the pixel value of lost slice is copied from the same position in the previous frame. To evaluate the proposed HRMIR approach, extensive experiments have been conducted, and as benchmark, we use conventional Optimal Intra refreshment [6] and RS-MDC [9] for comparison.

In the first set of experiment, frame by frame average PNSR is reported for Foreman and Bus CIF video sequences. We compare HRMIR results with Optimal Intra [6] and RS-MDC [9]. In this experiment, constant QP value is used. For the HRMIR approach, QP is set to 22 and 28 for Foreman and Bus respectively, while for the other two approaches, the encoded bitrate is close to but no less than the that of HRMIR approach. In Fig.4 full pixel accuracy motion estimation (ME) is used, whereas in Fig.5 motion estimation with 1/4 pixel accuracy is adopted. In both full pixel and sub-pixel motion estimation environments, the video quality of HRMIR and RS-MDC are similar at the beginning of several video frames for both the Foreman and Bus sequences. However, the video quality of RS-MDC decreases much faster than that of HRMIR, therefore, HRMIR outperforms RS-MDC significantly with frame number increasing. This result indicates that for those P-frames relatively far away from the Intra frame, only providing redundant coding is not enough to protect the video quality effectively. Meanwhile, when comparing HRMIR with Optimal Intra, for most of the frames, PSNR of HRMIR is higher than that of Optimal Intra. Another advantage of the HRMIR approach is that the video quality for each frame is more stable than the other two approaches, which is an essential characteristic of subjective high-quality video. When the encoder adopts sub-pixel ME, the accuracy of the end-to-end distortion calculated with the ROPE [6] method is compromised, and eventually, the optimal procedure in Sect.III-A becomes sub-optimal. However, comparing results in Fig.4 with that