9.10. The key observation is that B is independent of $W(1)$. Indeed, note that for all $0 < t_1 < \ldots < t_k < 1$, $(B(t_1), \ldots, B(t_k), W(1))$ is a centered normal random variable. Therefore, it suffices to show that $\mathrm{E}[B(t_i)W(1)] = 0$, but this is easy to check. Now,

$$\mathrm{E}\left[e^{i\sum_{j=1}^m u_j W(t_j)} \,\middle|\, |W(1)| \le \varepsilon \right] = \mathrm{E}\left[e^{i\sum_{j=1}^m u_j B(t_j)} \right] \mathrm{E}\left[e^{i\sum_{j=1}^m u_j W(1)} \,\middle|\, |W(1)| \le \varepsilon \right].$$

As for the second term, conditional on $|W(1)| \le \varepsilon$,

$$\mathrm{Im}\left(e^{i\sum_{j=1}^m u_j W(1)} \right) = \sin\left(\sum_{j=1}^m u_j W(1) \right) \le \left| \sin\left(\varepsilon \sum_{j=1}^m |u_j| \right) \right| \le \varepsilon \sum_{j=1}^m |u_j|,$$

for all $\varepsilon \in (0, 1/\sum_{j=1}^m |u_j|)$. This is because sin is increasing on $(0,1)$, and $|\sin x| = \sin x \le x$ there. This proves that

$$\mathrm{Im}\left(\mathrm{E}\left[e^{i\sum_{j=1}^m u_j W(1)} \,\middle|\, |W(1)| \le \varepsilon \right] \right) \le \varepsilon \sum_{j=1}^m |u_j| \to 0 \qquad \text{as } \varepsilon \to 0.$$

Similarly, $\mathrm{Re}(\cdots) \to 1$. This proves the result.