Received & Inspected

AUG 24 2016

FCC Mail Room

18 August 2016

Federal Communications Commission
Office of the Secretary
445 12th St., SW
Washington D.C. 20554

Attention Robert Pavlak
Reference: ET Docket 16-191

The two documents missing from my submission to the referenced docket are enclosed. They were found on the table after the shipment was sent and just as I was leaving for the extended travel.

For your general information, the instrumentation van has been prepared for measurements of noise from wind farms at VHF frequencies using a VHF antenna. This will be done over the next few months as time is available and as wind-speed permits such measurements.

I look forward to discussions with you and your staff,

Sincerely,

Ray Vincent

Ray Vincent
1515 Shasta No 1519
Davis, CA 95616
Tele: 530-747-6019

DOCKET FILE COPY ORIGINAL

SRI International

April 1980

Technical Memorandum

Temporal and Spectral Properties of Radio Noise on the HVDC Pacific Intertie

By:

W. R. Vincent

333 Ravenswood Ave. • Menlo Park, California 94025
(415) 326-6200 • Cable: SRI INTL MPK • TWX: 910-373-1246

I INTRODUCTION

Exploratory measurements of radio noise emanating from the Pacific HVDC Intertie were made near the Lahontan Dam in Nevada in March 1980. The site was located about 300 miles north of the converter terminal at Sylmar, CA and about 550 miles south of the converter terminal at Celilo, OR.

A separate technical memorandum describes the problem experienced at the Lahontan Dam of antenna corona breakdown.[1] This memorandum describes the temporal and spectral features of noise conducted along and emanating from the ±400-kV HVDC line.

The instrumentation employed for the Lahontan Dam measurements was identical to that used for measurements at Project UHV[2] and at the Sylmar, CA converter facility at the southern terminal of the Pacific HVDC Intertie.[3] The temporal and spectral structure of noise associated with HVDC converter operation was examined in these earlier measurements.

II DISCUSSION

The instrumentation was set up in accordance with IEEE Standard 430-1976 for exploratory noise measurements as shown in Figure 1. A 5-ft vertical antenna was used in place of the normal 9-ft length to avoid measuring antenna corona breakdown. In addition, a loop stick antenna oriented perpendicular to the overhead wires was used to measure the predominant H-field noise component. Preamplifiers were used with both the E- and H-field antennas, and preamplifier gains were adjusted to provide equal outputs when receiving a far-field signal. The loopstick was oriented for maximum received signal during premeasurement gain adjustments.

The 3-axis display photographs in Figure 2 show the temporal and spectral structure of noise emanating from the overhead HVDC link. Impulses spaced at about 1.4 ms intervals can be seen in both the E- and H-field data. The spacing and general appearance of the impulse structure

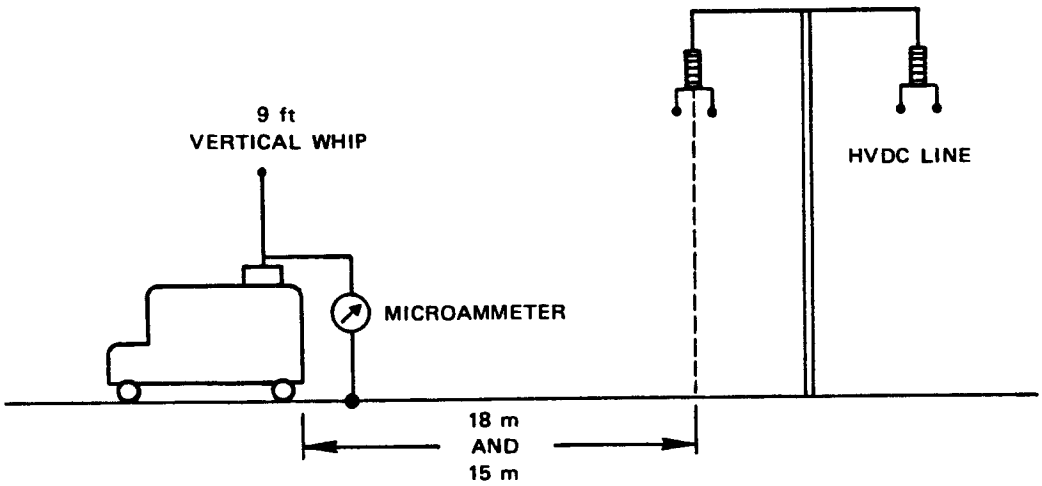
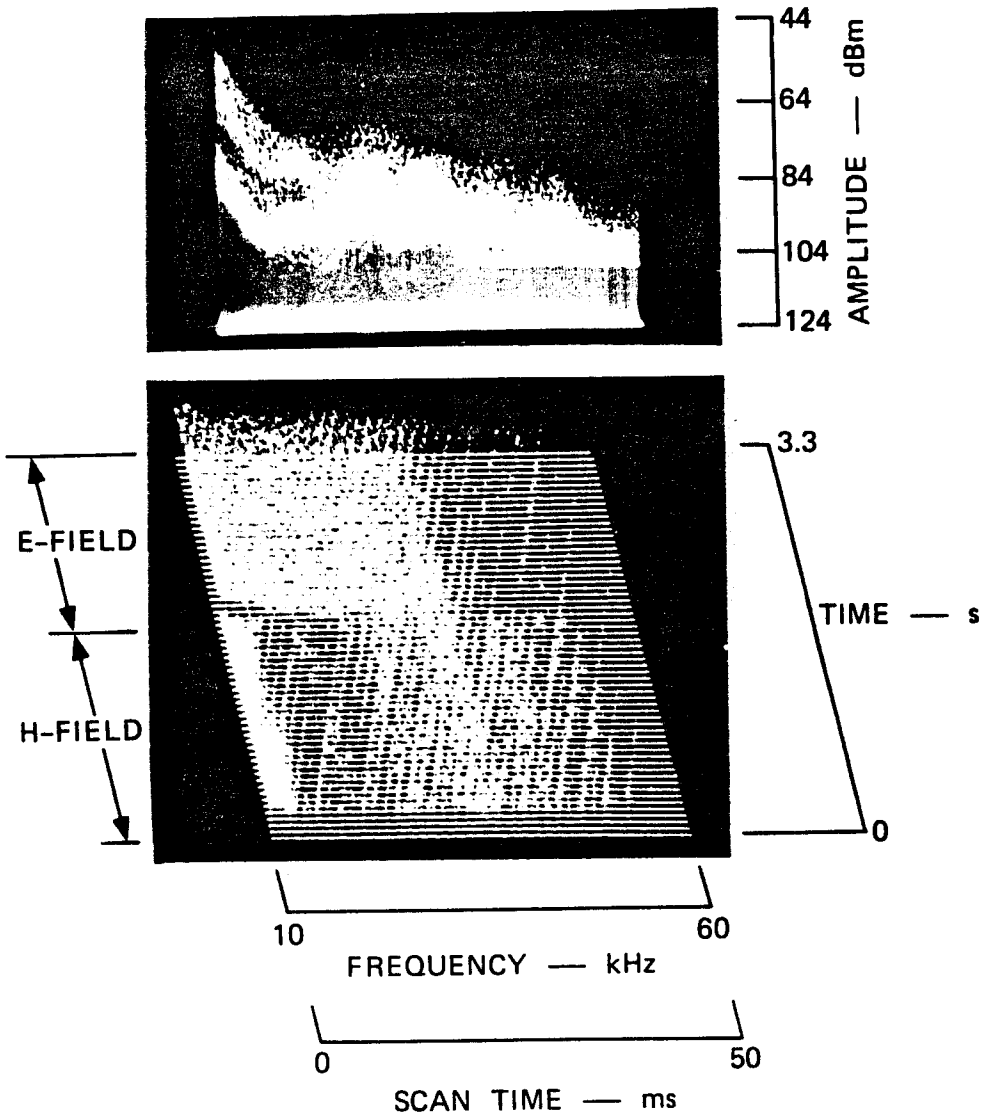


FIGURE 1 MEASUREMENT CONFIGURATION



15 MARCH 1980, 1608 PST
LAHONTAN DAM, HVDC
VALLEY SITE, 15 m WEST
35 kHz
50 kHz
3 kHz
50 ms
-20 dBm
+24 dB WHIP, 10 TO 40 LOOP

FIGURE 2 CONVERTER NOISE

was consistent with that found during earlier noise measurements at the Sylmar converter terminal.[3]

The upper photograph of Figure 2 shows amplitude versus frequency for the E- and H-field data in the lower view. The E field decreased in amplitude with increasing frequency. The H field appeared to have a small amplitude maximum at about 40 kHz; however, the loopstick sensor was about 10 dB more sensitive at 40 kHz than at the lower 10-kHz and upper 60-kHz limits of the 3-axis view. Thus, the H-field amplitude was almost constant in amplitude over the 10 kHz to 50 kHz frequencies and then decreased in amplitude with increasing frequency. Smaller scale amplitude variations versus frequency were noted in both the E field and H field These variations implied that standing waves existed along the power line.

Synchronous switching noise exceeded line corona noise by at least 30 dB over the 10-kHz to 50-kHz frequency band examined. It was the predominant noise observed at the Lahontan Dam site. The identification of E- and H-field converter switching noise at large distances from the converter terminals was not anticipated. This suggests that line attenuation was quite low at frequencies up to about 50 kHz.

Measurements at the Lahontan Dam site were made at short distances from the overhead line when compared to the wavelength of the noise (inductive field region). In the inductive field region, the E field cannot be related to the H field by the conventional far-field relationship:

$$\eta = \frac{|E|}{|H|} = 120\Pi \ .$$

Thus, both the E field and the H field must be measured to define the power level and intrinsic impedance of line associated noise. At the Lahontan Dam site, the intrinsic impedance varied with frequency, and it was about 600 Ω at 10 kHz, about 377 Ω at 40 kHz and decreased to lower values at higher frequencies.

Values of noise power and impedance are necessary inputs to the analysis of power carrier communications system performance. Useful

values for these parameters at a receiver location cannot be derived from the quasi-peak noise instrumentation recommended by existing noise measurement standards. For the specific case observed at Lahontan Dam, rms measurements would have produced valid results as well as peak measurements accompanied by information on the time domain to obtain the duty cycle.

III CONCLUSIONS

The instrumentation employed at the Lahontan Dam site provided spectral and temporal data on HVDC converter noise. Also the measurements provided values of intrinsic impedance, η, and noise power level over the 10-kHz to 60-kHz band of frequencies. Variations in these parameters with frequency were examined.

Corona on the ±400 kV HVDC line was expected to be the predominant source of noise. Impulsive noise from distant converter terminals, however, was found to be the major source of noise over the 10-kHz to 60-kHz band.

The measurements suggest that conventional quasi-peak measurements will be inadequate to define the noise properties necessary for the computation or the modeling of power carrier communications system performance. Of special concern is that both E-field and H-field measurements are required, when in the inductive field region of a power line, to define noise and to obtain values of intrinsic impedance and noise power. Unfortunately, most published material on power line noise provides only E-field or H-field data and only rarely both components.

REFERENCES

1. W. R. Vincent, "Corona Breakdown on a Nine-Foot Rod Antenna Used for Radio Noise Measurements on the HVDC Pacific Intertie," Technical Memorandum, SRI International, Menlo Park, CA (April 1980).

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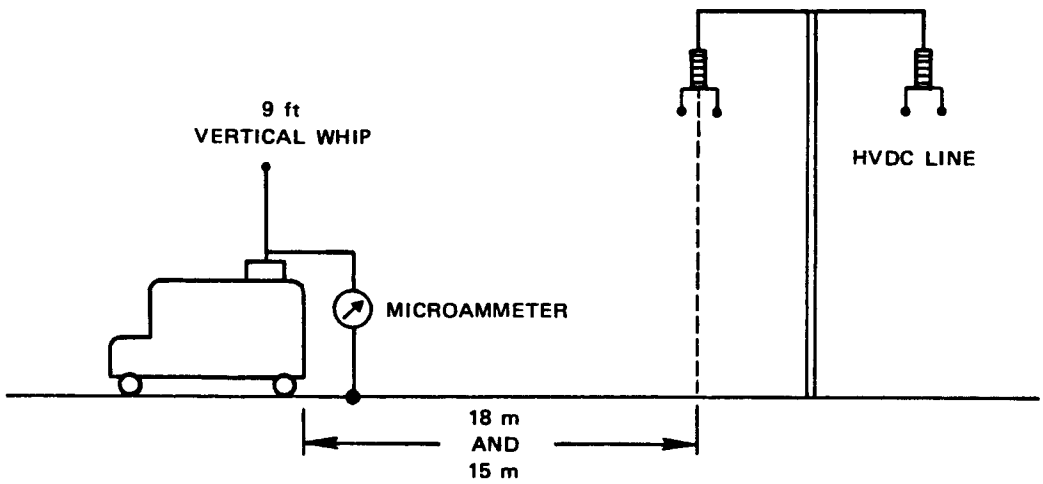

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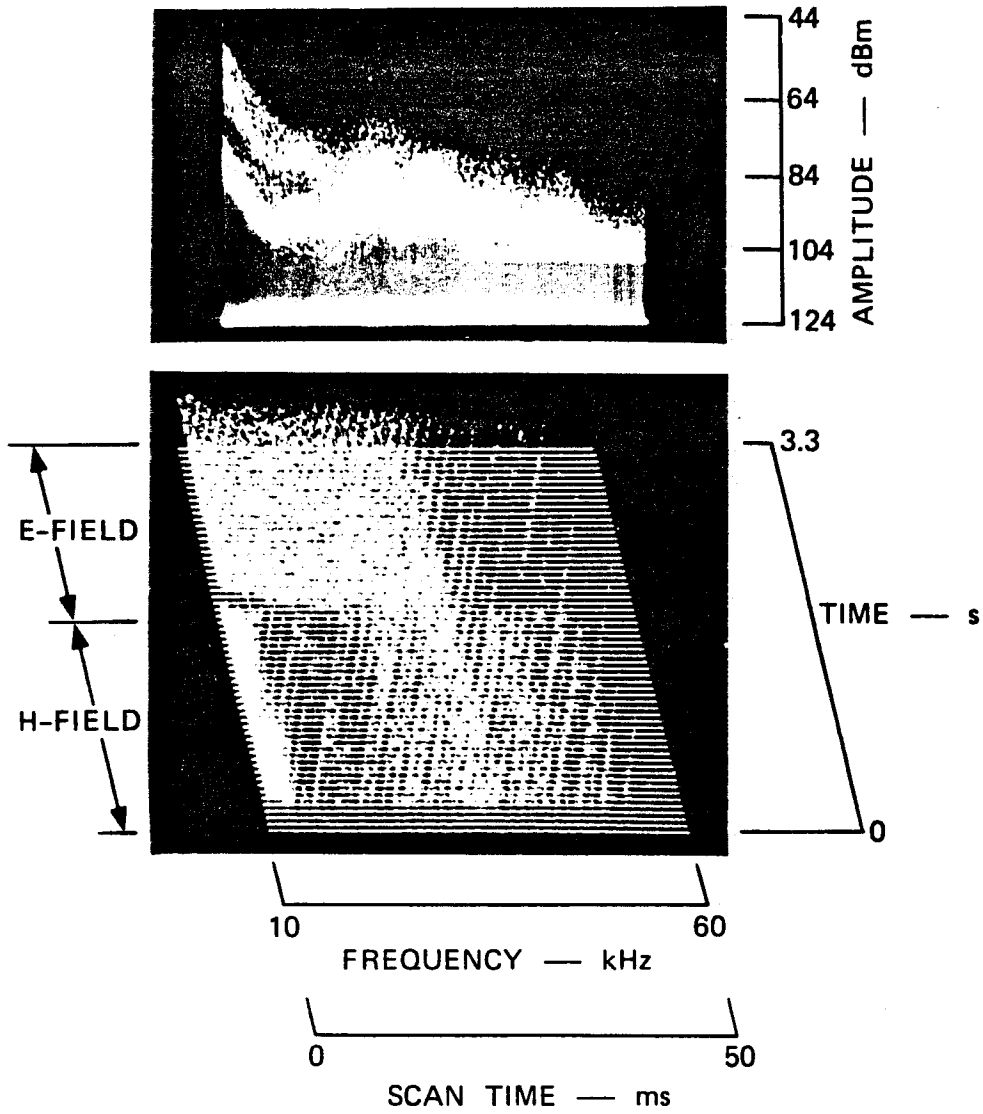

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