Proposal of Transport Layer by DiBEG

1. General
   We, DiBEG, or Digital Broadcasting Experts Group, of Japan, proposed Ph-1 and Ph-2 of the Transport Layer in response to the TV 3.0 CfP (Call for Proposal) issued by the SBTVD Forum. We describe the outline of our technical proposal of Ph-1 and Ph-2 for the transport layer.

2. Outline of Transport Layer
   Our proposed Transport Layer has already been deployed to the 4K and 8K services via satellite broadcasting in Japan. This Transport Layer's scheme is of MMT. We are offering the specifications of this MMT in our proposal.
   This document describes the outline of the MMT features.

Ph-1 Proposal on the Transport Layer

We submitted the statement based on the CfP requirements. The following description is the outline of the statement for the Transport Layer.

TL1.1: Signal platform audio/video/data sync
Our proposed MMT complies with these signal platforms.

TL1.2: Multi-platform audio/video/data sync
Our proposed MMT complies with these multi-platforms.

TL2.1: IPv4-based transport
Our proposed MMT complies with the IPv4.

TL2.2: IPv6-based transport
Our proposed MMT complies with the IPv6.

TL3.1 to 3.3: Latency, Error detection and Overhead
Over-the-air delivery latency depends on time-interleave. Overhead is required 4% for the over-the-air and 6% for the Internet delivery.

Ph-1 Proposal of Transport Layer

The following description outlines the statement on the Transport Layer.

TL4.1: Encryption support
Our proposed MMT incorporates an encryption function.

TL5.1: Identification of TV network, Original station and TX station
Our proposed MMT complies with these Identifications.

TL6.1: Signal Provision of the channel transports for emergency warning
Our proposed MMT incorporates emergency warning provision.

TL7.1: Wake-up capability
Wake-up capability includes in the Advanced ISDB-T. It is considered to be implemented in the Advanced ISDB-T.

TL8.1 and TL9.1 to 9.7: OASIS alert protocol and Country wide Alert
Alert function includes in the Advanced ISDB-T. It is considered to be implemented in the Advanced ISDB-T.

Ph-2 Proposal on the Transport Layer

1. Specifications of the technical proposal
   We submitted the Document of ARIB STD-B60 Version 1.13-E1 （English Translation）. This document describes the outline of ARIB MMT proposal.

2. Comments on the technical proposal
   MMT in Japan is already in the actual operation phase for 4K/8K satellite broadcasting, and the independent MMT equipment that existed in the development phase is no longer available. For the same reason, this response does not include the Files requested by Section 4.3.1.2.

   ARIB STD-B60, a standard document used for 4K/8K satellite broadcasting, is attached to this response. The MMT section of PL equipment is created based on this standard. Responses to CfP Phase-1 were also made based on this standard.

DiBEG MMT Proposal

Standard already in practical use

-ARIB STD-B60 Version 1.13
"MMT-Based Media Transport Scheme in Digital Broadcasting Systems"

http://www.arib.or.jp/english/html/overview/doc/6-STD-B60v1_13-E1.pdf

➢ Used in 4K/8K satellite broadcasting started 2018 in Japan (ISDB-S3)

➢ Can be applied to media transmission in plural media channels including broadcasting and communication, etc.

➢ Some "restrictions / extensions" from the base ISO/IEC standard

Based on ISO/IEC Standard

-ISO/IEC 23008-1:2017
Information technology — High efficiency coding and media delivery in heterogeneous environments — Part 1: MPEG media transport (MMT)

-ISO/IEC 23008-10:2015
Information technology — High efficiency coding and media delivery in heterogeneous environments — Part 10: MPEG media transport forward error correction (FEC) codes

Protocol Stack of DiBEG MMT
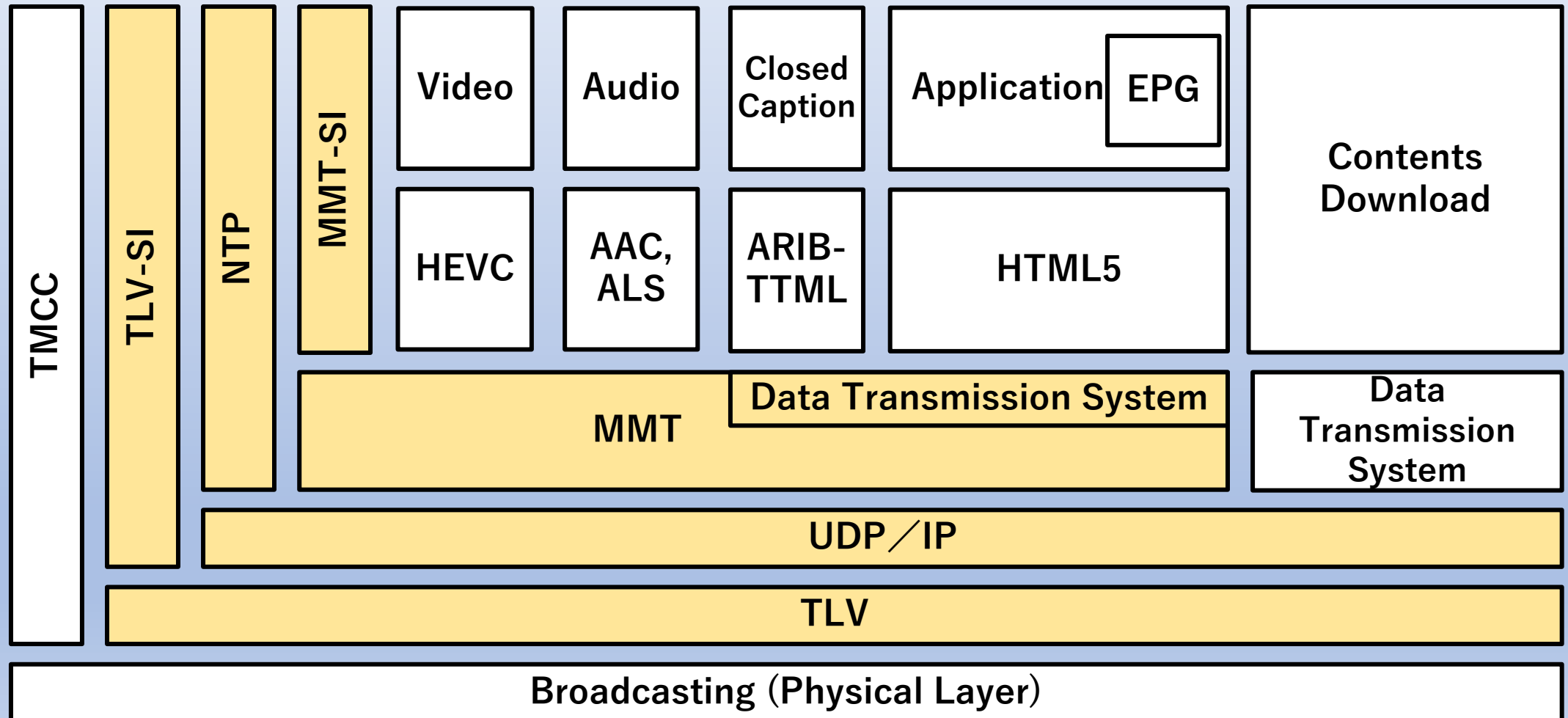
Major restrictions / extensions of ARIB STD-B60 from ISO/IEC standard

MMTP Payload

- Fragment types for metadata part of ISOBMFF are not used. (i.e. , only media sample data is carried by the payloads)

  ➢ To reduce the overhead of transmission as much as possible.

MMT Packet

- GFD mode is not used

  ➢ Since the needs of "carousel type transmission" adopted in ISDB-T or ISDB-S.

- HRBM is not used

  ➢ Since no requirement to control the buffer of receiver side from transmission side.

- Usage of extension header type is defined

  ➢ Since the needs for the description of "Data scrambling and downloading information"
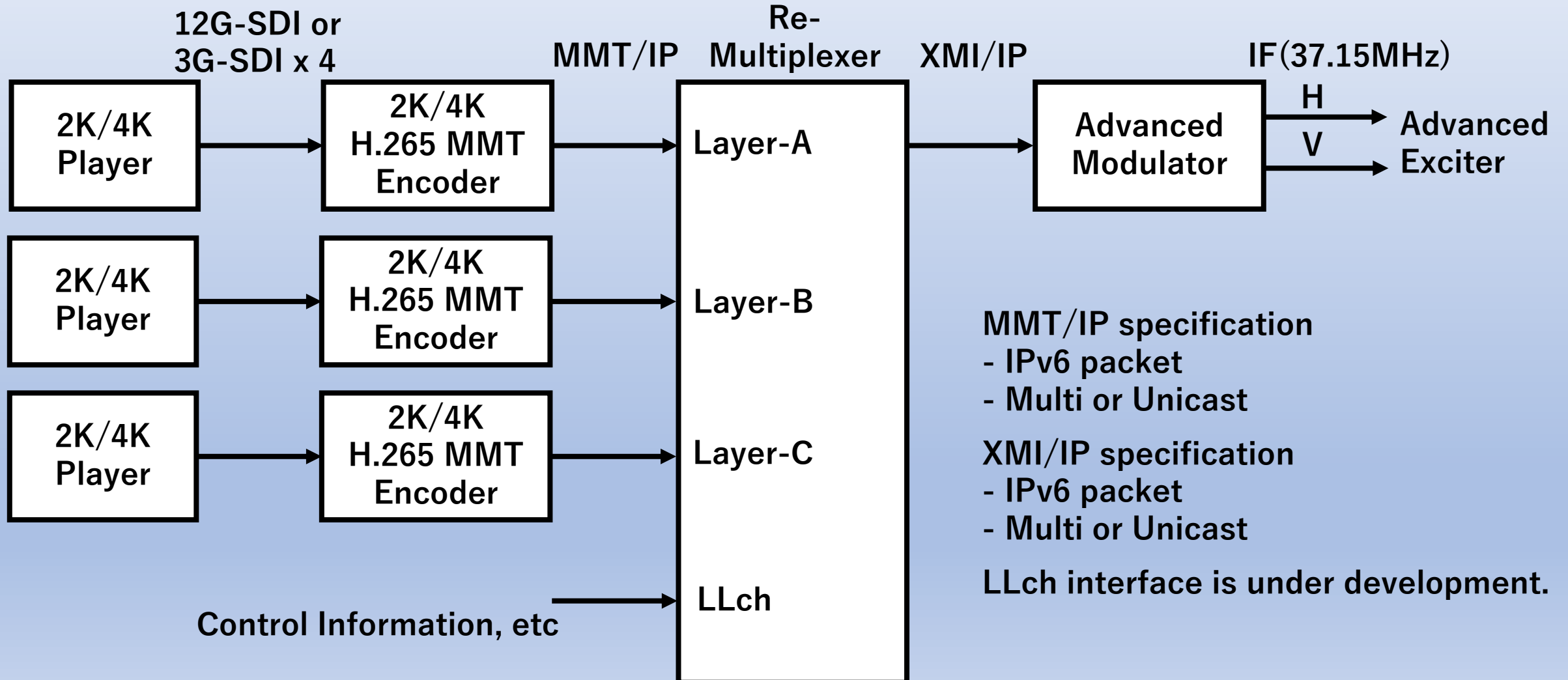
MMT Signaling

- Several messages and tables are not used

- Messages and tables for ARIB specific features e.g. CA, data delivery, lay out description and so on are added

  ➢ Since the requirements differ by the operation in each countries, control information is specified as necessary.

Related Section of ARIB STD-B60 for CfP major requirements

| TL1.1	single platform audio/video/data sync	frame-accurate	**2.2 Clock Synchronization in Broadcasting System** Description 4 An Example of Ralization for NTO Clock Synchronization and Presentation Synchronization Based on VCO
TL1.2	multi-platform audio/video/data sync	frame-accurate	**2.2 Clock Synchronization in Broadcasting System** Description 4 An Example of Ralization for NTO Clock Synchronization and Presentation Synchronization Based on VCO Description 1 Relationship between MMT Package and Service 2 Cross-Sectional Service of Broadcasting and Communication
TL2.1	IPv4-based transport		**2.1 Protocol Stack of Broadcasting System Using MMT** **7.3.3.1 MMT Package Table(MPT)**
TL2.2	IPv6-based transport		Table 7-9 Configuration of MMT_general_location_info (location information）
TL3.2	error detection		（Able to support by ISO/IEC 23008-10)
TL3.4	avoid unnecessary metadata duplication		**6.2 Summary of MFU/MPU**
TL4.1	encryption support		**7.3.3.4 Entitlement Control Message（ECM)** **7.3.3.5 Entitlement Management Message（EMM)** **7.3.3.8 CA Table（CAT)（MH)**
TL6.1	provide appropriate signaling of whether the channel transports emergency warnings (over-theair or by the Internet) or not		**7.4.3.10 Emergency Information Descriptor（MH)** **7.4.3.43 Emergency News Descriptor**
TL9.1	countrywide alert（with country identification）		**7.4.3.10 Emergency Information Descriptor（MH)** Area code
TL10.1	extensibility		**7.3.3.1 MMT Package Table(MPT)** Table 7-8 Asset type

Block Diagram of Advanced Headend Equipment

DiBEG
Digital Broadcasting Experts Group

Block Diagram of Headend system is mentioned as follows. MMT/IP is applied between Encoder and Re-Multiplexer

MMT/IP specification
- IPv6 packet
- Multi or Unicast

XMI/IP specification
- IPv6 packet
- Multi or Unicast

LLch interface is under development.

Block Diagram of Advanced Headend Equipment

Detailed Block Diagram of Encoder and Re-Multiplexer is mentioned as follows.
MMT/IP specification is applied to ARIB STD-B60 and ISO/IEC 23008-1.
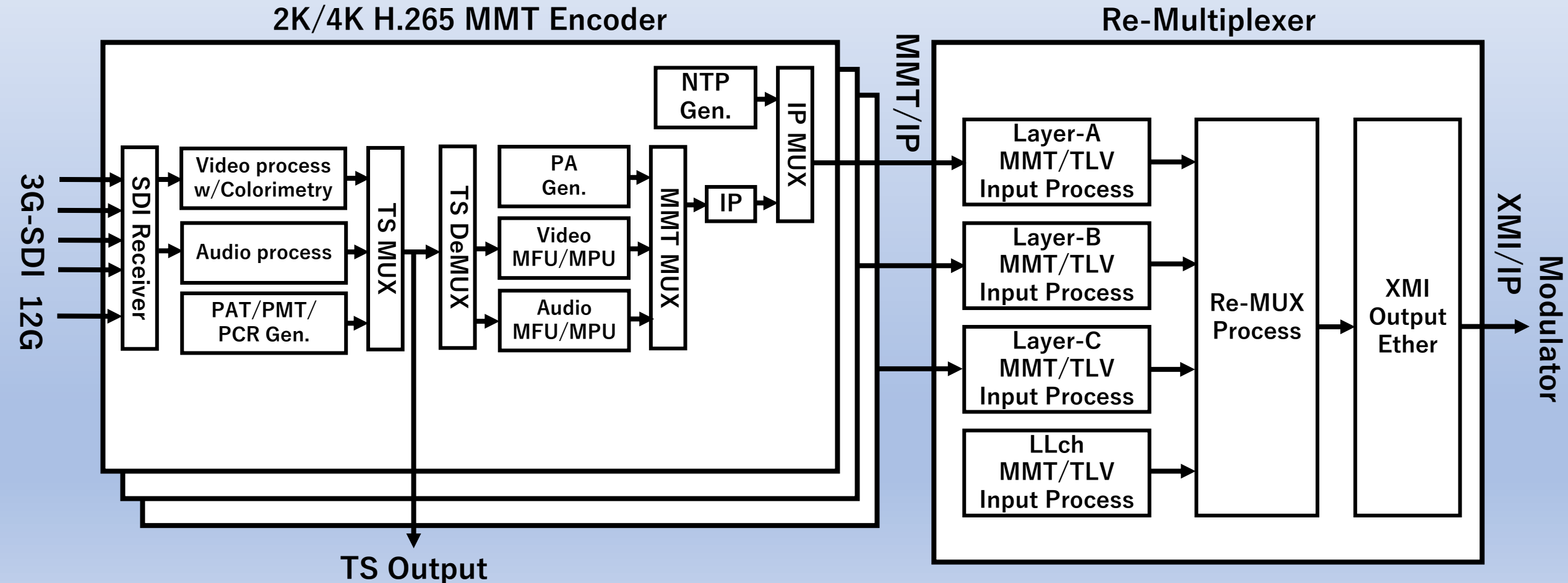
Test Block Diagram of IF Return for Transport Layer

Block Diagram of MIMO IF return is mentioned as follows. MMT/IP of Transport Layer is tested. C/N level, Constellation, MER and Video Quality were checked.
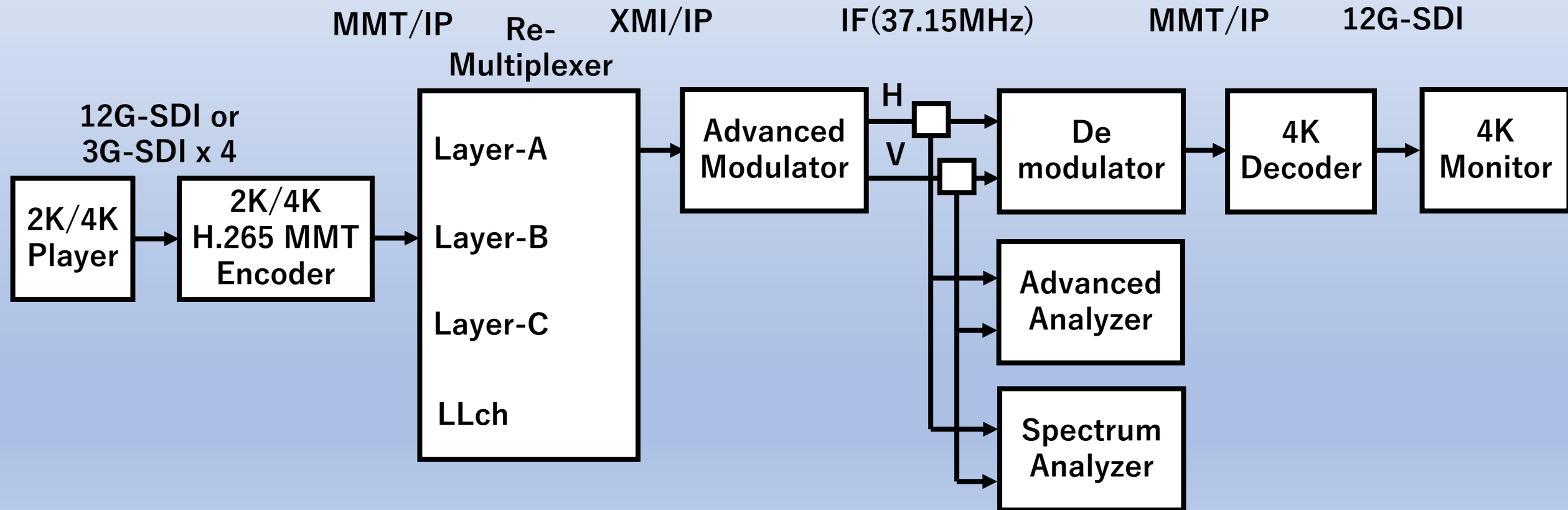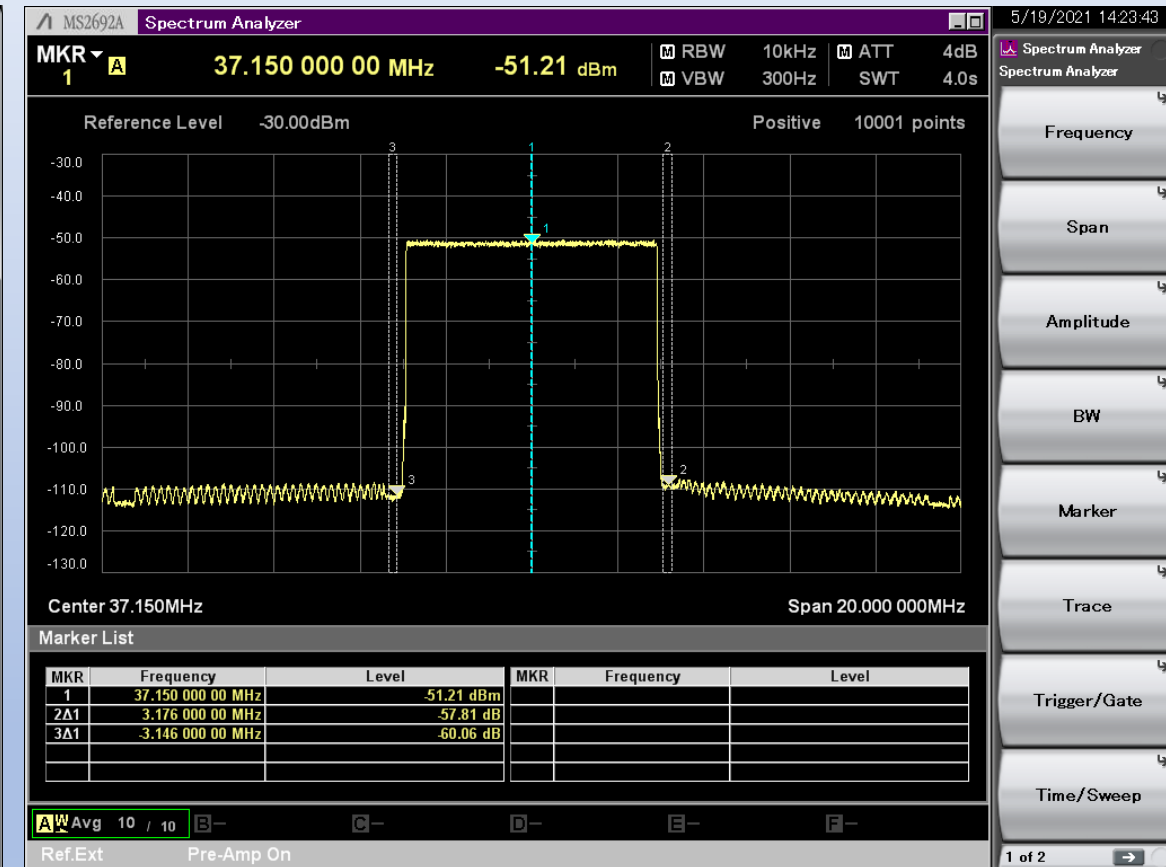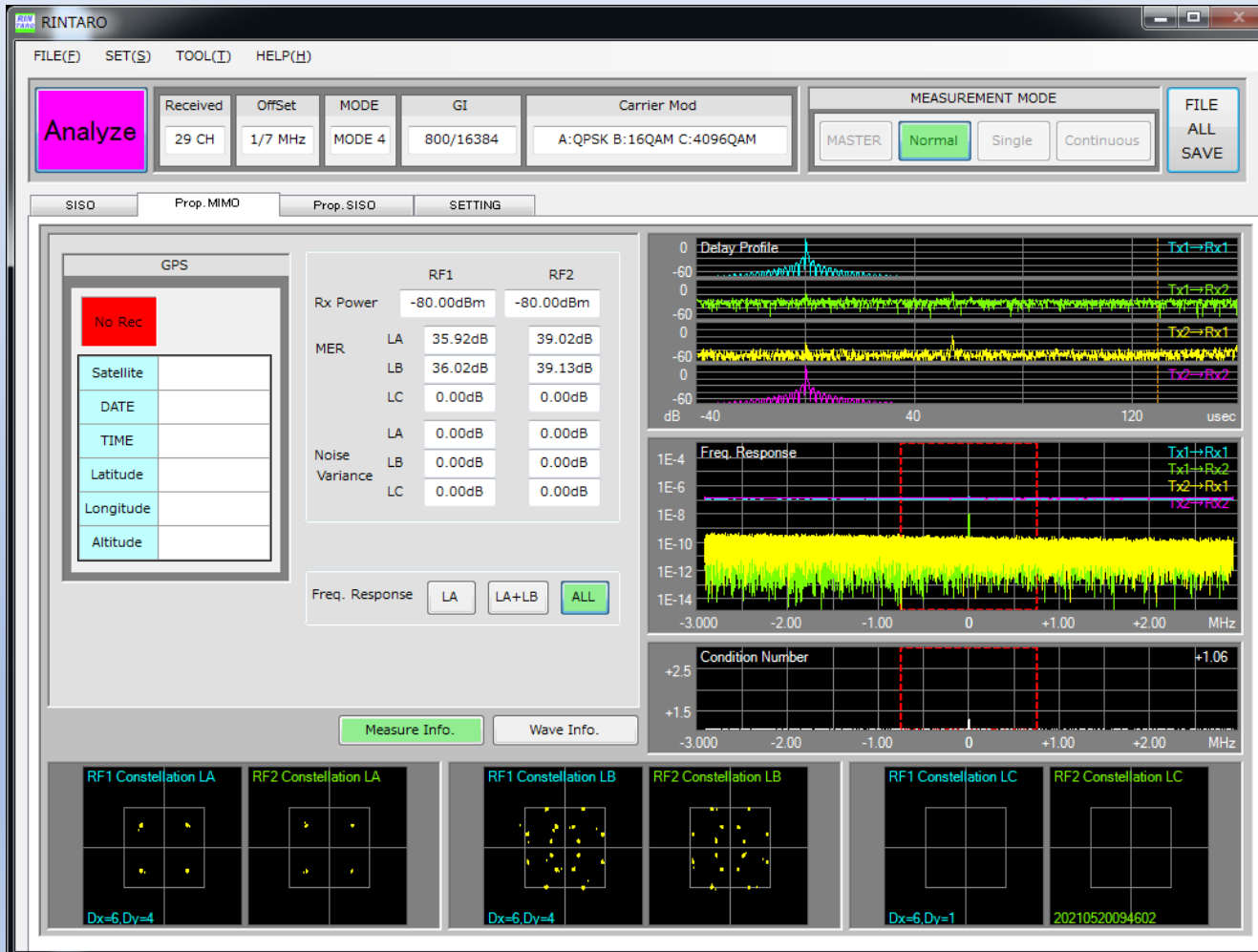
Test Results of IF Return for Transport Layer

Test result of MIMO IF return is mentioned as follows. MMT/IP of Transport Layer is tested. C/N level, Constellation, MER and Video Quality were checked.

No	MOD	C/N Level	MER	Constellation	Visual Check	Remarks
1	QPSK	N/A	N/A	N/A	N/A	
2	16QAM	57.8dB	36.0dB	Photo-1.1	OK	
3	64QAM	57.6dB	36.2dB	Photo-1.2	OK	
4	256QAM	57.3dB	35.2dB	Photo-1.3	OK	
5	1024QAM	57.4dB	36.7dB	Photo-1.4	OK	
6	4096QAM	56.5dB	40.2dB	Photo-1.5	OK	

Input level at Advanced Analyzer is -20dBm.

Test Result of IF Return for Transport Layer

Photo-1.1
Test result of MIMO IF return is mentioned as follows. Modulation is 16QAM.

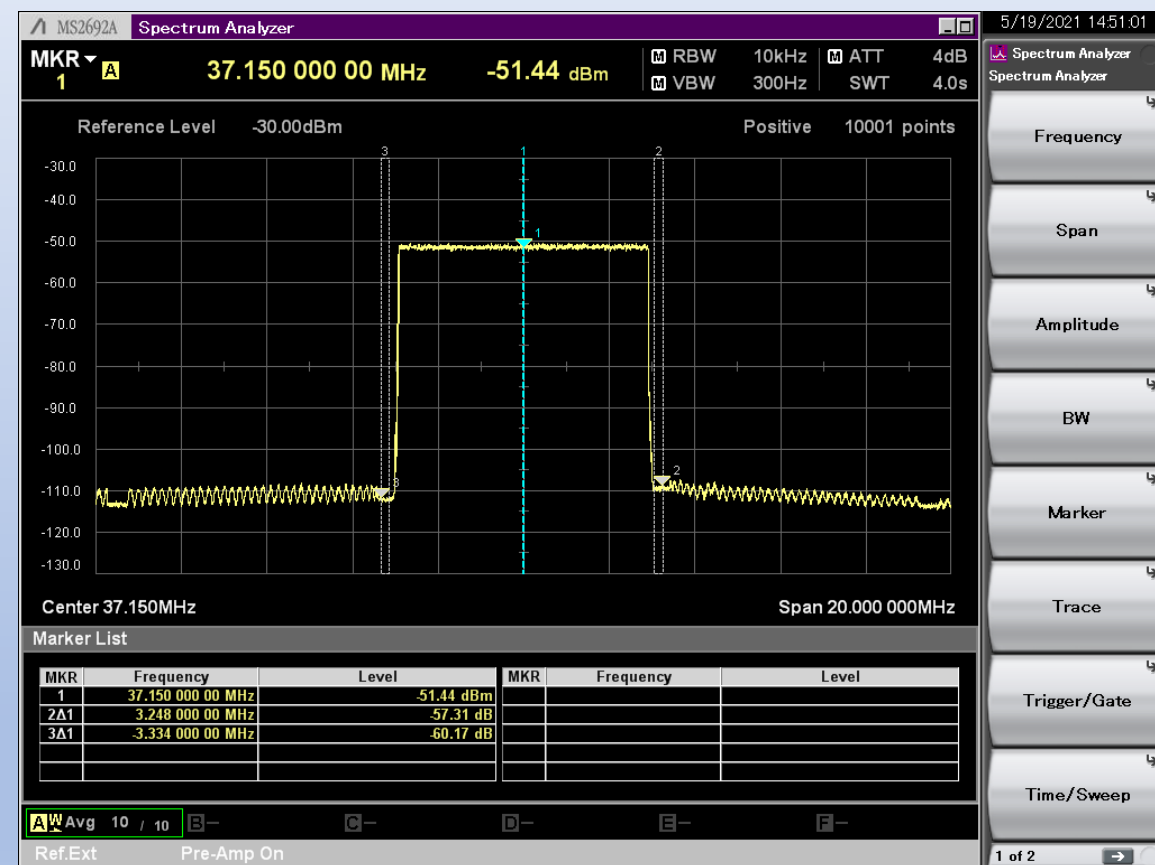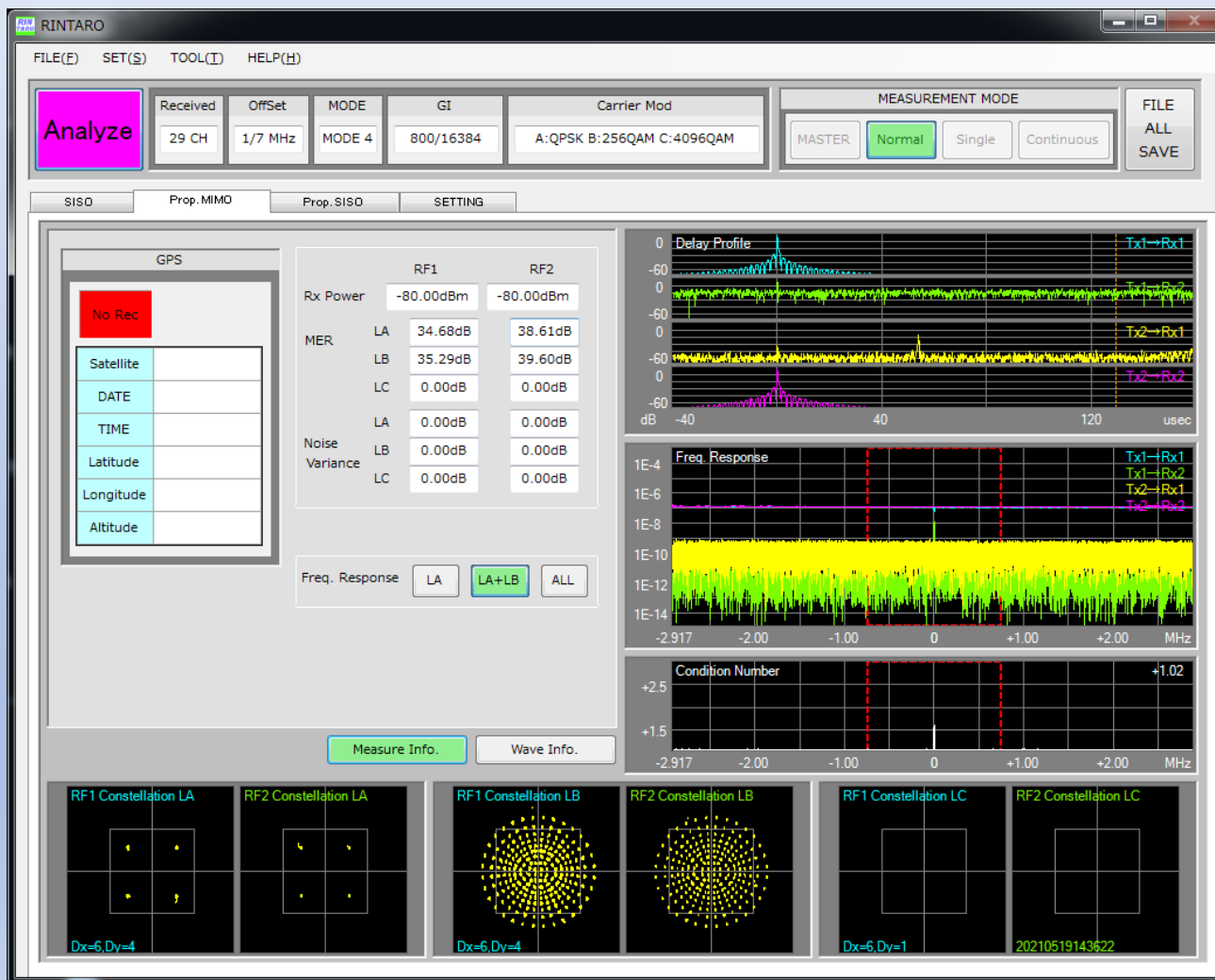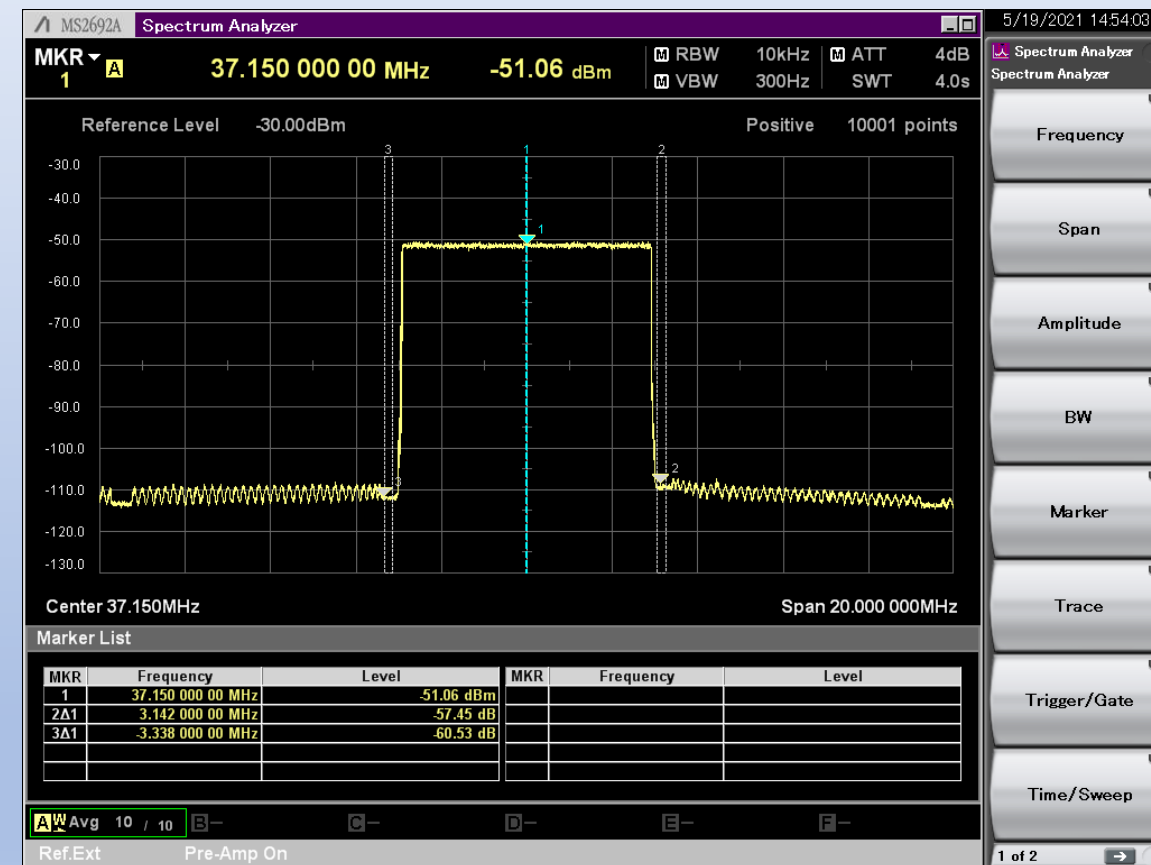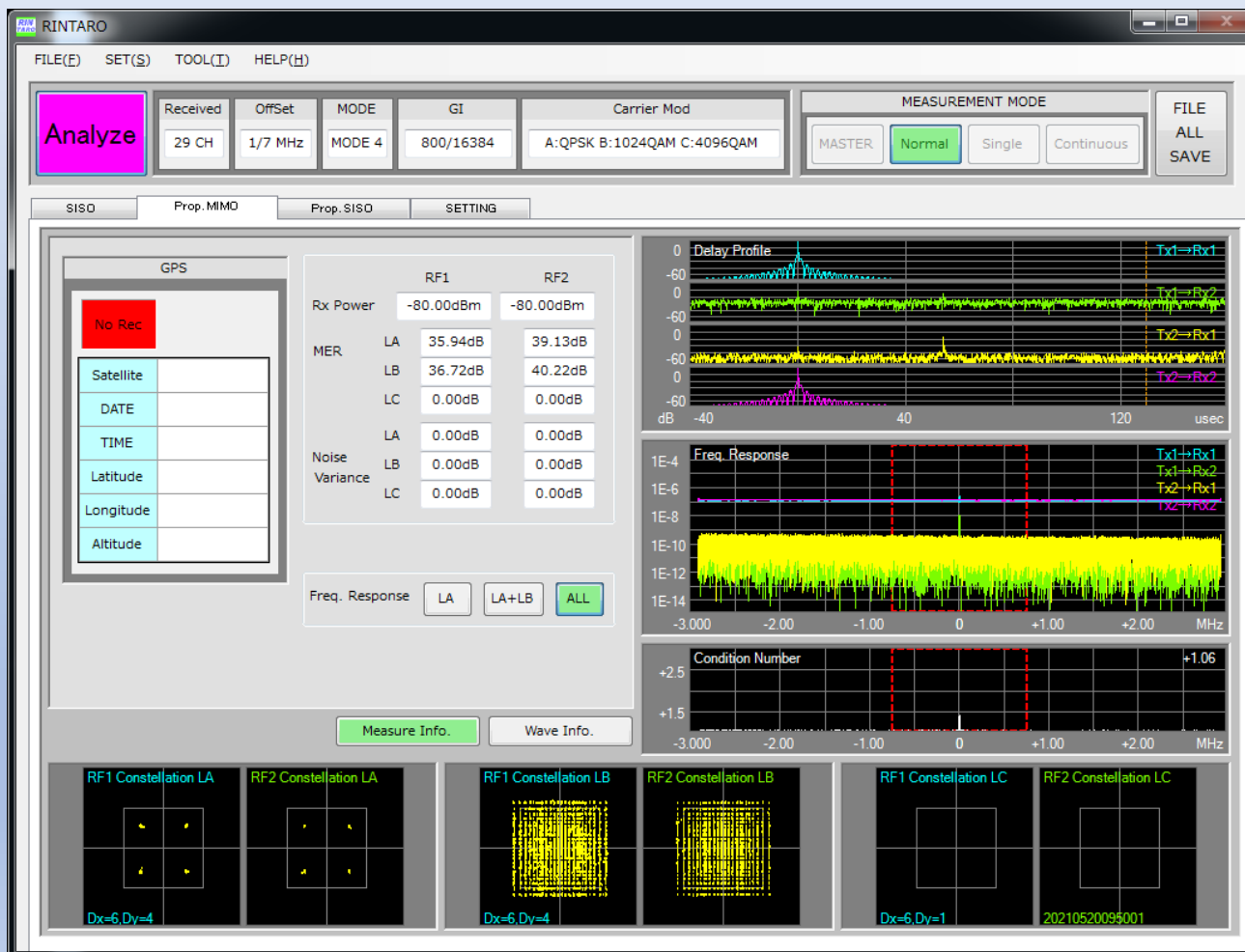# Test Result of IF Return for Transport Layer

Photo-1.2
Test result of MIMO IF return is mentioned as follows. Modulation is 64QAM.
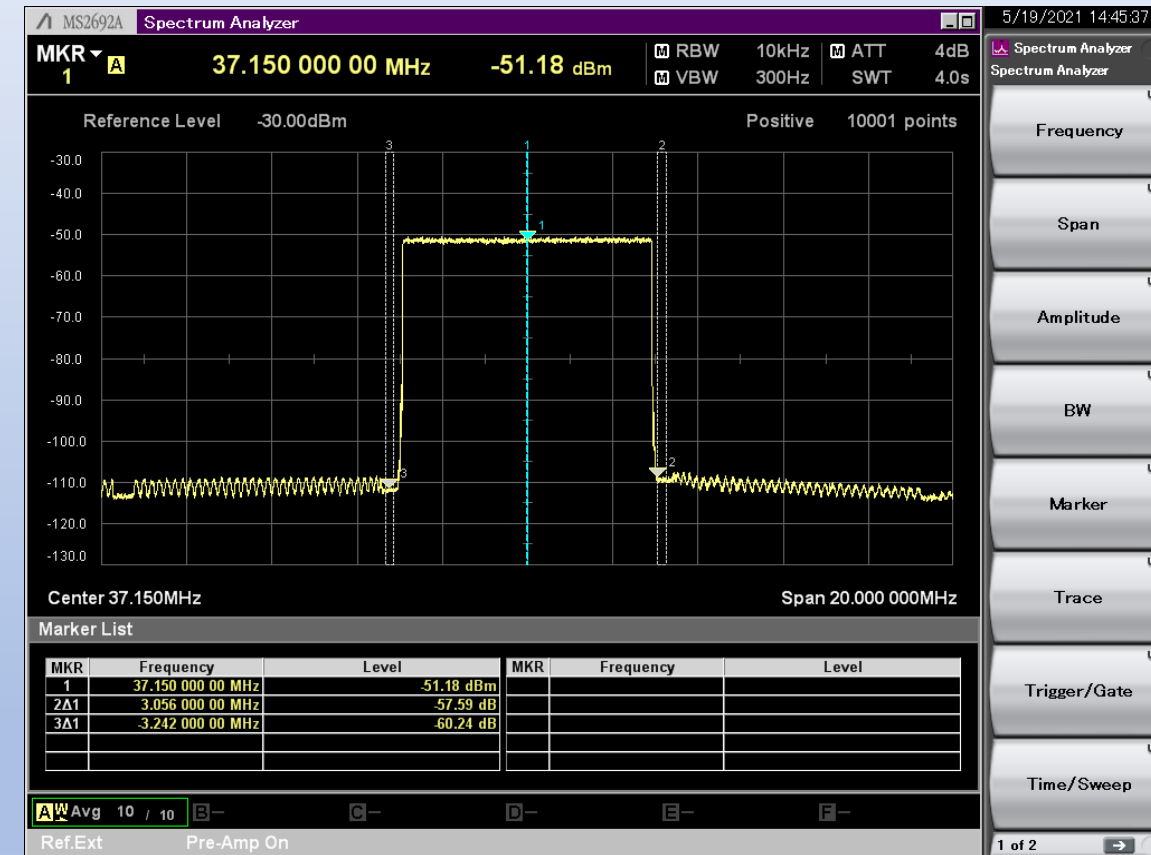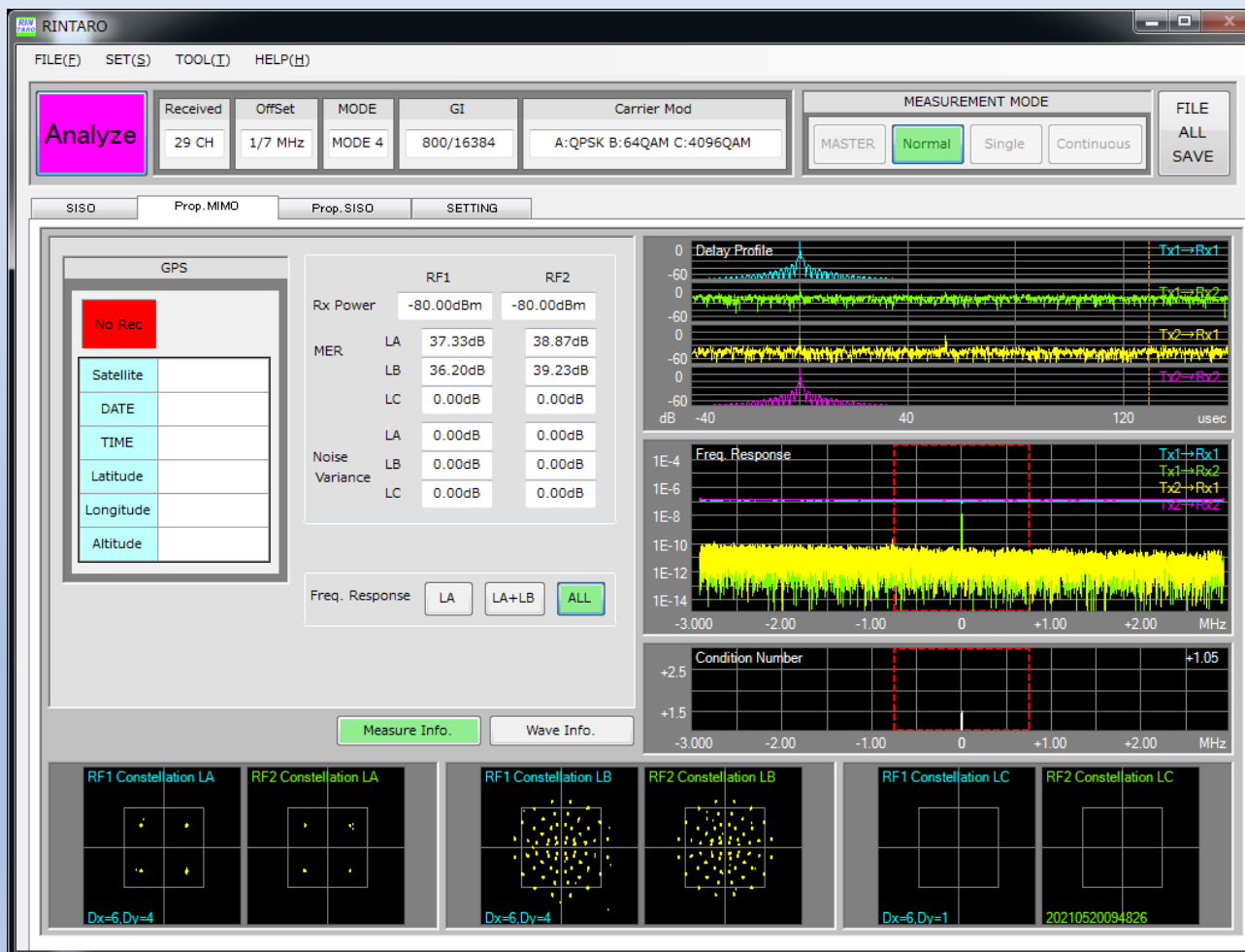
Test Result of IF Return for Transport Layer

Photo-1.3
Test result of MIMO IF return is mentioned as follows. Modulation is 256QAM.

Test Result of IF Return for Transport Layer
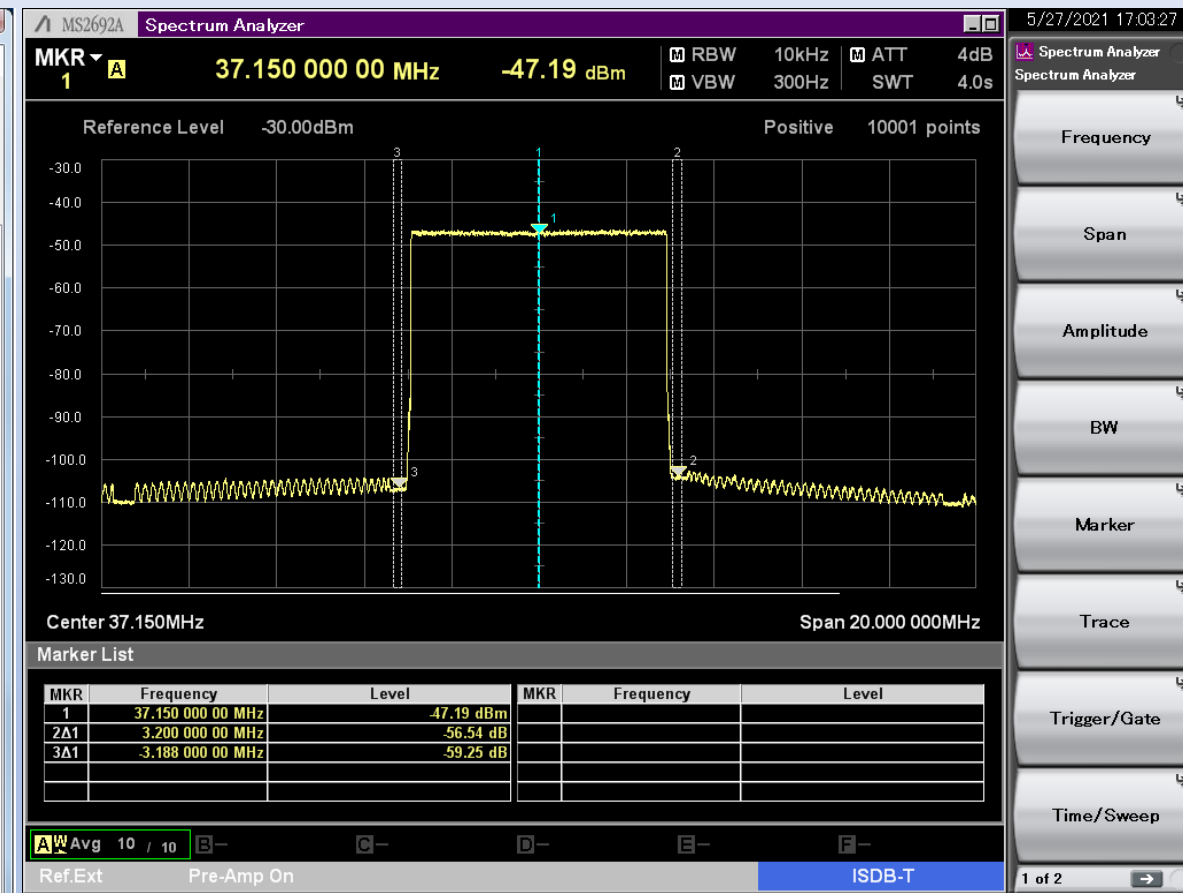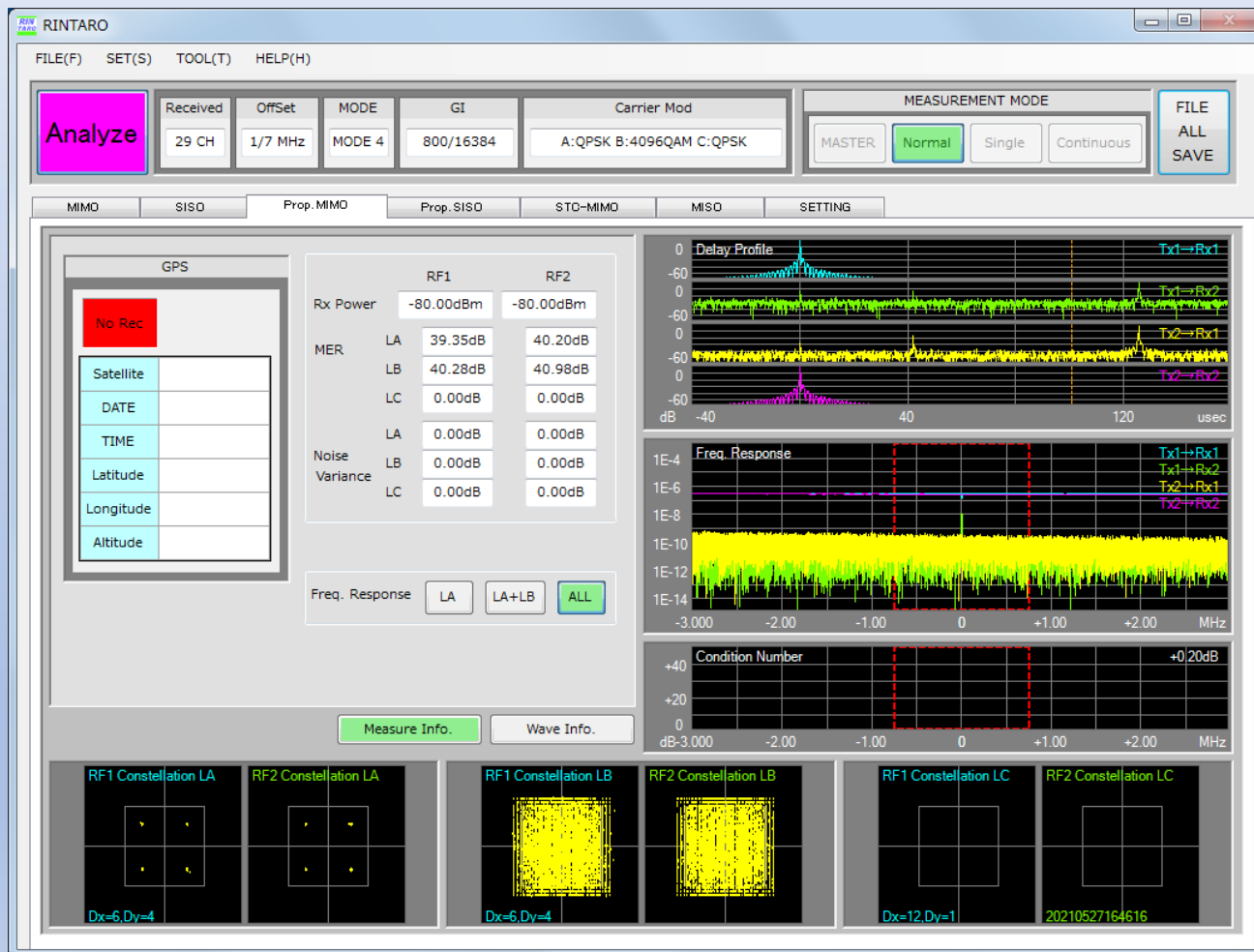
Photo-1.4
Test result of MIMO IF return is mentioned as follows. Modulation is 1,024QAM.

# Test Result of IF Return for Transport Layer

Photo-1.5
Test result of MIMO IF return is mentioned as follows. Modulation is 4,096QAM.

Test Results of IF Return for Transport Layer

Transmission parameters of MIMO IF return are mentioned as follows.

- Modulation 　　　: 16QAM, 64QAM, 256QAM, 1024QAM and 4096QAM
- Constellation 　　: Non-Uniform Constellation
- Error correction : LDPC (12/16) + BCH
- FFT 　　　　　　: 16k
- GI ratio 　　　　: 800/16384
- Pilot 　　　　　: Dx=6, Dy=4
- Time Interleave : I=2
- Layer 　　　　　: Layer-B, 32segments
- Program 　　　　: 4K (2160p), 25Mbps

Layer-B　　　Layer-A　　　Layer-B

5.83 MHz Bandwidth
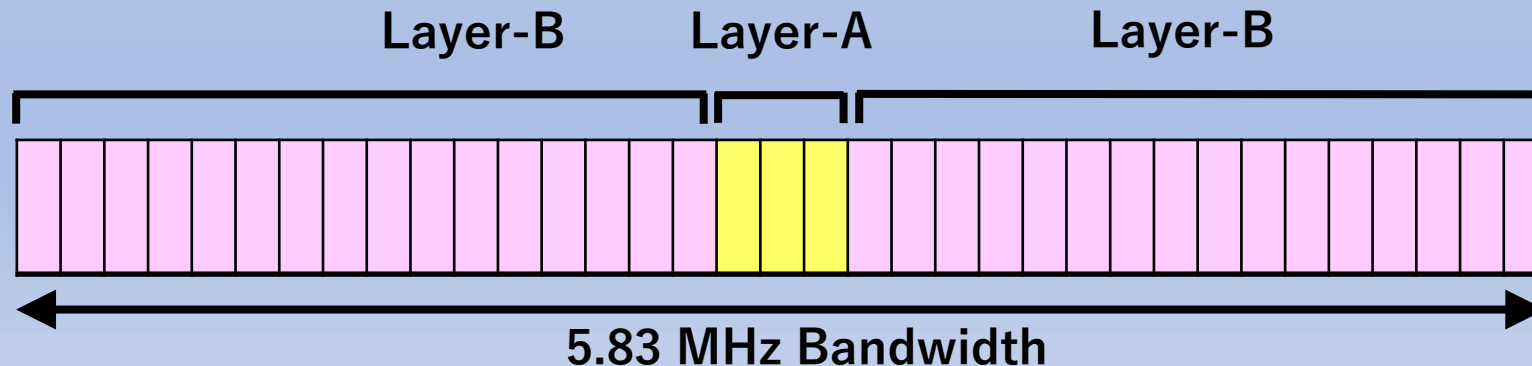
Muito obrigado!

ARIB／DiBEG extend technical cooperation to Brazil adopting Next Generation Broadcasting Standard!

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