DS2831
Digital TV Spectrum Analyzer

Key Benefits

- Fast Spectrum Analyzer: detect and troubleshoot ingress with exceptional sensitivity of -63.5dBmV @ 300KHz RBW.
- Non-intrusive color coded spectral density persistence test, showing transient noise hiding under upstream bursty signaling
- MER Measurement: up to 47 dB MER with 48 hours of statistical recording with 1 second resolution
- Analog TV and SC-QAM: troubleshoot typical analog interference and distortions as well as SC-QAM performance
- Time-Domain EVS Measurements: uncover interference from LTE signals under downstream QAM carriers with no service interruptions
- Characterize OFDM carrier performance and DOCSIS 3.1 cable modem performance
- 7" Capacitive Touchscreen: with excellent touch response and 7 hours of operating time



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Field Test Instruments



Key Features:

- Real spectrum analyzer performance from 4 MHz – 1.22 GHz (optional extension to 2.15 GHz)
- Downstream & Upstream Spectrum Analysis cover DOCSIS 3.1 frequency bands
- Spectrum Persistence Analysis: any frequency band, max span 206 MHz
- In-service Error Vector Spectrum identifies interference under OFDM and SC-QAM carriers with no interruptions in service
- ITU-T J 83 Annex A/B/C, QAM; auto-detects channel parameters
- Full DOCSIS3.1 capabilities with downstream OFDM and 32x SC-QAM bonded carriers, and upstream OFDM transmit feature with 8x SC-QAM bonded carriers
- Forward/Reverse passive non-intrusive sweep (does not require US sweep receivers for up to 195.2 MHz of high resolution sweep response in the Upstream path)
- Integrated Upstream Signal Generator (J.83A/B-FEC)
- Transport stream analysis with TR 101 290 Monitoring, auto-generated program lists, and program-channel mapping
- Gated Measurements: in-service CCN, CSO, CTB, CLDI, DG/DP, DOM, ICR tests
- Optical features such as OPM, VFL, and an optional Fiberscope
- Highly responsive capacitive touchscreen
- Programmable autotest allowing field engineers to perform multiple tests on a single "GO" button press
- Deviser EDGE asset and test data management software

Spectrum Analyzer

Featuring the latest technology, the DS2831 affords outstanding performance to the CATV engineer. Its RF features are based on a portable and true spectrum analyzer with 80dB+ of dynamic range, detecting impairments before they affects the customer. A host of new applications help HE/HUB and field engineers perform in-service measurements and locate interference. The in-service upstream persistence mode (any frequency band, max span 206 MHz) reveals interference under bursty signaling.

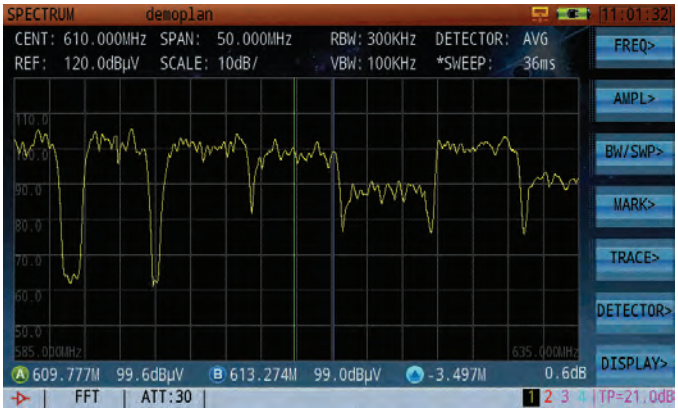


Figure 1: Spectrum analyzer with frequency range of 4 MHz to 1220 MHz (option to 2150 MHz), 80dB+ of dynamic range and –63.5 dBmV sensitivity @300 kHz.

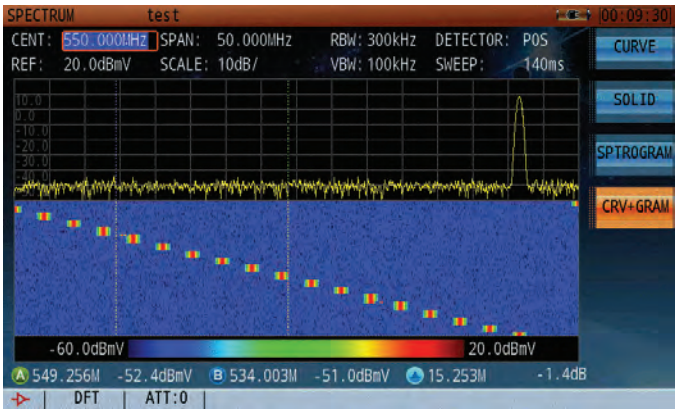


Figure 2: The spectrogram provides a scrolling three-dimensional display for tracking frequency and level over time.

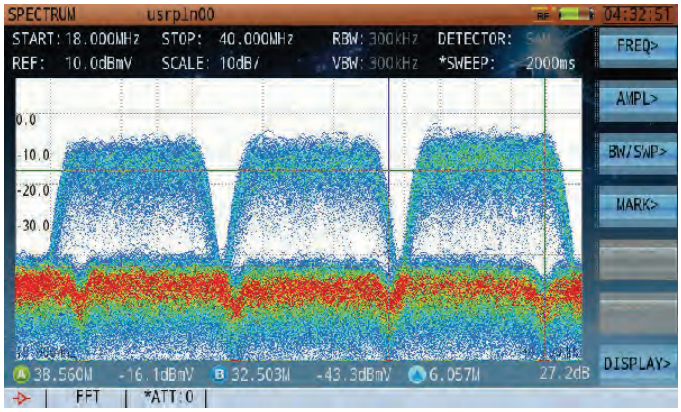


Figure 3: Persistence analysis shows low level CPD under DOCSIS upstream signal. Color coded for easy interpretation.

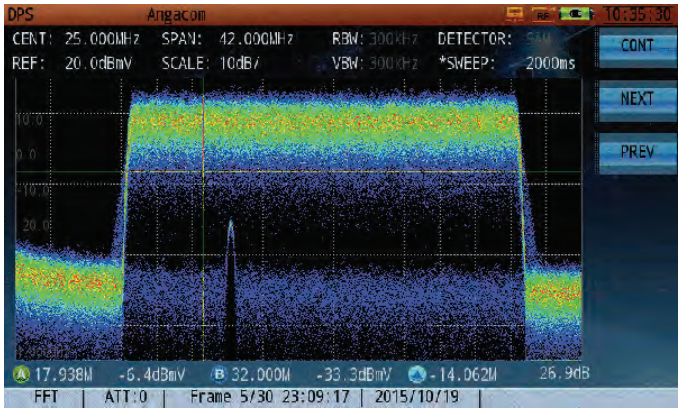


Figure 4: Persistence analysis: CW interference under Upstream DOCSIS 3.1 signal.

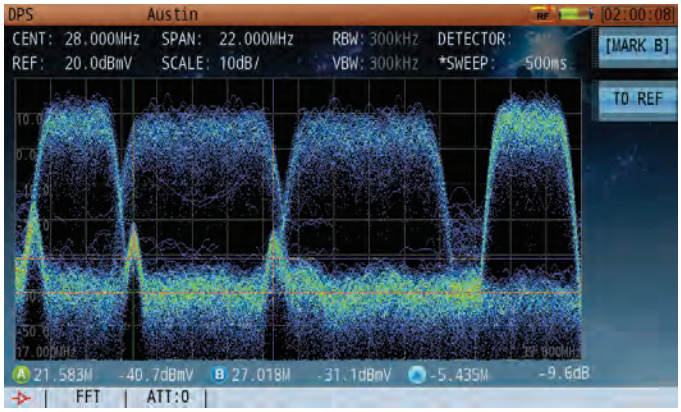


Figure 5: Persistence analysis: coherent CW and intermittent interference under Upstream DOCSIS 3.0 bonded signals.

Analog TV and Digital TV Test

In the Analog TV mode, when VITS signals are inserted, gated CCN, CSO, CTB, CLDI, DG-DP, DOM, and ICR measurements allow in-service channel testing. For DVB-C and CMTS downstream signals, the revolutionary Frequency & Time EVS function enables users to detect coherent distortions hiding under QAM carriers like LTE – without interrupting service.

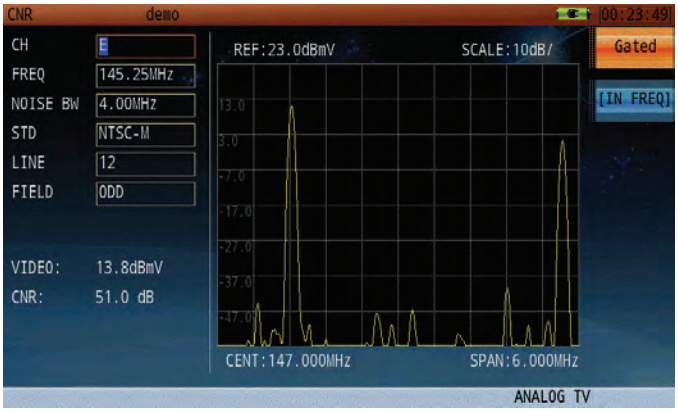


Figure 6: Analog TV Gated Measurement supports in-service CCN, CSO, CTB, CLDI, DG/DP, DOM and ICR measurements

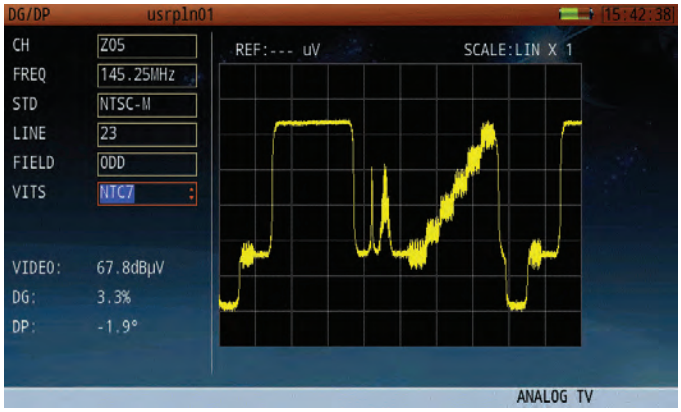


Figure 7: Use VITS and Analog TV Gated Mode to measure analog TV video parameters without interrupting service.

QAM Test: Basics

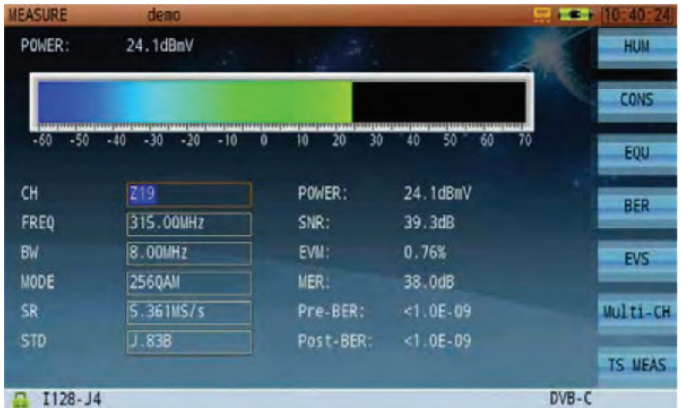


Figure 8: DVB-C channel measurements to characterize digital carrier metrics such as channel power, MER, Pre/Post BER.



Figure 9: Digital Hum measurement can detect changes in modulation amplitude (typically due to powerlines).



Figure 10: BER and MER Statistical Analysis is used to find impairments, interference and distortions over time.

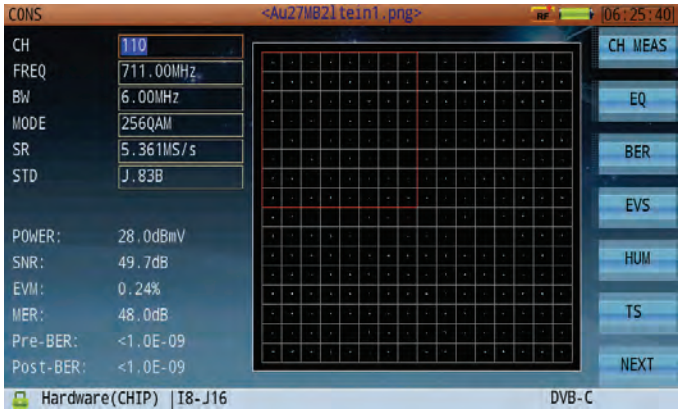


Figure 11: Constellation Display

QAM Test: Error Vector Spectrum (In-Service)

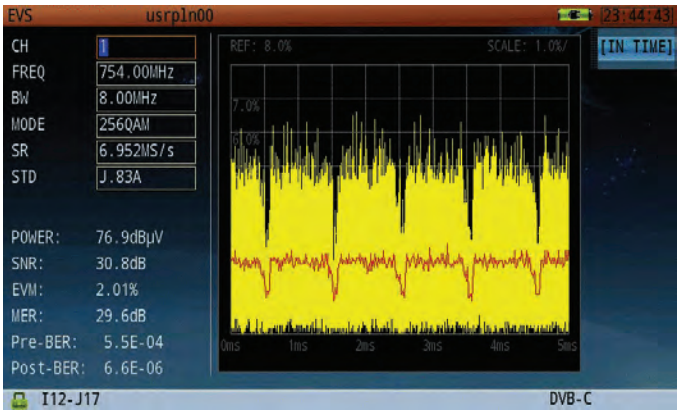


Figure 12: EVS Measurement (vs. Time) is used to find LTE interference signal signatures under a QAM carrier without interrupting service.

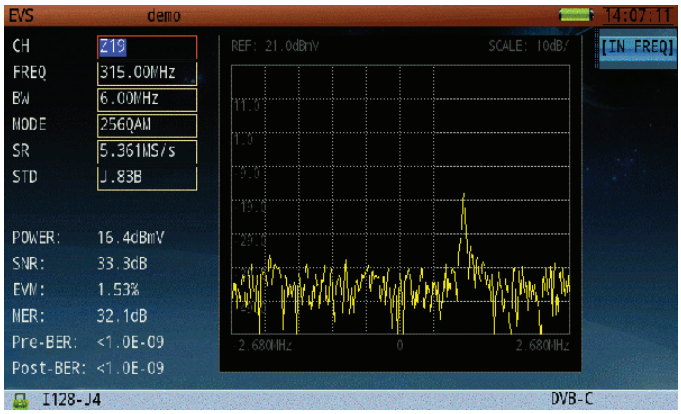


Figure 13: EVS Measurement (vs. Frequency) measures interference signals under a QAM carrier.

QAM Test: Finding Linear Distortions



Figure 14: The Adaptive Equalizer uniquely compensates for linear distortions such as phase noise, impedance mismatch & group delay in the HFC network.

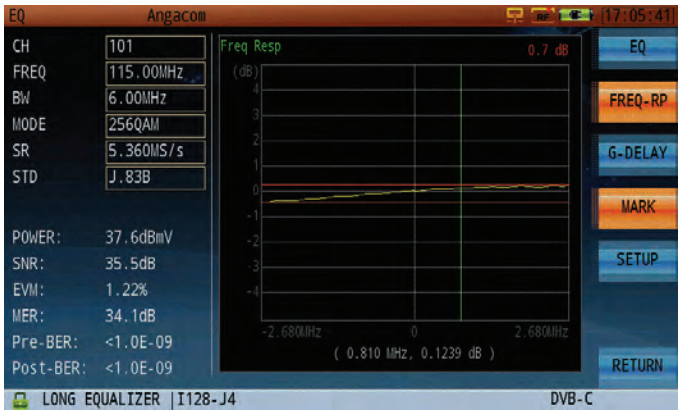


Figure 15: Frequency Response is derived from the adaptive EQ power coefficient. The in-band frequency response should not exceed ± 1.5 dB peak to valley.

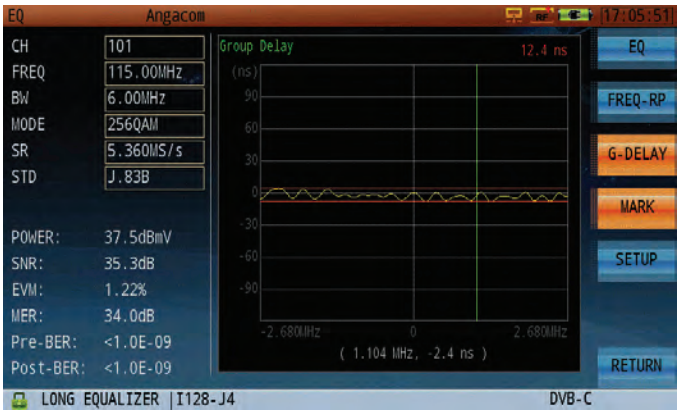


Figure 16: Group Delay is also derived from the adaptive EQ power coefficient. Group delay should not exceed 200 ns/MHz in the US or 75 ns/MHz in the DS.

Transport Stream Analysis

The DS2831 supports transport stream analysis, showing bandwidth usage, basic TS structure, TR 101 290, PiD view, PCR, PSiP, PAT, and PMT tables.

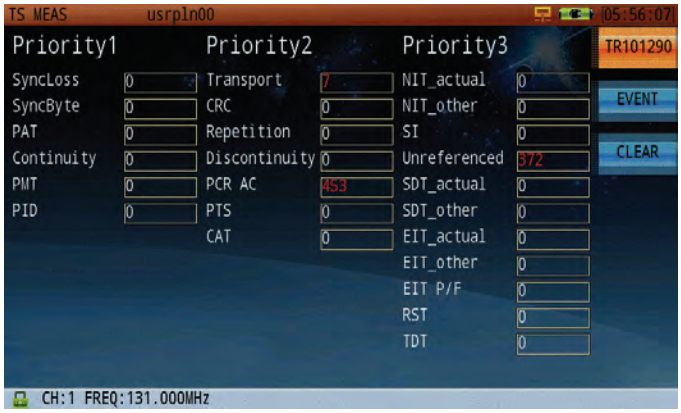


Figure 17: MPEG Transport Stream Analysis

Network Verification

Characterize network performance by verifying cable modem performance with the new DOCSIS 3.1 modem. The DS2831 is also backwards compatible with DOCSIS 3.0. Offering a resolution of up to 256KHz, the non-intrusive US sweep will show non-linearity and flatness issues such as standing waves, misalignment of the plant, suck-outs, and roll-off at the band edges by taking reference measurements at the HE or Node, and compare the sweep reference trace to a live sweep trace at any other active down the line. Finally, the IP test and the Wifi test will complete the network verification.

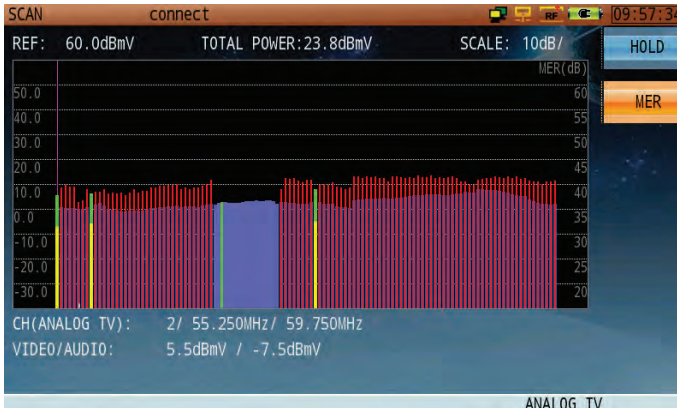


Figure 18: The channel scan function easily identifies OFDM signals.

Cable Modem Measurement

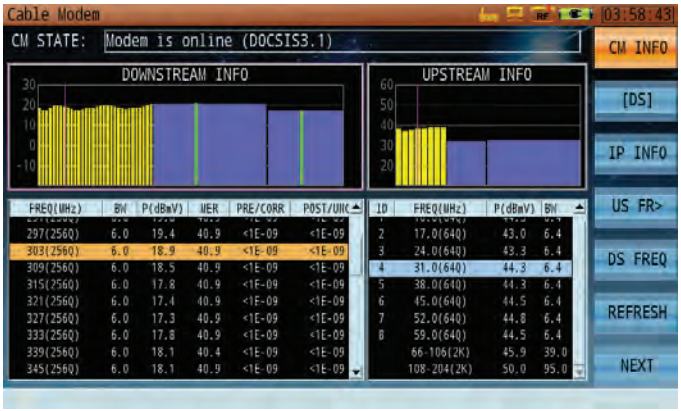


Figure 19: DOCSIS 3.1 Downstream and upstream OFDM demodulation identifies and characterizes OFDM signals.

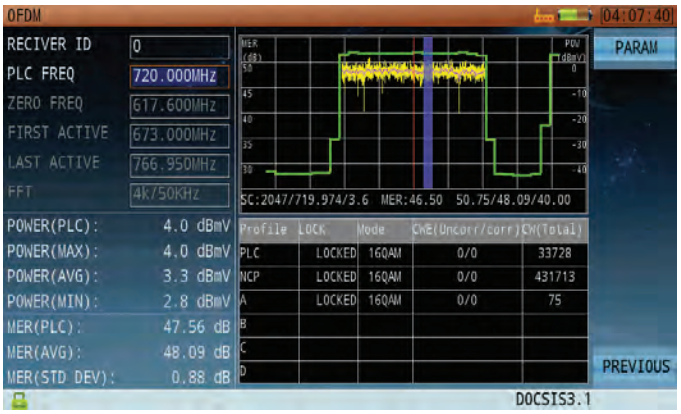


Figure 20: In-service Error Vector Spectrum for OFDM captures interference under your OFDM carrier signals

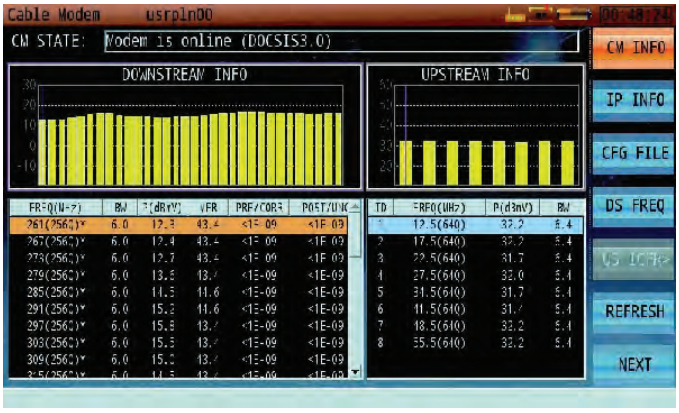


Figure 21: DOCSIS 3.0 32×8 Cable Modem Analysis

Frequency Response

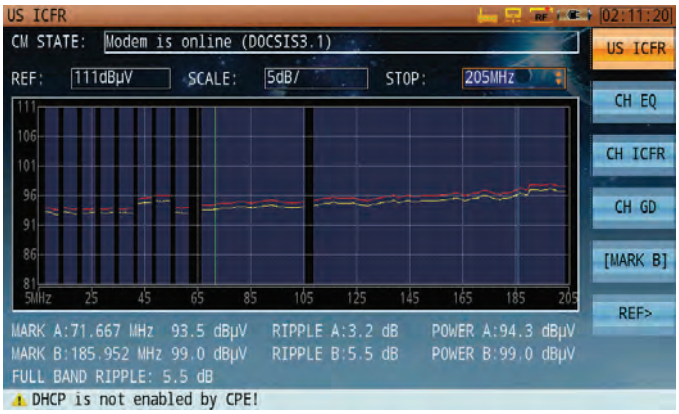


Figure 22: Sweep your return path up to 195.2MHz with your own 8x SC-QAM carriers and 1x 48MHz + 96MHz OFDMA Upstream DOCSIS signaling.



Figure 23: Use your own CMTS as your US sweep receiver, and get 256KHz of sweep resolution.



Figure 24: Get unprecedented Upstream Group delay from the integrated DS2831 US Cable Modem



Figure 25: Get Upstream in-channel frequency response from the integrated DS2831 US Cable Modem.

Upstream Signal Generator (USG)

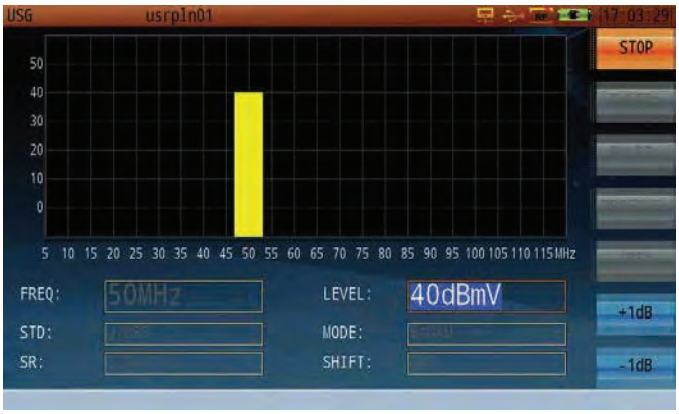


Figure 26: The Upstream Signal Generator can generate C/W carriers to QAM signals

Loopback



Figure 27: Loopback function is effective for testing attenuation and gain from 5 - 210 MHz. It can measure both CW & QAM signal frequency and sweep frequency.

Reverse Path Sweep

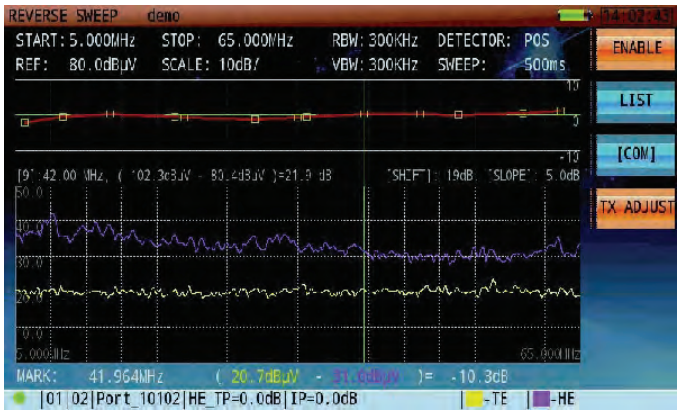


Figure 28: The DS2831 can perform reverse path sweep measurements when paired with the Deviser DS1610 Remote Monitoring System.

IP Test

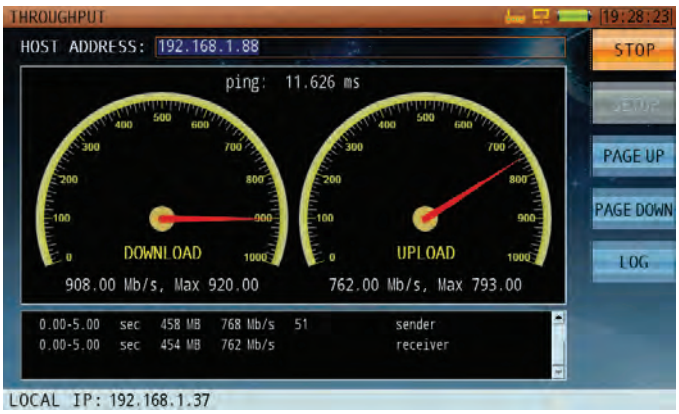


Figure 29: The IP test suite includes tests such as Ping, traceroute and FTP download/upload.

Wifi Analysis

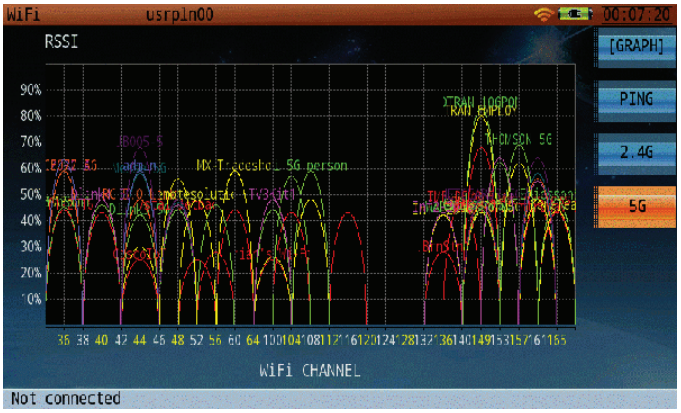


Figure 30: Wifi Analysis can retrieve SSID, channel and signal strength information from surrounding WiFi hotspots.

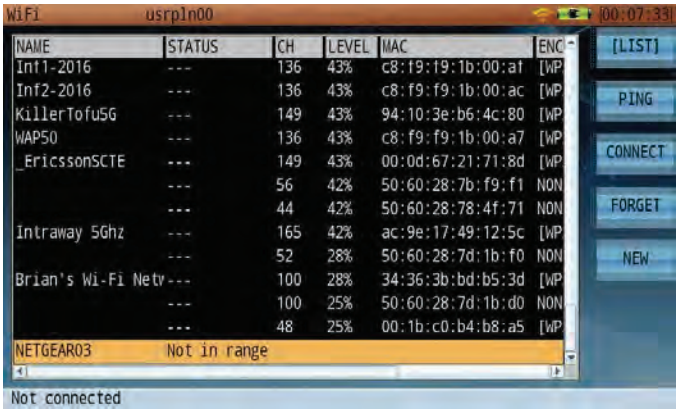


Figure 31: 5G WiFi Analysis - Graphical and List Modes can capture MAC addresses and encryption information from surrounding WiFi hotspots.

Auto Test

The auto test on the DS2831 runs through a pre-configured test sequence at the push of a button. Users can create test profiles that define a test procedure with pass/fail limits. This simplifies test result interpretation and ensures consistent testing. Even inexperienced users can run the test and verify that the installation is up to the same specification as others. The results are saved automatically.



Figure 32: Define limit profiles to perform auto tests. Results will show Pass or Fail according to channel plans & limit profiles, eliminating the need for interpretation.

Optical Testing

As fiber-optic technology continues to expand into the CATV network space, the DS2831's optical measurement options include an optical power meter and visual fault location - are now standard-issue (Fiberscope optional).



Figure 33: Measure the Optical Power levels at equipment or connector with an easy to interpret graphical gauge.

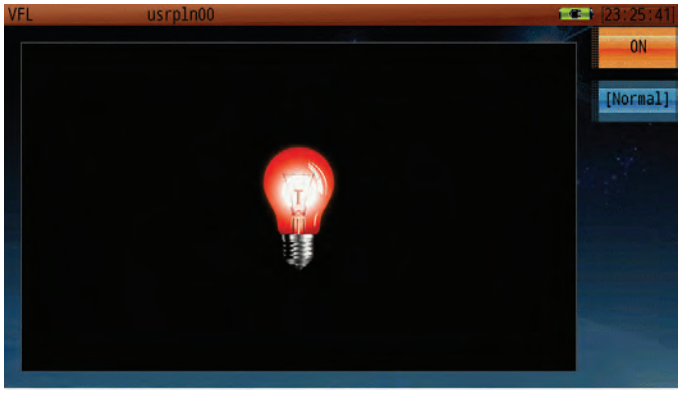


Figure 34: Check the fiber for continuity and detect damaged fibers or splices, including fiber breaks and excessive bends, with the Visual Fault Locator.

Fiberscope



Figure 35: Inspect the face of the fiber optic connectors with the Fiberscope. Pass/Fail software interprets results.



Figure 36: Fiberscope test with dirty connector.

Asset and Result Management

The DS2831 supports the Toolbox PC software for small scale applications. The newly developed and released enterprise software platform, Deviser EDGE, will manage users, assets, channel plans, firmware upgrades, test results and provide reporting capabilities.

Specifications

Downstream Spectrum Analysis		
Frequency Range		4~1220 MHz standard (up to 2150 MHz optional)
Frequency Stability		±1x10^{-6} (0 ~ 50°C / 32-122°F)
Frequency Step		1 kHz
Resolution Bandwidth (-3dB)		1kHz, 3kHz, 10kHz, 30kHz, 100kHz, 300kHz, 1 MHz, 3 MHz
Video Bandwidth (-3dB)		30 Hz, 100 Hz, 300 Hz, 1kHz, 3kHz, 10kHz, 30kHz, 100kHz, 300 kHz, 1 MHz, 3 MHz
Display Scale / Range		1, 2, 5, 10, 20dB/div; 8 vertical divisions
Sweep Time		20ms ~ 25s
Input Level Range		-60 ~ +60dBmV
Dynamic Range		80dB (30kHz RBW)
Sensitivity		-63.5dBmV @ (300kHz RBW, preamp on)
Attenuation		0 ~ 40 dB in 1 dB steps (Automatic/Manual modes)
Pre-Amplifier		18dB gain (Manual)
Measurement Accuracy		< ±1.0dB @ +25 ±5°C (typical)
Detector Modes		Positive Peak; Negative Peak; Sample; Average; RMS
Reference Level		-80 ~ +70dBmV
Markers		2 vertical markers
Analog TV Measurement		
Frequency Range		7 ~ 1220 MHz
Standards		B/G, I, D/K, L/L', M/N
Color Standards		NTSC, PAL, SECAM
Frequency Steps		10kHz
Level Measurement Range		-40 ~ +60dBmV
Accuracy		<±1.0dB @ +25 ±5 °C (S/N > 30dB)
Level Resolution		0.1dB
Resolution Bandwidth		300kHz
C/N range (>53dB, 0dB attenuation)	Optimum input	32 ~ 37dBmV (preamp off) 12 ~ 17dBmV (preamp on)
	Max input	60dB ±1.0dB (preamp off) 65dB ±3.0dB (preamp on)
CTB/CSO range (>53dB, 0dB attenuation)	Optimum input	22 ~ 67dBmV (preamp off) 2 ~ 7dBmV (preamp on)
	Max input	63dB w/ ±1.5dB accuracy, 78 channels(preamp off) 70dB w/ ±4.0dB accuracy, 78 channels (preamp on)
HUM Measurement		1~15%; ±0.5% (1~5%); ±1.0% (5~15%)
Depth of Modulation Range		40~95%, ±1.5% (C/N>40 dB)
Tilt Measurement		Up to 16 channels
Pre-Amplifier		18dB gain (Automatic)
Attenuator		40dB maximum (Automatic)

Upstream Spectrum Analysis	
Frequency Range	4 ~ 46 MHz (DOCSIS) 4 ~ 68 MHz (Euro DOCSIS 2.0) 4 ~ 88 MHz (Euro DOCSIS 3.0) 4 ~ 120 MHz US (DOCSIS 3.1) 4 ~ 210 MHz DS (DOCSIS 3.1)
Frequency Span	42 / 64 / 84 / 116 / 206 MHz, zero span
Resolution Bandwidth (-3dB)	300 kHz
Video Bandwidth	300 kHz
Display Scale / Range	1, 2, 5, 10, 20dB/div; 8 vertical divisions
Sweep Time	20ms ~ 25s
Input Level Range	-60 ~ +60dBmV
Attenuation	0 ~ 40 dB in 1 dB steps (Automatic/Manual modes)
Pre-Amplifier	18dB gain (Manual)
Measurement Accuracy	< ±1.0dB @ +25 ±5°C (typical)
Detector Modes	Positive Peak; Negative Peak; Sample; Average
Markers	2 vertical markers
Digital Persistence	
0 ~ 7 MHz	100% POI; minimum signal duration 2.5ms
4 ~ 46 MHz	100% POI; minimum signal duration 4.5ms
4 ~ 68 MHz	100% POI; minimum signal duration 4.64ms
4 ~ 88 MHz	100% POI; minimum signal duration 5.3ms
4 ~ 120 MHz	100% POI; minimum signal duration 6.3ms
4 ~ 210 MHz	100% POI; minimum signal duration 10.6ms
Digital TV Measurement	
Frequency Range	7 ~ 1220 MHz
Power Level Range	-30 ~ +50dBmV
Accuracy	<±1.5dB @ +25 ±5°C (C/N > 20dB)
Level Resolution	0.1 dB
Pre-Amplifier	18dB gain (Automatic)
Attenuator	40dB maximum (Automatic)
Modulation Type	16, 32, 64, 128, 256 QAM (J.83 Annex A, C) 64, 256 QAM (J.83 Annex B)
Interleave Depth	128 x 1 ~ 128 x 4 (J.83B) 12 x 17 (J.83A,C)
Symbol Rate	1.0 ~ 7.0 MS/s
SNR	>47 dB; Accuracy ±2.0dB
MER	>47 dB; Accuracy ±2.0dB
EVM	<0.36%
BER	1E-3 ~ 1E-9
Constellation	16, 32 64, 128, 256 QAM

Specifications (continued)

Cable Modem Measurements (Downstream)		
Frequency Range		108 ~ 1218 MHz / 258 ~ 1218 MHz
Demodulat.	DOCSIS 3.0	64QAM, 256QAM
	DOCSIS 3.1	Multi-carrier OFDM 16 to 4096QAM
Max Speed	DOCSIS 3.0	1.2 Gbps (32 DS channel bonding)
	DOCSIS 3.1	1.97 Gbps (2 OFDM 192MHz channels)
Channel Bonding	DOCSIS 3.0	Up to 32 SCQAM
	DOCSIS 3.1	2 OFDM, 192 MHz + 32 SCQAM
Bandwidth	DOCSIS 3.0	6MHz / 8MHz
	DOCSIS 3.1	OFDM 192MHz, SCQAM 6MHz / 8MHz
Input Signal Level		-15 ~ +15 dBmV

Cable Modem Measurements (Upstream)		
Frequency Range		5 ~ 85 MHz / 5~204MHz
Signal Bandwidth	TDMA	200/400/800/1600/3200/6400kHz
	S-CDMA	1600/3200/6400kHz
	OFDMA	96MHz (DOCSIS 3.1, BPSK to 4096 QAM)
Output Signal Level	TDMA	+8 ~ +54 dBmV (32QAM, 64QAM); +8 ~ +55 dBmV (8QAM, 16QAM) +8 ~ +58 dBmV (QPSK)
	S-CDMA	+8 ~ +53 dBmV (all modulations)
	OFDMA	+11 ~ +65 dBmV
Channel Bonding	DOCSIS 3.0	Up to 8 channels
	DOCSIS 3.1	Up to 2 OFDMA Channels
Max Speed		320 Mbps with 8 upstream channels bonding 720 Mbps with 1 OFDMA 96 MHz channel

Upstream Signal Generator	
Signal Modulation	CW, QPSK, 8/ 16 / 32/ 64 / 256 QAM (no FEC)
Symbol Rate	160 kHz/s; 320 kHz/s; 640 kHz/s; 1.28 MS/s; 2.56 MS/s; 5.12 MS/s
MER	>38dB; Accuracy ±2.0dB
Frequency Range	5 ~ 85 MHz
Frequency Step	1 MHz
Signal Level Range	8 ~ 60dBmV
Level Adjustable Step	1dB

Advanced Upstream Signal Generator (Option)		
Signal Modulation	Annex A	CW, QPSK, 16 / 64 / 256 QAM
	Annex B	CW, 64 / 256 QAM
FEC		RS (204, 188) J.83A; RS (128, 122) J.83B
Symbol Rate		1 ~ 7 MS/s
MER		>40dB; Accuracy ±2.0dB
BER		<1E-9
Frequency Range		4 ~ 210 MHz
Frequency Step		10kHz
Phase Noise		100dBc @ 10kHz; 115dBc @ 100kHz (CW @ 50 MHz)
Frequency Accuracy		2ppm
Settling Time		2ms
Signal Level Range		0 ~ 60dBmV
Level Accuracy		±1.5dB (CW); ±2.0dB (QAM)
Level Adjustable Steps		0.1dB

Transport Stream Analysis	
Real-Time Analysis	Real-time transport stream info, including service name, ID, provider info, video/audio PIDs. Detailed audio/ video data for unencrypted programs.
TR 101 290 Priority 1, 2, 3	TR 101 290 Priority 1, 2, 3 real-time testing & monitoring.
Basic Information	Various TS details, including data type % breakdown; transmission speed; packet length; network info.
PID List	Displays PIDs in current stream w/ type, symbol rate, and % of each.
PCR Monitor	Calculates PCR interval / accuracy; real-time dynamic graph of results; max/min interval / accuracy data.
PSI/SI List	Displays PSI/SI info (PAT, PMT, CAT, NIT, SDT, TDT, EIT) in tree view.
Program List (EPG Info)	Transport stream EPG, including program #, service name & ID, carrier frequency, provider info, modulation type & symbol rate.

Reverse Path Sweep	
FSK Tx Frequency	5 ~ 210 MHz
FSK Tx Amplitude	10 ~ 50dBmV
FSK Rx Frequency	42 ~ 300 MHz
FSK Rx Sensitivity	-40dBmV
Pilot Frequency	5 ~ 210 MHz
Pilot Frequency Amplitude	10 ~ 50dBmV
Tx Test Signal Amplitude	0 ~ 60dBmV
Tx Test Signal Frequency	5 ~ 210 MHz
Tx Test Frequency Point	1 ~ 16 frequency points
DS2831 Units Supported (head-end)	DS1610 supports up to 4 units

WiFi	
Frequency	2.4G, 5G
Supported Standards	802.11 a/b/g/n
Security Mode	WPA / WPA2 / WPA-PSK / WPA2-PSK
Encryption	WEP / AES / TKIP
Test Parameters	SSID, Level, Channel

Specifications (continued)

GPS Option	
C/A Code Rate	1.023MHz
Receiver Frequency	L1(1575.42MHz)
Track Channels	56
Positioning Performance	
2D Plant	5m [Average]
2D Plant	3.5m [Average], with DGPS Auxiliary
Drift	<0.02m/s
Timing Accuracy	1μs
Coordinate Frame	WGS-84
Maximum Elevation	18000m
Acceleration	<4g
Optical Power Measurement	
Accuracy	±0.17dB (± 3%)
Detector Type	InGaAs □2000μm
Dynamic Range	-50dBm ~ +27dBm
Linearity	0.07db/10dB
Resolution	0.01dBm, mW, μW, nW
Wavelength	850, 980, 1300, 1310, 1490, 1550, 1610nm
Interface	FC/SC/ST Universal Connector Interface adapter
Visual Fault Locator	
Output Wavelength	650 ± 10nm
Output Power	10mW
Safety Standard	IEC 60825-1: 2007
Interface	FC/PC
Fiber Inspection Scope	
Pass/Fail Testing	Supported
Resolution	0.5μm
Field of view	425μm × 320μm
Interface and Power Supply	USB 2.0
Focus	Manual adjustment, 2mm max travel
Dimensions	175mm ×□3500 (probe without cap)
Light Source	Blue LED
Operating Temperature	0 ~ 50°C
Storage Temperature	-20 ~ +70°C

Miscellaneous	
RF Input	75Ω F
USB	USB 2.0
Ethernet	RJ45, 10/100T Ethernet
Display	7" capacitive touchscreen; TFT LCD, 800x480 pixels
AC/DC Adapter	AC 100 ~ 240V / 50 ~ 60Hz; DC 12V / 5A
Battery	Li-ion, 7.4V / 10Ah
Charge Time	~4 hrs.
Working Time	~8 hrs.
Dimensions (WxHxL)	245mm x 155mm x 60mm (9.6" x 6.1" x 2.4")
Weight	~2.2kg (4.9 lbs)
Operation Temperature	-10 ~ +50 °C
Storage Temperature	-20 - +60 °C

Ordering Information

		For Contractors	For Installers	For Network Engineers	For HE or Hub Engineer
		DS2831-C	**DS2831-I**	**DS2831-S**	**DS2831-PRO**
	Spectrum Analysis Frequency	**1.228 GHz**	**1.228 GHz**	**1.228 GHz**	**1.228 GHz**
	MER	**41 dB**	**43 dB**	**45 dB**	**47 dB**
DS2831-802	2.15GHz frequency extension			O	O
DS2831-805	Spectrum Persistence			O	O
DS2831-803	CATV Distortions package	O	✓	✓	✓
DS2831-804	Video parameters package		O	O	✓
DS2831-806	EVS (error vector spectrum)			O	✓
DS2831-807	MPEG-2 package				O
DS2831-811	Wifi package	O	O	O	✓
DS2831-809	Forward/reverse passive sweep			O	O
DS2831-810	Upstream sweep with Kingstone			✓	✓
DS2831-808	USG test package	O	O	O	O
DS2831-812	1Gbps testing	O	O	O	✓
DS2831-813	OFDM testing	O	✓	✓	✓
DS2831-814	Web Remote Control	O	O	O	✓
DS2831-816	BER recording			✓	✓
DS2831-800	Visual Fault Locator (650nm, 10mW); Optical Power Meter (7 Wavelengths)	O	O	✓	✓
DI-1000	Lightel Optical Fibrescope w/ 6x tips	O	O	O	O
DS2831-819	EDGE certificate	O	O	O	O
DS2831-820	EDGE asset management system	O	O	O	O
DS2831-W1	1 year warranty extension/year, up to 5 years total	O	O	O	O

✓ = Standard Equipment **O =** Optional

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