ponents of the phase detector, C27 filters the internal stabilised voltage. The stability of the PLL is determined by the filter connected to pins 5 and 6 of IC4, R15, R16, C28, C31, C56, C57 determine the time constant of active low-pass filter. It is important here to pay special attention to recommended values of components. The tuning voltage from the PLL is connected to the pin 23 of IC1 to an internal varicap diode. The output from the first oscillator of the circuit in IC1 (oscillator buffer) is connected through the coupling capacitor C35 to pin 8 (FFM), the input pre-divider of the synthesiser IC4. In the majority of applications of the SAA1057 the reference frequency is determined by a 4MHz internal oscillator controlled by external quartz crystal connected to pin 17 (X). In our circuit we have chosen an economic option and used a common quartz crystal for the reference frequency of both PLL and ATMEL micro-computer [7]. The quartz crystal X1 is part of the oscillator in IC3 and the reference frequency for IC4 is connected through the capacitor C24 and resistor R11.

For the first mixer we have chosen frequency one intermediate frequency (10.7MHz) lower than the signal frequency. The synthesiser therefore generates frequencies from 126.3MHz to 130.3MHz for a reception frequency range from 137.0MHz to 141MHz. The synthesiser frequency can be finely tuned with use of trimming capacitor C21. The control word for setting the dividing ratio of the divider is accepted by the synthesiser IC4 through the inputs CLB, DLEN, DATA from the micro-processor IC3 via a three wire data bus, C-BUS, which is also connected to the connector PC-BUS for other uses.

3.3 Intermediate frequency

The first mixer oscillator is 10.7MHz lower than the input signal. The difference component (f_{IN}-f_{OSC}) is the intermediate frequency signal of 10.7MHz being amplified by the amplifier in IC1 and fed to the ceramic filter F1, this is a common type muRata 10.7MHz/180 kHz. The filtered signal is fed to the second mixer where it is mixed with the signal of a quartz crystal oscillator with the frequency of 10.245MHz (X2). The resulting difference component is filtered by ceramic filter 455kHz (F2) with a bandwidth is 30kHz. Due to frequency swing of the WEFAX signal's modulation of +/-17kHz the width of F2 should be approximately 40-50kHz. Unfortunately, the only ceramic filter available is the muRata/455/B. We have found that the narrower width of the filter has an unrecognisable impact on quality of the final image. Modulation of the first oscillator can have a substantial influence on the quality of decoded image. That is why increased attention must be paid, in this project, to the feedback loop of the PLL.

The signal after the filter F2 is amplified in the internal limiter with the output to the quadrature demodulator, which uses the resonance circuit L6-C19. In order to ensure only minor signal distortion after demodulation the linear characteristic of the demodulator must have width of at least 40kHz. For this reason we have chosen the value of the damping resistor of 39k. For use with the METEOSAT satellite a bandwidth of approximately 20kHz is sufficient.

3.4 Low-Frequency output

The demodulated low-frequency signal is a tone of 2.4kHz that passes through a simple filter, formed by R19, C37, C38, which suppresses undesirable products. After the filter the signal is divided into two parts, one to the potentiometer P2 which feeds the low-frequency amplifier IC2 with output to the loudspeaker, the other to the pre-amplifier IC6 for the 2.4kHz tone decoder circuit IC7, and also to the output for the PC sound card.

3.5 2400Hz tone decoder

A tone decoder [13] was included in the receiver after considering possible modi-