



Overview of Protocol Processing and Radio Signals Transport Challenges in a Cloud Based Testing System for Automotive Infotainment Applications

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Currently, there is an increase in number of radio infotainment systems. In this sense, solutions capable of making the infotainment systems tests more efficient becomes a challenge in automotive industry. One of the limitations of these tests is the fact of the test signals are generated in each test station in an inflexible way. Therefore, a new architecture of testing platforms was developed to revolutionize the test of automotive infotainment products, based on a Cloud-based Server-Client architecture to remotely configure standardized waveforms. In this sense, it is intend to create a single and bidirectional transmission channel in which it is possible to transmit a flexible number of tests simultaneously emulating several types of signals.

One of the challenges of this solution is the protocol implementation, in other words protocol implementation is the connection between cloud and client. With this in mind, it is intended to test modules such as FM, AM, GPS, in addition to performing LTE connectivity tests. Having this diversity of tests makes it necessary to develop a protocol that covers all the specifications, therefore it is a file-based protocol (Figure 1). Regarding FM waveforms generation, it is possible to configure (website) and generate FM signals with or without radio data system (RDS) with several specifications, from the modulation frequency, to the radio name and it can be configure a FM test with audio file. For this purpose, the protocol sends a file with the data of the signal FM (IQ data) and in cases where an audio file is requested, it is also sent an extra file with audio file data. All configuration and information regarding the type of test is sent in an auxiliary file.

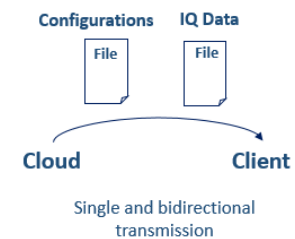


Figure 1. File-Based Protocol.

To test GPS signals it is possible to perform two types of test, the one-point GPS test and GPS route test. For the one-point GPS test the protocol approach is the same as in FM and AM. For the GPS route the operation test performs differently from the previous ones, because in order to carry out the route, the generators must always be sending each coordinate to the system to be tested. Thus, in order to generate GPS routes it is necessary to generate a large number of coordinates at one time, giving rise to large files, whose size depends on the route's length. This process requires a large number of memory and the protocol solution is to send the coordinates in a phased way to the client (in several IQ data files). Thus, in this test there are no restrictions on IQ data files number. In general, the signal limitations for these tests result from generator specifications, such sample rate and power level.

LTE connectivity tests are performed by deploying a small cell base station and respective core network that operate according to the standards defined by 3GPP. This means that the round-trip time and processing delay are tightly constrained, inhibiting the possibility of resorting processing capabilities in the cloud server and maintain real-time operation of the test device. Thus, it is necessary to adopt a different strategy from the formerly introduced and distribute a package containing the required software to deploy the test system. This package is transferred to the client, where the required processing will be executed. The adoption of such approach eliminates the necessity of resorting to cloud computing and does not require a constant interaction with the cloud, and thus avoiding the necessity of implementing a very high speed transport protocol that would be raised if processing resources were to be sourced in the cloud server environment. Therefore, the protocol must be adaptable for the diversity of signals to be tested, which raises a constant challenge for this type of testing system to apply in automotive industry.

The authors acknowledge the financial support received from PT2020 project number POCI-01-0247-FEDER-003522, IDTS: Infotainment Distributed Test System, co-funded by European Union (EU) by the FEDER (European Regional Development Fund) under of the COMPETE 2020 (Operational Program for Competitiveness and Internationalization).