

## Indirect Lightning Induced Transient Susceptibility Test System

(Waveforms 1,4 and 5A/5B) LSS 160SM8



### In Compliance With

- > DO-160G S22
- > MIL-STD-461G
- > AECTP 250
- > AECTP 500
- > GJB 8848-2016
- > HB 6167.24

### Introduction

When an aircraft is flying in severe convection environment, it will be frequently affected by lightning stroke, which will generate transient induced voltage or current on circuits and cables of airborne equipment, such phenomenon is called indirect lightning effect. It may make the aircraft get out of control, even bring about fuselage fire and other serious accidents. For safety reasons, the airborne equipment must be designed properly and tested completely to ensure the system and equipment with critical safety function to perform normally and its flight security when the aircraft is influenced by lightning stroke.

The LSS 160SM8 test system is capable of generating waveforms 1,4 and 5A/5B specified in RTCA/DO-160 Section 22, test level is from 1 to 5 for pins injection test and cable bundle test; in addition, the system also meets the A \ B \ C \ D class EUT pulse injection level defined in GJB 8848-2016, as well as multiple related standards such as MIL-STD-461G CS 117 lightning induction transient conduction sensitivity test.

The ETS 160MB test system includes various test auxiliary equipment to make it convenient to conduct tests, such as coupling transformer, power blocking device, transient blocking device, external DC capacitor etc. What's more, the Corelab software is also available for test remote control, which makes your test easy and convenient.

### Features

- > Modular design, the waveform module is detachable;
- > Capable of performing pins injection test and cable bundle test;
- > Capable of generating waveforms 1, 4 and 5A/5B;
- > 5.7 inch color touch screen with easy and distinct operation control;
- > Phase synchronization function in signal pins & power pins -direct injection method;
- > Corelab software are available for remote control.

### Application Areas

- > Military
- > Aviation

**Technical Parameters—Current Waveform 1 Cable Bundle and Ground Induction**

For Tests As Per DO-160G S22, MIL-STD-461G CS117(WF2/1)	
Coupling Mode	Cable induction (CI) Ground injection (GI)
Output Module	W1 CI/GI
Current Waveform 1	6.4 μs ± 20% / 69 μs ± 20%
Single Stroke Output	50 A ~ 4200 A (-0%~+20%); Output impedance ≤ 0.5 Ω
Multiple Stroke Output	50 A ~ 2000 A (-0%~+20%) (first stroke); output impedance ≤ 0.5 Ω 25 A ~ 1000 A (-0%~+50%) (subsequent stroke); Output Impedance ≤ 0.5 Ω
Number of Subsequent Pulses	1 ~ 14
Interval Time of Subsequent Pulses	10 ms ~ 200 ms, Random mode is available
Polarity	Positive or negative
Number of Test Times	1 ~ 99
Test Repetition	10 s ~ 99 s (shortest time depends on output amplitude)
Coupler	LCT- L5B
Maximum EUT Power Supply	Cable Induction (CI):none Ground Injection (GI): AC 230 V / 32 A 50/60 Hz; DC 230 V/32 A
Output Module	WAVE 1 CI/GI IH
Single Stroke Output	50 A ~ 3200 A (-0%~+20%);
Multiple Stroke Output	50 A ~ 1600 A (-0%~+20%) (first stroke) 25 A ~ 800 A (-0%~+50%) (subsequent stroke);

**Technical Parameters—Voltage Waveform 5A Signal Pins & Power Pins Direct Injection**

For Tests As Per DO-160G S22	
Coupling Mode	Pins direct injection (PDI)
Output Module	W5A PI
Output Impedance	1 Ω ± 10 %
Voltage/Current Waveform 5A	40 μs ± 20 % / 120 μs ± 20 %
Output Voltage	50 V ~ 3000 V (-0%~+10%) (open circuit)
Output Current	50 A ~ 3000 A (-0%~+10%) (short circuit)
Polarity	Positive or negative
Number of Test Times	1 ~ 99
Test Repetition	10 s ~ 99 s (shortest time depends on output amplitude)
EUT Power Supply	Max. 230 V
EUT Power Frequency	Max. 800 Hz
Power Blocking Device	Greater than peak value of signal or power voltage (optional)

**Technical Parameters—Voltage Waveform 4 Signal Pins & Power Pins Direct Injection**

For Tests As Per DO-160G S22	
Coupling Mode	Pins direct injection (PDI)
Output Module	W4 PI
Output Impedance	5 Ω ± 10 %
Voltage/Current Waveform 4	6.4 μs ± 20% / 69 μs ± 20%
Output Voltage	50 V ~ 3000 V (-0%~+10%), (open circuit)
Output Current	10 A ~ 600 A (-0%~+10%), (short circuit)
Polarity	Positive or negative
Number of Test Times	1 ~ 99
Test Repetition	10 s ~ 99 s (shortest time depends on output amplitude)
EUT Power Supply	Max. 230 V
EUT Frequency	Max. 800 Hz
Power Blocking Device	Greater than peak value of signal or power voltage (optional)

**Technical Parameters—Voltage Waveform 4 Cable Bundle and Ground Injection**

For Tests As Per DO-160G S22	
Coupling Mode	Cable induction (CI) Ground injection (GI)
Output Module	W4 CI/GI
Voltage Waveform 4	6.4 μs ± 20% / 69 μs ± 20%
Single Stroke Output	50 V ~ 3000 V (-0%~+20%); Output impedance ≥ 0.5 Ω
Multiple Stroke Output	25 V ~ 1000 V (-0%~+20%) (first stroke); Output impedance ≥ 0.5 Ω 10 V ~ 500 V (-0%~+50%) (subsequent stroke); Output impedance ≥ 0.5 Ω
Number of Subsequent pulses	1 ~ 14
Interval Time of Subsequent Pulses	10 ms ~ 200 ms, Random mode is also available
Polarity	Positive or negative
Number of Test Times	1 ~ 99
Test Repetition	10 s ~ 99 s (shortest time depends on output amplitude)
Coupler	LVT-L5B
Maximum EUT Power Supply	Cable induction (CI):none Ground injection (GI): AC 230 V / 32 A 50/60 Hz; DC 230 V/32 A

Technical Parameters—Current Waveform 5A Cable Bundle and Ground Induction	
For Tests As Per DO-160G S22, MIL-STD-461G CS117(WF4/5A)	
Coupling Mode	Cable induction (CI) Ground injection (GI)
Output Module	W5A CI/GI
Current Waveform 5A	40 $\mu\text{s} \pm 20\%$ / 120 $\mu\text{s} \pm 20\%$
Single Stroke Output	50 A ~ 10000 A (-0%~+20%); Output impedance $\leq 0.3 \Omega$
Multiple Stroke Output	50 A ~ 2000 A (-0%~+20%) (first stroke); Output impedance $\leq 0.3 \Omega$
	25 A ~ 1000 A (-0%~+50%) (subsequent stroke); Output impedance $\leq 0.3 \Omega$
Number of Subsequent pulses	1 ~ 14
Interval Time of Subsequent Pulses	10 ms ~ 200 ms, Random mode is also available
Polarity	Positive or negative
Number of Test Times	1 ~ 99
Test Repetition	10 s ~ 99 s (shortest time depends on output amplitude)
Coupler	LCT- L5B
Maximum EUT Power Supply	Cable induction (CI):none Ground injection (GI): AC 230 V / 32 A 50/60 Hz; DC 230 V/32 A

Technical Parameters—Current Waveform 5B Cable Bundle and Ground Induction	
For Tests As Per DO-160G S22	
Coupling Mode	Cable injection (CI) Ground injection (GI)
Output Module	W5B CI/GI
Current Waveform 5B	50 $\mu\text{s} \pm 20\%$ / 500 $\mu\text{s} \pm 20\%$
Single Stroke Output	50 A ~ 5000 A (-0%~+20%) Output impedance $\leq 0.3 \Omega$
Multiple Stroke Output	50 A ~ 2000 A (-0%~+20%) (first stroke); Output impedance $\leq 0.3 \Omega$
	25 A ~ 1000 A (-0%~+50%) (subsequent stroke); Output impedance $\leq 0.3 \Omega$
Number of Subsequent pulses	1 ~ 14
Interval Time of Subsequent Pulses	30 ms ~ 200 ms, Random mode is also available
Polarity	Positive or negative
Number of Test Times	1 ~ 99
Test Repetition	10 s ~ 99 s (shortest time depends on output amplitude)
Coupler	LCT - L5B
Maximum EUT Power Supply	Cable induction (CI):none Ground injection (GI): AC 230 V / 32 A 50/60 Hz; DC 230 V/32 A

Technical Parameters—Voltage Waveform 5B Signal Pins & Power Pins Direct Injection	
For Tests As Per DO-160G S22	
Coupling Mode	Pins direct injection (PDI)
Output Module	W5B PI
Output Impedance	1 $\Omega \pm 10\%$
Voltage/ Current Waveform 5B	50 $\mu\text{s} \pm 20\%$ / 500 $\mu\text{s} \pm 20\%$
Single Stroke Output	50 V ~ 1600 V (-0%~+10%) (open circuit)
	50 A ~ 1600 A (-0%~+10%) (short circuit)
Polarity	Positive or negative
Number of Test Times	1 ~ 99
Test Repetition	10 s ~ 99 s (shortest time depends on output amplitude)
EUT Power Supply	Max. AC/DC 230 V
EUT Power Frequency	Max. 800 Hz
Power Blocking Device	Greater than peak value of signal or power voltage (optional)

List Of Waveform Module and Test Type	
Waveform Module	Test type
W1 CI/GI; W1-CI/GI-IH	Current waveform 1 – cable bundle cable induction test Current waveform 1 – cable bundle ground injection test
W4 PI	Voltage waveform 4 – signal pins & power pins direct injection method
W4 CI/GI	Voltage waveform 4 - cable bundle cable induction test Voltage waveform 4 - cable bundle ground injection test
W5A PI	Voltage waveform 5A – signal pins & power pins direct injection method
W5A CI/GI	Current waveform 5A – cable bundle cable induction test Current waveform 5A – cable bundle ground injection test
W5B PI	Voltage waveform 5B – signal pins & power pins direct injection method
W5B CI/GI	Current waveform 5B – cable bundle cable induction test Current waveform 5B – cable bundle ground injection test

Technical Parameters—Intermediate Width Pulse (IP) Waveform 1	
For Tests As Per GJB 8848	
Coupling Mode	Ground injection (GI)
Output Module	W1 I
Current Waveform	6.4 $\mu\text{s} \pm 20\%$ / 69 $\mu\text{s} \pm 20\%$
Output current	50 A ~ 4000 A ( $\pm 10\%$ );
Polarity	Positive or negative
Number of Test Times	1 ~ 99
Test Repetition	8 s ~ 99 s (shortest time depends on output amplitude)
Coupler	LCT- L5B

Technical Parameters— Long Pulse (LP) Waveform 5B	
For Tests As Per GJB 8848	
Coupling Mode	Ground injection (GI)
Output Module	W5B V
Waveform	50 $\mu\text{s} \pm 20\%$ / 500 $\mu\text{s} \pm 20\%$
Voltage Output	1000 V ~ 2200 V ( $\pm 10\%$ );
Polarity	Positive or negative
Number of Test Times	1 ~ 99
Test Repetition	10 s ~ 99 s (shortest time depends on output amplitude)

Technical Parameters—Intermediate width pulse (IP) Waveform 4	
For Tests As Per GJB 8848	
Coupling Mode	Ground injection (GI)
Output Module	W4 V
Waveform	6.4 $\mu\text{s} \pm 20\%$ / 69 $\mu\text{s} \pm 20\%$
Voltage Output	50 V ~ 2500 V ( $\pm 10\%$ );
Polarity	Positive or negative
Number of Test Times	1 ~ 99
Test Repetition	10 s ~ 99 s (shortest time depends on output amplitude)







Technical Parameters—Long pulse (LP) Waveform 5B	
For Tests As Per GJB 8848	
Coupling Mode	Ground injection (GI)
Output Module	W5B I
Current Waveform	50 $\mu\text{s} \pm 20\%$ / 500 $\mu\text{s} \pm 20\%$
Output current	1000 A ~ 10000 A ( $\pm 10\%$ );
Polarity	Positive or negative
Number of Test Times	1 ~ 99
Test Repetition	8 s ~ 99 s (shortest time depends on output amplitude)


Technical Parameters— Long Pulse (LP) Waveform 5A	
For Tests As Per GJB 8848	
Coupling Mode	Ground injection (GI)
Output Module	W5A V
Waveform	40 $\mu\text{s} \pm 20\%$ / 120 $\mu\text{s} \pm 20\%$
Voltage Output	1000 V ~ 2500 V ( $\pm 10\%$ );
Polarity	Positive or negative
Number of Test Times	1 ~ 99
Test Repetition	10 s ~ 99 s (shortest time depends on output amplitude)

General Parameters	
Display	5.7 inch TFT touch screen
Working Power	220 V, $\pm 10\%$ , 50/60Hz
Fuse	10 A
User' s Memory Space	Infinite (PC)
Communication Mode	Ethernet lan, RJ45
Working Status Indication	LED indication and LCD display on front panel
Grounded Connection	Flat earth line
Waveform Output Terminal	Banana plug line
Dimension	35U cabinet
Weight	Approx. 320 kg
Ambient Temperature	15 $^{\circ}\text{C}$ ~ 35 $^{\circ}\text{C}$
Relative Humidity	45% ~ 75%
Atmospheric Pressure	86 kPa ~ 106 kPa

Technical Parameters—Long Pulse (LP) Waveform 5A	
For Tests As Per GJB 8848	
Coupling Mode	Ground injection (GI)
Output Module	W5A I
Current Waveform	40 $\mu\text{s} \pm 20\%$ / 120 $\mu\text{s} \pm 20\%$
Output current	1000 A ~ 14000 A ( $\pm 10\%$ );
Polarity	Positive or negative
Number of Test Times	1 ~ 99
Test Repetition	10 s ~ 99 s (shortest time depends on output amplitude)
Coupler	LCT- L5B

Accessories	
Fuse, Power Line, Flat Ground Line, Test Line, Alligator Clip, User Manual	

Options	
<p>1. Line Impedance Stabilization Network</p> <p>LISN AR 50</p> 	<p>The LISN AR 50 is used for isolating electric wave in cable bundle test and supply stable impedance for test system;                      Max AC 530 V, DC 600 V  <math>I_{rms}</math>: 50 A;                      Frequency Range: 10 kHz ~ 400 MHz.</p>
<p>2. Current Coupling Transformer</p> <p>LCT-L5</p> 	<p>The LCT-L5 is used for coupling current waveforms 1,5A,5B and meet the test requirement of single/multiple stroke (level 1~5) test.</p>
<p>3. External DC Capacitor</p> <p>C3350 /C33400</p> 	<p>The C3350/C33400 is used together with LISN for conducting cable bundle tests; Maximum DC voltage is 400 V (general configuration is 50 V);                      Capacitance: 33000 <math>\mu</math>F.</p>
<p>4. Voltage Coupling Transformer</p> <p>LVT-L5B</p> 	<p>The LVT-L5 is used for coupling voltage waveforms 4, 5A and meet the test requirement of single/multiple stroke (level 1 ~ 5) test.</p>
<p>5. Power Blocking Device</p> <p>CN-1</p> 	<p>The CN-1 is used to isolate voltages at the pins of the EUT from the low generator impedance so as to protect the generator;                      The maximum isolating ac/dc voltage is 400 V;                      Meet the test requirement of powered EUT for conducting pins injection test of waveforms 4, 5A, 5B.</p>
<p>6. Transient Blocking Device DN-416T</p> 	<p>DN-416T is used to prevent EUT power supply from being damaged by pulses 4, 5A and 5B;                      EUT Maximum ac/dc power supply is 400 V 16 A three-phase, 0 ~ 400 Hz (common mode);                      Meet the test requirement of powered EUT for conducting pins injection test of waveforms 4, 5A, 5B.</p>

Options	
<p>7. Digital Oscilloscope MDO3012 (Tektronix)</p> 	<p>Frequency 100 MHz;                      Sample Rate 1.25 GS/s;                      Record length 10 Mb.</p>
<p>8 Wide-band Current Monitor</p> <p>CWT 150</p> 	<p>Max. peak current 30 kA;                      Frequency: 0.2 Hz ~ 12 MHz</p>
<p>9. Differential Probe</p> <p>THDP0100 (Tektronix)</p> 	<p>6 kV differential mode, 100 MHz;                      The THDP0100 is used for measuring voltage of all waveforms.</p>
<p>10. Long Pulse Adapter Box ZJH8848L</p> 	<p>Used for measuring waveforms W1,W4,W5A and W5B.</p>
<p>11. Short Pulse Adapter Box ZJH8848S</p> 	<p>Used to measure waveform W2.</p>
<p>12. Corelab Software</p>	<p>The software is used for remote control;                      Support connection with oscilloscope for monitoring waveform;                      Support generating test report.</p>



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