

HD Radio in a Low Power Application

February 2004

By Ed Hollis, CBTRE, CBNT

KPCC 89.3 FM

Pasadena, California

KPCC 89.3 FM

600 Watts ERP Analog

- HD Radio Coverage in Los Angeles
 - 4,000 Square Miles
- 6 Watts ERP Digital Power
- 5880 Feet above Sea Level
- Impressed with IBOC Coverage
 - Similar to 600 Watts ERP Analog

People Who Guided
and Helped

HD Radio in a Low Power
Application Test

Inspiring People

- Mr. Don Creighton, Senior VP Technology, MPR
- Mr. Mike Starling, VP Engineering and Technology, NPR

Helping Companies

- Broadcast Electronics
 - IBOC Transmitter FMi 31
- Shively Labs
 - HD Radio High Level Injector Model 5526

The Workers

- Mr. Jan Andrews, Senior Engineer, NPR
- Mr. Lance Harper, Engineering and IT, SCPR
- Mr. Ethan Torrey, Chief of Research and Development, MPR
- Mr. Lyle Henry, CPBE, SCA Noise Measurements

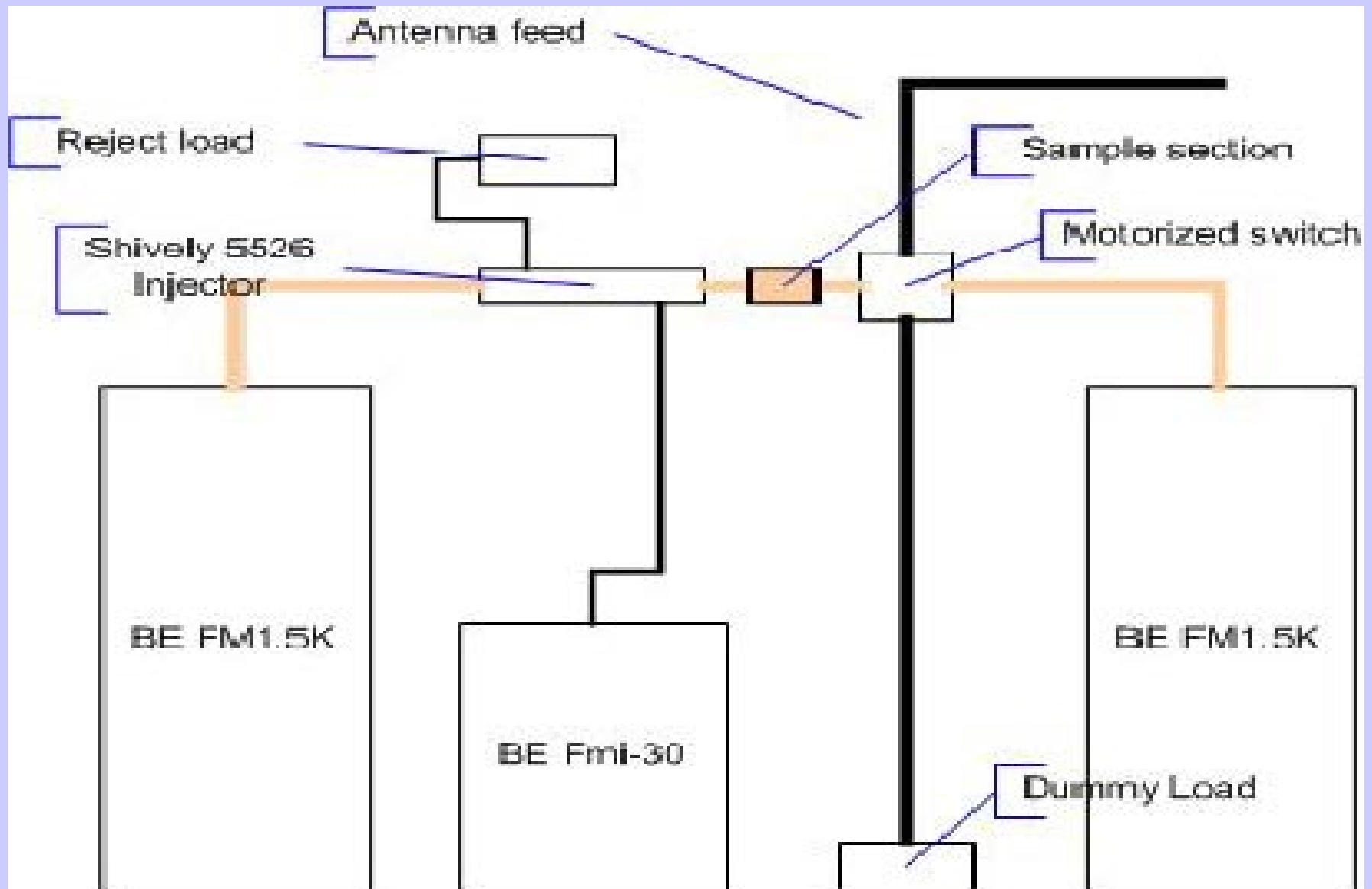
KPCC Transmitter at Mt. Wilson



HD Radio Test Details

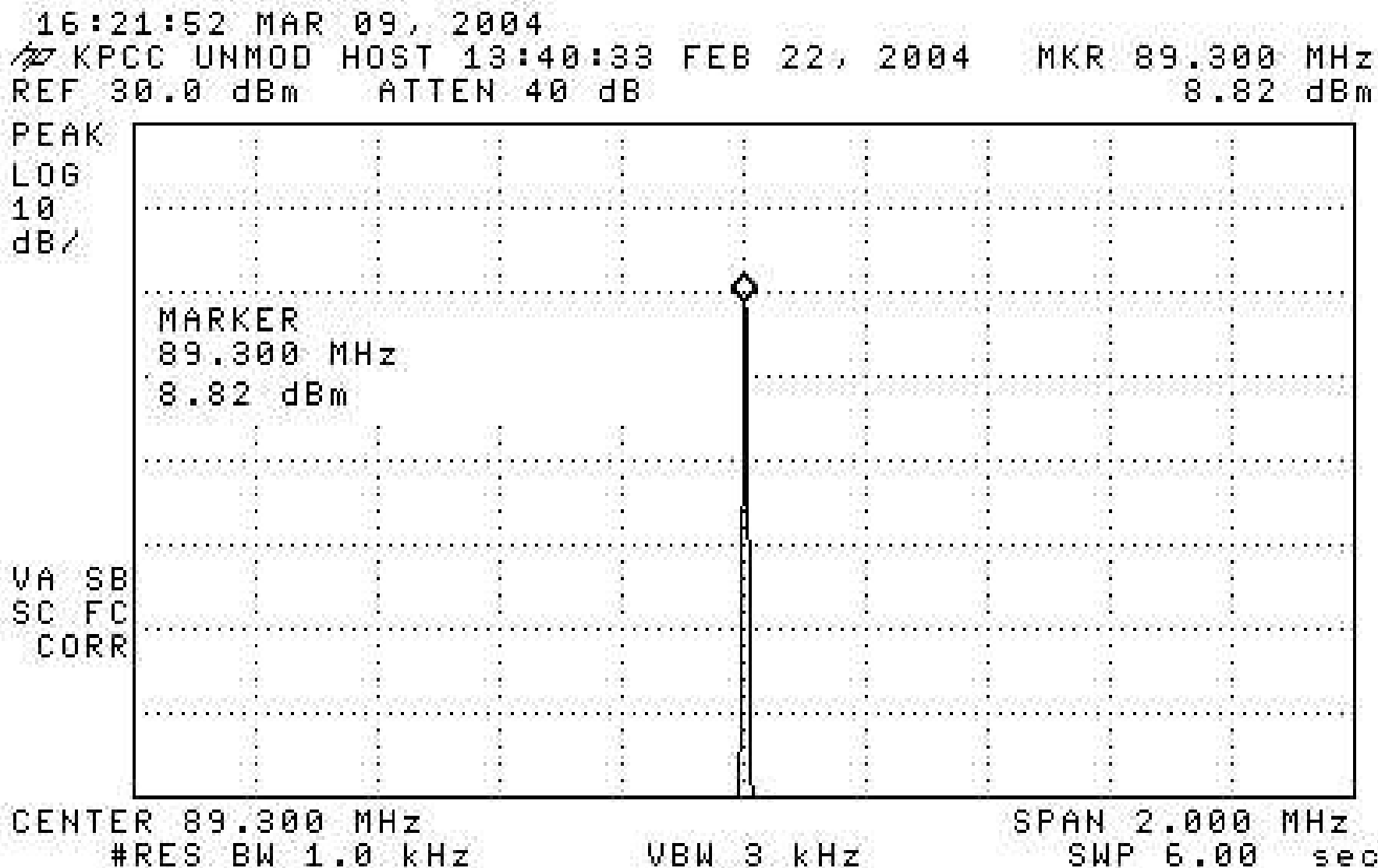
- High Level Combining Shively 5526
- Antenna Jampro _ Wavelength 2 Bay
- Feed Line 1 5/8" Heliax to Antenna
- BE 1.5A 3CX1500A7 Triode Analog
 - 600 Watts ERP
- BE FMi 31 Digital Transmitter
 - 6 Watts ERP

Block Diagram of Test Setup



Analog Only Waveform

Unmodulated



HD Radio Only Waveform

16:46:29 MAR 09, 2004

~~/~~ KPCC IBOC ONLY MB A 15:24:56 FEB 22, 2004R 89.870 MHz

REF .0 dBm ATTEN 10 dB

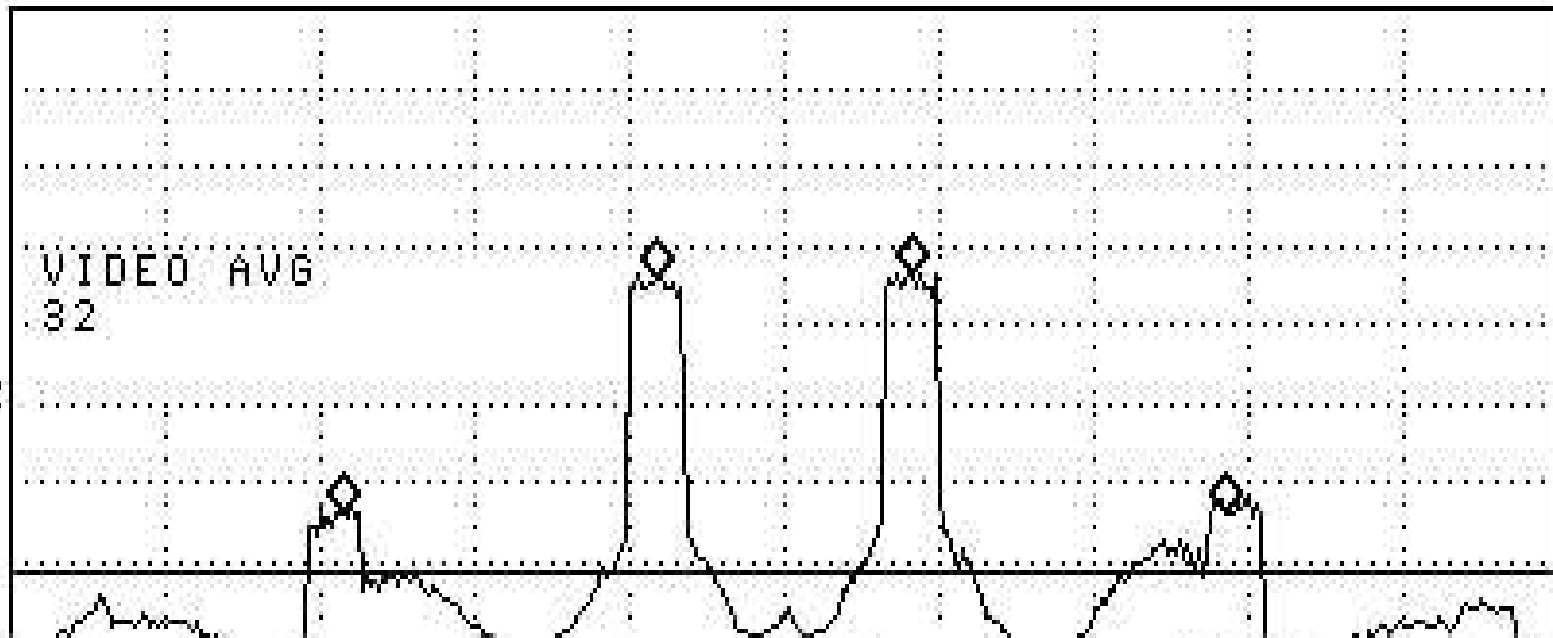
-64.15 dBm

SMPL

LOG

10

dB/



DL
-71.2
dBm

VIDEO AVG
.32

Marker	Trace	Type	Freq / Time	Amplitude
1:	(A)	Freq	89.135 MHz	-34.14 dBm
2:	(A)	Freq	89.465 MHz	-33.54 dBm
3:	(A)	Freq	88.730 MHz	-63.86 dBm
4:	(A)	Freq	89.870 MHz	-64.15 dBm

CENTER 89.300 MHz

#RES BW 1.0 kHz

#VBW 10 kHz

SPAN 2.000 MHz

SWP 6.00 sec

SCA Noise Measurements

- Quantitative Measurement
 - Belair SCA Monitor
- Qualitative Measurement
 - SCA Receiver of Good Quality
 - SCA Receiver of Standard Quality

Quantitative SCA Noise Measurements 67 KHz and 92 KHz

- With IBOC On
- 10% Injection of SCAs
 - Noise Increased in Both SCAs
 - 2.5 dB
- 5% Injection of SCAs
 - 67 KHz Noise Increased 4.1 dB
 - 92 KHz Noise Increased 1.5 dB

Qualitative SCA Noise Measurements 67 KHz and 92 KHz

- 10% and 5% SCA Injection Level
- No Increase in Noise to SCAs Heard

IBOC Signal

Further Study Needed

- Spurious Emissions
- Spectral Regrowth
- Interference to Neighboring FM Stations
 - In the Vicinity of the IBOC Transmitter
- Power Measurements
 - Average
 - Peak

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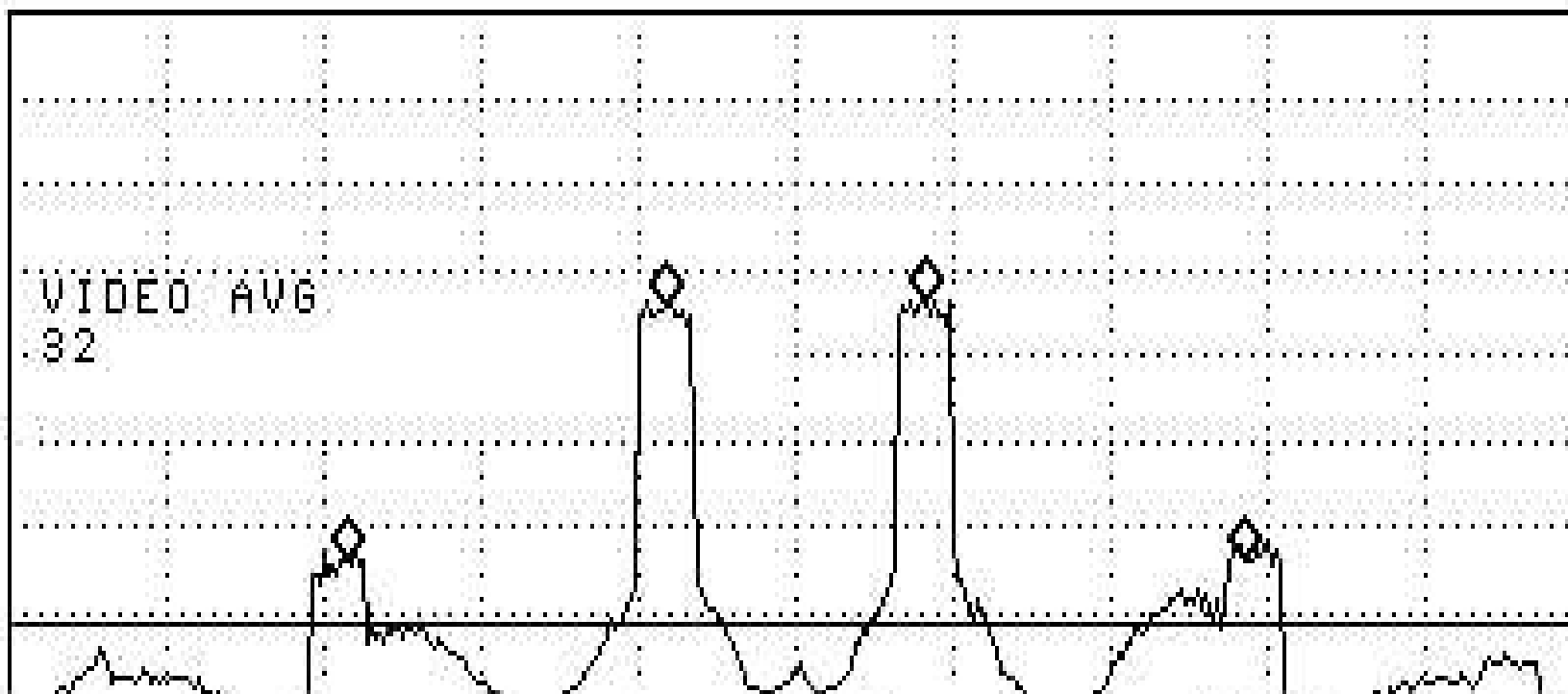
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KPCC HD Radio Coverage 6 Watts

Pasadena, California Courtesy of NPR

