ADAPTIVE INERFERENCE CANCELLER

H.OSHIMA and T.NAITO
Toyo Communication Equipment Co., Ltd.
2-1-1 Koyato, Samukawa, Koza, Kanagawa 253-01, JAPAN

In the area of radio communication, an adaptive interference canceller (AIC) [1] is known as an effective method to eliminate the interferences which have the same frequency as the desired signal. Previously developed AIC consists of special devices [2]. Recently we have developed an LMS-type analogue AIC with general devices. In this paper a description of the AIC equipment is given.

Widrow et al. proposed an adaptive interference cancelling system, which employs weight circuitries to control the phase and amplitude of the interferences. An weight circuitry itself is desirable if it is an ideal attenuator or amplifier, in the meaning of linear phase characteristics. But practical devices differ from such ideal ones [3]. Fig.1 shows an example of phase characteristics of a practical PIN attenuator which would be employed as an weight circuitry. To avoid this phase error, only a narrow range might be available for an attenuator. Then we employed an AGC (automatically gain controlled) amplifier to guarantee little phase error in the weight circuitries.

In Fig.2 the block diagram of the fabricated AIC equipment is shown. Conventional configuration and analogue signal processing are employed for simplicity.

Frequency characteristics was measured for CW interference cancellation. The result is shown in Fig.3. The upper curve denotes unadapted interference output power and the lower curve denotes that of adapted one. About 40 or 50 dB cancellation was performed almost equally from 220 through 400 MHz.

Spectral characteristics are shown in Fig.4. Two FM signals are incident in this measurement. More widely modulated signal simulates the interference and narrowly modulated one simulates the

desired signal. That visualizes the wideband performance of the AIC easily.

Fig.5 shows the in-out characteristics for CW interference at 300 MHz. The upper and the lower curves mean the same as Fig.3. And the saturation of the upper curve is caused by AGC. Over 30 dB input range the interference is cancelled 30 dB or more.

Fig.6 shows the convergence characteristics. Pulsed interference is incident on the input ports. When the interference turns on or off, the weight control signal varies monotonically with time. To distinguish convergence characteristics of adaptive control from that of AGC, RF input signal is incident directly behind the AGC module only in this measurement.

In this paper the profile of the equipment which is fabricated as AIC with popular devices is described. We are now trying to accelerate the convergence to adapt the frequency hopped interferences.

The authors are gratefully thankful to M.Yoshikawa of Toyo communication equipment Co., Ltd. for his experimental support.

REFERENCES

[1] B.Widrow,et al.,"Adaptive noise cancelling : principles and applications," Proc. IEEE,vol.63,no.12,pp.1692,Dec. 1975

[2] G.G.Rassweiler,et al.,"A miniturized lightweight wideband null steerer," IEEE Trans. Antenna Propagat.,vol.AP-24,no.5, pp.749,Sept. 1976

[3] H.Oshima,T.Naito,"Performance of power inversion adaptive array with received signal leakage through weighting circuitry," Proc. ISAP '85 214-6,vol.3,pp.807,Aug. 1985

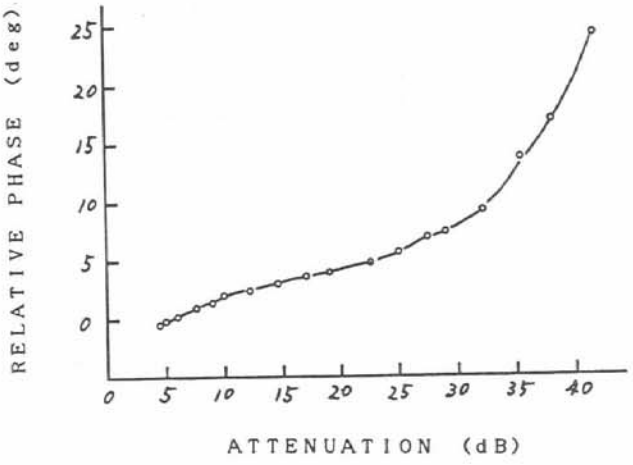


FIG. 1 PHASE CHARACTERISTICS OF PIN ATTENUATOR

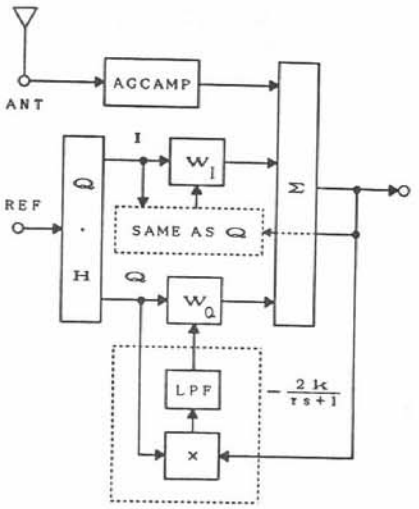


FIG. 2 BLOCK DIAGRAM OF FABRICATED EQUIPMENT

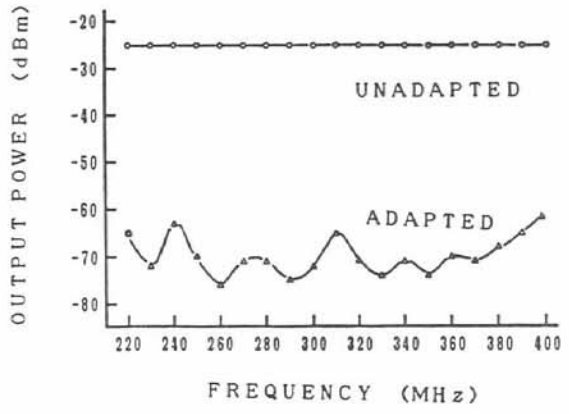


FIG. 3 FREQUENCY CHARACTERISTICS FOR CW

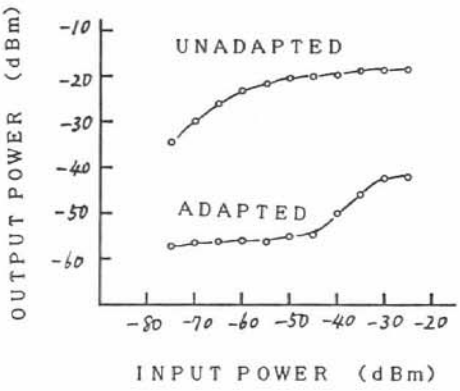
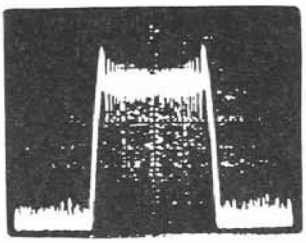
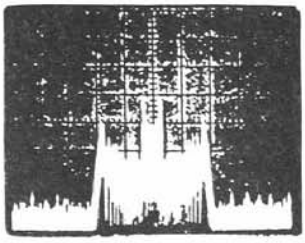


FIG. 5 IN-OUT CHRACTERISTICS



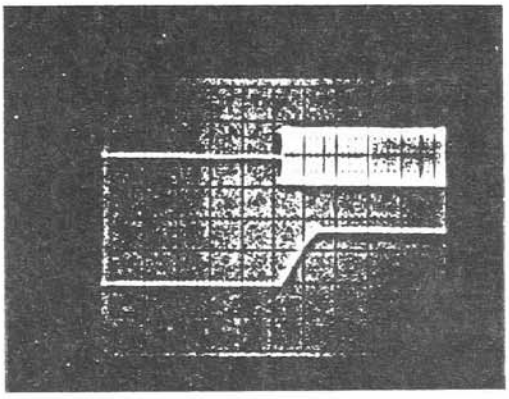
UNADAPTED



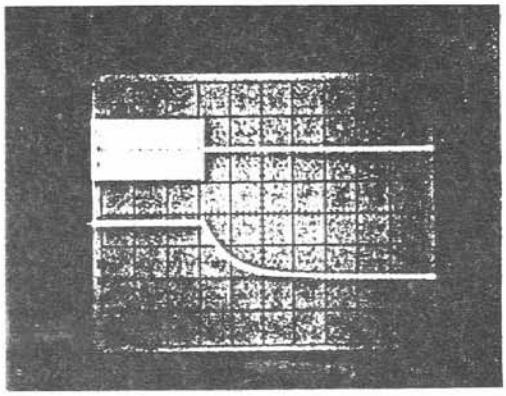
ADAPTED

F=300MHz 100kHz/div
ref=-20dBm 10dB/div

FIG. 4 SPECTAL CHARACTERISTICS



ON



OFF

CW : 0.1V/div ON : 5ms/div
WEIGHT: 0.5V/div OFF: 50ms/div

FIG. 6 CONVERGENT CHARACTERISTICS