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ADVANCED LOW VOLTAGE SINGLE CHIP RADIO IC

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ABSTRACT

We have developed new ICs for FM/AM and AM only radio including intermediate frequency filter, which have image cancelling circuits by Inphase/Quadrature mixers and Phase Shift Network (P.S.N).

INTRODUCTION

We made a complete single chip radio IC for reducing external parts and adjustment points. But Intermediate Frequency(IF) filter was not included. we have developed new ICs for FM/AM and AM only radio including IF filter.

New IC system include image cancelling circuits. The circuits have two mixers inquadrature and Phase Shift Network (P.S.N). So, IF can be very low without image interference characteristic getting worse. Therefore, Selectivity is sufficient in spite of active filter circuits having a 10~20 Q factor which can be included in IC. And we have achieved same performance IC as an usual radio using ceramic filters.

CONVENTIONAL IC SYSTEM

As IF filter needs sharp selectivity, we use IFTs or ceramic filters. At conventional radio system, IF is so high (455kHz or 10.7MHz), so it's very difficult to include filters in IC. Because high frequency filter circuits is too large scale, unstable. But at low IF system image frequency and desired frequency is very close, so image interference characteristic become poor.

NEW IC SYSTEM

To cancel image signal we use two mixers inquadrature and Phase Shift Network(P.S.N). New IC system is shown as fig-1 and Fig-2. Oscillator works on twice the mixing frequency. Binary dividers separate two 90 degrees phase-shifted mixing signals. These are fed to the two mixers. And next, phase difference of both IF signal (output from mixers)

increases 90 degrees by P.S.N.

After these signals are added (or subtracted), desired signal appear and image signal is canceled, therefore image interference characteristic is improved.

Most difficult point to design this new IC system is low current consumption and small chip size. Adequate current is needed for lower noise, and BPF occupys large chip size.

IC for AM/FMstereo

Fig.1 is the block diagram of AM/FMstereo IC. It works at 1.0volt. FM detector is pulse count circuits without any external parts.

Second IF filter is included in IC. IF is about 55kHz at AM, about 150kHz at FM. IF band pass filter(BPF) is 6 order at AM and 9 order at FM, therefore, AM selectivity is about 30dB($\Delta f = 9\text{kHz}$), and FM selectivity is about 60dB($\Delta f = 400\text{kHz}$). P.S.N is 4 order all pass network, it covers 50kHz~250kHz for AM and FM. image interference rejection ratio is about 40dB by Image cancelling circuits.

IC for AM only

At low price AM only IC, the package is very small. it has only 8 pins shown at Fig.2. The IC has power amplifier which can be used for speaker.

IF is same 55kHz but BPF is 4 order, so AM selectivity is about 17dB($\Delta f = 9\text{kHz}$), and image interference rejection ratio is about 40dB.

CONCLUSION

Using image cancelling system, in spite of low intermediate frequency we realize same performance single super heterodyne radio as conventional one using ceramic filter. consequently, IF filter can be included in IC, and advanced one-chip radio IC is developed.

This system can be applied not only for radio, but also for other communication receivers, to achieve a small size and to save cost.

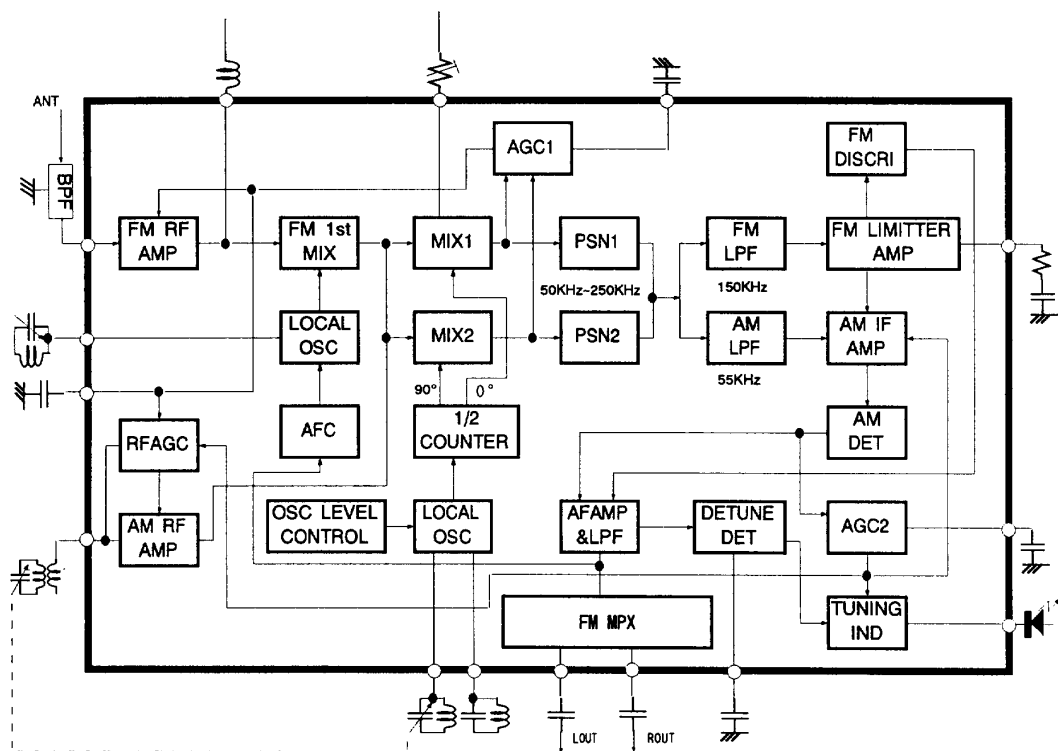


Fig. 1

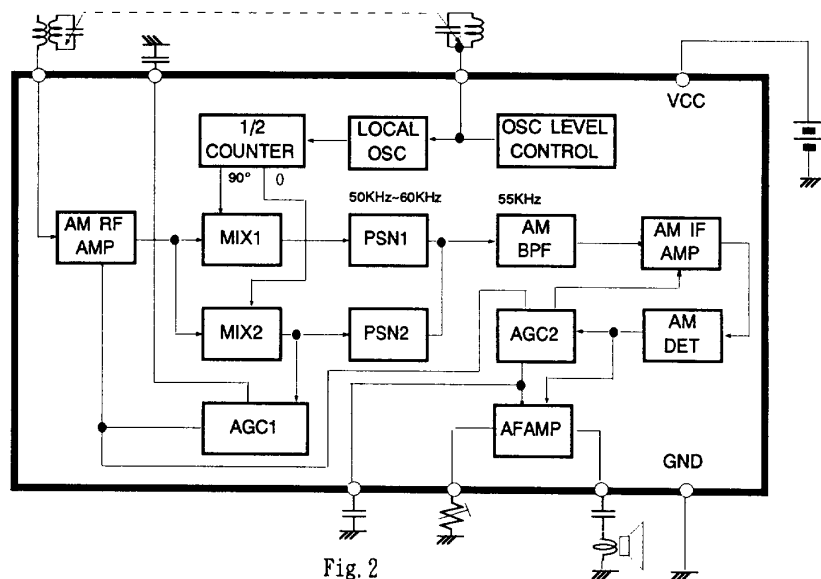


Fig. 2