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Investigation on the validation method of perception performance of the radar on an automated driving

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A fundamental safety requirement for automated/ autonomous vehicles was agreed upon in the UN economic commission for Europe, World Forum for harmonization of vehicle regulations (WP29), that "an automated/ autonomous vehicle shall not cause any non-tolerable risk." That means automated/autonomous vehicle systems, under their automated mode, shall not cause any traffic accidents resulting in injury or death that are reasonably foreseeable and preventable.

The automated driving system is in charge of all the driving tasks, such as perception, decision, and maneuvering in the automated driving vehicle. Especially, perception is most critical to ensuring the safety of driving. Therefore, it is essential to validate the perception performance under its operational design domain. As a basis of validation on perception performance, validation on the radar was conducted in this study. The validation in the proving ground and the validation using a radar test system were compared to organize the pros and cons of each method.

Fig.1 Proving ground

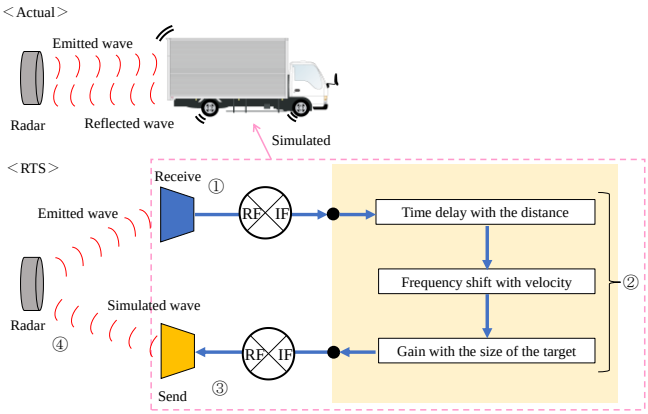

Fig.2 Radar test system

Table 1 Pros and cons of each validating methods

		Proving ground	RTS
Perception performance	Precise settlement of position and velocity of the target	△ Less precision and reproduction	○ High precision
	Time delay	○ No time delay	△ Time delay caused by sampling rate and system delay
Robustness on perception	Feature of the target (Reflection, Size, Figure, Texture, etc.)	△ Precise settlement with real material, but difficult to change conditions	△ High precision as a dot, without feature of the target such as figure
	Environmental conditions (Rain, etc.)	× Real condition is required, but not controllable	○ Rain can be simulated
	Traffic conditions (Other road users, etc.)	△ Precise settlement with real material, but difficult to change conditions	×Only limited targets, real condition with various disturbances is unable
Easiness of validation	Easiness, Efficiency	× Place and materials are required	○
	Safety	× Danger in the critical condition	○
	Reproduction	△ Huge distribution	○