HP CaLan 8591C
Cable TV Analyzer

Technical Specifications

Product Specifications and Data

A complete test solution for your cable TV system

The HP CaLan 8591C is the industry's only one-box tester for all RF and video measurements. With this analyzer you can make RF and video measurements without interrupting your cable TV system. The HP CaLan 8591C is a flexible troubleshooting tool and an automatic system tester. Non-interfering measurements are performed at the push of a button and can be made automatically.

The flexible hardware and software design lets you easily upgrade the analyzer to accommodate changes in required measurements and measurement techniques. For added flexibility, NTSC format is standard, with options available for worldwide PAL and SECAM formats and frequency plans.

HP CaLan's cable TV analyzer provides all this performance in a rugged, portable instrument ideal for field use. It comes in a durable carrying case that makes it easy to transport and that protects it from moisture and dirt. And the analyzer is fully operational within the case, so you never need to remove it.

HP CaLan 8591C cable TV analyzer

All specifications apply over 0°C to +50°C. The analyzer will meet its specifications after 2 hours of storage at constant temperature within the operating temperature range, 30 minutes after the analyzer is turned on and after CAL FREQ, CAL AMPTD have been run. Characteristics provide useful, but non-warranted, information about nominal performance.

Specifications

Frequency specifications

Frequency range	1 MHz to 1.8 GHz	
Frequency reference	Standard	Option 704[1]
Aging	+1 x 10^{-7}/year	+2 x 10^{-6}/year
Settability	+2.2 x 10^{-8}	+0.5 x 10^{-6}
Temperature stability	+1 x 10^{-8}	+5 x 10^{-6}
Frequency accuracy		
Freq span ≤10 MHz	±(frequency readout x frequency ref error[2] ±3.0% of span +20% of RBW +100 Hz)	
Freq span >10 MHz	±(frequency readout x frequency ref error[2] +3.0% of span +20% of RBW)	
Marker count accuracy	(S/N ≥25 dB, RBW/span ≥0.01)	
Freq span ≤10 MHz	±(marker frequency x frequency ref error[2] + counter resolution +100 Hz)	
Freq span >10 MHz	±(marker frequency x frequency ref error[2] + counter resolution +1 kHz)	
Counter resolution	Selectable from 10 Hz to 100 kHz	
Frequency span		
Range	0 Hz (zero span), 1 MHz to 1.8 GHz	
Resolution	4 digits	
Accuracy	±2% of span, span ≤10 MHz ±3% of span, span >10 MHz	
Frequency sweep		
Range		
Span ≥1 MHz	20 ms to 100 s	
Span = 0 Hz	20 µs to 20 ms (not Option 701)	
Accuracy		
20 ms to 100 s	±3%	
20 µs to 20 s	±2% (except Option 701)	
Sweep trigger	Free run, single, line, video, external	
Resolution bandwidth	1 kHz to 3 MHz, 8 selectable 3-dB bandwidths in 1, 3, 10 sequence	
Option 130	Adds 30, 100, and 300 Hz bandwidths	
Bandwidth accuracy	±20%	
Video bandwidth		
Range	30 Hz to 1 MHz in 1, 3 sequence	
Stability		
Phase noise	(1 kHz RBW, 30 Hz VBW, and sample det) <–90 dBc/Hz at >10 kHz offset from CW signal <–105 dBc/Hz at >30 kHz offset from CW signal	
Residual FM	<250 Hz pp in 100 ms (1 kHz RBW, 1 kHz VBW)	
System related sidebands	<–65 dBc at >30 kHz offset from CW signal	

[1] Will not meet FCC frequency accuracy requirements with this time base

[2] Frequency reference error = (aging rate x period of time since adjustment + initial achievable accuracy + temperature stability.

[3] Mixer power level (dBmV) = input power (dBmV) - input attenuation (dB).

[4] Referred to 300 MHz CAL OUT, 10 dB input attenuation.

[5] Referred to midpoint between highest and lowest frequency response deviations.

Amplitude specifications

Amplitude range	Displayed average noise level to +72 dBmV
Max safe input	
Peak power	+72 dBmV (0.2 W), input attenuation >10 dB
DC	100 V
Gain compression	
≥10 MHz	≤0.5 dB (+39 dBmV at input mixer[3])
Displayed average noise level	(input terminated, 0 dB attenuator, 1 kHzRBW, 30 Hz VBW, sample det)
Without preamp	≤–63 dBmV, 1 MHz to 1.5 GHz
With preamp	≤–83 dBmV, 1 MHz to 1 GHz
Spurious responses	(10 MHz to 1.8 GHz)
Second harmonic	<–70 dBc for +4 dBmV tone at input mixer[3]
Third order intermod	<–70 dBc for two +19 dBmV tone at input mixer[3] and ≥50 kHz separation
Other input related	<–65 dBc at ≥30 kHz offset, for +29 dBmV tone at input mixer[3]
Residual responses	(input terminated and 0 dB attenuator)
1 MHz to 1.8 GHz	≤–38 dBmV
Display range	
Log scale	0 to –70 dB from ref level is calibrated 0.1 to 20 dB/division in 1 dB steps
Linear scale	8 divisions
Scale units	dBm, dBmV, dBµV, V, W
Marker readout resolution	0.05 dB for log scale 0.05% of ref level for linear scale
Fast time sweeps for zero span (not Option 701)	0.7% of ref level for linear scale ≤1GHz
Reference level	
Range	Same as amplitude range
Resolution	0.01 dB for log scale 0.12% of ref level for linear scale
Accuracy	(referred to +29 dBmV ref level)
+49 to –10.9 dBmV	±(0.3 dB + 0.01 x dB from +29 dBmV)
Frequency response	
Absolute[4]	±1.5 dB
Relative flatness[5]	±1.0 dB
Calibrator output	
Frequency	300 MHz +(300 MHz x freq ref error[2])
Amplitude	+28.75 dBmV +0.4 dB
Input attenuator	
Range	0 to 70 in 10 dB steps
Accuracy	
0 to 60 dB	±0.5 dB at 50 MHz, ref to 10 dB attenuator
70 dB	±1.2 dB at 50 MHz, ref to 10 dB attenuator
Resolution bandwidth	(referred to 3 kHz RBW at ref level)
Switching uncertainty	
3 kHz to 3 MHz RBW	±0.4 dB
1 kHz RBW	±0.5 dB
30 Hz to 300 Hz RBW	±0.6 dB (Option 130)

Log to linear switching	±0.25 dB at reference leve
Display scale fidelity	
Log incremental accuracy	±0.2 dB/2 dB, 0 to –70 dB from ref level
Log maximum cumulative accuracy	±0.75 dB, 0 to –60 dB from ref level ±1.0 dB, 0 to –70 dB from ref level
Linear accuracy	±3% of reference level
Internal preamplifier	
Frequency range	1 MHz to 1.0 GHz
Gain	≥24 dB
Noise figure	≤10 dB

Option 011 built-in tracking generator

Frequency range	1 MHz to 1.8 GHz
Output power level	
Range	+42.8 dBmV to –27.2 dBmV
Resolution	0.1 dB
Absolute accuracy	±1.0 dB (+28.8 dBmV at 300 MHz)
Vernier accuracy (15° to 35° C)	±0.75 dB (+28.8 dBmV at 300 MHz)
Output flatness	±1.75 dB
Output power sweep	
Range	+42.8 dBmV to –32.2 dBmV
Resolution	0.1 dB
Spurious output (+42.8 dBmV output)	
Harmonic spurs	<–25 dBc
Non-harmonic spurs	<–30 dBc
Tracking generator feedthrough	<–57 dBmV

Option 107 TV receiver and time gate

Gate delay	(from gate trigger input to positive edge of gate output)
Range	1 µs to 65.535 ms
Resolution	1 µs
Accuracy	±1 [µs + (0.01% x gate delay)][6]
Gate length	(from positive edge to negative edge of gate output)
Range	1 µs to 65.535 ms
Resolution	1 µs
Accuracy	±[0.2 µs + (0.01% x gate length)]
Gate amplitude characteristics[6]	
Additional log error	±0.3 dB

General specifications

Temperature	
Operating	0° to +50°C in carrying case
Storage	–40° to +75°C
EMI compatibility	Conducted and radiated interference CISPR pub. 11 and FTZ 526/527/79
Audible noise	<37.5 dBA pressure and <5.0 Bels power (ISO DP7779)
Power requirement	
On (line 1)	86-127, or 195-253 Vrms, 47-66 Hz 103-126 Vrms, 400 Hz +10%
Standby (line 0)	Power consumption , 7 W
User memory (nominal)	32 Kbytes non-volative RAM
Data storage (nominal)	50 states and traces, internal memory 8 internal state registers 24 states and traces, memory card (HP 85702A)
Weight (nominal)	18.1 kg (40 lb)
Size (nominal)	213 mm (8.4") H x 366 mm (14.4") W x 460 mm (18.1") D
Warranty	1 year limited warranty for materials and workmanship

Input/output characteristics

Front panel connectors	
Input	75Ω BNC female
Cal output	75Ω BNC, +29 dBmV, 300 MHz
RF out (Option 011)	75Ω BNC female
Probe power	+15 Vdc, –12.6 Vdc, and ground (150 mA max each)
TV in (Option 107)	75Ω BNC female
Rear panel connectors	
Aux video out	50Ω BNC, 0-1 V
Monitor out	50Ω BNC
Selectable format	NTSC, 15.75 kHz, 60 Hz PAL, 15.625 kHz, 50 Hz
High sweep in/out	BNC, high TTL = sweep, low TTL = retrace
Sweep output	BNC, 5k Ω, 0 to +10 V ramp
Aux IF output	50Ω BNC, –10 to –60 dBm, 21.4 MHz
External trigger input (Opt. 107)	BNC, TTL levels, positive edge trigger
TV trigger output (Opt. 107)	BNC, TTL levels, negative edge trigger after sync pulse
TV monitor output (Opt. 107)	75Ω BNC, female, –0.28 to +0.714 V
10 MHz ref output	50Ω BNC, 10 MHz, 0 dBm
External ref in	50Ω BNC, 10 MHz, –2 to +10 dBm
RS-232	D connector, 9 pin
Parallel interface	D connector, 25 pin
HP-IB (Opt. 041)	SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, C1, C2, C3, C28
Earphone	1/8 inch monaural jack
Aux interface	9 pin "D" subminiature
Keyboard	5 pin DIN, Option 003 IBM AT keyboard compatible
Gate trigger input (Opt. 107)	50Ω BNC, pulse ≥30 ns
Gate output (Opt. 107)	50Ω BNC, TTL levels

[6]With gate enabled and triggered, CW signal, peak detector mode.

Cable TV measurement Specifications

Cable TV RF and video measurement
These specifications describe warranted performance of the HP CaLan 8591C cable TV analyzer and the HP CaLan 85721A cable TV measurement personality from 0° to 50°C after the warmup and calibration described earlier. Characteristics provide useful, but non-warranted, information about nominal performance. NTSC-formatted signals only are covered. A RAM card is needed for the HP 85721A to store test results. Test data may also be printed using an HP InkJet or HP LaserJet printer.

Input	75 Ω BNC female connector
Channel selection	Analyzer tunes to specified channels based on selected tune configuration
Tune configuration	Standard, off-the-air, HRC, IRC, T and FM (channel mode)
Channel range	1 to 158 and 201 to 300 1 tp 158 (system mode) 2 to 134 (Opt. 107)[7]
Channel frequencies	Defined by Code of Federal Regulations, Title 47,Telecommunications, Parts 73.603, 76.605, 76.612
Frequency range	5 to 1002 MHz (channel mode) 54 to 896 MHz (system mode) 50 to 850 MHz (Opt. 107)[7]
Amplitude range	–15 to +70 dBmV for S/N >30 dB 0 to +60 dBmV for coupler input (Opt. 107)
Visual carrier frequency	Visual carrier frequency is counted.
Precision frequency reference (standard)	
Resolution	100 Hz
Accuracy	±(1.2 x 10^{-7} x carrier frequency + 110 Hz)
At 55.25 MHz (Ch. 2)	±117 Hz
At 325.25 MHz (Ch. 41)	±149 Hz
At 643.25 MHz (Ch. 94)	±187 Hz
Option 704 frequency reference	
Resolution	1 kHz
Accuracy	±(7.5 x 10^{-6} x carrier frequency + 110 Hz)
At 55.25 MHz (Ch. 2)	±524 Hz
At 325.25 MHz (Ch. 41)	±2.55 Hz
At 643.25 MHz (Ch. 94)	±4.93 Hz
Visual-to-aural carrier frequency difference	Frequency difference between visual and aural carriers is counted.
Difference range	4.1 to 4.9 MHz
Resolution	100 Hz
Accuracy	±221 Hz for precision frequency ref (std) ±254 Hz for Option 704 frequency ref
Visual carrier level	The peak amplitude of the visual carrier is measured to an absolute standard traceable to the National Institute of Standards and Technology.
Amplitude range	–15 to +70 dBmV
Resolution	0.1 dB
Absolute accuracy	±2.0 dB for S/N >30 dB
Relative accuracy	±1.0 dB relative to adjacent channels in frequency ±1.5 dB relative to all other channels
Visual-to-aural carrier level difference	The difference between peak amplitudes of the visual and aural carriers is measured.
Difference range	0 to 25 dB
Resolution	0.1 dB
Accuracy	±0.75 dB for S/N >30 dB
Depth of modulation (characteristic)	Percent AM is measured from horizontal sync tip to maximum video level; measurement requires a white reference VITS and may not be valid for scrambled channels.
AM range	50 to 93%
Resolution	0.1%
Accuracy	±2.0% for C/N >40 dB
FM deviation (characteristic)	Peak reading of FM deviation
Range	±100 kHz
Resolution	100 Hz
Accuracy	±1.5 kHz
Hum/low frequency disturbance	Power-line frequency and low frequency disturbance is measured on modulated and/or unmodulated carriers. May not be valid for scrambled channels.
AM range	0.5 to 10%
Resolution	0.1%
Accuracy	±0.4% for hum ≤3% ±0.7% for hum ≤5% ±1.3% for hum ≤10%
Visual carrier-to-noise ratio (C/N)[8]	The C/N is calculated from the visual carrier peak level and the minimum noise level, normalized to 4 MHz noise bandwidth.
Optimum input range	See graphs
Maximum C/N range	Input level dependent; see graphs 59 to 71 dB over optimum input range
C/N resolution	0.1 dB
C/N accuracy	Input level and measured C/N dependent; see graphs ±1.0 to ±3.5 dB over optimum input range
CSO and CTB distortion[8]	Channel mode composite second order (CSO) and composite triple beat (CTB) distortions are measured relative to the visual carrier peak and require momentary disabling of the carrier. System mode measurements are made in the channel above the channel selected and assume that it is unused. If the analyzer has Option 107, a non-interfering CSO measurement can be made.
Optimum input range	See graphs
Maximum CSO/CTB range	Input level dependent; see graphs 66 to 73 dB over optimum input range
CSO/CTB resolution	0.1 dB
CSO/CTB accuracy	Input level and measured CSO/CTB dependent; see graphs +1.5 dB to +4.0 dB over optimum input range

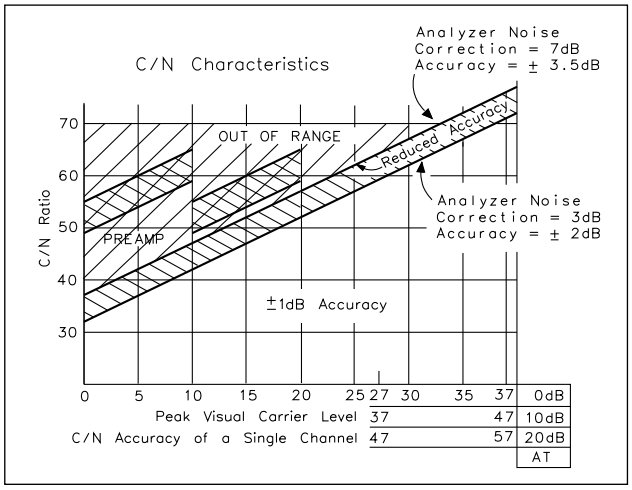
[7] For TV display, video tests (DG, DP, CLDI), and these non-interfering mode RF tests: C/N, CSO, in-channel flatness.
[8] A preamplifier and preselector filter may be required to achieve specifications.

Cross modulation	Horizontal line (15.7 kHz) related AM is measured on the unmodulated visual carrier.
Range	60 dB, useable to 65 dB
Resolution	0.1 dB
Accuracy	±2.0 dB for xmod. <40 dB, C/N >40 dB ±2.6 dB for xmod. <50 dB, C/N >40 dB ±4.6 dB for xmod. <60 dB, C/N >40dB
System frequency response	
(flatness)	System amplitude variations are measured relative to a reference trace stored during the setup.
Frequency response setup	
Fast sweep time	2 s (default) for no scrambling
Slow sweep time	8 s (default) for fixed-amplitude scrambling
Reference trace storage	50 traces that include analyzer states
Frequency response test	
Range	1.0 dB/div to 20 dB/div (2 dB default)
Resolution	0.05 dB
Trace flatness accuracy	±0.1 dB per dB deviation from a flat line and ±0.75 dB maximum cumulative error
Trace position accuracy	0.0 dB for equal temperature at test locations and ±0.4 dB maximum for different ambient temperatures

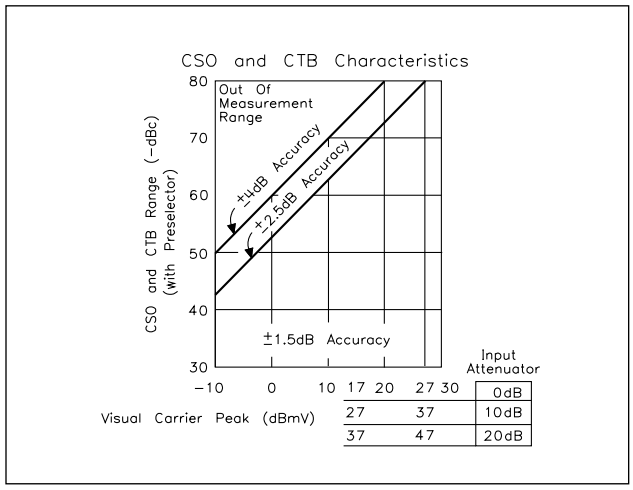
Non-interfering Video measurements	Option 107 required. Appropriate TV line must be selected. Requires FCC or NTC-composite signal.
Differential gain accuracy	±4% for room temp. and ≥20 dBmV level
Differential phase accuracy	±3° for room temp. and ≥20 dBmV level
Chrominance-luminance delay inequality accuracy	±45 ns, 32 ns typical
Non-interfering tests with gate on	
C/N and CSO[8]	(quiet line must be selected) See graphs
In-channel frequency response accuracy	(requires sin x/x, Philips ghost canceling reference, FCC multiburst, or NTC-7 combination signal) ±0.5 dB within channel

C/N, CSO, and CTB measurements

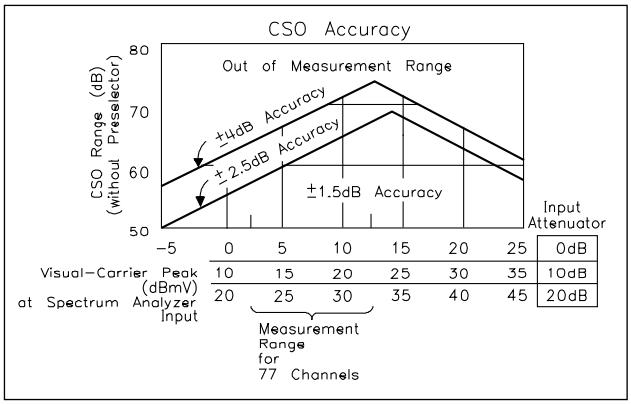
The four graphs summarize the combined HP CaLan 8591C and 85721A characteristics for C/N, CSO, and CTB testing on cable TV systems for CSO and CTB measurements with up to 77 channels and no amplitude tilt, and for C/N measurements with single channels. C/N, CSO, and CTB measurement accuracies and ranges can be read from the relevant graphs. They depend on the visual carrier peak level, the measurement reading, and the total power input to the analyzer. For C/N measurements with a preselector, there is no optimum range and the accuracy boundaries drop by the preselector's insertion loss (typically 2 dB).



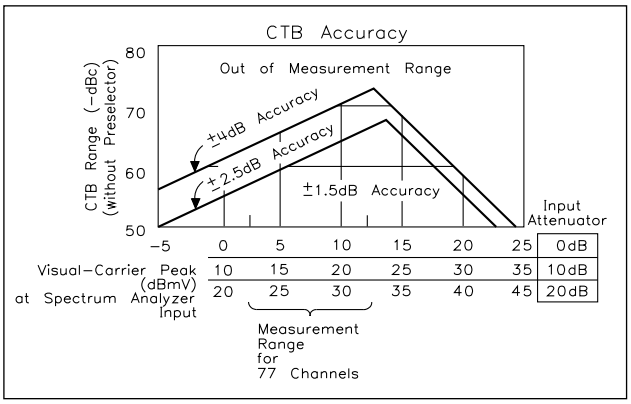
C/N accuracy(single channel)±1 dB accuracy



CSO accuracy (without external preselector filter)



CTB accuracy (without external preselector filter)



CTB accuracy (with external preselector filter)

Ordering Information

HP CaLan 8591C	Cable TV analyzer (1 MHz to 1.8 GHz)
Option 107[9]	TV receiver/video tester (includes 75-Ω coupler and cables)
Option 011	75-Ω tracking generator
Option 015	Replace yellow soft carrying case with tan soft carrying case
Option 040	Front panel cover (used without soft carrying case)
Option 041[10]	HP-IB and parallel[11] interfaces
Option 119	Noise figure card
Option 130	Narrow resolution bandwidths
Option 180[12]	TV picture display
Option 701	Delete TV trigger, AM/FM demodulator, fast time-domain sweeps
Option 704	Delete precision frequency reference
Option 908	Rack mount without handles
Option 909	Rack mount with handles
Option 915C	Component level information and service guide
Option W30	Two additional years return-to-HP service
Option W32	Two additional years return-to-HP calibration
Option R07	Retrofit kit for Option 107

Recommended accessories

HP 85702A	128K RAM card
HP 85721A	Cable TV measurements and system monitor personality (for HP 8590 E-series spectrum analyzers)
HP 85901A	Portable ac power source
HP C2634A	HP DeskJet 320 portable monochrome/color printer (parallel interface)
HP C2162A	HP DeskJet 540 monochrome/color printer (parallel interface)
HP C2164A	HP DeskJet 660C monochrome/color printer (parallel interface)
HP 24542U	RS-232 nine-pin cable (analyzer to PC)
HP 24542G	RS-232 nine-pin to 25-pin cable (analyzer to PC)
HP C2950A	Parallel 36-pin to 25-pin cable (analyzer to printer)
HP 10833A	HP-IB (GPIB) cable
HP CaLan 85921A	FCC report generator software (for HP CaLan 8591C or HP 8590E-series spectrum analyzers)

For price and ordering information (including options), call HP CaLan at 1-800-452-4844 ext. HPTV, your local Hewlett-Packard sales office, or your local authorized HP CaLan representative.

[9] Not compatible with option 180.
[10] Replaces standard RS-232 and parallel interfaces.
[11] Print and plot control only.
[12] Not compatible with Option 107

For more information on Hewlett-Packard Test & Measurement products, applications or services please call your local Hewlett-Packard sales offices. A current listing is available via Web through AccessHP at http://www.hp.com. If you do not have access to the internet please contact one of the HP centers listed below and they will direct you to your nearest HP representative.

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Printed in U.S.A. 6/95
5964-0243E