

**2715** - The 2715 is a complete cable TV RF testing solution.

# **Cable TV Spectrum Analyzer**

## 2715

This product is discontinued.

Characteristics

## **Features**

> Specs

Ordering Information

Print Data Sheet (1.06MB)





## Figure 2.

The following specifications and features apply after a 15 minute warm-up period and after all normalizations, including reference normalizations, have been performed. CATV characteristics represent typical performance and are dependent on general spectrum analyzer specifications. CATV characteristics need not be verified independently providing that all spectrum analyzer specifications are verified.

#### **Cable TV Measurements**

## **Channel Selection -**

Visual and aural carriers displayed when channel number is entered or front-panel selected.

Tune Configuration: STD, HRC, IRC and custom; configured using 2715 PC software.

Channel Range: 0 to 999; configured using 2715 PC software. Frequency Range: 1 MHz to 2.15 GHz; dependent on selected Channel Table.

## **Visual Carrier Frequency -**

Measured with internal counter to 1 Hz resolution with accuracy of  $5x10^{-7}$  x Carrier Frequency  $\pm 10$  Hz  $\pm 1$  Least Significant Digit.

## Visual-to-aural Carrier Frequency -

Aural carrier measured with internal counter relative to visual carrier.

Difference Range: 1 MHz to 10 MHz (depending on selected channel table) for an amplitude difference of  $\leq$ 30 dB and aural carrier to noise  $\geq$ 15 dB (300 kHz RBW).

Resolution: 1 Hz.

Accuracy:  $\pm 15$  Hz for visual-to-aural carrier difference  $\leq 8$  MHz.

## Visual Carrier Peak Level -

Absolute peak amplitude measured with preamp off.

Amplitude Range: -18 dBmV to +58.8 dBmV for visual carrier to noise  $\geq$ 30 dB (300 kHz RBW) and total input power  $\leq$ +70 dBmV.

Frequency Range: 15 MHz to 1015 MHz. Resolution: 0.1 dB.

Absolute Accuracy:  $\pm 2.5$  dB for visual carrier to noise  $\geq 30$  dB (300 kHz RBW); for FM signals, carrier to noise  $\geq 33$  dB (100 kHz RBW).

Relative Accuracy:  $\pm 0.5$  dB relative to adjacent channel,  $\pm 1.2$  dB relative to all others.

## Visual-to-aural Carrier Level Difference -

Difference Range: 0 to 30 dB for aural carrier to noise  $\geq$  15 dB (300 kHz RBW). Resolution: 0.1 dB.

Accuracy:  $\pm 0.75$  dB for a ural carrier to noise  $\geq 15$  dB (300 kHz RBW).

## **Digital Channel Averaged Power -**

Averaged amplitude measured with preamp off. Amplitude range: -30 dBmV to +37 dBmV (multi-channel) or -30 dBmV to +52 dBmV (preselected). Resolution: 0.1 dB. Absolute accuracy: ±2.5 dB.

## Carrier to Noise -

Default noise floor is a normalized 4 MHz bandwidth measured

relative to the visual carrier peak. Range and Accuracy: See Figure 1. Resolution: 0.3 dB. Gated, in-service measurement is in-band; non-gated, in-service measurement is at guard band below channel boundary.

## **Digital Channel Desired to Undesired Ratio -**

Channel averaged power is divided by total noise plus distortion power in the channel. Range and Accuracy: See Figure 2. Resolution: 0.3 dB.

## **Modulation Depth -**

% AM measured from sync tip to lowest white level in 10 sweeps (VITS line used if defined in channel table).

AM Range: 50% to 95%.

Resolution: 0.1%.

Accuracy:  $\pm 2\%$  for visual carrier to noise  $\geq 40$  dB (300 kHz RBW).



Figure 3.



Figure 4.



## Figure 5.



## Figure 6.

#### Hum/Low-frequency Disturbance -

Power line frequency measured on an unmodulated visual carrier and low frequency disturbance measured on the modulated carrier.

AM Range: 1% to 10% peak-to-peak.

Resolution: 0.1%.

Accuracy:  $\pm 1\%$  for hum  $\leq 5\%$  and visual carrier to noise  $\geq 25$  dB (300 kHz RBW);  $\pm 2\%$  for hum <10% and visual carrier to noise  $\geq 25$  dB (300 kHz RBW).

#### **Frequency Response -**

For fixed-amplitude scrambling or no scrambling, system amplitude variations (flatness) are displayed relative to a reference trace stored during frequency-response reference setup.

Range: 5 dB/div. Resolution: 0.2 dB. Flatness Accuracy: ±0.75 dB.

#### **In-channel Response -**

Expresses maximum variance in amplitude within some specified frequency range within a particular channel, given a "flat" test signal over that same specified range. The variance is referenced to the average of the highest and lowest amplitude within the frequency range.

Range:  $\pm 3 \text{ dB}$ .

Resolution: 0.1 dB.

Accuracy:  $\pm 0.5$  dB.

Test signal line number must be specified for in-service measurements.

#### Digital Channel Adjacent Channel Leakage -

Averaged power in adjacent channel(s) is divided by averaged power for the test channel. Range and Accuracy: See Figure 3. Resolution: 0.3 dB.

#### **Carrier Survey -**

Absolute peak amplitude of each visual carrier is measured and each associated aural carrier level is measured relative to the visual carrier for selected channels. Frequency counted only in ACCUR FREQ/AMPL mode.

Visual Carrier (FREQ/AMPL and ACCUR AMPL modes)

Amplitude Range: -18 dBmV to +58.8 dBmV for visual carrier to noise  $\geq$ 30 dB (300 kHz RBW) and total input power  $\leq$ +70

dBmV.

Frequency Range: 15 MHz to 1015 MHz.

Resolution: 0.1 dB.

Absolute Accuracy:  $\pm 2.5$  dB for visual carrier to noise  $\geq 30$  dB (300 kHz RBW); for FM signals, carrier to noise  $\geq 33$  dB (100 kHz RBW).

Relative Accuracy:  $\pm 0.5$  dB relative to adjacent channel,  $\pm 1.2$  dB relative to all others.

Visual Carrier (FAST AMPL mode)

Amplitude Range: -18 dBmV to +58.8 dBmV for carrier to noise  $\geq$ 30 dB (300 kHz RBW) and total input power  $\leq$ +70 dBmV.

Frequency Range: 15 MHz to 1015 MHz.

Resolution: 0.3 dB.

Absolute Accuracy:  $\pm 2.7$  dB for carrier to noise  $\geq 30$  dB (300 kHz RBW); for FM signals, carrier to noise  $\geq 33$  dB (100 kHz RBW).

Relative Accuracy:  $\pm 0.8$  dB relative to adjacent carrier;  $\pm 1.5$  dB relative to all other channels.

Aural Carrier (FREQ/AMPL and ACCUR AMPL modes)

Difference Range: 0 dB to 30 dB for aural carrier to noise  $\geq 15$  dB (300 kHz RBW).

Resolution: 0.1 dB.

Accuracy:  $\pm 0.75$  dB for a ural carrier to noise  $\geq 15$  dB (300 kHz RBW).

Aural Carrier (FAST AMPL mode)

Difference Range: 0 dB to 30 dB for carrier to noise  $\geq$ 15 dB (300 kHz RBW).

Resolution: 0.3 dB.

Accuracy:  $\pm 1.1$  dB for carrier to noise  $\geq 15$  dB (300 kHz RBW).

#### Analog Channel CTB and CSO -

Measured relative to visual carrier peak according to NCTA recommendations. Range and Accuracy for INTERACTIVE and AUTO modes: See Figures 4, 5 and 6. Only  $\pm 4$  dB curve applies to SINGLE SWEEP and CONTINUOUS modes. Resolution: 0.3 dB.

## Digital Channel CTB and CSO -

Measured relative to the averaged power of the test channel.

Range and Accuracy: See Figures 7 and 8. Resolution: 0.3 dB.

#### Aural (FM) Deviation -

Peak FM deviation is measured for the selected channel. Range: 10 kHz to 50 kHz; usable to 80 kHz. Accuracy: ±4 kHz.

#### **Cross Modulation -**

Peak of fundamental component of 3rd order distortion at horizontal sync frequency (AM) measured on the unmodulated visual carrier.

Range: 48 dB. For cross modulation levels below -20 dBc, equivalent frequency domain measurement of cross modulation results in a range of 58 dB.

Resolution: 0.1 dB.

Accuracy:  $\pm 2 \text{ dB}$  for cross modulation <36 dB;  $\pm 3 \text{ dB}$  for cross modulation <48 dB.

## Listen Mode -

Selected channel's aural carrier is FM demodulated and output fed to speaker or headphone jack; instantaneous peak FM deviation is displayed. If positive polarity video is selected, then AM audio will be demodulated.

**View Picture Mode -** Visual carrier is demodulated and displayed.

**View Modulation (Field) -** One video field of the selected channel's video is displayed.

#### View Modulation (Line) -

VITS line displayed; If VITS line isn't specified in channel table, line 17 displayed. Line number user-selectable. TV Line Selection: Via FREQ/MKRS knob. Line Format: NTSC or PAL. Line Range: 1-525 (NTSC); 1-625 (PAL). Sweep Time: 10 µsec/div.



Digital Signal CTB Measurement Range Limit For 2 dB Accuracy

Figure 7.



Digital Signal CSO Measurement Range Limit For 2 dB Accuracy

## Figure 8.

## **Spectrum Analyzer Specifications**

#### **Frequency Related**

**Frequency Range -**9 kHz to 1800 MHz. Opt. 50 and 75: 9 kHz to 2150 MHz.

**Center Frequency Accuracy -**  $5 \times 10^{-7}$  of center frequency  $\pm 700$  Hz.

**Frequency Counter Accuracy -**  $5 \times 10^{-7}$  of center frequency  $\pm 10$  Hz  $\pm 1$  LSD (least significant digit).

**Dot Marker Frequency Accuracy -** Center frequency accuracy +3% of span, typical.

**Frequency Counter Readout Resolution -** 1 Hz or 1 kHz, selectable.

**Typical Long-term Drift -** ±2 ppm/year.

## Short-term Drift -

 $\leq$ 400 Hz maximum drift between correction cycles (with SPAN/DIV  $\leq$ 20 kHz). Opt. 50 and 75:  $\leq$ 500 Hz above 1.8 GHz.

**Residual FM -**  $\leq$ 100 Hz p-p/20 msec at  $\leq$ 20 kHz span/div Opt. 50 and 75:  $\leq$ 120 Hz above 1.8 GHz.  $\leq$ 2 kHz p-p/20 msec at >20 kHz span/div. Opt. 50 and 75:  $\leq$ 2.4 kHz above 1.8 GHz.

#### Resolution Bandwidth (-6 dB) -

5 MHz, 1 MHz, 300 kHz, 100 kHz, 30 kHz, 10 kHz, 3 kHz, 1 kHz and 300 Hz.

**RBW Shape Factor (60 dB/6 dB)** -  $\leq$ 7:1 for RBW  $\leq$ 1 MHz.

#### **Noise Sidebands -**

 $\leq$ -70 dBc at 30 x RBW for RBW  $\leq$ 100 kHz. Opt. 50 and 75:  $\leq$ 69 dBc above 1.8 GHz.

#### Video Filter -

Auto: approximately 1/100 of RBW. Manual: 3 Hz to 300 kHz in 1-3 sequence or WIDE. Off: approximately RBW.

**Frequency Span/Div Range -** 100 MHz to 1 kHz selected in 1-2-5 sequence or any value from 100 MHz to 1 kHz via the keypad or UTIL menu, plus 180 MHz (MAX SPAN) and 0 Hz. Opt. 50 and 70: 215 MHz/div (MAX SPAN).

**Span Accuracy** -  $\pm 3\%$  measured over the center eight divisions.

#### **Amplitude Related**

#### Flatness -

 $\pm 2$  dB (relative to reference level at 100 MHz) measured with 10 dB internal RF attenuation (preamp off). Opt. 50 and 75:  $\pm 3$  dB above 1.8 GHz.

Vertical Display Modes - 10, 5, 1 dB/div, Linear.

**Measurement Range -** -90 dBmV (preamp on) to +68.8 dBmV (-139 to +20 dBm).

#### **Display Dynamic Range -**

80 dB maximum (Log Mode); 8 divisions maximum (Linear mode).

Opt. 50 and 75: Dynamic range reduced if there is signal energy at or near 2.11 GHz. Baseline will typically rise to within 10 to 20 dB of signal applied near 2.11 GHz.

## **Reference Level Range -**

Log Mode: -21.2 dBmV to +68.8 dBmV (-70 to +20 dBm); -41.2 dBmV to +48.8 dBmV with preamp on. Linear Mode: 10.83  $\mu$ V/div to 342.33 mV/div (1.08  $\mu$ V/div to 34.23 mV/div with preamp on).

## **Reference Level Steps -**

Log Mode: 1 dB or 10 dB.

Linear Mode: 10.83  $\mu$ V/div to 342.33 mV/div in 1-2-5 sequence;  $\geq$ 0.2 div/increment with FINE REF LVL STEP activated.

## Display Amplitude Accuracy -

10 dB/div:  $\pm 1.0$  dB/10 dB to a maximum cumulative error of  $\pm$  2.0 dB over the 70 dB range and a maximum cumulative error of

 $\pm$  4.0 dB over the 80 dB range; accuracy and range specifications are affected by the SNR of selected RBW and are valid only for the maximum specified in the following table:

RBW dB	Down
5 MHz	40
1 MHz	40
300 kHz	50
100 kHz	50
30 kHz	60
10 kHz	60
3 kHz	80
1 kHz	80
300 Hz	80

5 dB/div:  $\pm 1.0$  dB/10 dB to a maximum cumulative error of  $\pm 2.0$  dB over the 40 dB range.

1 dB/div:  $\pm 1$  dB maximum error over the 8 dB range. Linear Mode:  $\pm 5\%$  of full scale.

**RF** Attenuation Range - 0 to 50 dB in 2 dB steps.

**Maximum Sensitivity (at 300 Hz RBW) -** -78 dBmV (-127 dBm); -90 dBmV (-139 dBm) with preamp on.

## Spurious Response (Preamp Off)

## **Residual Spurious Response -**

 $\leq$ -51 dBmV ( $\leq$ -100 dBm) with 0 dB RF attenuation, except at 1780 MHz where the spurious response is  $\leq$ -41 dBmV ( $\leq$ -90

dBm).

Opt. 50 and 75: ≤-26 dBmV (-75 dBm) at 2.0 GHz.

## **3rd Order IM Distortion -**

 $\leq$ -70 dBc from any two on-screen signals with any frequency span.

Opt. 50 and 75: typically  $\leq$ 65 dBc at 2.15 GHz.

**2nd Harmonic Distortion -**  $\leq$ -66 dBc measured with 1st mixer input level of  $\leq$ +9 dBmV.

## LO Emission -

 $\leq$ -21 dBmV ( $\leq$ -70 dBm) with 0 dB RF attenuation. Opt. 50 and 75:  $\leq$ -21 dBmV ( $\leq$ 70 dBm) (sweep above 350 MHz).  $\leq$ +29 dBmV, typical (-20 dBm) (sweep below 90 MHz).

**0 Hz Spur -**  $\leq$ +39 dBmV ( $\leq$ -10 dBm) reference to input with 0 dB RF attenuation.

#### Input Related

#### **RF Input -**

75 Ohm BNC with quick change to 75 Ohm type F connector. Opt. 50: 50 Ohm Type N connector.

#### VSWR -

With RF Attenuation  $\geq 10$  dB: 1.5:1 maximum to 1 GHz. With 0 dB RF Attenuation: 2:1 maximum to 1 GHz.

**Maximum Safe Input -** +70 dBmV (0.1 W or 2.2 V) continuous peak with 100 VDC blocking capacitor.

**1 dB Compression Point -**  $\geq$ +34 dBmV (-15 dBm) with 0 RF attenuation and 1st mixer at +19 dBmV (-30 dBm).

#### **Sweep Related**

Sweep Selections - Normal, single sweep and manual scan.

**Sweep Times -** 1 µsec/div to 2 sec/div in a 1-2-5 sequence.

Sweep Accuracy -  $\pm 10\%$  over the center 8 divisions.

**Trigger -** Free run, internal, external, line, TV line and TV field.

#### **Trigger Amplitude -**

Internal: One division or more of signal. External: 100 mV peak minimum; DC coupled (15 Hz to 1 MHz).

#### **Other Inputs/Outputs**

**External Trigger -** BNC connector, 10 kilohm impedance, DC coupled, 0.1 µsec minimum pulse width; 50 V (DC + pk AC) maximum.

**External Video Input -** 100 Ohm impedance DC coupled; 0-50 kHz BW; 0-1.6 V (200 mV/div typical) signal input for vertical deflection of CRT beam.

**Video Output -** 0-1.6 V of video signal, inversely proportional to vertical display amplitude; 0 V is top of screen; 1 kilohm impedance.

**Sweep Gate Out -** TTL level that is HI while CRT beam sweeps.

**Sweep Output -** +1.3 to -1.3 V, negative-going ramp, proportional to the horizontal sweep; output impedance  $\leq 50$  Ohm.

**Digital Communications -** Either RS-232 or GPIB interface provided as a no-cost option.

## Environmental

**Temperature -**Operating: 0° to +50°C (MIL T-28800E). Nonoperating: -55° to +75°C.

**Humidity** - Nonoperating: Five cycles (120 hrs) in accordance with MIL-Std-28800E, Class 5.

**Vibration -** Meets MIL T-28800E, Method 514, Procedure X (modified).

**Shock** - Operating and nonoperating: Three guillotine-type shocks of 30 g, one-half sine, 11 ms duration each direction along each major axis; total of 18 shocks.

## Altitude -

Operating: 15,000 ft. Nonoperating: 50,000 ft.

## **Electromagnetic Compatibility -**

EC92 EMC Directive 89/336/EEC: Emissions:

EN50081-1.

Radiated emissions, 30 MHz to 1 GHz: EN55022 Class B (CISPR 22 B).

Conducted emissions, 150 kHz to 30 MHz: EN55022 Class B

(CISPR 22 B).

Conducted emissions, power line harmonics, 0 to 2 kHz: IEC 555-213.

Immunity:

EN50082-1.Electrostatic discharge, 8 kV, IEC 801-2.

Radiated immunity, 27 MHz to 500 MHz, IEC 801-3.

No response above -90 dBm in a 3 V/meter field.

Fast transients, capacitive clamp, 1 kV power leads, 500 V control leads, IEC 801-4.

Power line surge, 1 kV differential mode, 2 kV common mode, IEC 801-5.

## **General Characteristics**

**Power Requirements -** 105 W maximum (1.4 A) at 115 V, 60 Hz; operates 48 Hz to 440 Hz, 90 to 132 VAC or 48 Hz to 63 Hz, 90 VAC to 250 VAC; battery power option available.

## **Physical Characteristics**

Dimensions, with Feet, Handle and Front-Panel Cover	mm	in.
Height	137	5.4
Width	361	14.2
Depth	445	17.5
Weight	kg	lbs.
Net	<10.6	23.5

## **Other Capabilities**

**Markers -** Single marker/delta marker; next right, next left peaks; next lower, next higher peaks; (highest) peak find; marker to center frequency; select start/stop frequencies; transpose DELTA markers.

**Measurement Modes -** Noise, carrier-to-noise, bandwidth (user-definable "dB down" points), 99% occupied bandwidth, signal search and cable TV measurements (see Cable TV).

**Time Delay Setup -** Uses built-in time-of-day clock to initiate measurement sequences and sequence repeat interval; START TIME, REPEAT INTERVAL, RUN N TIMES.

PC-Based Software Package - Provides report generation, test

data analysis, data history, channel tuning table definition, user-defined program definition, limits checking, alarming and 271X display transfer.

#### Nonvolatile Memory -

Lithium battery backup, 124 K available; used to save cable TV measurement results, setup table parameters, large user-definable key routines, antenna tables and channel tuning tables. Saved Displays: 108 maximum.

Saved Front-Panel Setups: 36 maximum.

**Digital Storage Display -** Selectable acquisition modes of positive peak only, positive/ negative peak; SAVE A, B, C and active D trace; up to four traces on screen; MAX HOLD A, B; MIN HOLD C; B, C minus A; TITLE MODE; digital storage off provides analog display.

**Ensemble Averaging -** Provides weighted averaging of display, results in reduction of measured noise values and impulse signals.

**Direct Entry of Control Parameters -** Frequency, span/div, reference level; RBW, video filter, vert. scale and sweep rate via menu.

**Internal Preamp -** Preamp can be switched in/out of circuit (degrades flatness above 600 MHz, provides a maximum of 12 dB sensitivity improvement).

Alternate Reference Level Units - dBm, dBmV, dBV, dB $\mu$ V, dB $\mu$ W, dB $\mu$ V/m (dBmV and dB $\mu$ V only in CATV measurement mode).

**dBµV/m Mode -** Automatically compensated field strength measurement with up to five user-selected antennas.

**User-Definable Power-On Status -** Instrument powers up to user-definable state or supplied default settings.

**Constant Rate Tuning -** Same on-screen tuning sensitivity regardless of span/div selection.

**Center Measure -** Signal nearest center frequency is centered with frequency and peak amplitude automatically read out (not a marker mode); the centered signal is counted.

**Signal Track -** Drifting signal is kept at display center with correct frequency and peak amplitude displayed.

**Graticule Illumination -** Contrast enhancement for CRT photography.

**Direct Plot/Print -** Supports Epson FX and LQ Series compatible Printers using RS-232 interface or HPGL compatible plotters via GPIB interface.

**External Tracking Generator Opt. 5 -** Provides scalar analysis for checking/aligning filters, amplifiers, cables or most 2-port networks. Includes LO output port.

**TV Sideband Analyzer/LO Output Opt. 15 -** Provides a 1st LO output for a 1405 TV Sideband Analyzer for frequency-agile modulator sweep.

**Rackmount Opt. 30 -** Converts unit to a rackmounted installation; 5.25-in. rack height, 19-in. rack width.

**Portable-to-Rack Adapter Opt. 34 -** Provide rackmounting of instrument in standard enclosure with handle, offering immediate instrument portability when needed; 7-in. rack height, 19-in. rack width.



**Features** 

Specs
<u>Ordering Information</u>
<u>Print Data Sheet (1.06MB)</u>

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**ISO 9001** Tektronix Measurement products are manufactured in ISO registered facilities.

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