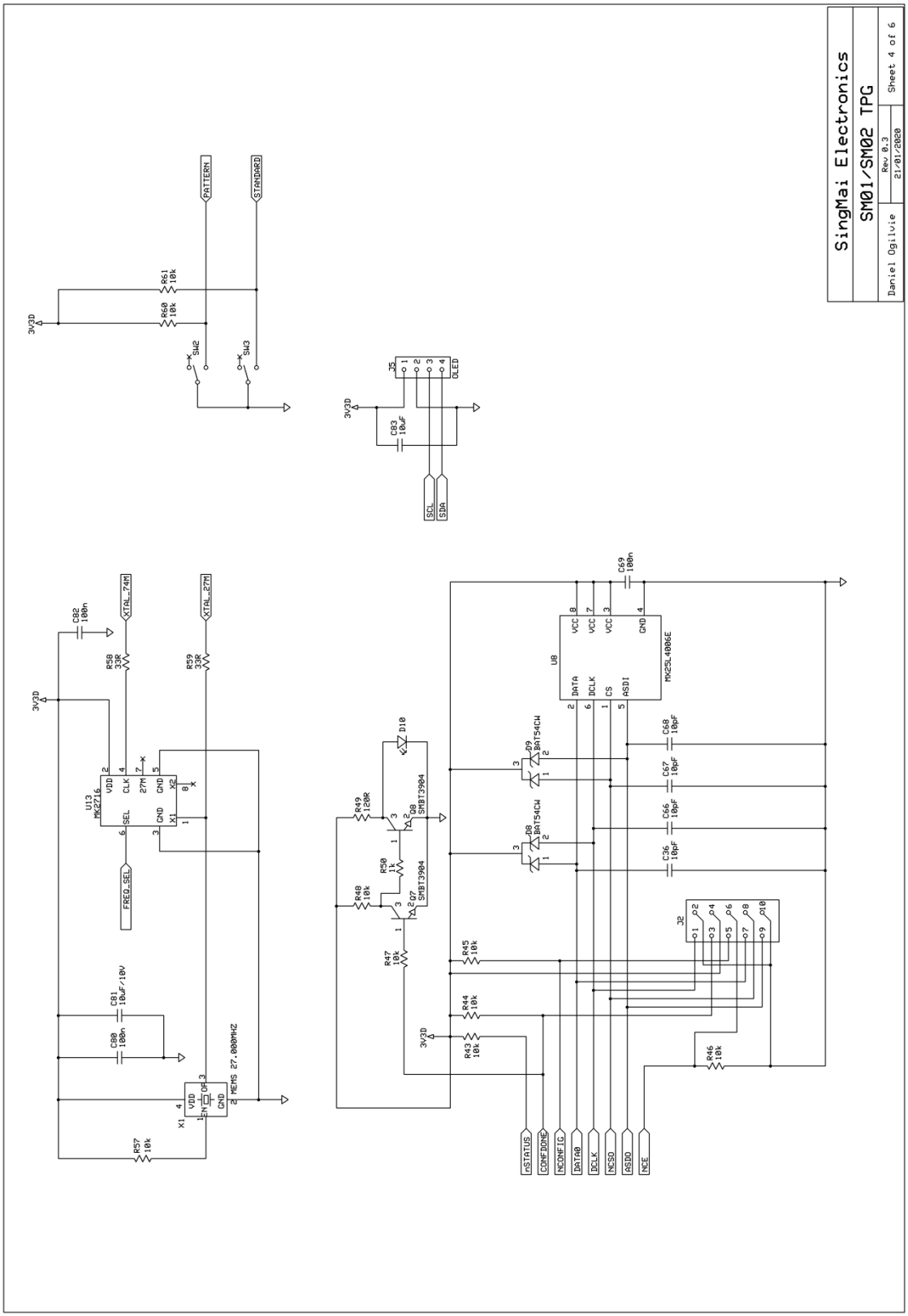


Figure 43 SM01 Schematics Sheet 4 - Peripherals.

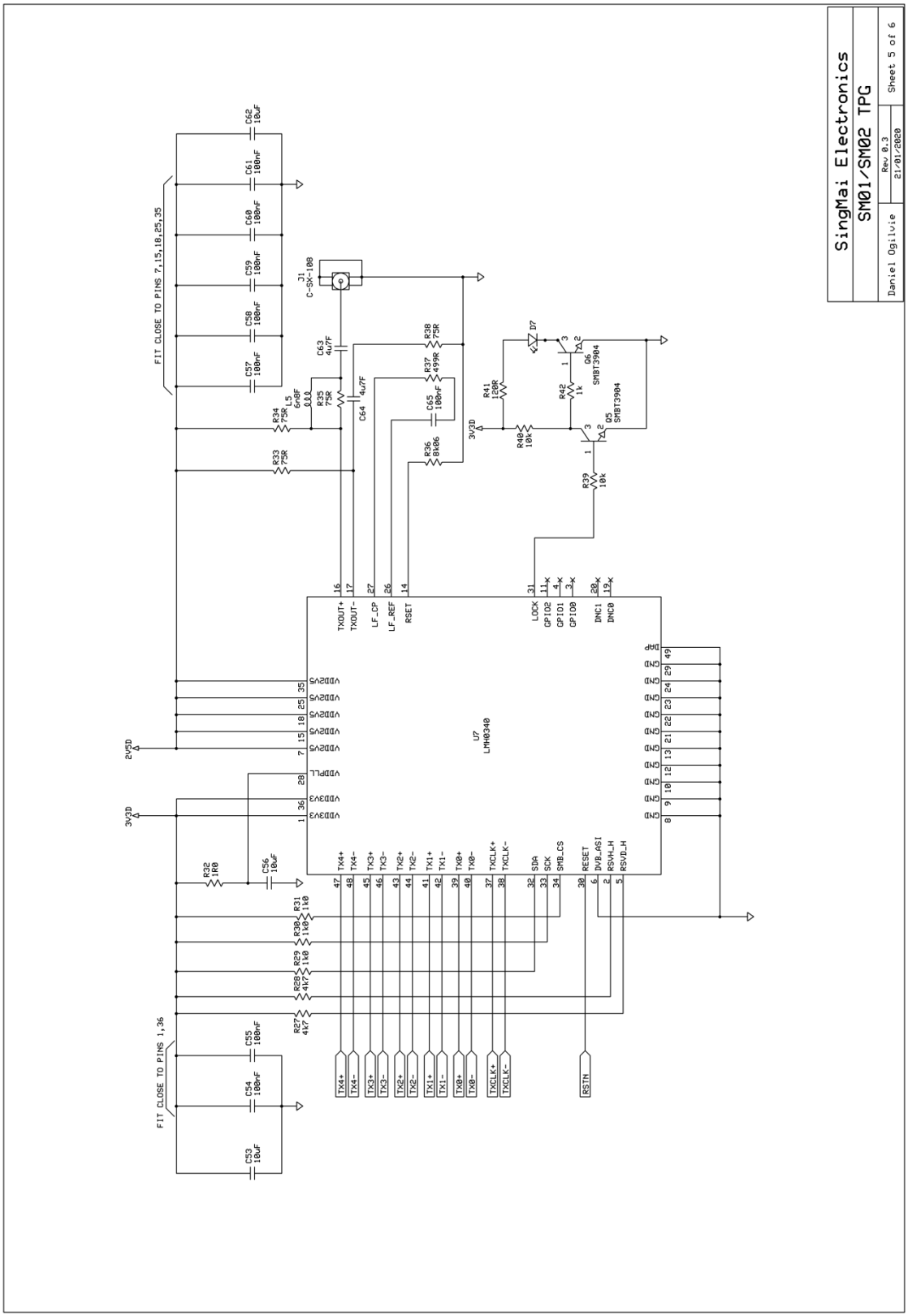


Figure 44 SM01 Schematics Sheet 5 SDI output.

Appendix C: Replacing the batteries

TBD.