

## APPENDIX D

### ACCESSORIES AND OPTIONS

#### ACCESSORIES

The 2712 Spectrum Analyzer is shipped with the accessories listed in Table D-1. Additional optional accessories are listed in Table D-3. Optional AC mains power cords are also available meeting various international standards (see Table D-2).

Table D-1. Standard accessories.

Item	Tektronix P/N
User's Manual	070-8137-00
U.S. Power Cord (optional power cords are shown in Table D-2)	161-0104-00
Front Cover	200-2520-00
Adapter, 50ohm N Male to BNC Female	103-0045-00
Minimum Loss Attenuator, 50ohm N-type Male to 75ohm BNC Female	131-4199-00

Table D-2. Optional power cords.

Option	Item	Tektronix P/N
A1	Universal Euro, 220 V/50 Hz at 16A	161-0104-06
A2	United Kingdom, 240 V/50 Hz at 13A	161-0104-07
A3	Australian, 240 V/50 Hz, at 10A	161-0104-05
A4	North American, 240 V/60 Hz, at 12A	161-0134-00
A5	Swiss, 250 V/50 Hz, at 6A	161-0167-00

Table 2-1. Frequency related characteristics.

Characteristic	Performance Requirement	Supplemental Information
<b>Frequency</b>		
Range	9 kHz to 1.8 GHz	Tuned by the <b>FREQ/ MKRS</b> knob, <b>FREQUENCY</b> arrow keys, or set via the front-panel keypad or Utility Menu.
Accuracy	$5 \times 10^{-7}$ of center frequency $\pm 10$ Hz $\pm 1$ least significant digit	Assume zero drift since last normalization procedure.
Long Term Drift		2 PPM/Year.
Short Term Drift	<400 Hz	Between correction cycles.
Readout Resolution		1 kHz or 1 Hz (counter readout) menu selectable.
<b>Frequency Span/Div</b>		
Range		From 100 MHz/div to 1 kHz/div in a 1-2-5 sequence, with the <b>SPAN/DIV</b> arrow keys, or set to arbitrary value via front-panel keypad or the Utility Menu; also 180 MHz/div in <b>MAX SPAN</b> and 0 Hz for <b>ZERO SPAN</b> .
Accuracy/Linearity	Within 3%	Measured over the center 8 divisions.
<b>Flatness</b>		
(About the midpoint between two extremes)	$\pm 1.5$ dB	Measured with 10 dB of RF Attenuation. Flatness affected by: input VSWR gain variation mixer conversion

Table 2-1 (Continued)

Characteristic	Performance Requirement	Supplemental Information
<b>Residual FM</b>		
SPAN/DIV $\leq$ 20 kHz	$\leq$ 100 Hz peak to peak total in 20 ms.	Short term, after 1 hr warm-up.
SPAN/DIV $>$ 20 kHz	$\leq$ 2 kHz peak to peak total in 20 ms.	
<b>Resolution Bandwidth</b>		
Filter bandwidths measured 6 dB down		Standard selections: 300 Hz, 3 kHz, 30 kHz, 300 kHz, 5MHz Option 12 <sup>1</sup> adds: 1 kHz, 1 MHz, and 200 Hz, 9 kHz, 120 kHz EMC filters Option 14 <sup>1</sup> adds: 100 Hz, 1 kHz, 10 kHz, 100 kHz, 1 MHz
Shape Factor (60 dB/6 dB)	7:1 or less for all resolution BWs $\leq$ 1MHz	
<b>Noise Sidebands</b>		
	$\geq$ 70 dBc at 30 times resolution BW for all bandwidths $\leq$ 100 kHz	
<b>Video Filter</b>		
		Twelve post-detection low-pass filters with nominal bandwidths of 3 Hz, 10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300 kHz, and WIDE. See Table 6-2 for automatically-selected filter bandwidths in normal, EMC and QP modes. Filters can also be manually selected via the UTIL Menu.

<sup>1</sup> Options 04, 12, and .4 are mutually exclusive.

Table 2-2. Frequency/amplitude related characteristics.

Characteristic	Performance Requirement	Supplemental Information
Marker		Marker frequency & amplitude readouts displayed on screen preceded by "M". Use the FREQ/MKRS knob or the MKR ←→ keys to position the marker to any point on a digital sweep. Signal must be above threshold.
Accuracy		
Frequency		Same as Span/Div
Amplitude		Function of reference level, vertical scale, and normalizations. See display dynamic range in Table 2-3.
Delta Marker		
	When activated, a 2nd marker appears. First marker remains stationary while the 2nd is moveable.	Frequency and amplitude differences between markers are read out on screen preceded by "D". The FREQ/MKRS knob or the MKR ←→ keys position the moveable marker.
Accuracy		
Frequency	$1 \times 10^{-6} \pm 10 \text{ Hz}$	When both signals are counted.
Amplitude		Same as marker.
Center Measure		
		When activated, the signal nearest center screen (or nearest the marker if it is active) is moved to center screen and measured. The frequency and amplitude values, preceded by "C", are displayed on screen.
Readout resolution	1 kHz or 1 Hz	Menu selectable.
Auto Track		Continuously repeats the Center Measure function, thereby "tracking" a drifting signal. Signal must be above the threshold. If the signal decreases below the threshold level, the 2712 enters idle mode.

Table 2-3. Amplitude related characteristics.

Characteristics	Performance Requirement	Supplemental Information
Vertical Display Mode		10 dB/Div, 5 dB/Div, 1 dB/Div and Linear.
Reference Level		Top graticule line.
Range		
Log Mode		-70 dBm to +20 dBm (-23 dBmV to +66.9 dBmV.)
Linear Mode		8.83 $\mu$ V/div to 280 mV/div.
Step size		
Log Mode		1 dB or 10 dB.
Linear Mode		
10 dB step size		1-2-5 sequence between 10 $\mu$ V/div and 280 mV/div >0.2 division per step.
1 dB step size		
Accuracy		Dependent on calibrator accuracy, normalization, and frequency response.
Display dynamic range		
Log	80 dB maximum	
Lin	8 divisions	
Accuracy		
10 dB/div mode	$\pm 1.0$ dB/10 dB to a maximum cumulative error of $\pm 2.0$ dB over 70 dB range, and $\pm 4.0$ dB cumulative over 80 dB range.	
5 dB/div mode	$\pm 1.0$ dB/10 dB to a maximum cumulative error of $\pm 2.0$ dB over the 40 dB range.	
1 dB/div mode	$\pm 1$ dB maximum error over the 8 dB range.	
Linear mode	$\pm 5\%$ of full scale	
RF attenuator range		0 to 50 dB in 2 dB steps.

Table 2-3 (continued)

Characteristics	Performance Requirement	Supplemental Information
Sensitivity (without preamp)		
Resolution BW	Center Frequency 100 MHz    1.8 GHz	Equivalent maximum input noise for each res BW.
5 MHz	-85 dBm    -77 dBm	<p><i>NOTE:</i> Decrease in sensitivity is approximately linear from 100 MHz to 1.8 GHz.</p> <p>Start spur results in maximum 20 dB sensitivity loss from 10 MHz to 9 kHz.</p> <p>Sensitivity with preamp is not specified above 600 MHz.</p>
300 kHz	-97 dBm    -89 dBm	
30 kHz	-107 dBm   -99 dBm	
3 kHz	-117 dBm   -109 dBm	
300 Hz	-127 dBm   -119 dBm	
Sensitivity with preamp)		
5 MHz	-97 dBm	
300 kHz	-109 dBm	
30 kHz	-119 dBm	
3 kHz	-129 dBm	
300 Hz	-139 dBm	
Intermodulation Responses		
Residual (no input signal)	-100 dBm or less except at 1780 MHz where the residual is -90 dBm or less	With 0 dB RF attenuation.
Intermodulation products (3 <sup>rd</sup> order)	-70 dBc or less	From any two on-screen signals within any frequency span.
Intermodulation frequency spur	-10 dBm or less	Reference to input with 0 dB RF attenuation.
Third harmonic distortion	-66 dBc or less	Measured with 1 <sup>st</sup> mixer input level < -40 dBm.
Spurious emission	-70 dBm or less	With 0 dB RF attenuation.

Table 2-4. Input/output signal characteristics.

Characteristic	Performance Requirement	Supplemental Information
RF input		Type N 50 $\Omega$ female connector.
VSWR (RF atten $\geq 10$ dB)	1.5:1 maximum	
VSWR (0 dB RF atten)	3.0:1 maximum	
Maximum safe input		20 dBm (0.1 W or 2.2 V) and 100 VDC continuous. <b>DO NOT EXCEED MAXIMUM INPUT RATINGS</b>
1 dB compression point	-15 dBm minimum at first mixer input	First mixer optimum input level must be set to -30 dBm ((INPUT)/4).
Ext trig (J102)		BNC connector, 10 k $\Omega$ impedance, DC coupled for external trigger signals.
Amplitude		
Minimum		Typically 100 mV, 15 Hz to 1 MHz.
Maximum		50V (DC + peak AC).
Pulse Width		0.1 $\mu$ s minimum.
Accessory conn. (J103)		CB-9 female connector.
Pin 1: External Video Input		Typically 100 $\Omega$ , DC coupled, 0- 1.6V (200mV/ Div), 0-50kHz input signal for vertical deflection of the crt beam. Signal is processed by the digital storage circuits (which can be turned off) and the 1, 5, and 10 dB scale factor circuits. Also used as the Model 1405 marker input.
Pin 2: Ground		Chassis and signal.

Table 2-4 (continued)

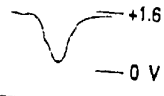
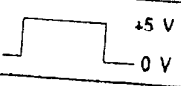
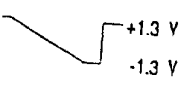
Characteristic	Performance Requirement	Supplemental Information
J103: - continued		
Pin 3: Video Output		Provides 0-1.6 V video signal proportional to the vertical display height. 0 V is the top of the screen. Impedance is 1 k $\Omega$ .
Pin 6: Sweep Gate		TTL level signal that goes to +5 V while the crt beam is sweeping.
Pin 7: Sweep Output		Provides a nominal +1.3 V to -1.3 V negative going ramp, proportional to the horizontal sweep position. Output impedance < 50 $\Omega$ .
Pins 4, 5, 8, and 9		Not used.
Standard Digital Communications Port (J104)	Conforms to IEEE Standard 438-1978	24-pin back-panel connector. See Table 2-7 for optional serial port information.

Table 2-5. Power requirements.

Characteristic	Performance Requirement	Supplemental Information
Input voltage		
Line voltage range	90 to 250 VAC	
Line frequency range	48 to 63 Hz	
Line voltage range	90 to 132 VAC	
Line frequency range	48 to 440 Hz	
Line fuse	2 A slow-blow	
Input power	90 W (1.2 A) for standard instrument 105 W (1.4 A) maximum with options	At 115 V, and 60 Hz.
Leakage current		3.5 mA rms maximum or 5 mA peak maximum.



Table 2-6. General characteristics.

Characteristic	Performance Requirement	Supplemental Information
Sweep		Normal, Manual Scan, Single Sweep, and Video Monitor (Option 10).
Sweep Rate	1 $\mu$ s/Div to 2 sec/Div in a 1-2-5 sequence	
Accuracy	$\pm 10\%$ over the center 8 divisions	
Triggering		Free run, internal, external, line, TV line, and TV field.
Internal or external trigger level	Signal height $> 1$ division	See Ext Trig in Table 2-4.
Internal Calibrator		
Amplitude	-30 dBm $\pm 0.3$ dB	Provides 100 MHz fundamental and harmonic comb.
Frequency	100 MHz $\pm 2$ kHz	
Drift	$\pm 2$ PPM/Year	
Real Time Clock		
Oscillator Frequency	32.768 kHz	
Stability	$\pm 50$ ppm	
Drift	$\pm 5$ ppm/year	
Non-Volatile Memory (Battery backed-up)		Instrument settings, waveforms, and some normalization results are stored in NVRAM.
Battery Type		Lithium cells
Battery Life: At +55°C		1 to 2 years.
At +25°C		At least 5 years.
Temperature Range for Data Retention		-10°C to +75°C.

**WARNING**

*Handling and disposing of lithium cells can be hazardous. Refer all battery maintenance to a Tektronix service center.*

Table 2-7. Electrical characteristics of instrument options.

NOTE: Options 04, 12, and 14 are mutually exclusive.

Characteristic	Performance Requirement	Supplemental Information
Option 04		Tracking Generator.
Frequency		Tracks spectrum analyzer.
Range TG tracking (offset)	100 kHz to 1.8 GHz Sufficient to align TG in analyzer bandpass	Typically -5 kHz to +60 kHz.
Output level		
Range Accuracy	-48 dBm to 0 dBm ±1.5 dB	0.1dB steps. At 100 MHz.
Output impedance VSWR	2:1 or better when output level <-8 dBm	50 Ω nominal
Flatness		
Tracking generator	±1.0 dB 100 kHz-1.8 GHz ±1.5 dB to 1.8 GHz	Typically ±1 dB to 1.8 GHz
TG/2712 combination	±2.5 dB 100 kHz-1.0 GHz ±3.0 dB to 1.8 GHz	With 10 dB RF attenuation in analyzer
User-corrected	±0.2 dB	Using B,C MINUS SAVE A
System dynamic range	>100 dB	Sensitivity >-100 dBm
System residual FM		≤100 Hz <sub>p-p</sub> total in 20 ms
Spurious signals		
Harmonic	-20 dBc or better with respect to fundamental	At frequencies ≥100 kHz
Non-harmonic	-35 dBc or better with respect to fundamental	
Option 08	Conforms to EIA Standard RS-232(D).	RS-232 serial port substitution for standard GPIB port (both ports cannot be installed in 2712 simultaneously). Male DB9 connector.
Option 10		Video monitor capability

Table 2-7 (continued)

Characteristic	Performance Requirement	Supplemental Information
Option 12		Quasi-peak detector and additional RBW filters.
Resolution BW		Adds 1 MHz, 120 kHz (EMC), 9 kHz (EMC), and 1 kHz filters; substitutes 200 Hz (EMC) filter for the standard 300 Hz. (6 dB nominal BW)
Shape factor (60 dB/6 dB)	7:1 or less	
Sensitivity (without preamp)		Equivalent maximum input noise for each res BW.
Resolution BW	Center Frequency	
	100 MHz	1.8 GHz
200 Hz	-128 dBm	-120 dBm
1 kHz	-122 dBm	-114 dBm
9 kHz	-112 dBm	-104 dBm
120 kHz	-101 dBm	-93 dBm
1 MHz	-92 dBm	-84 dBm
Sensitivity (with preamp)		NOTE: Decrease in sensitivity is approximately linear from 100 MHz to 1.8 GHz.  Start spur results in maximum 20 dB sensitivity loss from 10 MHz to 9 kHz.  Sensitivity with preamp is not specified above 600 MHz.
200 Hz	-140 dBm	
1 kHz	-134 dBm	
9 kHz	-124 dBm	
120 kHz	-113 dBm	
1 MHz	-104 dBm	
EMC Mode Display Dynamic Range	40 dB maximum (Log) 8 divisions (Lin)	
Accuracy 5 dB/div	±1 dB/10 dB to a maximum cumulative error of ±2 dB over first 35 dB. ±2 dB total from 35 to 40 dB.	
1 dB/div	±1 dB maximum over the 8 dB range.	
Linear	±5% of full scale	

Table 2-7 (continued)

Characteristic	Performance Requirement	Supplemental Information
Resolution BW		Additional resolution BW filters. Adds 1 MHz, 100 kHz, 10 kHz, and 1 kHz filters. (6 dB nominal BW)
Shape factor (60 dB/6 dB)	7:1 or less	
Sensitivity (without preamp)		Equivalent maximum input noise for each res BW.
Resolution BW	Center Frequency	<p><b>NOTE:</b> Decrease in sensitivity is approximately linear from 100 MHz to 1.8 GHz.</p> <p>Start spur results in maximum 20 dB sensitivity loss from 10 MHz to 9 kHz.</p> <p>Sensitivity with preamp is not specified above 600 MHz.</p>
	100 MHz    1.8G Hz	
1 MHz	-92 dBm    -84 dBm	
100 kHz	-102 dBm    -94 dBm	
10 kHz	-112 dBm    -104 dBm	
1 kHz	-122 dBm    -114 dBm	
Sensitivity (with preamp)		
1 MHz	-104 dBm	
100 kHz	-114 dBm	
10 kHz	-124 dBm	
1 kHz	-134 dBm	
15		
15 L.O. output level	+5 dBm to +10 dBm	

## ENVIRONMENTAL SPECIFICATIONS

The environmental characteristics of the 2712 Spectrum Analyzer are listed below. A brief description of each characteristic and how it was obtained is provided. The 2712 meets MIL T-28800E, type III, class 5, style C specifications.

Table 2-8. Environmental characteristics.

Characteristic	Description
<b>Temperature</b>	
Operating and humidity	0° C to +50° C MIL T-28800E 5 cycles (120 hours).
Non-operating <sup>2</sup>	-55° C to +75° C.
<b>Altitude</b>	
Operating	15,000 ft.
Non-operating	50,000 ft.
<b>Humidity</b>	
Non-operating	Five cycles (120 hours) in accordance with MIL-Std-28800E, class 5.
<b>Vibration</b>	
Operating (Instrument secured to a vibration platform during test)	MIL-Std-28800E, Method 514 Procedure X (modified). 15 minutes along each of 3 major axes at a total displacement of 0.015 inch peak-to-peak (2.4 g at 55 Hz), with frequency varied from 10 Hz to 55 Hz in 1-minute sweeps. Hold for 10 minutes at 55 Hz. All major resonances must be above 55 Hz.
<b>Shock</b>	
(Operating and Non-operating)	Three guillotine-type shocks of 30 g, one-half sine, 11 ms duration each direction along each major axis; total of 18 shocks.
<b>Transit Drop</b>	
(free fall)	8 inch, one per each of six faces and eight corners (instrument is tested and meets drop height of 12 inches).

<sup>2</sup> After storage at temperatures below -15° C, the instrument may not reset when power is first turned on. If this happens, allow the instrument to warm up for at least 15 minutes, then turn POWER OFF for 5 seconds and back ON.

Table 2-8 (continued)

Characteristic	Description
Electromagnetic Interference	
Radiated and conducted emissions	
FCC	FCC Part 15, sub-part J, Class A.
VDE	VDE 0871, Class B.

## PHYSICAL SPECIFICATIONS

Table 2-9 lists the weight and dimensions of the 2712 Spectrum Analyzer.

Table 2-9. Physical characteristics.

Characteristic	Description
Weight	<11.25 kg (25 lbs) maximum, including standard accessories. <10.2 kg (22.5 lbs) nominal for basic model
Dimensions	
Height with feet and handle	137 mm (5.4 in)
Width (with handle)	361 mm (14.2 in)
(without handle)	328 mm (12.9 in)
Depth (with front panel cover)	445 mm (17.5 in)
(without front panel cover)	428 mm (16.85 in)
(with handle extended)	511 mm (20.1 in)