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*Everything Needed to Fully Analyze Analog
& Digital TV-RF Signals, Off-Air or Cable,
in a Handy Handheld Instrument*

Introducing the Sencore SA1454 TV-RF Signal Analyzer & Spectrum Analyzer

A Changing World of TV-RF Signals

Wow, are things changing in the world of TV-RF signals! It was just a few years ago that NTSC analog RF-TV signals were the standard among broadcasters and cable systems. Now there are over one thousand off-air 8-VSB digital RF-TV signals being transmitted and QUAM digital RF-TV signals are common among cable systems. Furthermore, cable system modem, phone services and video-on-demand (VOD) services have added carriers in the reverse frequency range from 5-50 MHz. Cable channels have been added, extending many cable system bandwidths to 870 MHz.

These technology advancements are dramatically and forever changing how we measure and analyze TV-RF signals. Problems no longer can be resolved with a simple signal level measurement. Analyzing methods must test level and signal quality to insure that the final picture exceeds DVD quality and cable system digital, internet and phone services work properly without interruption.

Introducing the Sencore SA1454

These new technologies and signals have revolutionized TV-RF signal analyzing. Today a TV-RF analyzer must provide comprehensive test analysis on the old familiar NTSC analog TV signals and must test level and signal quality on TV digital signals. Furthermore, it must provide features to inspect modem, phone, VOD, FM and other RF carriers on a cable system. The Sencore Signal Analyzer, model SA1454 does all this and more. Here is quick summary of what it offers.

Figure 1. The SA1454 fully analyzes analog and digital TV-RF signals, off-air broadcast or cable, in a handy handheld instrument.



Measure NTSC Analog Signal Level & Quality

The current analog NTSC TV-RF signals will be around for many more years. Each TV channel consists of a video and sound RF carrier. The signal level of these carriers, specified in dBmV, is important to insuring a noise free video picture on a display. However, signal level alone does not insure a good picture. Important signal quality measurements include a carrier-to-noise ratio, and low frequency interference or hum % measurement are needed.

The SA1454 measures critical signal levels of the audio and video carrier in standard dBmV. It further provides an indication of the audio-to-video carrier level ratio, carrier-to-noise ratio, and hum % on each NTSC channel. The tests may be used to test the quality of both off-air antenna or cable NTSC channel signals.

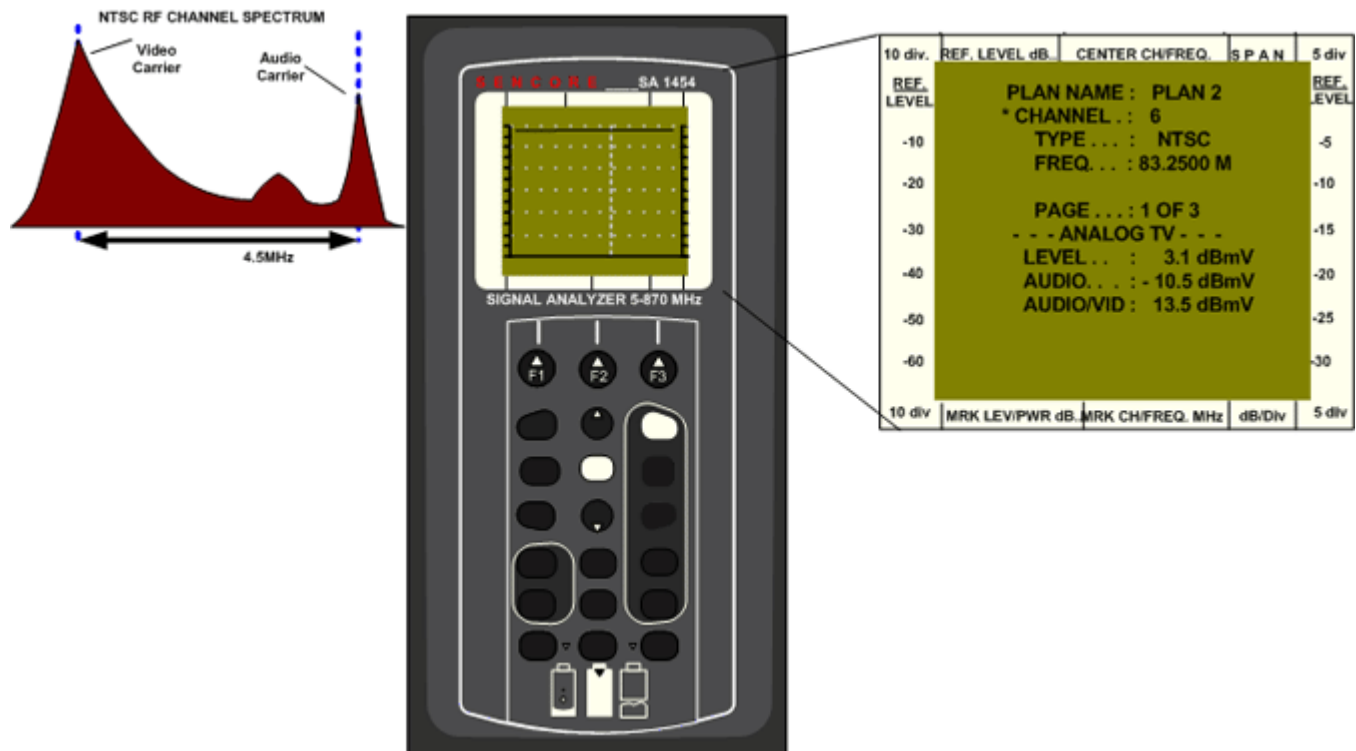


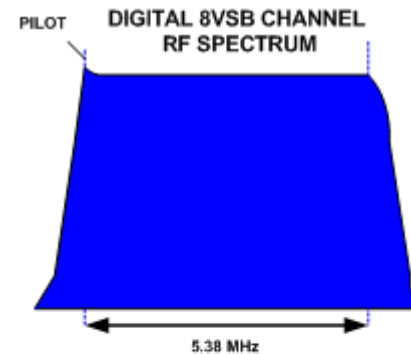
Figure 2. The SA1454 analyzes NTSC video and audio dBmV levels, carrier-to-noise and hum.

Analyze Off-Air 8VSB Digital Signal Level & Quality

The new terrestrial or off-air HDTV signal is based upon a digital signal scheme commonly referred to as "ATSC" and/or "8VSB". The 8VSB digital TV signal has a suppressed pilot carrier and distributes signal energy nearly equally across a 5.4 MHz bandwidth so it fits into the 6 MHz channel band. In reality, transmission multi-path and phase delays vary this flatness, which if excessive, can cause signal decoding problems.

The Sencore SA1454 accurately measures the average dBmV level by automatically tuning through the channel band taking multiple measurements which are averaged for an accurate level indication. Digital signal levels above -20dBmV are needed for good reception. A Peak/Valley measurement indicates the difference between measurement samples across the digital channel band.

The SA1454 further analyzes the digital signal quality with a carrier-to-noise (C/N) measurement and bit-error-rate (BER) reading. The C/N ratio test indicates the difference in power in dB between the TV digital channel power and the noise near the channel band. A BER measurement indicates how many errors are estimated to occur each second in the receiver's decoder. Reduced signal level, multi-path or other interferences cause more decoding errors and are indicated by the BER measurement. A "Pass", "Marginal" or "Fail" indication summarizes the quality of the digital signal reception.



10 div.	REF. LEVEL dB..	CENTER CH/FREQ.	S P A N	5 div
REF. LEVEL	PLAN NAME : PLAN 1			REF. LEVEL
-10	* CHANNEL . . : 33			-5
-20	TYPE . . . : 8 VSB			-10
-30	FREQ. . . : 587.000 M			-15
-40	SYM Rate : 10.760 MS/S			-20
-50	PAGE . . . : 1 OF 1			-25
-60	- - - - DIGITAL TV - - - -			-30
	AVG. POWER = -10.2 dBmV			
	PEAK/VAL. . = 4.4 dB			
	NEAR C/N . . = 26.6 dB			
	BER . . = 5x10 ⁻⁷ GOOD			
10 div	MRK LEV/PWR dB.	MRK CH/FREQ. MHz	dB/Div	5 div

Figure 3. The SA1454 measures the level, peak-to-valley, carrier-to-noise, and bit-error-rate of a digital 8VSB TV-RF signal.

Analyze Cable QUAM Digital Signal Level & Quality

In the past several years many cable companies have implemented and announced the delivery of new digital service packages. These digital services place added signals onto the cable system along with the traditional NTSC channels. The digital service programming is transported through the cable system using 6 MHz channel bands. Each channel band is packed with several digital video programs. The modulation scheme used to develop the 6 MHz channel band signal is QUAM (Quadrature Amplitude Modulation). The QUAM modulation scheme is defined by the number of amplitude points, typically 256 or 64, and the digital symbol rate, typically 5.361 MS/S or 5.057 MS/S (million samples per second)

Analyzing cable TV signals must be expanded to include a means to test the level and signal quality of the 6 MHz QUAM signals. When installing or troubleshooting a residential or commercial RF distribution system you must insure the digital service package QUAM signals are the proper level and quality. Insufficient levels or quality to the STB (set-top-box) decoder causes intermittent dropout or total loss of digital picture decoding.

The SA1454 analyzes the QUAM digital signals for the average power level in dBmV. The level is important as most cable systems place the new QUAM digital carriers at the high frequency end of the cable bandwidth. Added cable and passive device signal losses along with insufficient amplifier gain at these higher frequencies often result in marginal signal levels to the STB.

Noise and interference can impede proper QUAM decoding even with adequate signal levels. Additional analyzing tests are needed to insure proper decoding and signal quality. The SA1454 analyzes the QUAM signal for channel flatness displaying a Peak/Valley measurement. It further analyzes the C/N (carrier-to-noise) and BER (bit-error-rate).

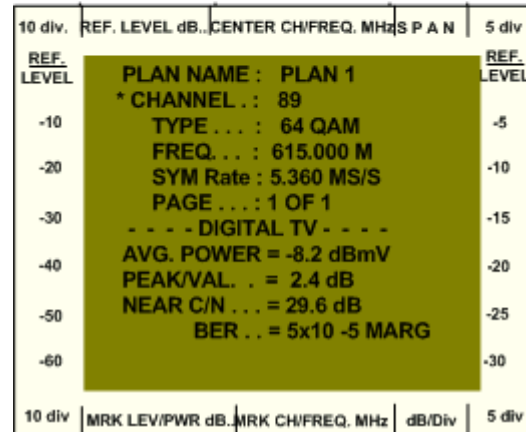
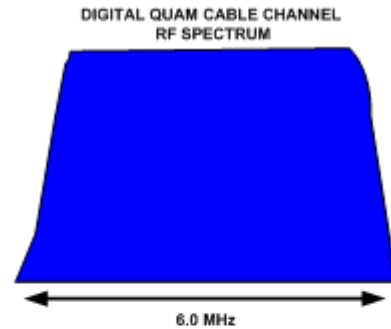


Figure 4. QUAM cable signals are analyzed for average level dBmV, peak/valley, carrier-to-noise and BER using the SA1454 to insure proper set-top-box decoding.

Single or Multiple Channel Spectrum Analyzing

Interference carriers in the NTSC analog channel typically produce slanted lines that move through the picture. Interference carriers cannot be detected with a level meter. A common source of unwanted interference carriers is overdriving of an RF amplifier which produces sum & difference carriers at the output of the amplifier. Another cause is local radio, FM, or other broadcast carriers. If these off-air signals sneak into the shielded cable they may fall in the channel bandwidth.

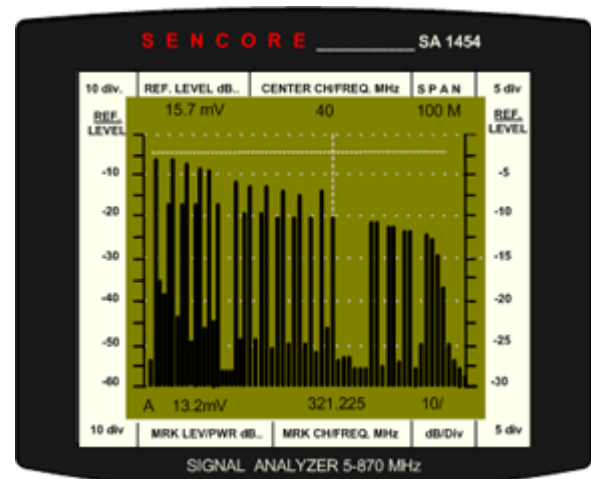
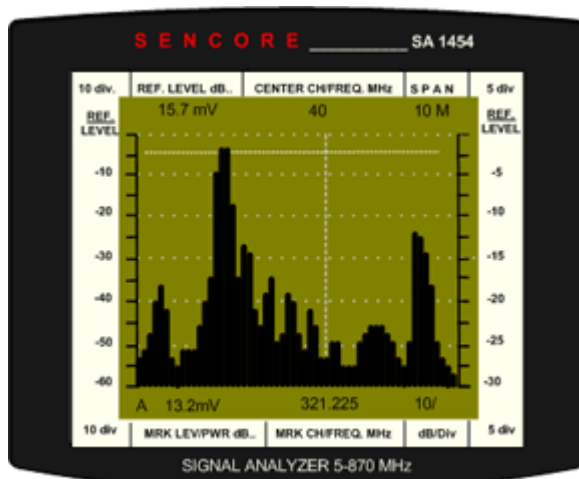


Figure 5. A spectral display inspects for interference in or near a channel band or shows at a glance the relative levels of all channels in a selected frequency span.

Interference carriers can be identified and causes can be isolated with the use of a spectrum analyzer. A spectrum analyzer shows a graph of signal energy across the channel band or across a selected frequency span. Each analog channel has a recognizable video carrier, modulation energy and audio carrier spikes on the display. A digital channel shows a nearly even distribution of energy across the 5.4 MHz channel band. Spikes that are not a normal part of the channel signal are likely undesired interference carriers. Flatness variation of the digital signal energy across the channel band indicates signal degradation.

The SA1454 integrates a spectrum analyzer with a signal level/quality meter. The combination of analyzing tests provides a comprehensive TV-RF signal analyzer. The spectrum analyzer can view a single channel (10MHz Span) to closely inspect either an NTSC or digital channel. Other spans may be selected to view multiple channels on the display. Level and frequency cursors may be used to measure level or the frequency of signals on the spectral display.

Reverse Channels or Low Frequency Spectrum Analyzing

Most cable systems now have many signal carriers that do something other than deliver video programming. Cable systems employ forward and/or reverse carriers used for broadband internet services, telephony services, video-on-demand services, digital audio services, etc.

When extending a cable system in a residential or commercial building it becomes necessary to design and test to be sure these signals are passing through the system properly. When problems arise with these cable services they are difficult to resolve with a signal level meter. Often the location and purpose of the carriers are unknown. Secondly, a level meter may have difficulty tuning to these carriers and properly measuring the signal level.

The SA1454 spectral display shows the presence and frequency location of special signal carriers on the cable system. The signal spectrum from 5 to 54 MHz can be analyzed when working with reverse signal paths within the cable system.

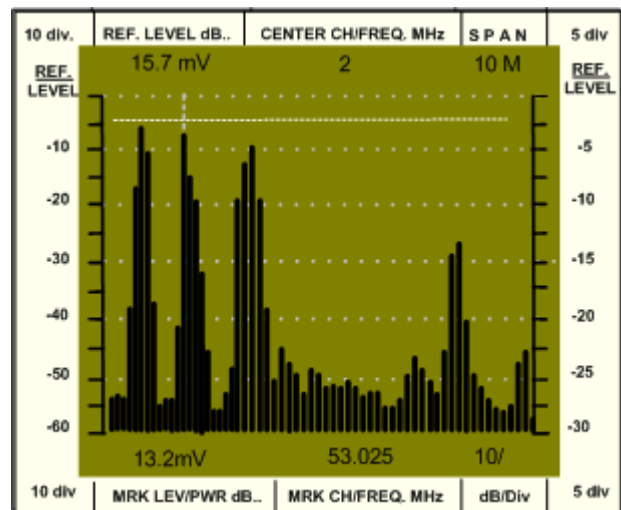
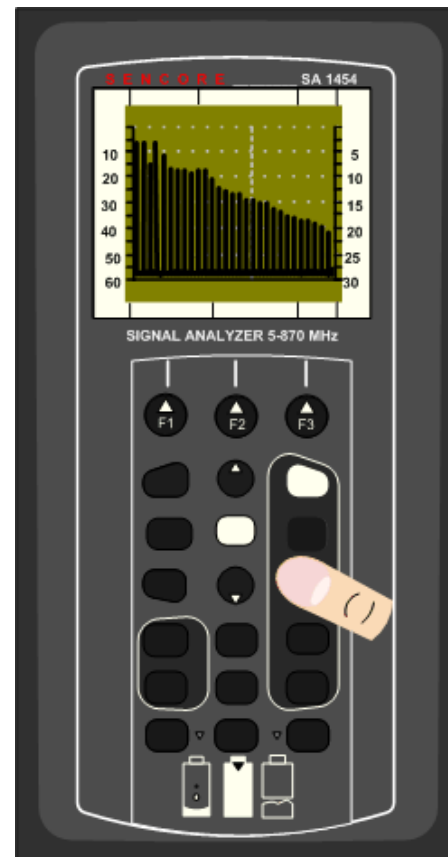


Figure 6. A spectrum display shows special carriers used for modem, telephony, digital and audio services. A special carrier at 53 and 52 MHz are shown below channel 2.

Bar Graph Channel Spectral Viewing

Many cable systems have over 200 channel carriers. The spectrum analyzer display can easily show so many channels during an active spectrum scan that the display is too busy with information. The BAR GRAPH function simplifies the display so a single bar graph shows the relative level of each analog or digital channel. The level of each channel bar is continuously updated so you can see the level changes as you make amplifier adjustments. Moveable measurement cursors indicate level and the channel.

Figure 7. A bar graph display quickly summarizes the levels of all video carriers on the system.

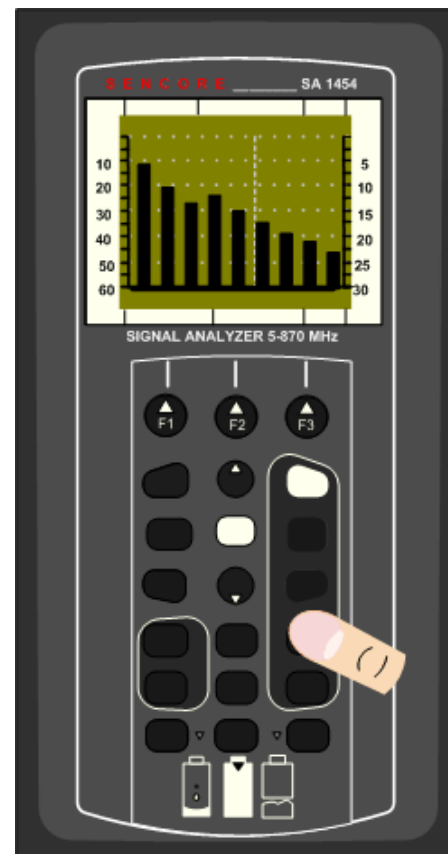


Channel Tilt Analysis

A big challenge in any TV- RF distribution system is keeping the signal levels of the lowest and highest frequencies in the system balanced. Imbalance is expected as higher frequencies are attenuated or have more losses as they pass through coaxial cable. Equalization is often needed to reduce the signal level of lower frequency channels. Amplifiers may have slope or tilt controls to reduce the amount of amplification to lower frequency channels in comparison to high frequency channels.

Using a conventional signal level meter to measure tilt involves measuring the level of both a high and low frequency channel and calculating their difference in signal level. The SA1454 provides a graphic display which accurately plots the signal level of up to 9 channels referenced for the tilt measurement. One glance at the display screen quickly reveals the tilt or difference in levels between the highest and lowest channel frequencies on the distribution system. The display is updated every second for ease in setting amplifier tilt and gain adjustments.

Figure 8. A tilt display automatically graphs 9 reference channels which should include the highest and lowest frequency carriers on the system for fast tilt analysis and amplifier adjustments.



Log Channel Measurements for Printed Reports

Often a record or report is required to document the cable signal or antenna reception signal quality for proof of job completion or customer site surveys. The SA1454 is capable of logging the channel measurements to memory contained in the instrument. Once logged, the measurements can be recalled for inspection. The measurements may also be printed.

The Digital Future is NOW!

The future is now as digital TV-RF signals are here to stay. The SA1454 Signal Analyzer provides everything you need to fully analyze analog & digital TV-RF signals, off-air broadcast or cable, in a handy handheld instrument. Call today for more information (1-800-736-2673) or visit our website at <http://www.sencore.com>.