

# Investigation on the validation of millimeter wave radar for automated driving with RTS

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Although the primary mechanism of RTS (Radar Test System) used to evaluate the performance of millimeter-wave radar is the same, several kinds of calculation and transmission/reception methods exist. Moreover, there is a concern that the gain/loss of each system is different. In this study, we compared an RTS with a standard horn antenna and an analog RTS with a digital RTS and summarized the differences in pros and cons due to the differences in calculation methods.

In static conditions, the analog and digital systems were comparable in reproducing the distance to the target. On the other hand, in dynamic conditions, there is a difference between the timings when the distance is set and measured due to the influence of delay factors and timing deviations of the RTS. It can be inferred that the system delay affects the measured value and the timing deviation affects the error variation.

This suggests that, for example, when evaluating the safety of an automated vehicle with millimeter-wave radar and other sensors, the test equipment, each sensor, and the vehicle may recognize different target positions simultaneously. The influence of RTS is considered relatively small compared to the measurement period of millimeter-wave radar and the delay in the system, but it should be considered.

In order to validate the various RTSs widely used to evaluate the performance of millimeter-wave radar, it is vital to continue to recognize the advantages and disadvantages of the latest technologies and their combinations and to understand the limitations and constraints of each system correctly.

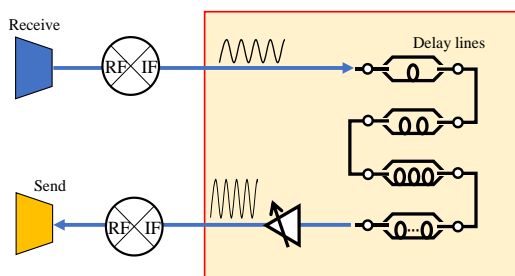


Fig.1 Analog RTS

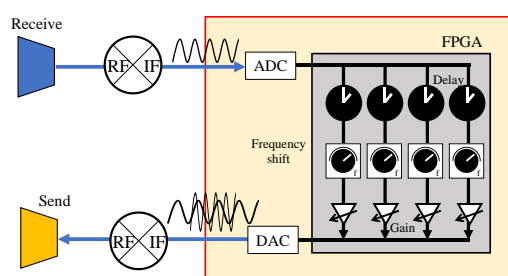


Fig.2 Digital RTS

Table 1 Comparison of analog and digital calculation

			Analog	Digital
Feature of the target	Scale	Range	○	◎
		Resolution	○	○
	Reflection (direction)		△	△
Motion of the target	Distance	Range	○	◎
		Resolution	○	◎
	Angle	Range	△ (moving system required)	
		Resolution	× (depends on moving system)	
	Velocity	Range	○	○
		Resolution	○	○
	Posture		×	×
	Time properties	Delay	switching delay	sampling rate
		Resolution	no limitation	setting rate
Switching behavior		influenced	not influenced	
Traffic situation	Reflection from other than target		×	△
	Distortion on reflected radar wave		×	△