

Anritsu MS2721A Spectrum Analyzer

Getting the Whole Picture

Test gear not only needs to be accurate to be useful, but also easy to operate, especially for those who do not use it every day. According to Burt Weiner, the Anritsu MS2721A helps the radio engineer to see exactly what is happening in the RF chain.

For me, the need to obtain a proper spectrum analyzer really became apparent in June of 1994 when the FCC proclaimed in Section 73.44 of the Rules that a swept-frequency RF spectrum analyzer was virtually required for demonstrating NRSC compliance for the required yearly AM NRSC Proof.

As a contract engineer in the Los Angeles area, I have accumulated a great deal of test gear over the years in order to properly service my clients. From radio carrier frequency measurements to TV sync levels and timing, my garage turned into something close to a laboratory for broadcast investigation.

However, the requirements for meeting the new NRSC-2 made it necessary to move up a notch in terms of capabilities. After all, spectrum analyzers are not common in the radio industry.

UPGRADING TEST GEAR

Spectrum analyzers have always been considered an esoteric piece of test equipment well out of the reach of most of us. With the slowdown of the aerospace industry, test equipment has started to pour into the used test equipment market place. No place is this more prevalent than on eBay.

My first analyzer was a Tektronix 492. While it did not have the pre-requisite 300 Hz Resolution Bandwidth (RBW) for measurement compliance within 11.5 kHz of the carrier, it did an "OK" job. A few years later I upgraded to a Tektronix 494P which gave me a better displayed noise floor and 100 Hz RBW. But oddly enough, it did not provide the required – and standard – 300 Hz found in other Tektronix analyzers, probably because the 49x series were considered microwave products.

The 492 and the 494P are really neat analyzers but not really suited to "portable" field work in spite of having a handle. I found myself schlepping the spectrum analyzer, tripod, loop antenna, a generator, outboard preamp and a passel of attenuators used in various configurations around the preamp to try and get a decent gain structure and noise floor and at the same time maintaining sufficient headroom. All of this was time consuming and began taking its toll on my back.

PREPARING FOR DIGITAL

As IBOC transmission began to appear it was soon apparent that I really needed to break down and get an instrument that not only had the 300 Hz RBW but had Average Detection and be able to set the number of samples over which the desired spectrograph was averaged. Front-end dynamic range and Displayed Average Noise Level were also major considerations.

Since I do a lot of microwave work I decided that my new instrument had to go up to at least 6 GHz with continuous coverage and without the use of outboard converters. I started looking at my usual supplier of test equipment, eBay, but was not finding what I really wanted.

The idea of having to buy a new piece of test equipment that cost more than my first home, was a wee bit intimidating, to say the least.

I discovered the folks at Anritsu were about to release their new Spectrum Master (MS2721A), a model well suited to the broadcast community because of its extended range and enhanced features. This unit, which covers from 100 kHz to 7.1 GHz, appeared to have all the features that I needed and is a truly portable, handheld lab-grade instrument.

CAREFUL PLANNING

What frightened me most was not the price but the thought of how to approach my Minister of Finance – Margaret. She has always been quite understanding and agreeable when "we" needed to purchase necessary equipment but this might just be pushing it a bit far.

I began by leaving brochures of the MS2721A lying around where they could be found and then, after a while, brochures with prices.

One day the Minister of Finance was watching me pack up the car to go out to do a round of NRSC proofs. I picked up the 494P and as I lifted its heavy 48 pounds out to the car I muttered my best imitation of Igor from the movie, "Young Doctor Frankenstein." Next came the sixty-pound Honda generator with the appropriate huffing and puffing and louder muttering.

OPPORTUNITY STRIKES

So, the Minister of Finance says to me, "Dear, isn't there something lighter you could get to do that?" "Well ... funny you should ask."

The next morning I put in a call to our local Anritsu representative, Murray Guidi, at C-Wave in Redondo Beach, CA. I arranged for a demonstration at my home, where I had access to a variety of signals I wanted to check out, so we could put the Anritsu through its paces.



Anritsu MS2721A

I must tell you, when Murray opened the case and handed it to me, I was stunned at just how large the eight-inch display screen looked. Fortunately, Murray had planned on leaving the instrument with me for several days and I could take it with me to do a few NRSC proofs.

A COMFORTABLE FIT

Having used spectrum analyzers for many years I found the controls of the MS2721A very intuitive. In less than an hour's time I had pretty much mastered the instrument and was able to quickly find my way around and set it up to display what I needed.

I now found myself getting much better results with gear weighing a total of about ten pounds. Speaking of weight, the MS2721A itself is only about seven pounds with its protective cover and internal battery.

After using the instrument for almost a week, I felt I had no choice left – I must have one for myself. With the approval of the Minister of Finance, I placed the order. It arrived about one week later.



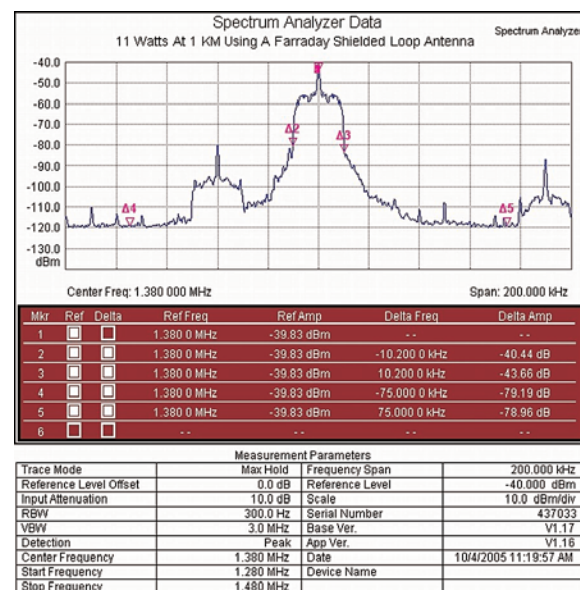
The unit is easy to carry and use on site.

LOW POWER MEASUREMENTS

One of the things that immediately impressed me with the operation of the MS2721A was the low noise floor of the instrument.

With the antenna input connector terminated with 50 Ohms, the instrument set was for 300 Hz RBW at 30 kHz Video Bandwidth, the internal preamplifier was on and in peak detection mode. I was able to obtain an instrument-displayed noise floor of approximately -135 dBm. This meant that for NRSC proofs I was limited only by the external ambient noise.

My first real test of this was to measure a client station in the desert that had a nighttime power of only eleven Watts. At a distance of approximately one kilometer, the instrument showed the peak carrier at almost 80 dB above the noise floor.



Eleven Watts at 1 km is almost 80 dB above the ambient noise.

Something worth mentioning is that I was about two kilometers away and in the main lobe of another station operating at five kilowatts at the other end of the band. The dynamic range of the MS2721A's front-end is more than sufficient to handle this without any problems.

IBOC MEASUREMENTS

When setting up and measuring IBOC signals using iBiquity methodology you are looking at an averaged rather than a peak-held signal display. The MS2721A is capable of such average detection and allows you to set the number of sample sweeps for a given averaged spectrograph, with the display counting the samples as they are taken.

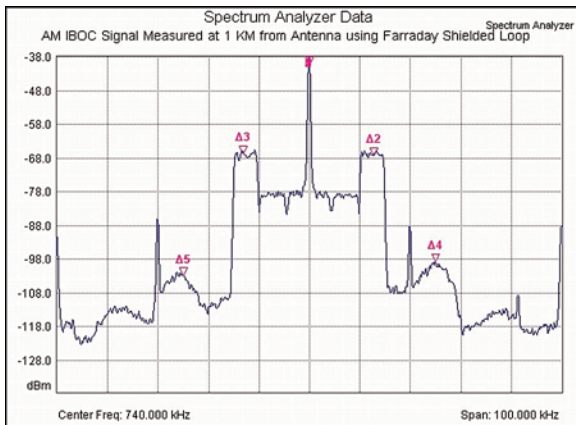
At 300 Hz RBW I found the average single trace sweep time for 100 and 200 kHz spans is about 250 milliseconds. When making FM measurements with 1 kHz RBW and a span of 1200 kHz, the individual trace sweep time is about 275 milliseconds. This allows you to see the result of an adjustment fairly quick even with 50 or more samples.

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Field Guide

by Burt Weiner

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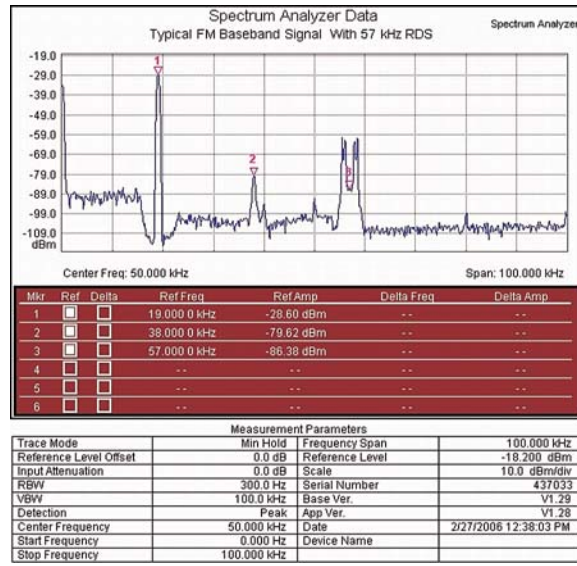
Measurement Parameters			
Trace Mode	Average	Stop Frequency	790.000 kHz
Trace Average	50	Frequency Span	100.000 kHz
Reference Level Offset	0.0 dB	Reference Level	-37.624 dBm
Input Attenuation	0.0 dB	Scale	10.0 dBm/div
RBW	300.0 Hz	Serial Number	437033
VBW	300.0 kHz	Base Ver.	V1.29
Detection	Sample	App Ver.	V1.28
Center Frequency	740.000 kHz	Date	3/22/2006 2:28:40 PM
Start Frequency	690.000 kHz	Device Name	

Looking at an AM IBOC signal.

The wide bandwidth of the MS2721A is a very welcome feature. As you can see from the following spectrograph, it does a very credible job of looking at the FM broadcast baseband output of a FM monitor in my workshop. With specifications of 100 kHz to 7.1 GHz, I have found it to be quite accurate displaying amplitude as far down as to below 10 kHz.

The internal demodulator is capable of AM, wide FM, narrow FM and SSB. It has two features that I think are especially handy. First, you can almost listen and

scan at the same time. You can set the amount of time it listens between scans. I have mine typically set to listen for two seconds and scan. With the short scan time noted above it is almost the same as having continuous audible monitoring.



Measurement Parameters							
Trace Mode	Min Hold	Frequency Span	100.000 kHz	Reference Level Offset	0.0 dB	Reference Level	-18.200 dBm
Input Attenuation	0.0 dB	Scale	10.0 dBm/div	RBW	300.0 Hz	Serial Number	437033
VBW	100.0 kHz	Base Ver.	V1.29	Detection	Peak	App Ver.	V1.28
Center Frequency	50.000 kHz	Date	2/27/2006 12:38:03 PM	Start Frequency	0.000 kHz	Device Name	
Stop Frequency	100.000 kHz						

Off-Air FM Composite Baseband

The other neat feature is that you can set the demodulation mode and frequency separately from the swept frequency of interest anywhere within the range of the instrument. I have found this very handy in searching for interference – or just listening to the radio while I work.

MASTER SOFTWARE TOOLS

Anritsu's Master Software Tools (MST) is available free from Anritsu's website. It gives you the capability to download and install new releases in the firmware for the MS2721A as well as other related software.

Using the MST program I can edit titles, add or modify markers and save the traces as JPEG files for easy import into reports. The program will also alert you when new releases are available.

The MS2721A has both internal and removable memory. The removable memory consists of a common Compact Flash Memory card located on the top of the instrument near the external power connector.

The card can easily be removed by pushing a release button next to it, causing the card to pop out far enough to be able to grab it with your fingers. I can put the card into my computer's reader and in a few seconds I have all of my stored traces along with the instrument parameters for each trace.

Burt Weiner is a well-experienced radio engineer in Los Angeles. Contact Burt at biwa@earthlink.net

– TECHIE STATS –

Features:

- Handheld (6.4 lbs), battery-operated design.
- Large, daylight-viewable transreflective 8" color display.
- Built-in pre-amplifier
- Displayed Average Noise Level < -153 dBm typical in a 10 Hz resolution bandwidth at 1 GHz.
- RBWs: 10 Hz to 3 MHz in 1-3 sequence; VBWs: 1 Hz to 3 MHz in 1-3 sequence.
- Three traces with Trace Averaging.
- Six Markers plus six delta markers.
- Multi-segmented upper and lower limit lines.
- Stores up to 2000 measurement test set-ups/Save up to 2000 measurement traces.
- Automatic time and date stamp of saved data including instrument parameters.
- Alphanumeric labeling of saved measurements.
- 50-Ohm Interface standard (75-Ohm interface capability - instrument internally corrects for adapter loss)
- RJ45 Ethernet 10/100 Base T and USB 2.0 Interfaces.
- AM, FM and SSB demodulation with built-in speaker and headset jack.

The Pro Announcer 500PH Takes On Streaming Audio

"The AIRcorp 500PH can handle anything we throw at it, from -50 dBm to +20 dBm. This range would kill most digital encoders."

--Dr. Jim White, President, Chicago Radio Engineers, on using an AIRcorp 500PH to process the streaming audio signal for a client's website. (Read more at cre-radio.com.)

AIRcorp
www.aircorp.biz 972-304-0455

Missing Some of Your Radio Guides? Get Them All on the BDR

Sometimes that magazine you lent out does not come back. Or, you left it at the studio, and need it at the transmitter. Version 2.7 of the Broadcaster's Desktop Reference (BDR) now includes every issue of **Radio Guide** from January 2003 to the present. Plus, there is an index for the PDFs, for easier location of older articles.

The BDR is an ongoing effort to provide useful tools, information, and history of interest to broadcasters.

The CD includes several sets of **Radio Utilities**, an AM and FM/TV database viewer (including DA patterns), as well as EAS printer paper sources, project schematics, historical data and pictures – even some humorous Top Ten lists.

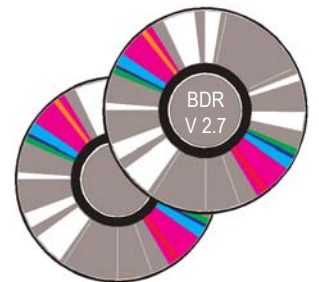
Recent additions include the archives of the BROADCAST mailing list from www.radiolists.net, going back over seven years. Using your reader, lots of tech tips from the field and other helpful info are quickly searchable.

A Table of Contents for the BDR can be found at: www.olderadio.com/bdr.htm

The proceeds from this CD fund both future improvements of the BDR as well as helping the efforts of olderadio.com to document the industry's history.

There is no set price for the BDR. Many find \$15-\$20 appropriate to cover the costs of materials and shipping, plus a little extra for funding the improvements. If you pay more, it will be put to good use.

If you have wideband Internet, we can now make arrangements for you to get the BDR quicker, via the Internet.



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