

Agilent 8591C Cable TV Analyzer

Product Overview



The industry's only one-box tester for all non-interfering RF and video measurements

A complete test solution for your cable TV system

Keep your customers happy and save time with non-interfering measurements

When your customers subscribe for cable TV service, they expect quality service without interruption. Now you can perform all RF¹ and video measurements without interrupting the system. The non-interfering measurements are performed at the push of a button and can be done automatically for the entire system. The Agilent 8591C switches from a flexible troubleshooting tool to an automatic system tester at the touch of a button. So, you can make unattended measurements when it is convenient for you while keeping your customers happy.

1. CTB testing is performed on unoccupied channels.



Agilent Technologies

Upgrades for the future

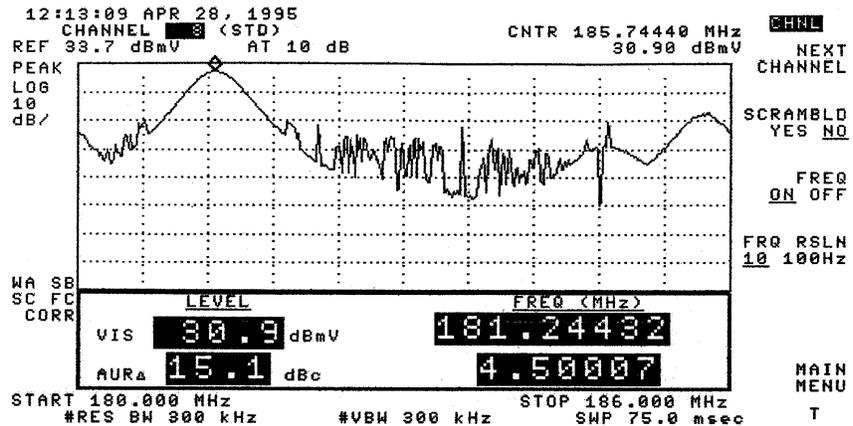
The 8591C is designed with flexibility in mind. To accommodate changes in required measurements and measurement techniques, you can easily upgrade your Agilent cable TV analyzer thanks to flexible hardware and software designs. For added flexibility, the analyzer includes the NTSC format as standard, with options available for worldwide PAL and SECAM formats and frequency plans.

Protecting your investment

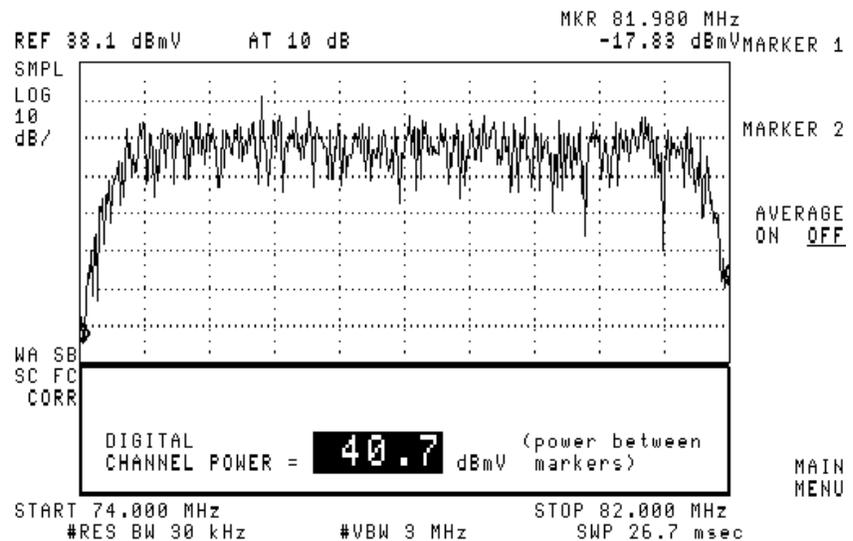
The latest developments in digital video transmission pose new measurement challenges for cable TV operators. One of the most important measurements that must be made is digital carrier power. The 8591C now comes standard with digital carrier power measurements for most countries using NTSC and PAL formats. This added feature was developed to let you measure digital cable TV channel power quickly, accurately and economically. You can view the power and spectrum of the channel being measured and define the test parameters such as channel frequency and bandwidth.

Portable and rugged

Agilent'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.



Carrier level and frequency test FCC 76.605(a) (1,3,5) performed at the push of a key



Digital channel power across an 8 MHz bandwidth

System troubleshooting with the Agilent 8591C

When problems occur, the 8591C cable TV analyzer gives you powerful troubleshooting tools. In channel mode, the analyzer lets you select channels by numbers and perform complex measurements such as carrier level, carrier frequency, and C/N at the push of a button. For more in-depth analysis, you can press a button to convert your cable TV analyzer into a full-featured spectrum analyzer.

Built-in preamplifier

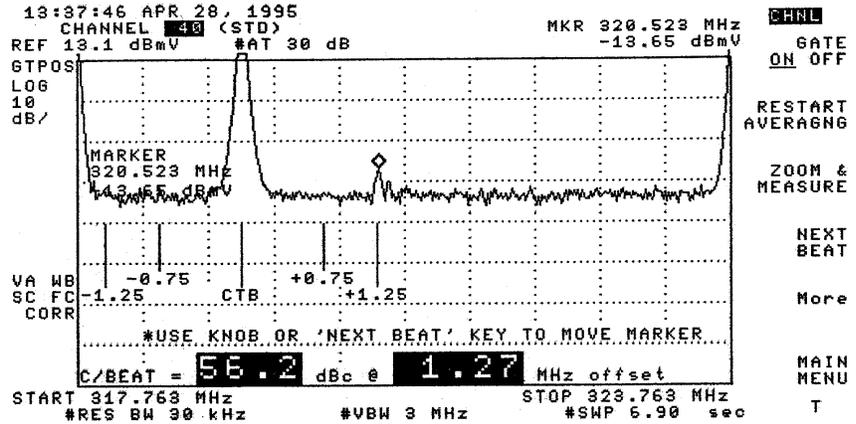
To aid C/N troubleshooting at the subscriber's tap, the analyzer includes a built-in 24 dB preamplifier. The preamplifier is specified to 1 GHz to cover all VHF and UHF cable TV channels, and it is switched in and out automatically when system power level is low (0 to 20 dBmV). Preamplifier gain is automatically subtracted from the reference level and marker readouts so that you can read the correct power levels directly from the screen.

Non-interfering tests

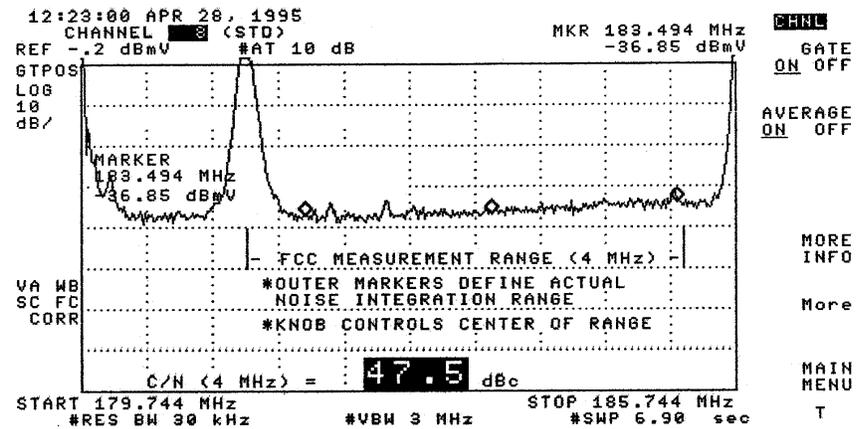
Option 107 adds non-interfering RF and video measurement capability to the 8591C cable TV analyzer (or Agilent 8590 E-series analyzers). Until now, carrier-to-noise and composite second order measurements were made with the modulation turned off. With the 8591C, these measurements are made during a quiet line (horizontal line without video modulation) selected by the user. Additionally, if a channel's vertical interval test signals (VITS) include a Philips ghost canceling reference, a $(\sin x)/x$, or a multi-burst signal, you can perform in-channel frequency response tests without disabling your system.

Video measurements for FCC compliance

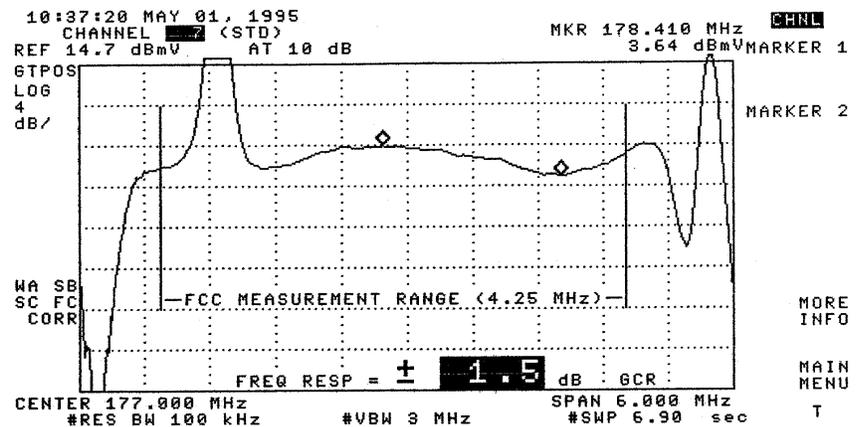
The FCC requires you to make three key video measurements: differential gain (DG), differential phase (DP), and chrominance-luminance delay inequality (CLDI). The 8591C (or Agilent 8590 E-series analyzers) with Option 107 provides this measurement capability in a single instrument that includes RF-to-baseband conversion, video demodulation, and video testing. And, you can perform video testing anywhere in your system because the 8591C is portable.



Non-interfering composite second order (CSO) test FCC 76.605(a) (8)



Non-interfering carrier-to-noise (C/N) measurement FCC76.605(a) (7)



Non-interfering in-channel flatness test FCC 76.605a (6)

No video knowledge required

Just select the video test and wait for the answer; you don't have to be a video expert to run the tests. In a matter of seconds the 8591C displays the DG/DP and CLDI numeric answers—no interpretation is required.

TV receiver operation

With Option 107 you can operate the analyzer as a television receiver. You can simultaneously hear the sound from the analyzer's built-in speaker and see the TV picture on the analyzer's display. This capability allows you to quickly identify picture quality problems such as noise, distortion, hum, and ingress. If you don't need the full capacity of Option 107 but still want to view TV picture problems, Option 180 gives you just the picture without sound (it omits the non-interfering RF and video measurements.)

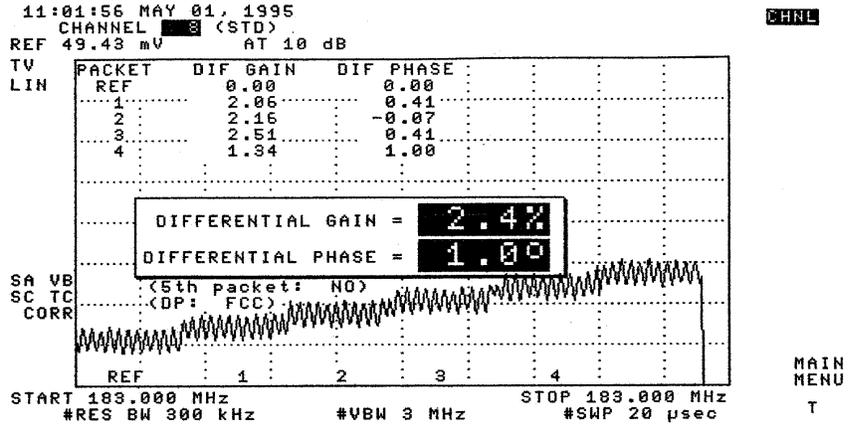


Distortion displayed on the TV screen

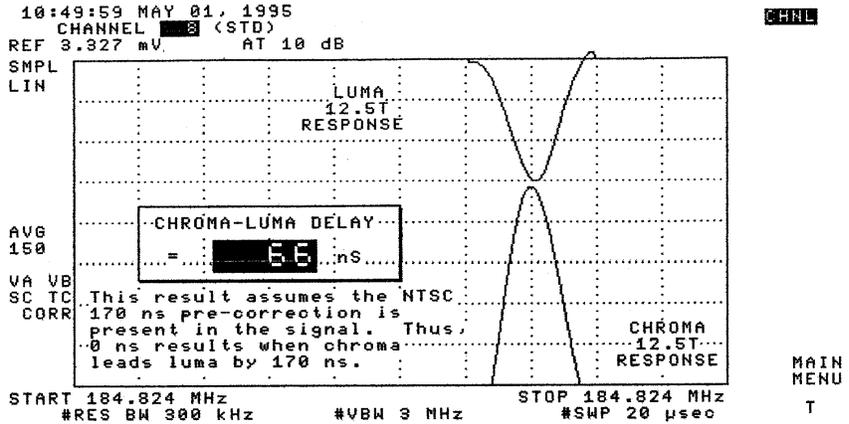
Automatic system testing with the Agilent 8591C

Frequent system testing is one way to maintain cable TV system quality. In system mode, the 8591C tests system performance automatically without disrupting service.

The analyzer automatically performs selected tests on any or all channels without the aid of an operator or PC. This mode is also useful for running the 24-hour test required by FCC regulations.



Simultaneous differential gain and differential phase video measurements FCC 76.605 (a) (12, 13)



Chrominance-luminance delay inequality measurement FCC 76.605 (a) (11)

11:34:45 APR 28, 1995

ENTER Tests, & Line/Field/Signal information where appropriate. Press DONE when finished.
(To DELETE a Test, ENTER negative Test Number)

TEST	Selected Tests for Channel 8:
?	1,2,3,4,5,6,7,8,9
1	Visual/Aural Carrier Levels
2	Visual/Aural Carrier Frequencies
3	Depth of Modulation
4	Hum
5	CSO
6	Carrier-to-Noise Ratio
7	DG, DP, CLDI
8	In-Channel Frequency Response
9	FM Deviation

Test plan creation menu for selecting channels and tests

Customize system test plans without a PC

You can design your own test plans for different systems, test locations, and test conditions. The analyzer's test plan menu lets you select measurements for each channel or range of channels. STD, AIR, IRC, HRC, and T channel plans are built in so you can set up your system's channel plan quickly and easily from the front panel of the analyzer.

No external equipment is required. You can easily select tests for each channel, and on-screen help text will lead you through the setup. The analyzer stores up to five test plans, and additional plans can be stored on RAM cards that are loaded quickly from the front panel.

After setting up the test plans, you can make measurements at any time. A single keystroke starts the test immediately. Or, for time-delayed and repeated measurements, you can enter start and stop times and dates, with repeat-time intervals. The cable TV analyzer does the rest.

11:24:40 APR 28, 1995
DATA FILE: 2 PAGE #: 3

Tests	Channel Number				
	7	8	9	10	11
Vis Lvl dBmV	31.8	31.2	32.4	31.2	31.2
Aur Lvl dB	15.4	14.8	15.7	16.5	14.6
Vis Freq MHz	175.23995	181.24433	187.25988	193.24667	199.24989
Aur Freq MHz	4.50004	4.50008	4.50012	4.50003	4.49996
MOD DEPTH %	87.9	86.8	88.9	88.5	75.8
HUM %	2.0	1.5	2.0	1.7	2.2
CSO dB	50.8	66.6	70.2	71.0	66.0
C/N dB	44.4	47.8	47.4	49.8	46.7
LN, FLD	13.8	13.8	13.8	13.8	13.8
CLDI ns	69	88	-96	26	-
DS %	12.9	2.7	9.8	3.5	-
DP % (FCC TEST)	-3.7	-2.7	9.1	-9.9	-
LN, FLD, SIG	18.0,F	18.0,F	14.0,F	18.0,F	-,-,-
FREQ RESP dB	1.8	0.6	8.7	1.3	-
LN, FLD, SIG	19.8,6	19.8,6	19.8,6	17.8,M	-,-,-
FM DEV kHz	36.1	21.7	24.7	33.3	12.4

SYSTEM
NEXT PAGE
PREV PAGE
GOTO PAGE
PRINT REPORT
STORE TO CARD
Main Menu
T

Test results printed from analyzer display

Turn test data into instant reports

Test data can be printed in tabular form suitable for formal reports using HP or Epson printers. Test results are listed under the channel number measured, and scrambled channels are underlined. Results from up to 34 test runs can be stored on RAM cards for future analysis. For reference, each file includes details of the analyzer's serial number, configuration, and user-entered test location and temperature.

PC software is available for extracting the stored test data from the 8591C and storing it in a PC data file. With a spreadsheet program (for example, Lotus 1-2-3, Microsoft Excel, or Borland QuatroPro), you can turn the test data into custom reports for your system.

With the 85921B FCC report generator software, your test data can be easily formatted for FCC RF and video proof-of-performance reports (compatible with the 85721B, Rev. A.01.04, personality).

Two interface ports

The 8591C comes standard with both serial (RS-232) and parallel interfaces that can simultaneously connect to different external equipment. Use the serial port for your PC when you extract test data from the analyzer. You can print test data and analyzer displays by connecting your printer to the parallel port. Option 041 gives you an GPIB and parallel interface combination instead.

85721B CABLE TV MEASUREMENT SYSTEM (NTSC VERSION)													
File #	Date	Time	Loc Code	Tempature	Serial #	Oven ?	Beat Ch #	CTB(-dBc)	CSO(-dBc)				
2	04/26/95	19:04	1234	70.0	58	YES	58	57.0	53.0				
Channel	Carrier Freq MHz	Visual Level dBmV	Aural Level Dll(-dBc)	Aural Freq Dif (MHz)	Depth of Modulatr (%)	HUM (%)	CSO (-dBc)	C/N (-dBc)	CLDI (ns)	Diff Gain (%)	Diff Phase (degrees)	In-Chnl Freq Rsp (+/-dB)	FM Deviation (+/-kHz)
2	55.25995	26.3	13.3	4.50004	88.1	2.4	70.2	45.3	-117	2.2	-1.0	1.9	28.1
3	61.24810	26.5	12.5	4.50011	89.0	2.9	85.2	45.5				1.2	48.6
4	67.23994	27.7	13.9	4.50005	88.7	2.0	85.6	46.2	-28	3.8	2.1	1.2	31.9
5	77.25995	28.1	13.6	4.50007	86.8	2.0	54.7	44.7	-73	4.3	-2.0	2.6	34.1
6	83.26023	29.1	14.9	4.50006	83.5	1.8	55.5	46.6					11.3
7	175.23994	31.8	15.4	4.50004	87.9	2.0	50.8	44.4	69	12.9	-3.7	1.8	36.1
8	181.24434	31.2	14.8	4.50008	88.1	1.5	66.6	47.8	88	2.7	-2.7	0.6	21.7

Lotus 1-2-3 report printed from PC display

FCC proof of performance measurements at the touch of a button

The 8591C cable TV analyzer includes the Agilent 85721A measurement personality card, which provides dedicated cable TV measurements. The personality is loaded into the 8591C analyzer before shipment, or you can purchase it separately for use with Agilent 8590 E-series spectrum analyzers.

RF measurements

- Automatic tuning of cable TV and TV broadcast carriers
- Visual and aural carrier levels and frequencies
- System channel survey
- Depth of modulation
- TV aural and FM broadcast carrier deviation
- Carrier to noise ratio²
- In-channel frequency response²
- Hum/low frequency disturbances
- System frequency response
- Baseband TV line and field viewing
- TV aural and FM broadcast carrier demodulation
- Distortion (CSO²/CTB³)
- Crossmodulation
- Ingress and co-channel interference viewing
- Digital carrier power

Video measurements

- Differential gain⁴
- Differential phase⁴
- Chrominance-luminance delay inequality⁴

Valuable options are standard

- For a significantly reduced price, the 8591C bundles many 8590 E-series analyzer options that are needed for cable TV testing.

Agilent 8591C standard features

- 75 Ω input impedance
- Precision frequency reference
- Protective soft yellow carrying case
- Serial and parallel interfaces
- Fast time domain sweeps and Analog+ display
- AM/FM demod with speaker and TV sync trigger
- 85721A cable TV measurements and system monitor personality
- 85702A 128K RAM card accessory
- Internal preamplifier
- Type-F-to-BNC adapter accessory

2. Requires Option 107 for non-interfering mode

3. Non-interfering CTB can be performed on an unoccupied channel.

4. Requires Option 107

Cable TV measurement specifications

Cable TV RF and video measurement

These specifications describe warranted performance of the Agilent 8591C cable TV analyzer and the 85721A cable TV measurement personality from 0°C 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 Agilent 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 range	1 to 158 and 201 to 300 (channel mode) 1 to 158 (system mode) 2 to 134 (Option 107) ⁵
Channel frequencies	Defined by <i>Code of Federal Regulations</i> , 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 (Option 107) ⁵
Amplitude range	-15 to +70 dBmV for S/N ≥ 30 dB 0 to +60 dBmV for coupler input (Option 107)
Visual carrier frequency	Visual carrier frequency is counted.
Precision frequency reference (standard)	
Resolution	100 Hz
Accuracy	±(1.2 × 10 ⁻⁷ × 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 × 10 ⁻⁶ × 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 dB for S/N ≥ 30 dB
Relative accuracy	±1 dB relative to adjacent channels in frequency ±1.5 dB relative to all other channels
Digital carrier power characteristics	
Accuracy	±0.7 dB for 8 MHz channel bandwidth and 10 averages

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% 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 ratio⁶ (C/N)	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 to ±3.5 dB over optimum input range
CSO and CTB distortion⁶	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 dB over optimum input range

5. For TV display, video tests (DG, DP, CLDI), and these non-interfering mode RF tests: C/N, CSO, in-channel flatness

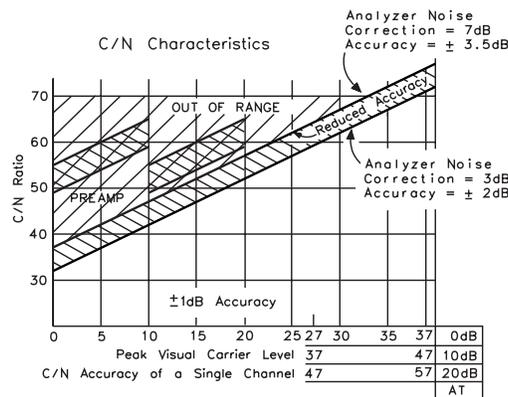
6. A preamplifier and preselector filter may be required to achieve specifications.

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 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

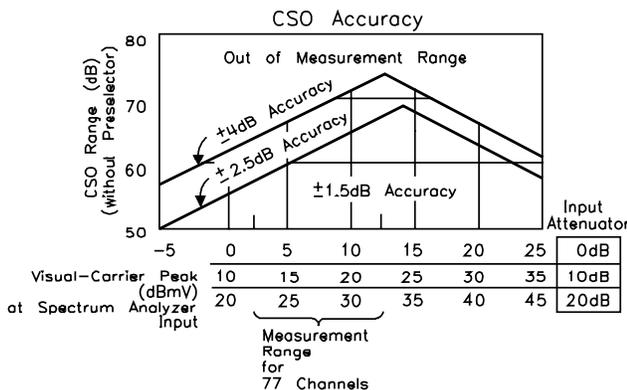
System frequency response (flatness)	System amplitude variations are measured relative to a reference trace stored during the setup.
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Frequency response setup	
Fast sweep time	2 s (default) for no scrambling
Slow sweep time	8 s (default) for fixed-amplitude scrambling
Reference trace storage	50 traces that include analyzer states

Frequency response test	
Range	1 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



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



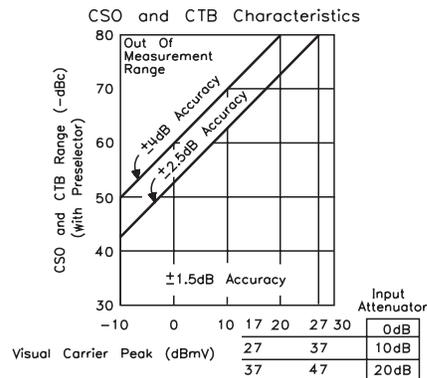
CTB accuracy (without external preselector filter)

Non-interfering Video measurements	Option 107 required. Appropriate TV line must be selected.
Differential gain accuracy	Requires FCC or NTC-7 composite signal. ±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

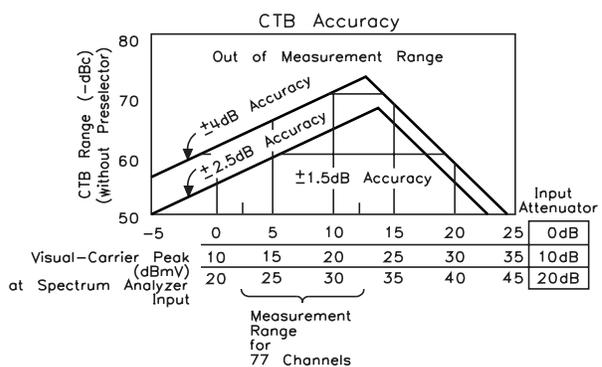
Non-interfering tests with gate on⁶	(quiet line must be selected) See graphs (requires sin x/x, Philips ghost canceling response accuracy reference, FCC multi-burst, or NTC-7 combination signal)
C/N and CSO	±0.5 dB within channel
In-channel frequency	

C/N, CSO, and CTB measurements

The four graphs summarize the combined 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).



CSO accuracy (with external preselector filter)



CTB accuracy (without external preselector filter)

Ordering information

8591C Cable TV analyzer (1 MHz to 1.8 GHz)

8591C CATV analyzers include:

- RS-232 and parallel interfaces
- Yellow soft carrying case
- English manual set

Options

To add options to a product, use the following ordering scheme:

Model options 8591C-Option 1
 8591C-Option 2

Hardware options

8591C-107⁷ Non-interfering RF and video measurements
 (includes 75 Ω coupler and cables)

8591C-119 Noise figure card

8591C-130 Narrow resolution bandwidths

8591C-180⁸ TV picture display

Trigger and demod

8591C-701 Delete TV trigger, AM/FM demodulator,
 fast time-domain sweeps

Tracking generator

8591C-011 75 Ω tracking generator

Data interfaces

8591C-041 GPIB and parallel⁹ interfaces
 (Replaces standard RS-232 and parallel interfaces)

Frequency reference

8591C-704 Delete precision frequency reference

Calibration documentation

8591C-UK6 Commercial calibration certificate with test data

Accessories

8591C-015 Tan soft carrying case (replaces yellow case)

8591C-908 Rack mount without handles

8591C-909 Rack mount with handles

8591C-030 FCC report generator software

8591C-B70 BenchLink spectrum analyzer software

Documentation

8591C-910 Additional set of manuals

8591C-915 Component-level information and service guide

Warranty and service

For warranty and service of 3 years, please order 36 months of R-51B (quantity = 36). Standard warranty is 12 months.

R51B Return-to-Agilent warranty and service plan

Calibration¹⁰

For 3 years, order 36 months of the appropriate calibration plan shown below.

R-50C-001 Standard calibration

Retrofit kits - field installable

8591CU-R01 Retrofit kit for fast time domain sweeps

8591CU-R02 Retrofit kit for TV trigger and AM/FM demod

8591CU-R04 Retrofit kit for precision frequency reference

8591CU-R07 Retrofit kit for TV receiver/video tester

8591CU-R11 Retrofit kit for 1.8 GHz, 75 Ω tracking generator

8591CU-R19 Retrofit kit for noise figure card

8591CU-R21¹¹ Retrofit kit for GPIB interface

8591CU-R23¹¹ Retrofit kit for RS-232 interface

8591CU-R24¹¹ Retrofit kit for parallel printer interface

8591CU-R30 Retrofit kit for narrow resolution bandwidths

8591CU-R41 Retrofit kit for GPIB and parallel interfaces

8591CU-R80 Retrofit kit for TV picture on screen

Recommended accessories

85702A 128K RAM card

85901A Portable AC power source

24542U RS-232 nine-pin cable (analyzer to PC)

10833A GPIB cable (1M)

7. Not compatible with Option 180

8. Not compatible with Option 107

9. Print and plot control only

10. Options not available in all countries

11. Serial numbers greater than 3523A or 3525U use single I/O

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

Agilent Technologies aims to maximize the value you receive, while minimizing your risk and problems. We strive to ensure that you get the test and measurement capabilities you paid for and obtain the support you need. Our extensive support resources and services can help you choose the right Agilent products for your applications and apply them successfully. Every instrument and system we sell has a global warranty. Support is available for at least five years beyond the production life of the product. Two concepts underlie Agilent's overall support policy: "Our Promise" and "Your Advantage."

Our Promise

Our Promise means your Agilent test and measurement equipment will meet its advertised performance and functionality. When you are choosing new equipment, we will help you with product information, including realistic performance specifications and practical recommendations from experienced test engineers. When you use Agilent equipment, we can verify that it works properly, help with product operation, and provide basic measurement assistance for the use of specified capabilities, at no extra cost upon request. Many self-help tools are available.

Your Advantage

Your Advantage means that Agilent offers a wide range of additional expert test and measurement services, which you can purchase according to your unique technical and business needs. Solve problems efficiently and gain a competitive edge by contracting with us for calibration, extra-cost upgrades, out-of-warranty repairs, and on-site education and training, as well as design, system integration, project management, and other professional engineering services. Experienced Agilent engineers and technicians worldwide can help you maximize your productivity, optimize the return on investment of your Agilent instruments and systems, and obtain dependable measurement accuracy for the life of those products.

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