

Agilent CaLan 8591C

Cable TV Analyzer

Data Sheet

A complete test solution for your cable TV system

The Agilent Technologies 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 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.

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.

Agilent 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.



Agilent Technologies

Innovating the HP Way

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 | |

- Will not meet FCC frequency accuracy requirements with this time base
- Frequency reference error = (aging rate x period of time since adjustment + initial achievable accuracy + temperature stability)
- Mixer power level (dBmV) = input power (dBmV) - input attenuation (dB)
- Referred to 300 MHz CAL OUT, 10 dB input attenuation
- 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 kHz RBW, 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) | |

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| Log to linear switching | ±0.25 dB at reference level |
| 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 |

| | |
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| Internal preamplifier | |
| Frequency range | 1 MHz to 1.0 GHz |
| Gain | ≥24 dB |
| Noise figure | ≤10 dB |

Option 011 built-in tracking generator

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|------------------------|------------------|
| Frequency range | 1 MHz to 1.8 GHz |
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| | |
|---------------------------|---------------------------------|
| 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) |

| | |
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| Vernier accuracy (15° to 35° C) | ±0.75 dB (+28.8 dBmV at 300 MHz) |
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| Output flatness | ±1.75 dB |
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| Output power sweep | |
| Range | +42.8 dBmV to –32.2 dBmV |
| Resolution | 0.1 dB |

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| Spurious output (+42.8 dBmV output) | |
| Harmonic spurs | <–25 dBc |
| Non-harmonic spurs | <–30 dBc |

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| Tracking generator feedthrough | <–57 dBmV |
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Option 107 TV receiver and time gate

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|-------------------|---|
| 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)] |

| | |
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| Gate amplitude characteristics⁶ | |
| Additional log error | ±0.3 dB |

General specifications

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| Temperature | |
| Operating | 0° to +50°C in carrying case |
| Storage | –40° to +75°C |

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| 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) |

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|--------------------------|---|
| 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 |

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| User memory (nominal) | 32 Kbytes non-volatile RAM |
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| Data storage (nominal) | 50 states and traces, internal memory 8 internal state registers 24 states and traces, memory card (Agilent 85702A) |
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| Weight (nominal) | 18.1 kg (40 lb) |
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| Size (nominal) | 213 mm (8.4") H x 366 mm (14.4") W x 460 mm (18.1") D |
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| Warranty | 1 year limited warranty for materials and workmanship |
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Input/output characteristics

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| 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 |
| GPIO (Opt. 041) | SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, C1, C2, C3, C28 |

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| 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 Agilent CaLan 8591C cable TV analyzer and the 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 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 to 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 | $\pm(1.2 \times 10^{-7} \times \text{carrier frequency} + 110 \text{ Hz})$ |
| | At 55.25 MHz (Ch. 2) $\pm 117 \text{ Hz}$ |
| | At 325.25 MHz (Ch. 41) $\pm 149 \text{ Hz}$ |
| | At 643.25 MHz (Ch. 94) $\pm 187 \text{ Hz}$ |
| Option 704 frequency reference | |
| Resolution | 1 kHz |
| Accuracy | $\pm(7.5 \times 10^{-6} \times \text{carrier frequency} + 110 \text{ Hz})$ |
| | At 55.25 MHz (Ch. 2) $\pm 524 \text{ Hz}$ |
| | At 325.25 MHz (Ch. 41) $\pm 2.55 \text{ Hz}$ |
| | At 643.25 MHz (Ch. 94) $\pm 4.93 \text{ Hz}$ |
| 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 | $\pm 221 \text{ Hz}$ for precision frequency ref (std) $\pm 254 \text{ Hz}$ 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 | $\pm 2.0 \text{ dB}$ for S/N >30 dB |
| Relative accuracy | $\pm 1.0 \text{ dB}$ relative to adjacent channels in frequency $\pm 1.5 \text{ dB}$ 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 | $\pm 0.75 \text{ dB}$ 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 | $\pm 2.0\%$ for C/N >40 dB |

FM deviation (characteristic)

| | |
|------------|------------------------------|
| | Peak reading of FM deviation |
| Range | $\pm 100 \text{ kHz}$ |
| Resolution | 100 Hz |
| Accuracy | $\pm 1.5 \text{ kHz}$ |

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 | $\pm 0.4\%$ for hum $\leq 3\%$ $\pm 0.7\%$ for hum $\leq 5\%$ $\pm 1.3\%$ for hum $\leq 10\%$ |

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 $\pm 3.5 \text{ dB}$ over optimum input range |

CSO and CTB distortion⁸

| | |
|-----------------------|---|
| | 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 $+1.5 \text{ dB}$ to $+4.0 \text{ dB}$ 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 >40 dB |

| | |
|---|---|
| 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 |

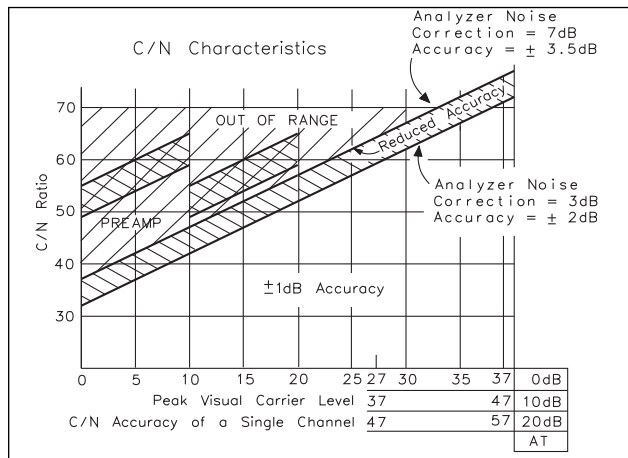
| | |
|--------------------------------|---|
| Frequency response test | |
| Range | 1.0 dB/div to 20 dB/div (2 dB default) |
| Resolution | 0.05 dB |
| Trace flatness accuracy | ±0.1 dB per dB deviation from a flat line and ±0.75 dB maximum cumulative error |
| Trace position accuracy | 0.0 dB for equal 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 |

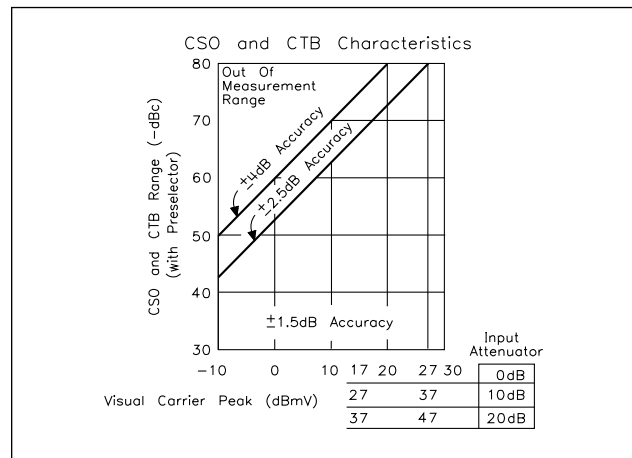
| | |
|---|---|
| Non-interfering tests with gate on | |
| C/N and CSO ⁸ | (quiet line must be selected) See graphs |
| In-channel frequency response accuracy | (requires sin x/x, Philips ghost canceling reference, FCC multiburst, or NTC-7 combination signal) ±0.5 dB within channel |

C/N, CSO, and CTB measurements

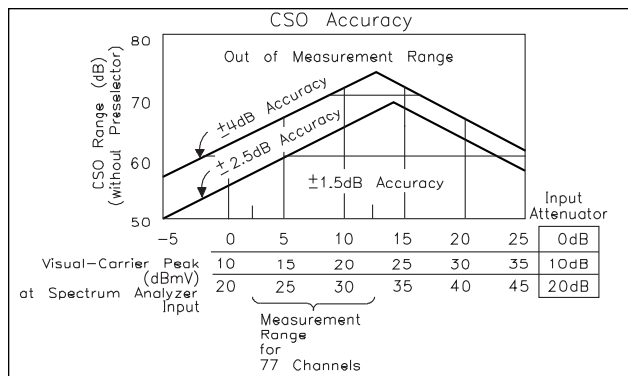
The four graphs summarize the combined CaLaN 8591C and 85721A characteristics for C/N, CSO, and CTB testing on cable TV systems for CSO and CTB measurements with up to 77 channels and no amplitude tilt, and for C/N measurements with single channels. C/N, CSO, and CTB measurement accuracies and ranges 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).



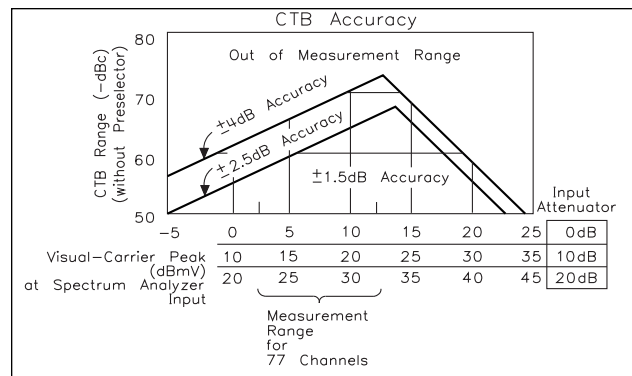
C/N accuracy (single channel) ± 1 dB accuracy



CSO accuracy (without external preselector filter)



CTB accuracy (without external preselector filter)



CTB accuracy (with external preselector filter)

Ordering Information

Agilent CaLan

| | |
|--------------------------------|---|
| 8591C | Cable TV analyzer (1 MHz to 1.8 GHz) |
| Option 107⁹ | 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 041¹⁰ | GPIB and parallel ¹¹ interfaces |
| Option 119 | Noise figure card |
| Option 130 | Narrow resolution bandwidths |
| Option 180¹² | 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-Agilent service |
| Option W32 | Two additional years return-to-Agilent calibration |
| Option R07 | Retrofit kit for Option 107 |

Recommended accessories

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

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

Agilent Technologies' Test and Measurement Support, Services, and Assistance

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Our Promise

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Your Advantage

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Innovating the HP Way