Implementation of Smart Antenna and Transceiver API on OSSIE Platform for Wireless Innovation Forum Standards

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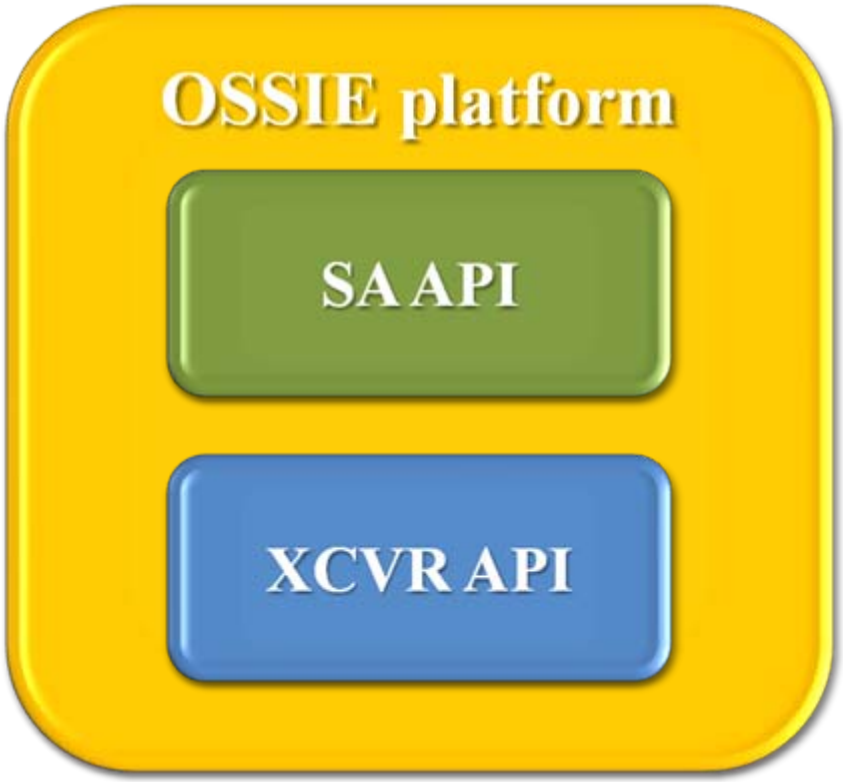
Contents

SA: Smart Antenna
API: Application Program Interface
XCVR: Transceiver

1. Introduction

❑ Objective

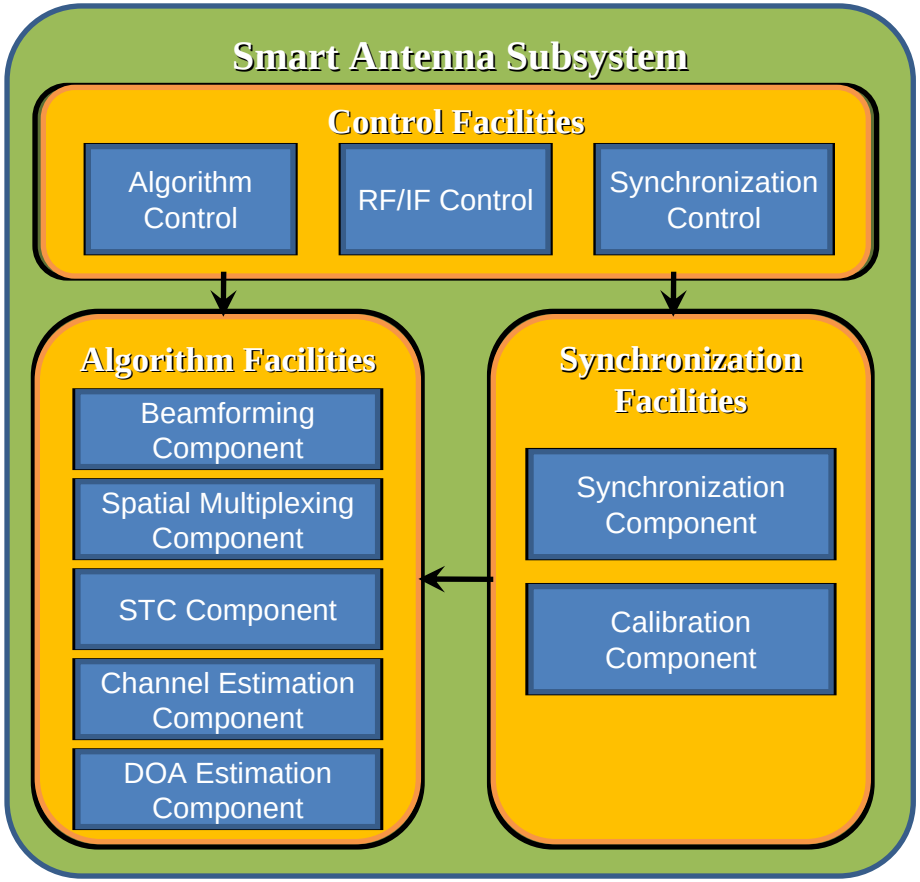


Interoperability Test

- Implementation of both APIs based on OSSIE platform
- To modify SA API and XCVR API in such a way that the two APIs be compatible with each other
- To accelerate the standardization of both APIs

2. SA API and XCVR API

❑ SA subsystem



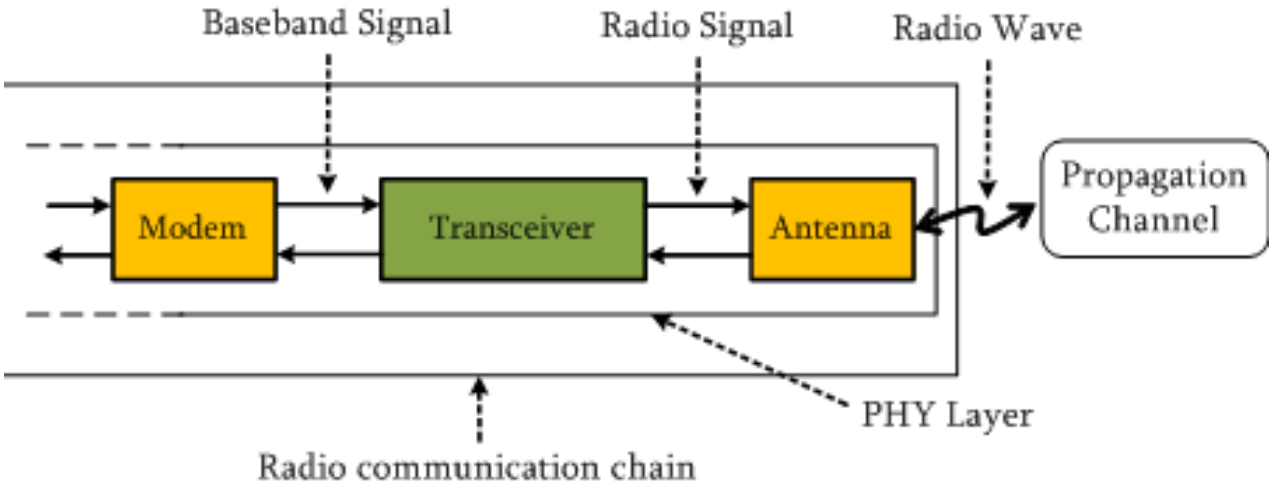
- Control Facilities
  - Manage the control interfaces required in SA subsystem
- Synchronization Facilities
  - Manage the synchronization interfaces required for symbol/frame synchronization and calibration
- Algorithm Facilities
  - Manage the various algorithms required for SM, STC, beamforming, DOA estimation, etc.

*SM: Spatial Multiplexing
**STC: Space Time Coding
***DOA: Degree of Arrival

2. SA API and XCVR API

❑ XCVR API

- The XCVR is comprised between the Modem and the Antenna.
- The XCVR exchanges the baseband signal with modem, and radio signal with the antenna subsystem.
- Modem, XCVR and Antenna are generally considered as part of the PHY layer.

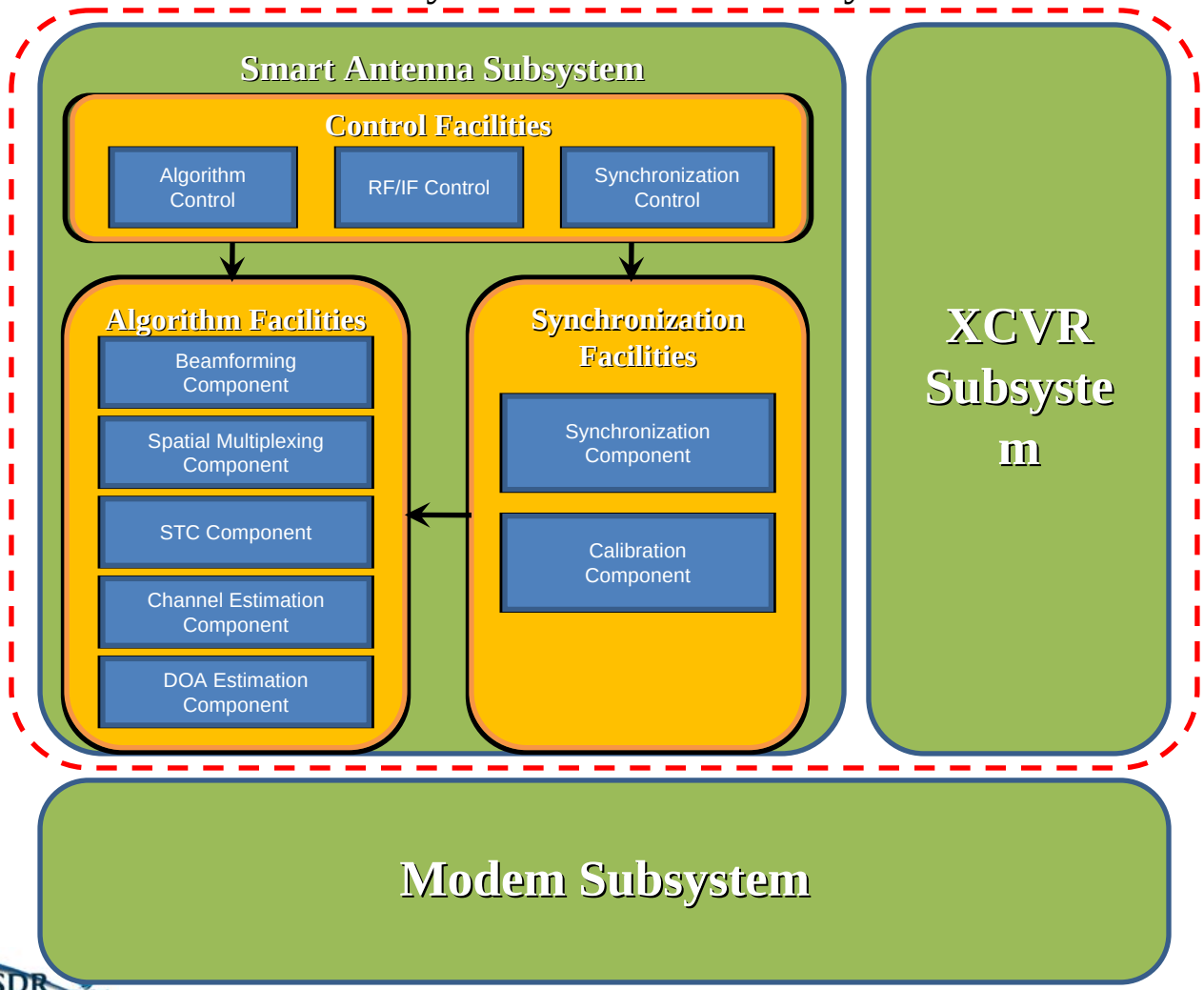


<Block diagram of XCVR subsystem>

2. SA API and XCVR API

❑ Entire system

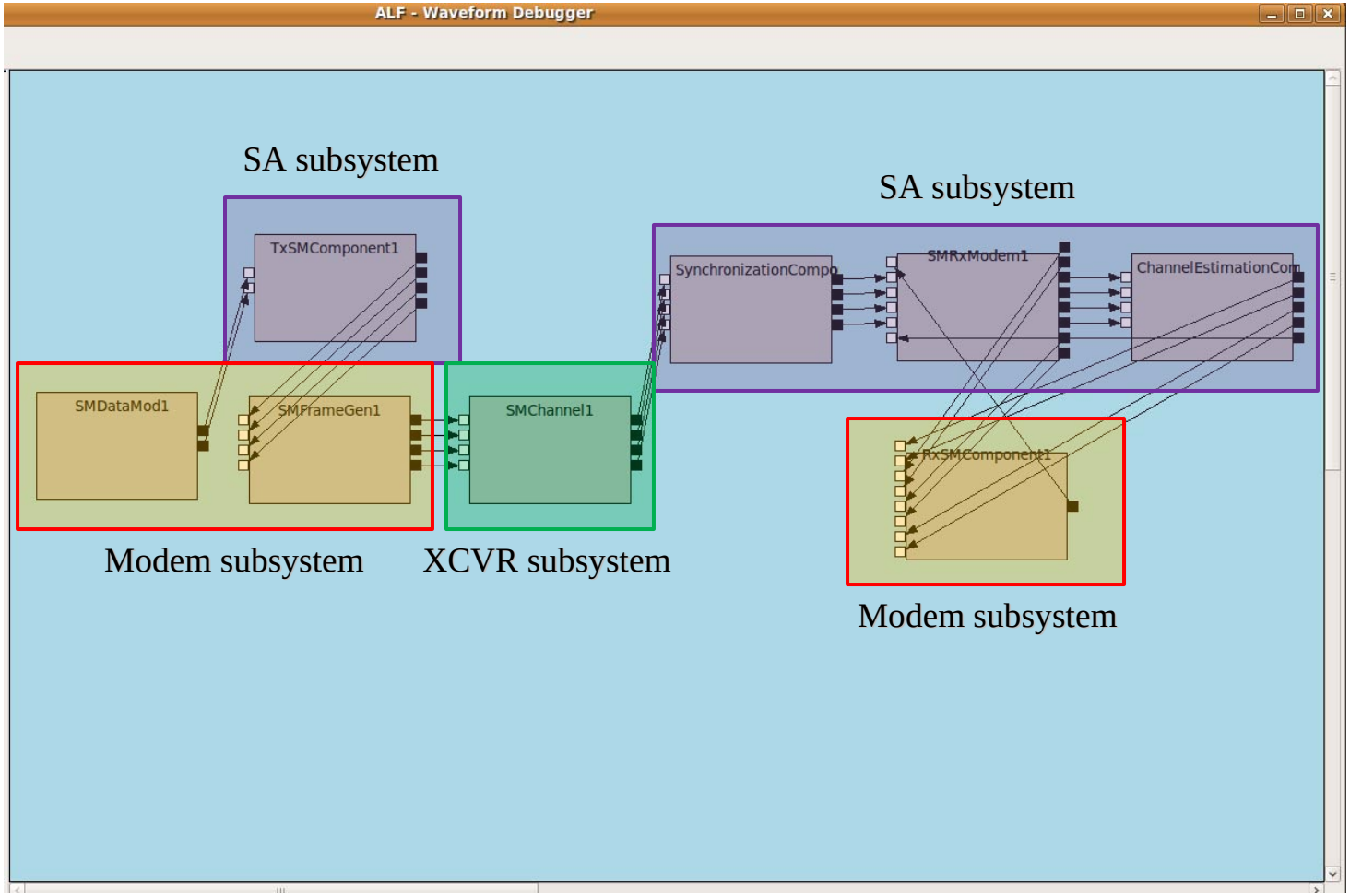
- We implemented both SA subsystem and XCVR subsystem.



3. Implementation and Experiment

❑ Implementation of SA API

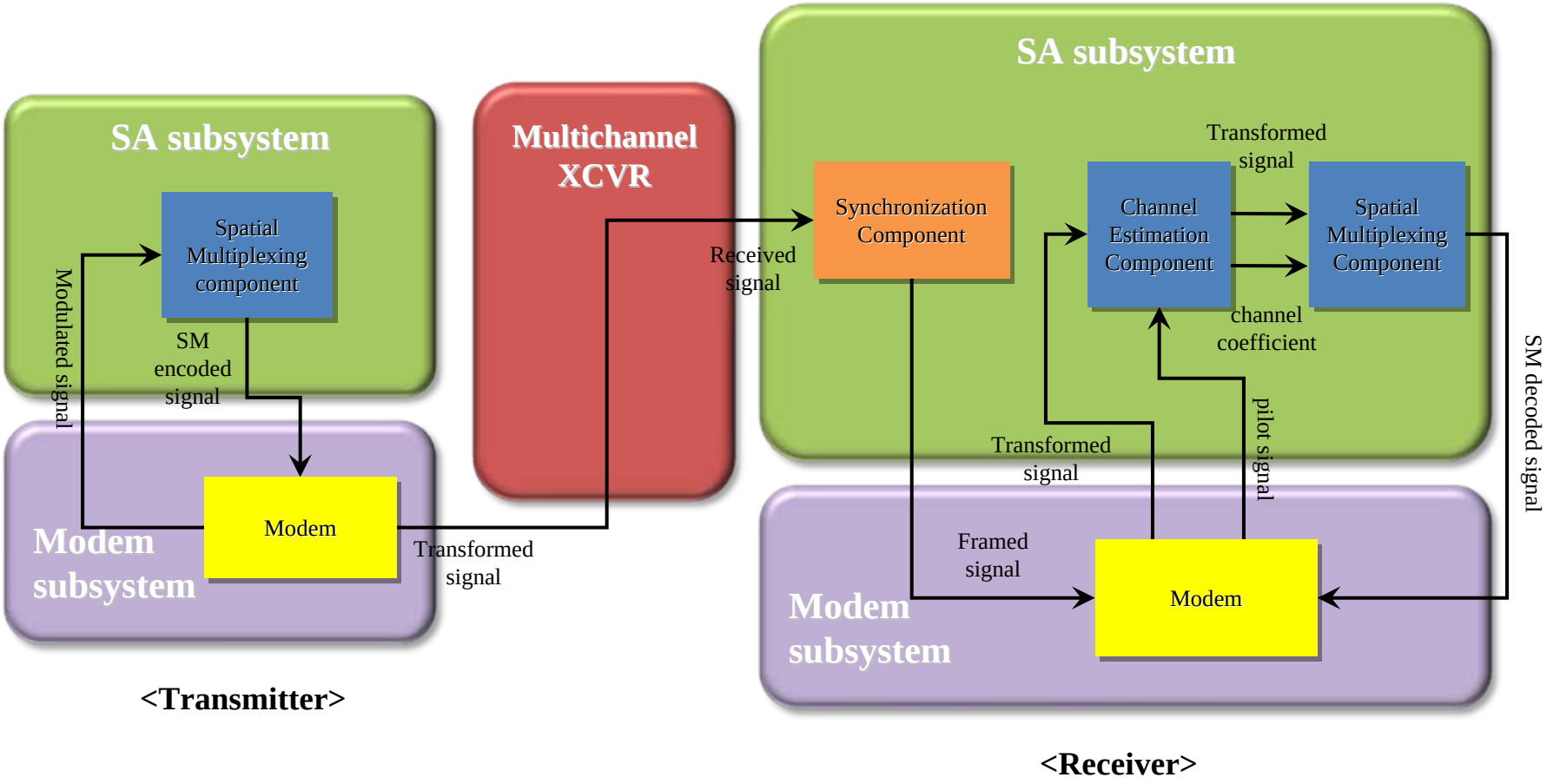
- Spatial Multiplexing case



3. Implementation and Experiment

❑ Implementation of SA API

- Spatial Multiplexing case



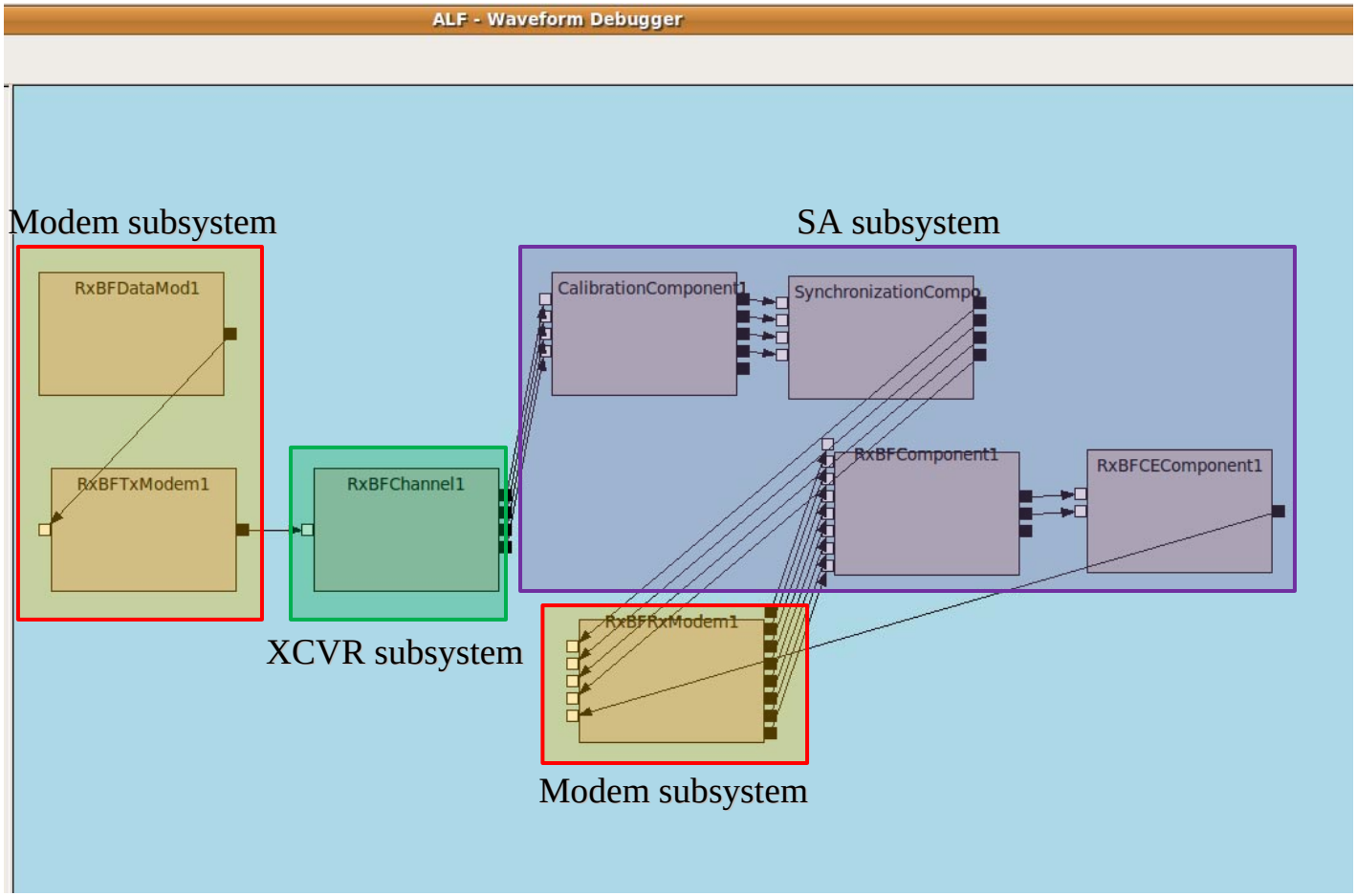
<Transmitter>

<Receiver>

3. Implementation and Experiment

❑ Implementation of SA API

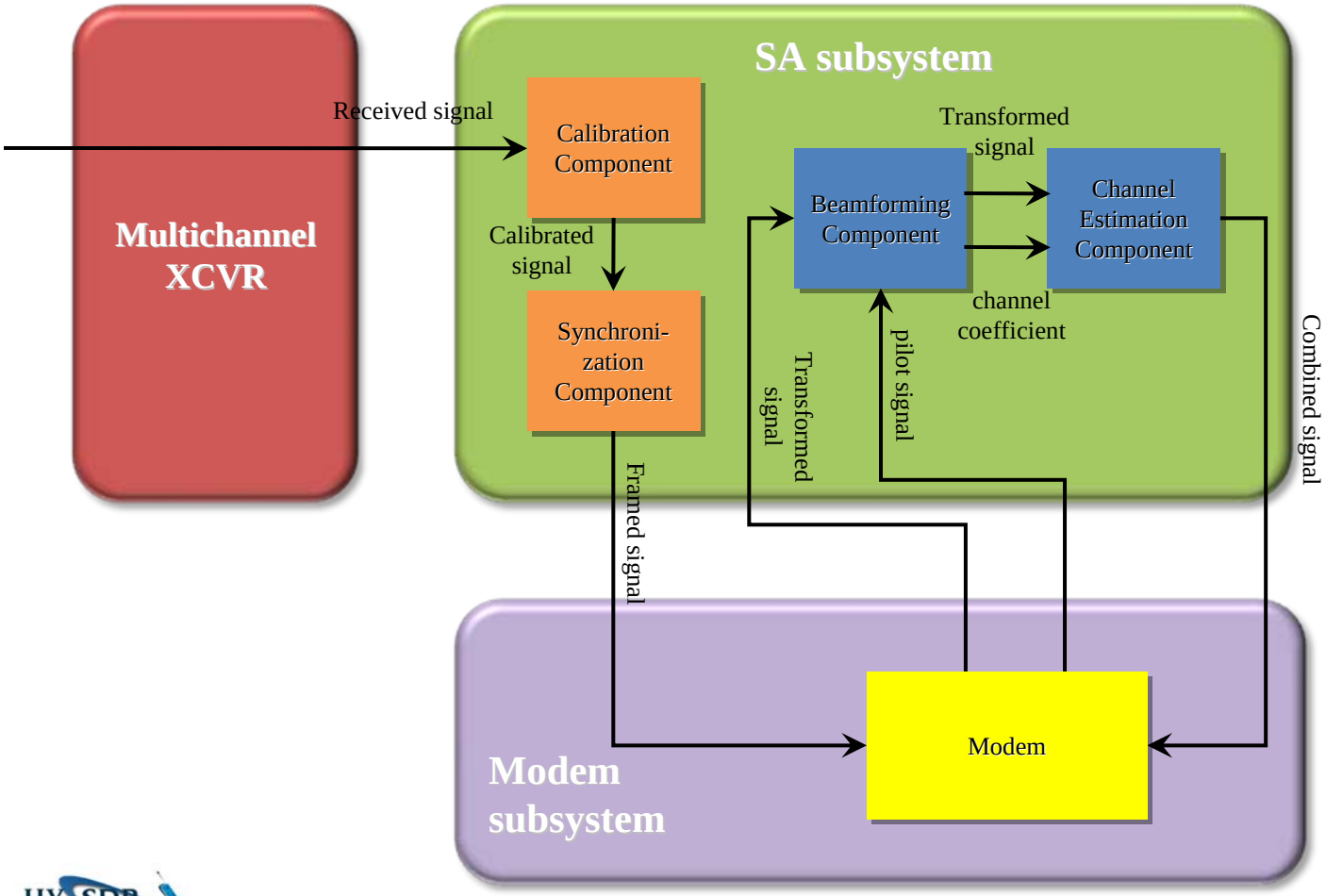
- Receive Beamforming case



3. Implementation and Experiment

❑ Implementation of SA API

- Receive Beamforming case

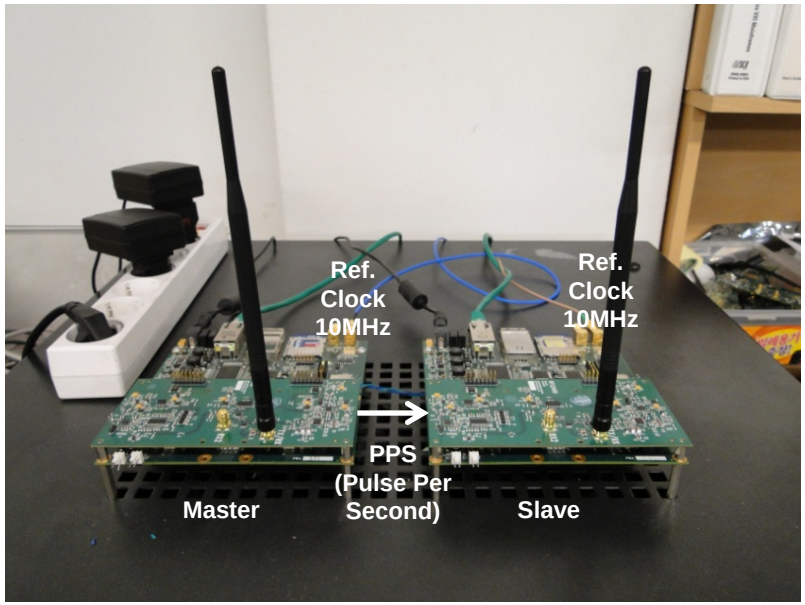


3. Implementation and Experiment

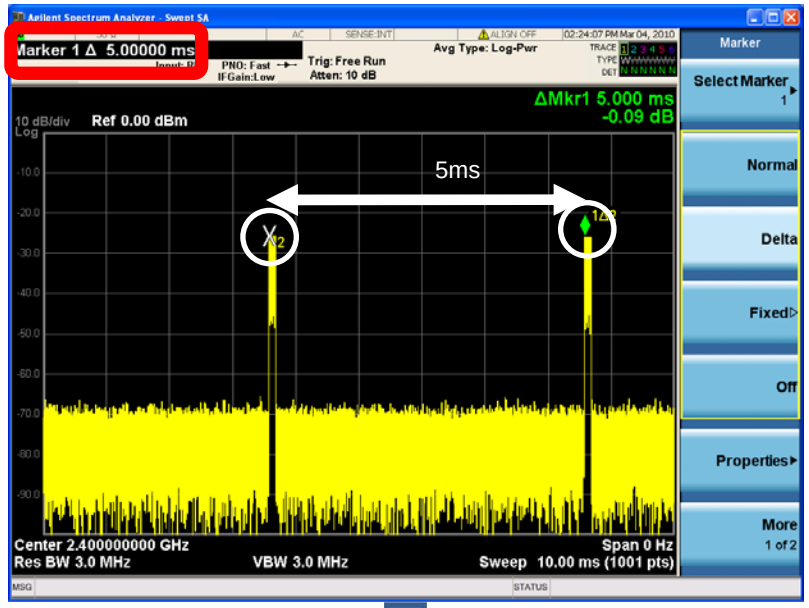
❑ Implementation of XCVR API

- Current version of XCVR API provided by WINNF does not support multi-antenna system.
- In new 2.0 specification of XCVR API, multichannel structure is introduced.
- 2-channel XCVR has been implemented to verify the feasibility of this new structure.
- Two USRP2 XCVRs, working independently are used in our implementation.

3. Implementation and Experiment



<Transmit and receive antennas using USRP2>

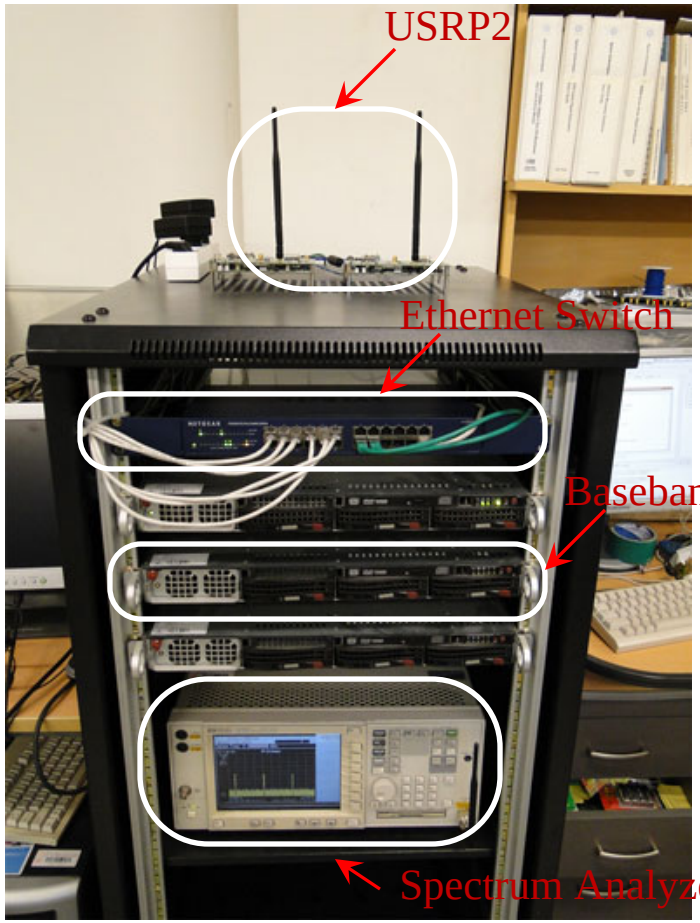


Signals in the 2 antennas are perfectly synchronized so that they look like one.

• Transmit signal in time domain is shown that the interval between the preamble signals is 5ms, and the duration of a preamble signal is 102.4us.

3. Implementation and Experiment

❑ Implemented system of SA and XCVR subsystem

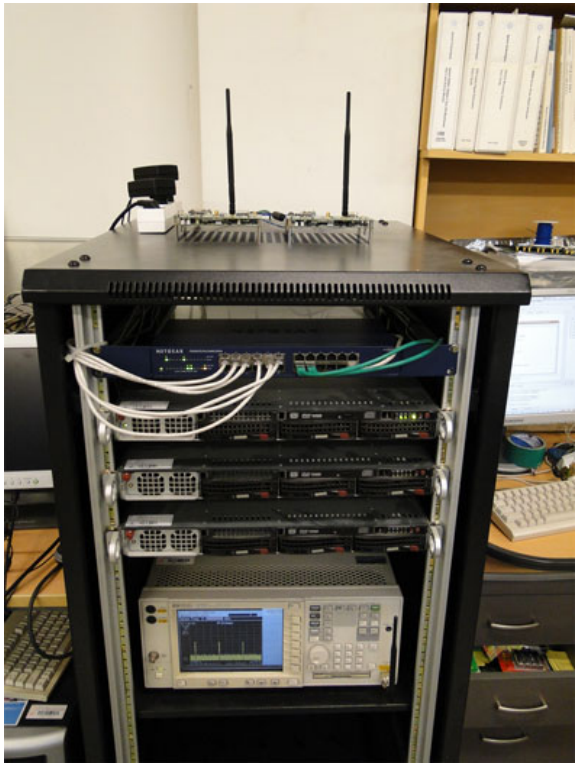


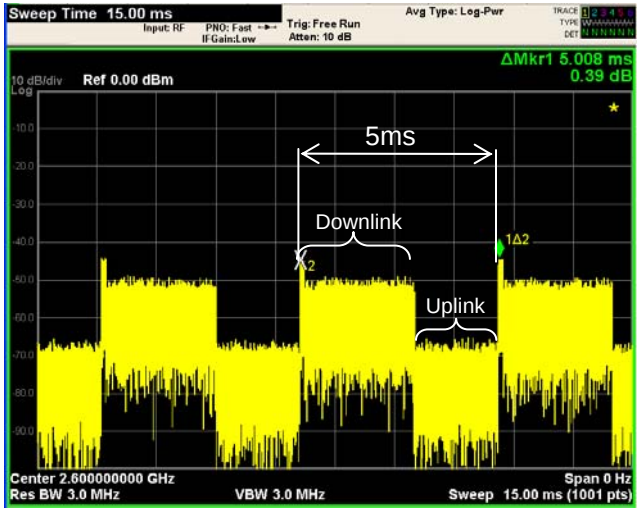
<Implemented system>

- The transmit and receive antennas are connected to USRP2.
- The receive signal from each antenna is transferred to the baseband unit through the Ethernet switch.
- Baseband unit is a personal computer which has an OSSIE platform.

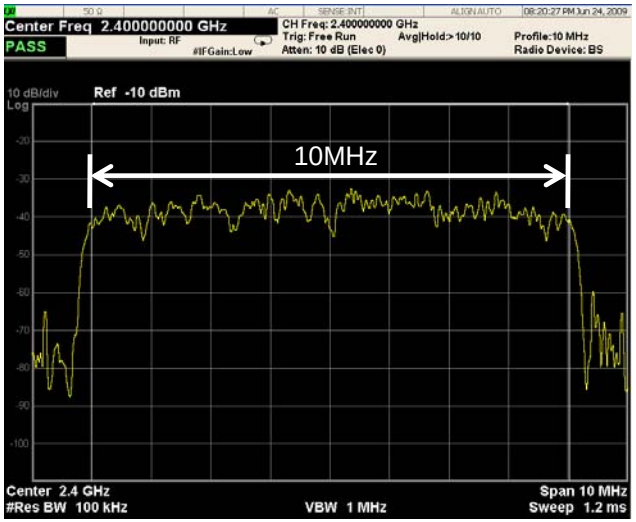
3. Implementation and Experiment

- Verification of transmit signal
  - ① Duplex: TDD
  - ② Frame Duration: 5ms
  - ③ Bandwidth: 10MHz





<Time Domain Measurement>



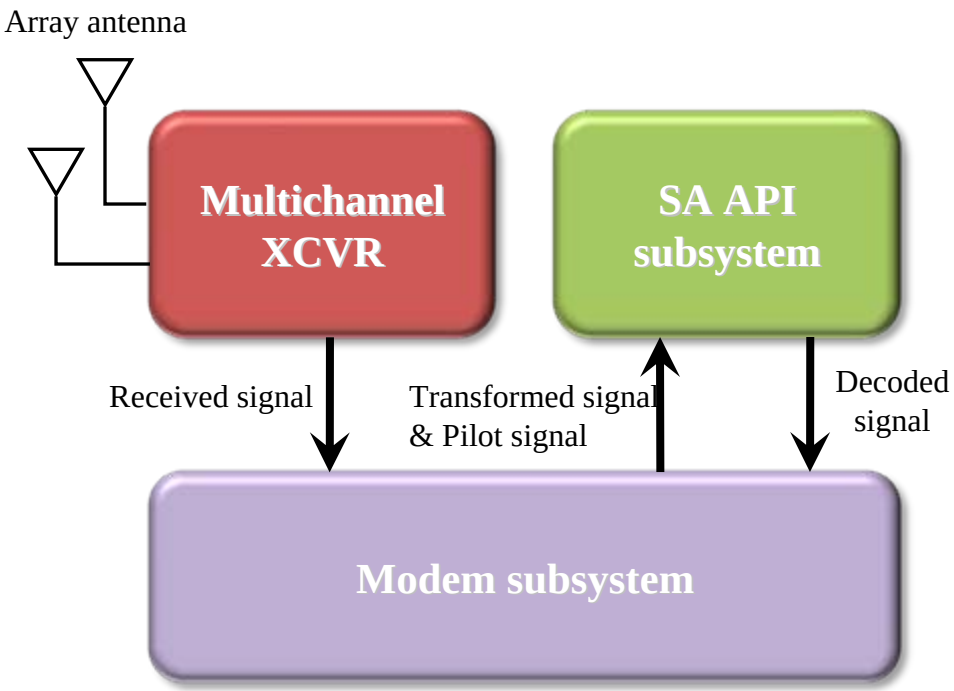
<Frequency Domain Measurement>

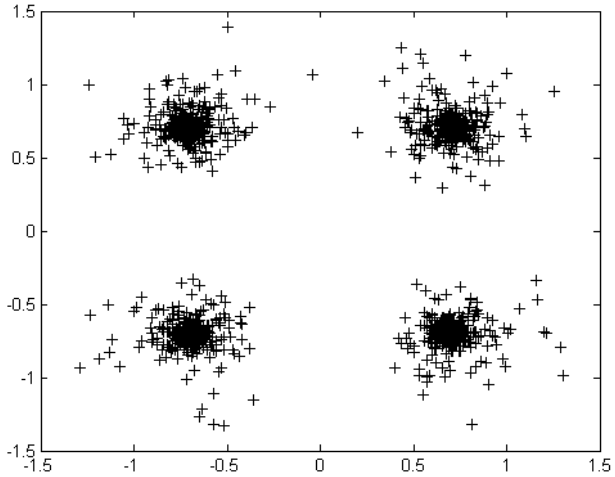
3. Implementation and Experiment

❑ Verification of receive signal

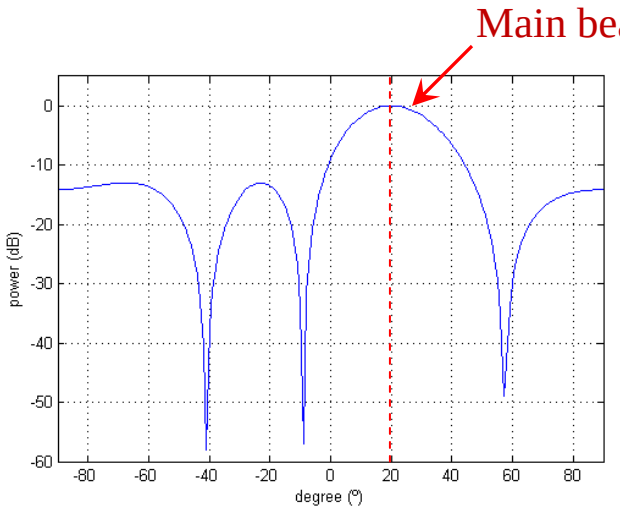
① Spatial Multiplexing case

② Receive beamforming case





Constellation of received signal after SM decoding algorithm



Beam pattern(DoA:20°)

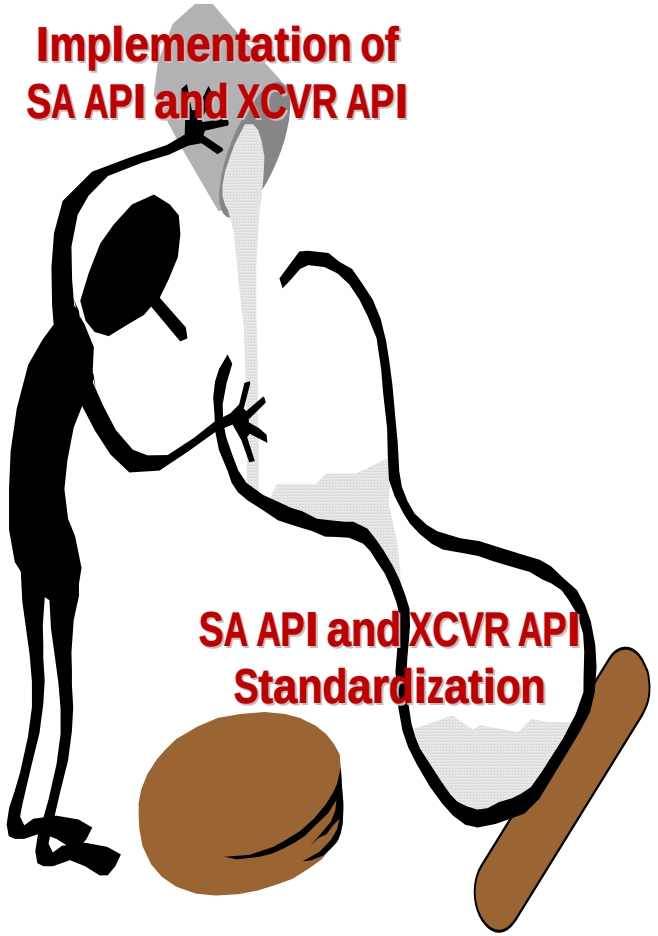
4. Conclusion

• We implemented the components and interfaces in SA API standard on OSSIE platform.

• We implemented the multichannel XCVR for multiple antenna system on OSSIE platform.

• The interoperability between the two APIs has been confirmed through the implementation.

• The implementation of SA and XCVR API will accelerate the standardization of both APIs.



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If you have any further question, please contact me by e-mail.

I will reply as soon as possible.