

SPECIFICATION AND PERFORMANCE CHECK

SPECIFICATION

Performance Conditions

The electrical characteristics are valid only if the SG 503 has been calibrated at an ambient temperature between +20°C and +30°C and is operating at an ambient temperature between 0°C and +50°C unless otherwise noted.

The SG 503 is calibrated for use with a furnished coaxial cable accessory (See Standard Accessories in Replaceable Mechanical Parts list section) terminated into a 50-ohm load.

Items listed in the Performance Requirements column of the Electrical Characteristics are verified by completing the Performance Check in this manual. Items listed in the Supplemental Information column are not verified in this manual; they are either explanatory notes or performance characteristics for which no limits are specified.

Table 2-1

ELECTRICAL CHARACTERISTICS

Characteristics	Performance Requirements	Supplemental Information
Frequency Range	250 kHz to 250 MHz, plus 50 kHz reference frequency.	
Output Accuracy	Within ± 0.7 of the least significant displayed digit.	
Amplitude Range	5 mV to 5.5 V peak-to-peak over three decade ranges and terminated into a 50- Ω load.	
Accuracy	At 50 kHz reference frequency; within 3% of indicated amplitude on X1 range, 4% on X.1 range, and 5% on X.01 range.	Accuracy must be set to within 0.3% on X1 range and checked to be within 2.0% on X.1 and X.01 ranges.

NOTE

Flatness (Peak-to-Peak) valid only when precision coaxial cable is used. Flatness referenced to NBS corrections of Tektronix standards. NBS uncertainties not included.

Table 2-1 (cont)

ELECTRICAL CHARACTERISTICS

Characteristics	Performance Requirements	Supplemental Information
Flatness (Peak-to-Peak) Amplitude Multiplier Setting: X1, X.1, X.01	From 250 kHz to 50 MHz output amplitude will not vary more than 1% of the value at 50 kHz. From 100 MHz to 250 MHz amplitude variation is within 3% of the value at 50 kHz.	
Amplitude Multiplier Setting: X1	50 MHz to 100 MHz range; output amplitude will not vary more than 1% of the value at 50 kHz.	
Amplitude Multiplier Setting: X.1 and X.01	50 MHz to 100 MHz range; output amplitude will not vary more than +1.5% and -1.0% of the value at 50 kHz.	
Harmonic Content	Harmonic suppression relative to fundamental: Second harmonic at least 35 dB down. Third and all higher harmonics at least 40 dB down.	

Table 2-2

ENVIRONMENTAL CHARACTERISTICS

Characteristics	Performance Requirements	Supplemental Information
Temperature Operating	0°C to +50°C.	
Storage	-40°C to +75°C.	
Altitude Operating	To 15,000 feet maximum operating temperature decreased by 1°C/1000 feet from 5000 to 15000 feet.	
Storage	To 50,000 feet.	
Vibration Operating and Non-operating	With the instrument complete and operating, vibration frequency swept from 10 to 55 to 10 Hz at 1 minute per sweep. Vibrate 15 minutes in each of the three major axes at 0.015 inch total displacement. Hold 10 minutes at any major resonance, or in none, at 55 Hz. Total time, 75 minutes.	
Shock Operating and Non-operating	30 g's 1/2 sine, 11 ms duration, 3 shocks in each direction along 3 major axes, for a total of 18 shocks.	

Table 2-3

PHYSICAL CHARACTERISTICS

Characteristics	Information
Overall Dimensions (measured at maximum points) Height	5.0 inches 12.7 centimeter
Width	2.6 inches 6.6 centimeter
Length	12.2 inches 31.0 centimeter
Net Weight (Instrument Only)	2.25 lbs. 1.02 kilograms

PERFORMANCE CHECK

Introduction

This procedure checks the electrical characteristics of the SG 503 that appear in the Specification section of this manual. If the instrument fails to meet the requirements given in this performance check, the calibration procedure should be performed. This procedure can also be used by an incoming inspection facility to determine acceptability of performance.

The electrical characteristics in Section 2 are valid only if the SG 503 is calibrated at an ambient temperature of +20°C to +30°C and operated at an ambient temperature of 0°C to +50°C. Forced air circulation is required for ambient temperature above +40°C.

Tolerances that are specified in this performance check procedure apply to the instrument under test and do not include test equipment error.

Test Equipment Required

The test equipment listed in Table 2-4, or equivalent, is required to perform the performance check. Test equipment characteristics listed are the minimum required to verify the performance of the equipment under test. Substitute equipment must meet or exceed the stated requirements. All test equipment is assumed to be operating within tolerance.

Special test devices are used where necessary to facilitate the procedure. Most of these are available from Tektronix, Inc. and can be ordered through your local Tektronix Field Office or representative.

Table 2-4

LIST OF TEST EQUIPMENT REQUIREMENTS

Description	Performance Requirements	Application	Example
✓ Oscilloscope	Bandwidth, dc to 100 MHz; minimum deflection factor, 1 mV/div with differential comparator; sweep rate, 10 ms/div to 1 μ s/div; accuracy, within 3%.	Used throughout procedure to provide display.	TEKTRONIX 7603, 7A13, 7B70 Oscilloscope System. <i>7603/7A26 7653A</i>
✓ Digital Voltmeter	Range, 0 to 50 V; accuracy, within 0.1%.	Output voltage flatness check.	TEKTRONIX DM 501 Digital Multimeter. ^a <i>3468A</i>
✓ Digital Counter	Range, 50 kHz to 250 MHz.	Output accuracy	TEKTRONIX DC508 Digital Counter. ^a <i>7260A</i>
✓ Power Module	Three compartments or more.	All tests.	TEKTRONIX TM 503 or TM 504. ✓
✓ Calibration Generator	Amplitude calibration, 5 mV to 5 V; accuracy, $\pm 0.25\%$ into 1 M Ω ; output, square wave at approximately 1 kHz.	Amplitude Set check.	TEKTRONIX PG 506 Calibration Generator. ^a <i>CG5001 ✓</i>
✓ Spectrum Analyzer	Range, 100 kHz to 300 MHz; calibrated levels in decade steps from -45 dB to -35 dB; impedance, 50 Ω ; accuracy, linear display, within 10%.	Buffer Distortion, Harmonic-Suppression check.	TEKTRONIX 7L12 Spectrum Analyzer. <i>8566B ✓</i>
Peak-to-Peak Detector	Frequency range, 50 Hz to 500 MHz; requires 1.2 V p-p input voltage.	Output voltage flatness check.	Tektronix 067-0625-00 Calibration Fixture. <i>\$805</i>
✓ Coaxial cable	Impedance, 50 Ω ; length, 36 inches; connectors, bnc; (precision coaxial cable).	Provides signal interconnection.	Tektronix Part No. 012-0482-00 (supplied with SG 503).
✓ Patch cord (2 required)	Bnc to banana plug-jack, 18 inch.	Provides signal interconnection.	Tektronix Part No. 012-0090-00 (black) 012-0091-00 (red)
✓ Coaxial cable (2 required)	Impedance, 50 Ω ; length, 42 inches; connectors, bnc.	Provides signal interconnection.	Tektronix Part No. 012-0057-01.
✓ Attenuator, 2X (2 required).	Impedance, 50 Ω ; connectors, bnc.	Output voltage flatness check.	Tektronix Part No. 011-0069-02.
✓ Tee connector	Connectors, bnc.	Reference amplitude check.	Tektronix Part No. 103-0030-00.
✓ Adapter	GR to bnc female.	Output voltage flatness check.	Tektronix Part No. 017-0063-00.
✓ Termination	Impedance, 50 Ω ; connectors, bnc.	Output termination for signal generator.	Tektronix Part No. 011-0049-01.
✓ Resistor	Fixed, 2.4 M Ω , 1/2 W, 5%.	Output voltage flatness check.	Tektronix Part No. 301-0245-00.

^aRequires TM 500-Series Power Module.

Preliminary Procedure

1. Ensure that all power switches are off.
2. Ensure that all test equipment and the SG 503 under test are suitably adapted to the line voltage to be applied.
3. Install the SG 503 into the power module, and if applicable, install all other TM 500-series test equipment into the power module.
4. Connect the equipment under test and the test equipment to a suitable line voltage source. Turn all equipment on and allow at least 20 minutes for the equipment to warm up and stabilize.

Initial Control Settings

Set the following controls during warm-up time:

SG 503

AMPLITUDE MULTIPLIER	X1
FREQUENCY VARIABLE	Midrange
FREQUENCY RANGE (MHz)	REF \approx .05
OUTPUT AMPLITUDE	5.0

Oscilloscope

Intensity, Focus	Set for well-defined trace and normal brightness.
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Differential Comparator

Volts/Div	.1 V
Variable	fully clockwise (cal)
+Input	ac
-Input	ac
Bandwidth Limit	5 MHz

Time Base Plug-In

Time/Div	.2 ms
Variable	(cal in)
Triggering	
+Slope	selected
Mode	P-P Auto
Coupling	ac hf rej
Source	Ext
Position	Set so trace starts at left side of graticule.
Magnifier	X1

PERFORMANCE CHECK PROCEDURE

NOTE

The SG 503 must be terminated into an accurate 50-ohm load for all checks. Measure the 50-ohm termination to determine percent of error. A 2% error in the termination (1 ohm) will cause amplitude errors of 1%. For example, a 51-ohm termination causes an amplitude error that is 1% high at 50 kilohertz.

1. Check Reference Amplitude Accuracy at 0.05 megahertz.

a. Connect a 1 kilohertz, 5 volt square-wave signal from the calibration generator, through a bnc tee connector, to the + input of the differential comparator, using a 42-inch cable. Connect a 42-inch cable from the tee connector to the time-base unit external trigger input.

b. Connect the precision 50-ohm cable (supplied with SG 503) to the SG 503 OUTPUT connector.

c. Connect a 50-ohm termination to the remaining end of the precision 50-ohm cable; connect the other end of the 50-ohm termination to the - input of the differential comparator.

d. Set the time-base triggering controls for a stable display; a crt display similar to Fig. 2-1 is obtained.

e. Check—that the corners of the idealized waveform are aligned as illustrated in Fig. 2-1, within 1.5 vertical divisions. Disregard waveform tilt.

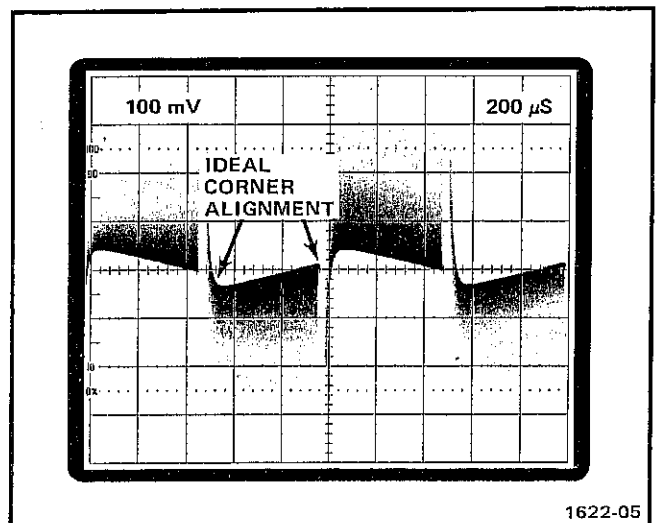


Fig. 2-1. Representation of complex waveform (idealized) with 5 volt reference amplitude at 0.05 MHz, properly set.

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f. Set the SG 503 OUTPUT AMPLITUDE control to 0.5; set the calibration generator for a 0.5 volt, 1 kilohertz square-wave signal.

g. Set the differential-comparator deflection factor for 10 mV/div.

h. Check—that the waveform is similar as illustrated in Fig. 2-2, (within 1.5 vertical divisions).

i. Disconnect all cables.

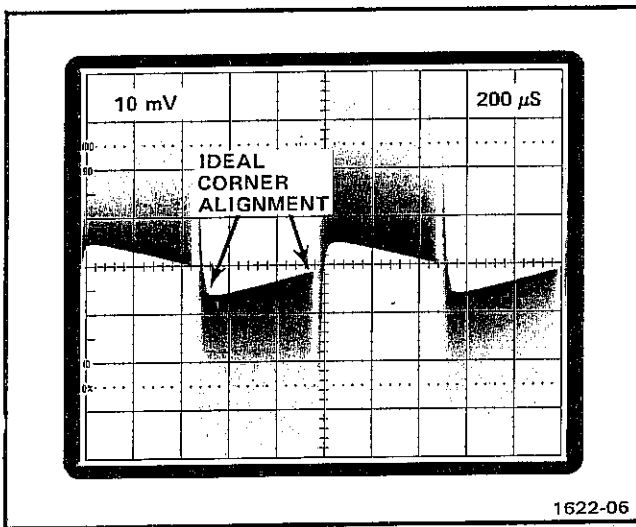


Fig. 2-2. Display of complex waveform (idealized) with 0.5 volt reference amplitude of 0.05 MHz, properly set.

2. Check Harmonic Suppression and Leveling

a. Connect the SG 503 output to the spectrum analyzer input, using the precision 50-ohm cable (supplied with SG 503).

b. Set the SG 503 OUTPUT AMPLITUDE control to 5.5 and the AMPLITUDE MULTIPLIER switch to the X1 position.

c. Set the SG 503 FREQUENCY RANGE (MHz) switch to the 100-250 range.

d. Position the fundamental display to the top graticule line with the spectrum analyzer position control. See Fig. 2-3 for reference.

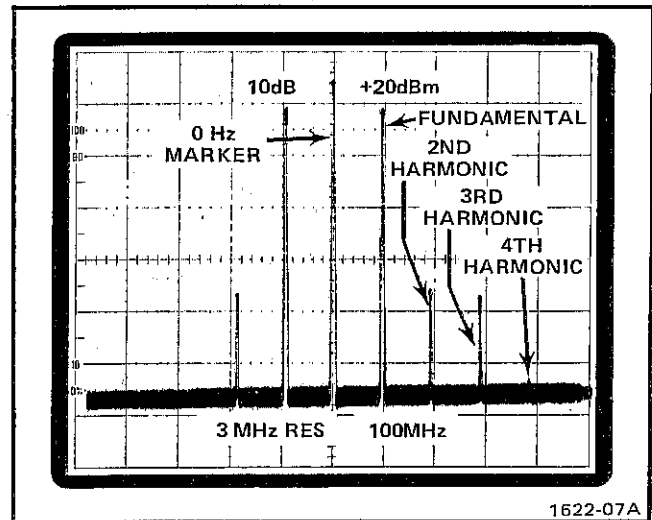


Fig. 2-3. Display of 100 MHz signal and harmonics.

NOTE

It will be necessary to change the spectrum analyzer input attenuation (sensitivity) to maintain a reasonable display on screen, with harmonics above the baseline noise level and within the graticule area.

e. Slowly adjust the SG 503 FREQUENCY VARIABLE control over its entire range and check that the vertical distance (suppression) between the top of the fundamental and second harmonic display is at least 3.5 divisions; the tops of the remaining harmonics are separated at least 4.0 divisions. (Adjust the spectrum analyzer Frequency Span/Div control as necessary to maintain the harmonic display on screen.) See Fig. 2-3.

f. Set the SG 503 FREQUENCY RANGE (MHz) switch to the 50-100 range.

g. Repeat part e of this step for the remaining frequency ranges, using Table 2-5 as reference. (Suppression limit of 45 decibels down corresponds to 4.5 divisions on the display.)

NOTE

All coil adjustments have been adjusted for minimum harmonic amplitude at the high end of the associated range (worst case harmonic conditions). Check that the output remains leveled (display will blink if unlevelled condition occurs) as the SG 503 FREQUENCY VARIABLE control is slowly rotated over its associated frequency range.

Table 2-5

SG 503 FREQUENCY RANGE (MHz)	SG 503 FREQUENCY VARIABLE Typical Displayed Count (Frequency Range) ¹	Typical Harmonic Suppression (2nd and all higher harmonics, relative to fundamental)
100-250	97.5-260	≥40 dB down
50-100	41.0-109	≥40 dB down
25-50	23.7-52.5	≥40 dB down
10-25	9.09-27.3	≥45 dB down
5-10	4.70-11.1	≥45 dB down
2.5-5	2.30-5.50	≥45 dB down
1-2.5	.950-2.55	≥45 dB down
.5-1	.480-1.05	≥45 dB down
.25-.5	.240-.520	≥45 dB down
REF≈.05	.049-.051	≥45 dB down

¹The minimum and maximum displayed count on each range will vary slightly between instruments.

h. Disconnect the cable from the spectrum analyzer.

3. Readout Accuracy

a. Connect the SG 503 output to the frequency counter using the 50 Ω coax. (Set the counter to 50 Ω.)

b. Set the SG 503 OUTPUT AMPLITUDE to a level that stabilizes the frequency counter display.

c. Slowly adjust the SG 503 FREQUENCY VARIABLE control over its entire range at each of the frequency range positions of the FREQUENCY RANGE (MHz) switch.

d. Check that the frequency counter display is within ±0.7 of the least significant displayed digit on the SG 503.

4. Check Flatness (Peak-to-Peak Amplitude Regulation)

a. Set the SG 503 controls as follows: FREQUENCY RANGE (MHz) switch to REF ≈ .05 position, and the AMPLITUDE MULTIPLIER switch to X1.

b. Connect a 2.4 megohm, 5% resistor across the digital voltmeter floating input terminals. Connect the SG 503 via the precision cable (012-0482-00) and the bnc female-to-GR adapter to the input of the peak-to-peak detector. Use two bnc to banana-plug-jack patch cords to connect the output of the peak-to-peak detector to the floating input terminals on the digital voltmeter; maintain correct polarity, HI to + and LO to -. Set the digital voltmeter to the 20 volts dc range.

c. Slowly adjust the SG 503 OUTPUT AMPLITUDE VOLTS P-P control until the digital voltmeter display indicates ±.000. Output amplitude from the SG 503 should be about 1.1 to 1.2 volts; this establishes a 0.0% reference setting at .050 megahertz.

d. Slowly adjust the SG 503 FREQUENCY VARIABLE control over its entire range at each of the frequency range positions of the FREQUENCY RANGE (MHz) switch.

e. Check—the flatness deviation from 0.25 megahertz to 50 megahertz, must be within 1% of the value at .050 megahertz. The total percentage deviation calculation must include the digital voltmeter reading and the calibration factor of the peak-to-peak detector. For example, a reading of +.008 volt on the digital voltmeter is equivalent to +0.8% deviation. Applying a correction factor of -0.3% results in a total percentage deviation of +0.5%.

f. Check—the flatness deviation from 50 megahertz to 100 megahertz, must be within 1% of the value at .050 megahertz. The same calculation must be considered for this deviation reading as described in part e of this step.

NOTE

A 1% total percentage deviation ensures flatness specification when the SG 503 is operating at the X.1 and X.01 AMPLITUDE MULTIPLIER switch positions.

g. Check—the flatness deviation from 100 megahertz to 250 megahertz, must be within 3% of the value at .050 megahertz. The same calculation must be considered for this deviation reading as described in part e and f of this step.

h. To check the flatness deviation at a higher voltage output from the SG 503, insert two 2X attenuators between the SG 503 cable and the peak-to-peak detector. Repeat part c of this step to obtain another 0.0% reference reading of about 4.7 volts output from the SG 503.

i. After obtaining the new 0.0% reference indication on the digital voltmeter, repeat parts e and f of this step to check flatness deviation for about 4.7 volts output from the SG 503. Tolerance limits are the same as in parts e and f of this step.

j. Disconnect all cables from the SG 503.

This completes the Performance Check procedure of the SG 503 Leveled Sine Wave Generator.

② set up REF level
 to achieve ±.000 VDC
 output to 3458A/3468A

① Use a 432A + 8478A Thermistor
 mount - need BARRILL ADAPTER 2-7
 THERM MOUNT - THE ADAPTER TO BNC -