

SET eXPerience 2021

Response to TV 3.0 project CfP Phase-1 and 2 Transport Layer

DiBEG/Japan

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)

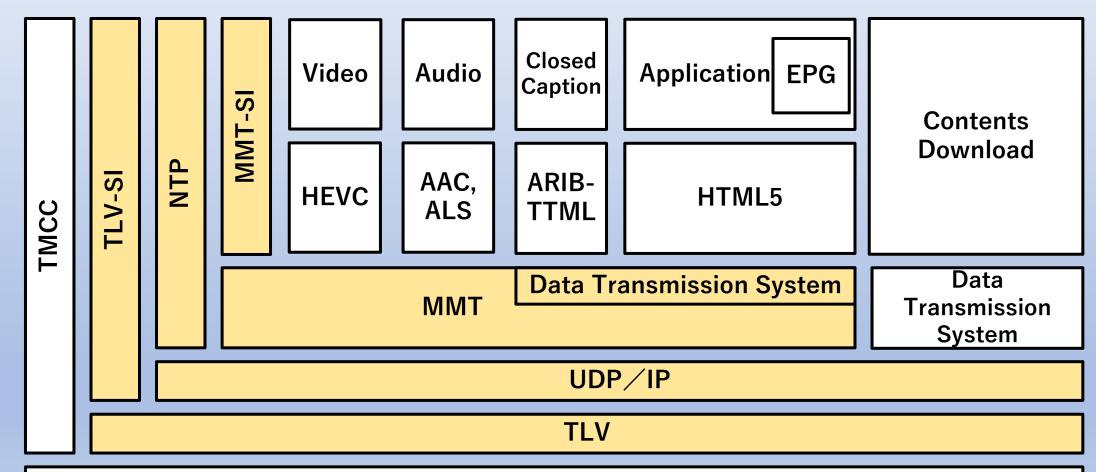
-ISO/IEC 23008-10:2015

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





ARIB STD-B60



Broadcasting (Physical Layer)

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.

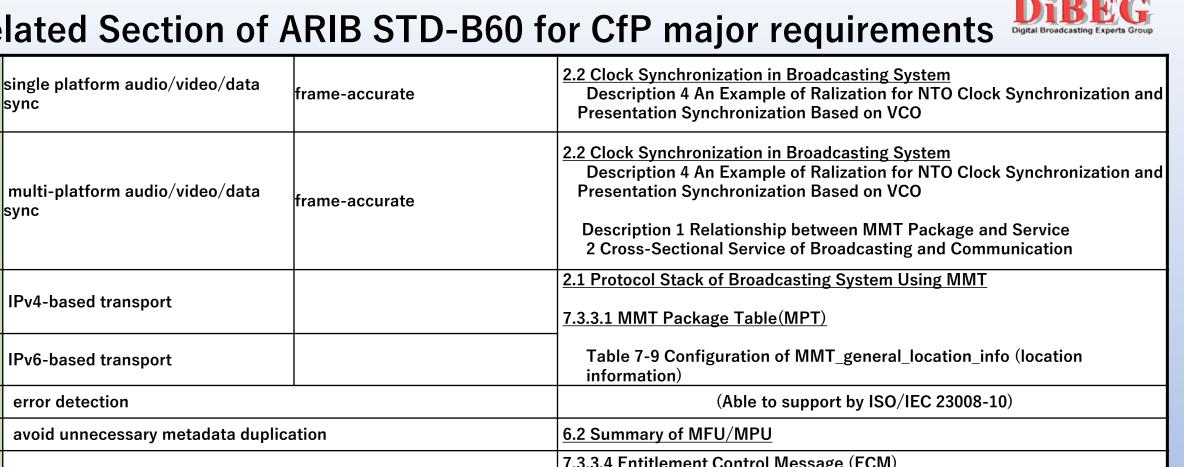
Related Section of ARIB STD-B60 for CfP major requirements

TL1.1

TL1.2

sync

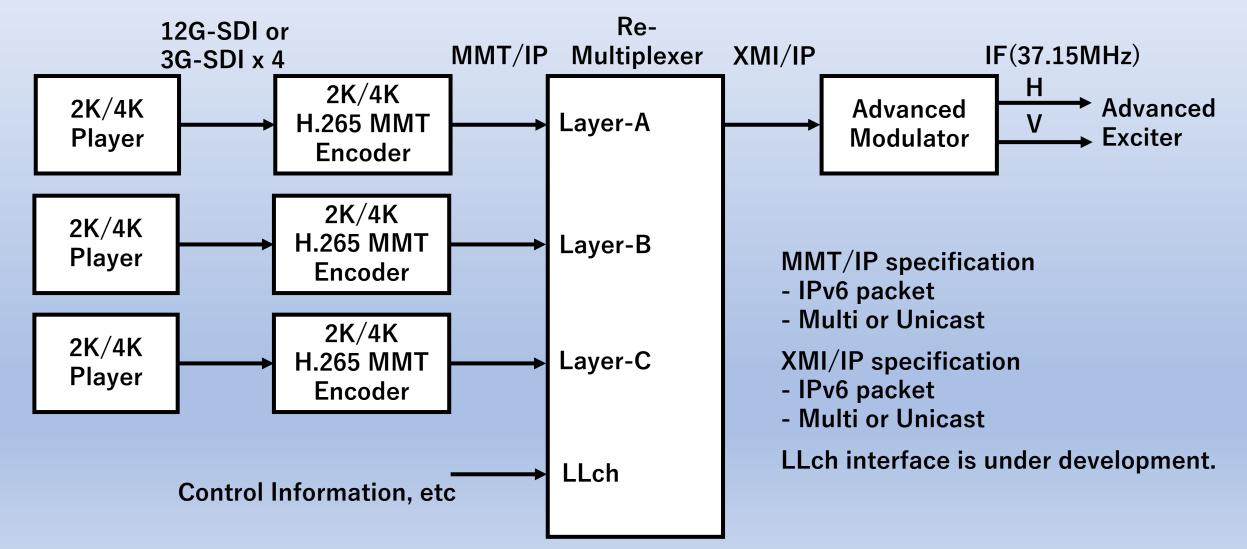
sync



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			

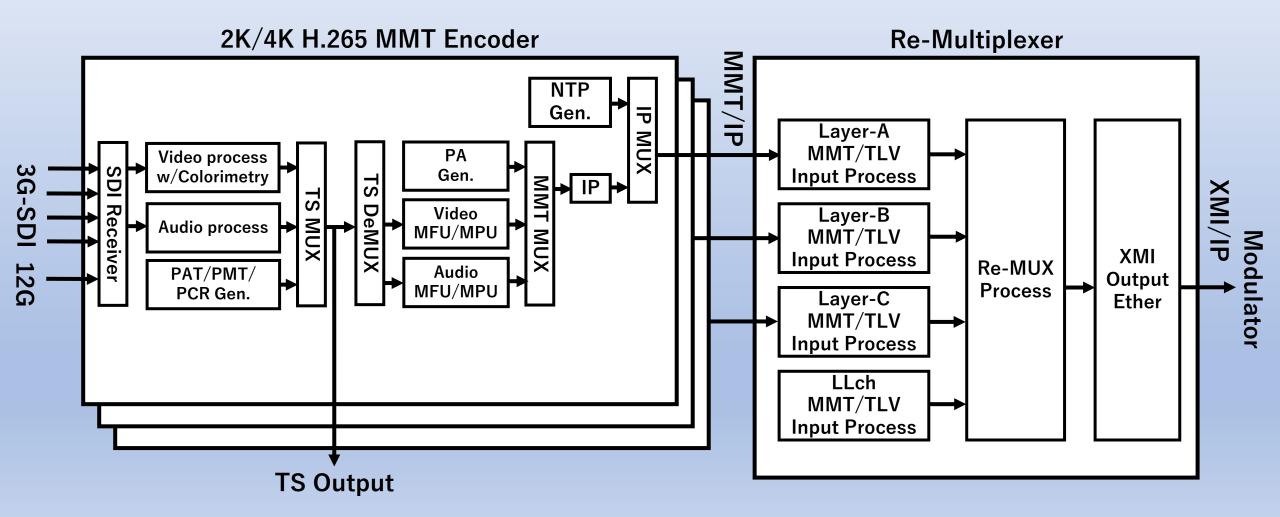
Block Diagram of Advanced Headend Equipment

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



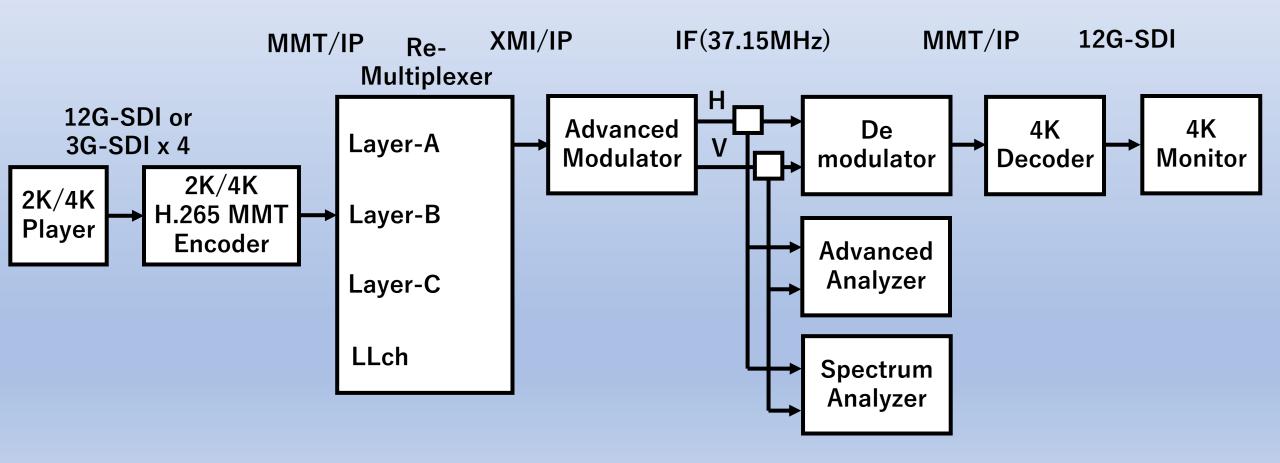
Block Diagram of Advanced Headend Equipment

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 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.



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

🗱 RINTARO		✓ MS2692A Spectrum Analyzer		5/19/2021 14:23:43
FILE(<u>F)</u> SET(<u>S</u>) TOOL(<u>I</u>) HELP(<u>H</u>)		MKR - A 37.150 000 00 MHz -51.21 dBm	BRBW 10kHz ATT 4dB	🛴 Spectrum Analyzer Spectrum Analyzer
Received OffSet MODE GI Carrier Mo 29 CH 1/7 MHz MODE 4 800/16384 A:QPSK B:16QAM C		-30.0 -30.00dBm	Image: WBW 300Hz SWT 4.0s 4.0s	⊌ Frequency
SISO Prop. MIMO Prop. SISO SETTING		-40.0 -50.0	~	يا Span
GPS RF1 RF2 -60 No Rec -80.00dBm -80.00dBm -60 LA 35.92dB 39.02dB 0	0 Delay Profile Tx1→Rx1 50 0 yapraty (my partial factor) (1 yapraty) (1 ya	-60.0		پ Amplitude
Satellite LB 36.02dB 39.13dB -60 DATE LC 0.00dB 0.00dB -60 THUS LA 0.00dB 0.00dB -60	60 Transformed and the data state of the st	-80.0 + + + + + + + + + + + + + + + + + +		BW P
Latitude Noise LB 0.00dB 0.00dB 1E-4 Longitude LC 0.00dB 0.00dB 1E-4 1E-6 Altitude 1E-4 1E-6 1E-8 1E-8 1E-1		-110.0 M		Marker
Freq. Response LA LA+LB ALL 1E-12	the table is a strategic state of the strategic s	Center 37.150MHz Marker List	Span 20.000 000MHz	Trace
+2.5 Measure Info. Wave Info.		MKR Frequency Level MKR Freq 1 37.150 000 000 MHz -51.21 dBm -51.21 dBm - 2Δ1 3.176 000 00 MHz 57.81 dB - - 3Δ1 -3.146 000 00 MHz -50.06 dB - -	uency Level	Trigger/Gate
	-3.000 -2.00 -1.00 0 +1.00 +2.00 MHz Constellation LB RF1 Constellation LC RF2 Constellation LC	AWAvg 10 / 10 B- D- Ref.Ext Pre-Amp On		Time/Sweep 1 of 2 _●
Dx=6,Dy=4	Dx=6,Dy=1 20210520094602			



Photo-1.2 Test result of MIMO IF return is mentioned as follows. Modulation is 64QAM.

		:021 14:45:37
FILE(E) SET(S) TOOL(I) HELP(H)	MKR ▼ A 37.150 000 00 MHz -51.18 dBm I RBW 10kHz I ATT 4dB I Spectrum A 1 300 Hz -51.18 dBm III VBW 300 Hz SWT 4.0s Spectrum A	rum Analyzer Analyzer
Analyze Received OffSet MODE GI Carrier Mod 29 CH 1/7 MHz MODE 4 800/16384 A:QPSK B:64QAM C:4096QAM MASTER MEASUREMENT MODE FILE Analyze 1/7 MHz MODE 4 800/16384 A:QPSK B:64QAM C:4096QAM MASTER Continuous FILE	Reference Level -30.00dBm Positive 10001 points	equency
SISO Prop. MIMO Prop. SISO SETTING 0 Delay Profile	-40.0 -50.0	Span
GPS RF1 RF2 -60 <td>-60.0 -70.0 -80.0</td> <td>ې nplitude</td>	-60.0 -70.0 -80.0	ې nplitude
Satellite LB 36.20dB 39.23dB -60 DATE LA 0.00dB 0.00dB 0.00dB TIME LA 0.00dB 0.00dB -40 120 usec		B₩
Latitude Noise LB 0.00dB 0.00dB 1E-4 Freq. Response Tx1+Rx1 Longitude LC 0.00dB 0.00dB 1E-6 12-7 Rx1		vlarker
Attitude 1E-10 Of the Second state of the Second		Trace
+2.5 Condition Number +1.05	MKR Frequency Level MKR Frequency Level 1 37.150 000 00 MHz 51.18 dBm	ger/Gate
Measure Info. Wave Info. -3.000 -2.00 -1.00 +1.00 +2.00 MHz RF1 Constellation LA RF1 Constellation LB RF2 Constellation LB RF1 Constellation LC RF2 Constellation LC RF2 Constellation LC	A@Avg 10 / 10 B - O - D - E - Image: Constraint of the second sec	e/Sweep →
Dx=6,Dy=4 Dx=6,Dy=4 Dx=6,Dy=4 Dx=6,Dy=1 20210520094826		



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

		5/19/2021 14:51:01
FILE(E) SET(S) TOOL(I) HELP(H)		🟃 Spectrum Analyzer 🤇 Spectrum Analyzer
Analyze Received OffSet MODE GI Carrier Mod Measurement Mode FILE All All Single Continuous FILE All SAVE	Reference Level -30.00dBm Positive 10001 points -30.0 3 2 1 2	Frequency
SISO Prop. MIMO Prop. SISO SETTING 0 Delay Profile Tx1-Rx1	-40.0 -50.0	ч Span
GPS RF1 RF2 -60 <td>-60.0</td> <td>ېا Amplitude</td>	-60.0	ېا Amplitude
Satellite LB 35.29dB 39.60dB -60	-90.0	با BW
Latitude Noise LB 0.00dB 0.00dB 1E-4 Freq. Response Tx1-Rx1 Longitude LC 0.00dB 0.00dB 0.00dB 1E-6 12-7 12-7 Altitude 1E-8 1E-8 1E-8 12-7 12-7 Re2	-110.0 M	ہا Marker
Freq. Response LA LA+LB ALL 1E-12 All	Center 37.150MHz Span 20.000 000MHz Marker List	ч Trace
-2.917 -2.00 -1.00 0 +1.00 +2.00 MHz +2.5 Condition Number +1.02	MKR Frequency Level MKR Frequency Level 1 37.150 000 00 MHz .51.44 dBm	4 Trigger/Gate
Measure Info. Wave Info. *1.5 -2.917 -2.917 -2.00 -2.917 -2.00 RF1 Constellation LA RF1 Constellation LB RF2 Constellation LC RF2 Constellation LC	AWAvg 10 / 10 B- D- E- I-	ч Time/Sweep
RF1 Constellation LA RF2 Constellation LA RF1 Constellation LB RF2 Constellation LB RF2 Constellation LC • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • •	Ref.Ext Pre-Amp On	1 of 2 💽



Photo-1.4 Test result of MIMO IF return is mentioned as follows. Modulation is 1,024QAM.

RINTARO FILE(E) SET(S) TOOL(I)		MS2692A Spectrum Analyzer MKR ▼ A 37.150 000 00 MHz -51.06 dBm	Image: Symplectic sympl
	arrier Mod D24QAM C:4096QAM MASTER Normal Single Continuous AVE	-30.0 -30.00dBm	Image: Weight of the sector
SISO Prop.MIMO Prop.SISO SETTING	0 Delay Profile	-40.0 -50.0	Span
GPS RF1 RF2 No Rec -80.00dBm -80.00dBm MER LA 35.94dB 39.13dB	-60 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	-60.0	Amplitude
Satellite LB 36.72dB 40.22dB DATE LC 0.00dB 0.00dB TIME LA 0.00dB 0.00dB	-60 -40 40 120 usec	-90.0	BW
Latitude Variance LB 0.00dB 0.00dB Longitude	IE-4 Trat→5k1 1E-6 Tx1→5k1 1E-8 Tx2→7k2 1E-8 Tx2→7k2	-110.0 M., MWWWWWWWWWWWWWWW	Marker
Freq. Response LA LA+LB ALL	1E-10 1E-12	-130.0 Einstein Center 37.150MHz Marker List	Span 20.000 000MHz Trace
Measure Info.	+2.5 Condition Number +1.06	MKR Frequency Level MKR Fre 1 37.150 000 00 MHz .51.06 dBm .51.06 dBm .51.06 dBm 2Δ1 3.142 000 00 MHz .57.45 dB .57.45 dB .53.038 000 00 MHz .60.53 dB .50.53 dB	equency Level Trigger/Gat
RF1 Constellation LA RF2 Constellation LA RF1 Constellation LB	-3.000 -2.00 -1.00 0 +1.00 +2.00 MHz RF2 Constel ation LB RF1 Constel ation LC RF2 Constel ation LC	AWAvg 10 / 10 B- D- Ref.Ext Pre-Amp On	Time/Swee
Dx=6.Dv=4	Dx=6,Dy=1 20210520095001		



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

RINTARO					5/27/2021 17:03:27
FILE(F) SET(S) TOOL(T) HELP(H)	MKR 1	З7.150 000 00 мнz	-47.19 dBm	10kHz M ATT 4dB 300Hz SWT 4.0s	🐱 Spectrum Analyzer Spectrum Analyzer
Analyze Received OffSet MODE GI Carrier Mod MEASUREMENT 29 CH 1/7 MHz MODE 4 800/16384 A:QPSK B:4096QAM C:QPSK MASTER MASTER Normal Site	FILE	Reference Level -30.00dBm		Positive 10001 points	پ Frequency
MIMO SISO Prop.MIMO Prop.SISO STC-MIMO MISO SETTING	-40.0 -50.0				وا Span
GP3 RF1 RF2 -60 <td>-70.0</td> <td></td> <td></td> <td>, , , ,</td> <td>يا Amplitude</td>	-70.0			, , , ,	يا Amplitude
Satellite LB 40.28dB 40.98dB 0 DATE LC 0.00dB 0.00dB 0.00dB TIME LA 0.00dB 0.00dB 0.00dB Noise LB 0.00dB 0.00dB 1E-4 Freq. Response	-90.0 120 usec -90.0 -90.0 -90.0 -90.0 -90.0	0			BW
Longitude Variance LC 0.00dB 0.00dB 1E-6	1x) +162 Tx2 +162 Tx2 +162 120.0	0			Marker
Freq. Response LA LA+LB ALL -3.000 -2.00 -1.00 0	+1.00 +2.00 MHz Mark	nter 37.150MHz ser List		Span 20.000 000MHz	Trace
Heasure Info. Wave Info. O Image: Condition Number Image: Condition N	+0.20dB MKR 1 2A1 3A1 +1.00 +2.00 MHz	37.150 000 00 MHz 47. 3.200 000 00 MHz -5	MKR Frequency 19 dBm	Level	ہ Trigger/Gate
RF1 Constellation LA RF2 Constellation LA RF1 Constellation LB RF2 Constellation LB RF1 Constellation LB	LC RF2 Constellation LC	wg 10 / 10 ⋿- -	D- 3-	-	په Time/Sweep
<td>20210527164616</td> <td>Ext Pre-Amp On</td> <td></td> <td>ISDB-T</td> <td>1 of 2 →</td>	20210527164616	Ext Pre-Amp On		ISDB-T	1 of 2 →



Transmission parameters of MIMO IF return are mentioned as follows.

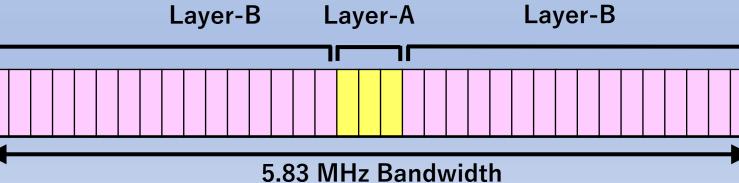
- Modulation : 16QAM, 64QAM, 256QAM, 1024QAM and 4096QAM
- Constellation : Non-Uniform Constellation
- Error correction : LDPC (12/16) + BCH
- FFT

:16k

- GI ratio : 800/16384
- Pilot

- : Dx=6, Dy=4
- Time Interleave : I=2
- Layer
- Program

- : Layer-B, 32segments
- :4K (2160p), 25Mbps





Muito obrigado!

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

di-jim3 @ arib.or.jp

