NRK Device ST 2110, ST 2059 and NMOS Conformance

[20xx-20xx]

601 Platform Standards

1. Contents

2. Version Control

Rev.	Date	Detail	Author(s)
3.0	17/06/22	First draft release of document for review Alignment with architectural model and AVoIP live media production formats.	GH
3.1	27/06/22	Updates from NRK review: Stig Krokstad, Henning Bernsten, Thomas Berglund, Odd Erling Høgberg, Erik Vold, Dag Gulbrandsen. 1. Added NMOS IS-07 and 09 to optional standards support table. 2. Added mandatory RTP Offset = 0 parameter to ensure AES67 / ST 2110 compatibity. 3. Added requirement for 64 channel flow for certain categories of audio devices.	GH
3.2	17/08/2022	NMOS IS-07, 08 and 10 made mandatory in Section 5 standards tables. Updated link to TR-1001-1. Section 7. Update to IS-04 heartbeat support parameter support. Added section 11. Security, requiring demonstration of robust cyber security practices per EBU r143. Updated diagram in Section 4.	GH
3.3	02/09/2022	Section 9. Point 13 - Added requirement. «It must be possible for a Receiver to subscribe to a multicast group that originates on the same interface (i.e. loopback).» Section 9. Point 8 – Minor adjustment to expected device behaviour.	GH

3. Introduction

To support the transition to AVoIP production, our industry has created many new standards and built on many existing ones.

To build supportable, interoperable IP production platforms, it is critical that vendors implement these standards in a consistent way. Furthermore, it is necessary that vendors support the specific configuration options within those standards necessary for successful deployment within NRK's AVoIP infrastructure.

This document details the NRK's conformance requirements for AVoIP devices supporting ST 2110, ST 2059 and AMWA NMOS standards.

Broadly speaking, endpoints must adhere to the requirements detailed in EBU Tech 3371 (https://tech.ebu.ch/docs/tech/tech3371.pdf), AMWA NMOS JT-NM_TR-1001 (https://www.jt-nm.org/tr-1001-1) and AMWA NMOS BCP-003 (https://amwa-tv.github.io/nmos/). Additionally, endpoints must adhere to the requirements detailed in this document.

When reviewing the documentation, vendors are requested to state their product compliance by marking the feature "comply" and where more detail is required, describe the current product capability. Where a feature is not currently available within a product, vendors must state their current capability and when the required feature will become available. Where a feature is not relevant to a product, vendors should simply mark it "not applicable". Where a feature will be implemented vendors should mark it "roadmap [delivery date]". Where a vendor has no plans to implement a requested feature, it should be marked "does not comply".

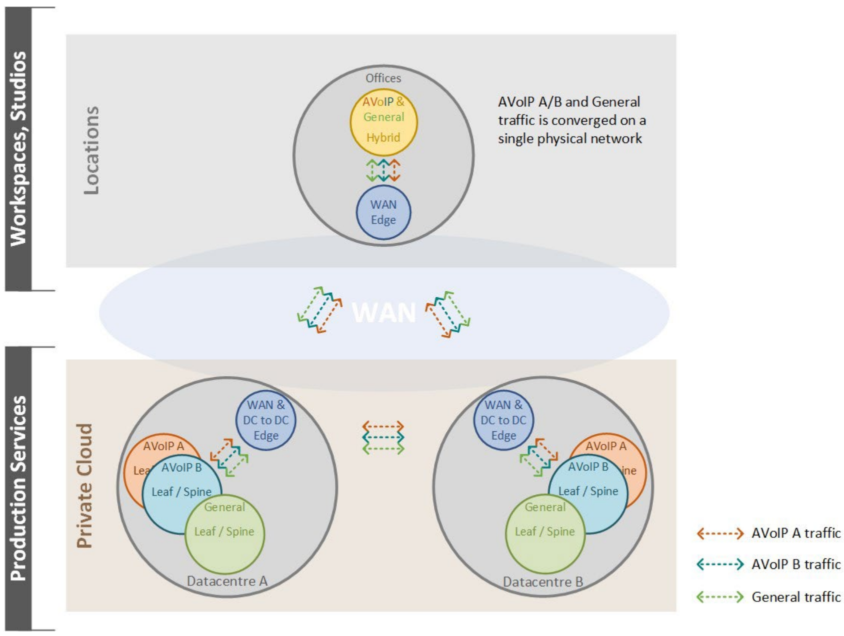
4. Platform Configuration Overview

NRK's production platform shall be built around two datacentres.

Within each datacentre is all the backend processing equipment required to support operational workspaces (e.g. edit suites, PCRs, MCRs, Tx suites etc) located in different regional offices in Norway.

Regions and datacentres are all connected via a nationwide, high-bandwidth WAN. Additionally, datacentres are directly connected via resilient and diverse high-bandwidth network connections.

Within a datacentre, two independent leaf/spine networks (Fabric A and Fabric B) provide the audio/video switching fabric. A third leaf/spine network provides control and monitoring connectivity. Devices supporting ST 2110 are connected to both A and B networks. Resilient, GPS locked PTP GMs provide ST 2059 profile PTP to network fabrics. Each leaf will be configured as a Boundary Clock (BC). BC's shall select the best clock to lock to. Endpoints shall lock to the local BC.



Within a region, control and AVoIP traffic is converged on a single network. The network is virtualised and dedicated AVoIP uplinks between switches create A and B networks and carry ST 2110 traffic. Resilient, GPS locked PTP GMs provide ST 2059 profile PTP to network fabrics. Each leaf will be configured as a Boundary Clock (BC). BC's shall select the best clock to lock to. Endpoints shall lock to the local BC.

Devices deployed across the platform are required to be interoperable across the WAN and between datacentres. The instantaneous path differential (PD) timing for resilient ST 2022-7 flows between the datacentres shall be less than 10ms. Between a datacentre and region, instantaneous path differential timing for resilient ST 2022-7 flows shall be less than 50ms. Receivers must be 2022-7 Class B compliant and be able to tolerate an instantaneous PD of up to 50ms.

Network flows within the DCs and Offices are orchestrated by SDN controllers. No other SDN controllers are permitted within the platform.

All endpoints must support IS-04 for registration/discovery and IS-05 for direct device control. Each datacentre and office shall have a separate IS-04 registry.

5. Standards

Devices must support the following standards, where applicable:

#	Standard	Title
1	SMPTE ST 2059	SMPTE Profile IEEE-1588 PTP
2	SMPTE ST 2110-10	System Timing and Definitions
3	SMPTE ST 2110-20	Uncompressed Active Video
4	SMPTE ST 2110-21	Traffic Shaping Uncompressed Video
5	SMPTE ST 2110-22	Constant Bit-Rate Compressed Video
6	SMPTE ST 2110-30	PCM Digital Audio
7	SMPTE ST 2110-31	AES3 Transparent Transport
8	SMPTE ST 2110-40	SMPTE ST 291-1 Ancillary Data
9	SMPTE ST 2022-7	Seamless Protection Switching
10	AMWA NMOS IS-04 v1.3.x	Discovery and Registration
11	AMWA NMOS IS-05 v1.1.x	Device Connection Management
12	AMWA NMOS IS-07 v1.0.x	Event & Tally
13	AMWA NMOS IS-08 v1.0.x	Audio Channel Mapping
14	AMWA NMOS IS-10 v1.0.x	Authorization
15	AMWA NMOS BCP-003	Security recommendations for NMOS APIs
16	IEEE 1588v2	Precision Clock Synchronization Protocol for Networked Measurement and Control Systems
17	IEEE 802.1AB	Specifically, the Link Layer Discovery Protocol (LLDP)
18	AES67	High-performance streaming audio-over-IP interoperability
19	IETF RFC 3376	IGMPv3/SSM
20	ISO/IEC 21122	JPEG XS low-latency lightweight image coding system
21	AES-r16-2016	PTP parameters for AES67 and SMPTE ST 2059-2 interoperability
22	VSF TR-08	Transport of JPEG XS Video in ST 2110-22

Table 1. Mandatory standards support

Devices should support the following standards:

#	Standard	Title
1	AMWA NMOS IS-09 v1.0.x	System Parameters
2	SMPTE ST 2110-41	Fast Metadata [when it is released]

Table 2. Optional standards support

6. Exceptions to EBU Tech 3371: Minimum User Requirements to Build and Manage an IP-Based Media Facility Using Open Standards and Specifications

Devices must adhere with the requirements detailed in the latest version of EBU Tech 3371, with the following exceptions:

- I.1.1 Single link video: SMPTE ST 2110-20

  *"For simplicity of operation, troubleshooting and optimally dense use of the network, video Media Nodes ~~should~~ **shall** use single link streams (i.e. Media Nodes should not use SMPTE ST 2110-23). For instance, a single 59.94 Hz UHD stream requires a 25 Gigabit Ethernet (GbE) port and a high-density device (such as a multiviewer or a vision mixer) ~~should~~ **shall** take benefit of bi-directional 100 GbE."*

  Please note alterations to text above.

- I.3.1 Universal, multichannel, low latency audio: SMPTE ST 2110-30 Level B

  *"In addition to SMPTE ST 2110-30 Level A, which is compatible with all AES67 and 2110-30 devices, audio Senders and Receivers shall support Level ~~B~~ **C** to support low latency applications **and future multi-channel audio applications**;"*

  Please note alterations to text above.

- I.4.2 Stream protection with SMPTE ST 2022-7:2018

  "Receivers shall support SMPTE ST 2022-7:2018 Class D with Ultra Low-Skew 150 µs that is adapted to engineered LAN with adding minimal latency"

  Requirement does not apply.

- II.2.1 & II.2.2 PTPv2 configurable within SMPTE and AES profiles

  "PTP parameters of Media Nodes shall be configurable within the union of the ranges covered by the both SMPTE ST 2059-2 profile, the AES67 media profile and the IEEE-1588 default profile so that we can use the Media Nodes for the full range of possible operational scenarios;"

  "However, it is recommended to the users to select an operational point within the range of AES-r16-2016 so that it is compatible with equipment previously delivered on the market that might be limited to one of the two profiles;"

Please ignore. PTP GMs shall be configured with SMPTE ST 2059-2:2021 default parameters. Importantly, in this release of the standard, portDS.logAnnounceInterval has been change from -2 to 0, reducing the frequency of Announce message which enables a common PTP domain for AES67 and ST 2110 devices.

7. Exceptions to JTNM TR-1001-1:2020 System Environment and Device Behaviours for SMPTE ST 2110 Media Nodes in Engineered Networks

Devices must adhere with the requirements detailed in the latest version of JTNM TR-1001-1:2020, with the following exceptions:

- 10.2.6 NMOS System Parameters (IS-09)

  *" Media Nodes ~~shall~~ **should** use the registry heartbeat_interval value specified in the System API defined in AMWA IS-09 when maintaining their registration."*

  Please note alterations to text above.

- 10.3 Multicast Media Streams

  *"Media Nodes ~~should~~ **shall** provide a user mechanism for selecting the DSCP markings of the generated streams."*

  Please note alterations to text above.

- 11.2 Media Node Startup and Multicast Addresses

  "The System API defined in IS-09 includes a System ID, which shall be assigned uniquely (e.g. randomly) in each facility. Media Nodes shall store the System ID and their DHCP-assigned address as part of their current operating settings, and shall check at re-start, before generating any multicast outputs, that the current Network Environment's System ID and DHCP-assigned address match the previously stored values. If the current system ID and address are the same as before, then recalling the previous operating settings might be appropriate and safe, subject to the clause below."

  Products should support IS-09.

8. Interoperability

8.1. RTP Payload Values

1. Devices must support SDP configuration.
2. Receiver endpoints must autodetect and select RTP payload values from the Sender SDP file.
3. Devices must support SDP Payload Type values 96 to 127. See Section 6, Table 4 of https://datatracker.ietf.org/doc/html/rfc3551 and Section 6.2 of ST 2110-10.

8.2. Synchronisation, Timing and Latency

1. As defined within ST 2059, all devices shall support IEEE1588-2008. IEEE1588v1 is not supported.
2. Default values within ST 2059-2:2021 shall be used.
3. Devices shall support a hybrid PTP communications model. Sync and Follow_Up (multicast), Delay_Request and Delay Response (Unicast).
4. Devices must be capable of handling asynchronous baseband video and audio inputs. If alignment cannot be achieved, Audio is to be passed through out of sync and an alarm raised.
5. Devices must have an optional "minimum latency" mode, whereby baseband outputs are presented without further frame synchronisation.
6. SMPTE ST 2110-10 mandates that the media clock and the network timebase shall share the SMPTE ST 2059-1 epoch, with an offset of zero between the Media Clock and the RTP Clock, as specified in SMPTE ST 2110-10. All audio devices (specifically AES67) shall adhere to this.

8.3. Traffic Shaping

1. Senders shall adhere to ST 2110-21 'Narrow' or 'Narrow Linear' definitions.
2. If a Sender complies with the 'Wide' definition, vendors must state how 'Wide' the Sender is.
   The SMPTE ST 2110-21 'Wide' definition permits a range of performance levels. For example, whilst one Sender implementation may come very close to meeting 'Narrow' performance, another may meet the widest definition of 'Wide'. Senders marginally outside of the Narrow definition may (subject to testing) be acceptable.
3. Receivers must be ST 2110-21 'Type A' compliant i.e. capable of receiving signals from a type N, NL, or W sender, regardless of the value of the sender's `ts-refclk clksrc` or the sender's `TROFF` parameter value. Vendors must state any device performance implications resulting from supporting 'Wide' flows.

8.4. Receiver WAN Interoperability

1. Some endpoints will be required to receive 2022-7 protected flows which have originated from a Sender located at another site on NRK's WAN. The instantaneous path differential timing between diverse network paths across the WAN will be greater than 10ms. Devices must meet the 2022-7 "Class B" definition and be capable of handling an instantaneous path differential of up to 50ms.

8.5. Audio Devices and Endpoints

1. The NRK audio architecture is based around the exchange of 1-channel, 2-channel, 8-channel and 16-channel, 125us ST 2110-30 flows (Conformance Level: C). Audio Senders and Receivers responsible for processing uncompressed PCM audio must be capable of processing flows in these formats.
2. Audio devices required to send or receive flows via trunk links shall support up to 64 channels of audio per flow.
3. The NRK audio architecture also supports the exchange of 2-channel 125us ST 2110-31 flows (Conformance Level : C). Audio Senders and Receivers responsible for processing AES3 signal must be capable of processing flows in this format.
4. An audio Sender which is capable of handling more than 2 channels of audio must be capable of generating multiple 2 channels flows up to the maximum number of channels the device can handle.
5. An audio Receiver which is capable of handling more than 2 channels of audio must be capable of receiving multiple 2110-30 or 31 flows.
6. Receivers capable of receiving multiple 2110-30 multicast groups must be able to receive groups with different channel counts.
7. Receivers capable of receiving multiple 2110-30 multicast groups must be able to shuffle audio as required. Associated with this, support for AMWA IS-08 (future) should be planned as a roadmap feature.
8. All AES67 / ST2110 audio devices shall support 2022-7 on two physical network interfaces.
9. The device must guarantee phase coherence to within two samples between channels in a flow.

9. Device Behaviours

1. Devices must be capable of locking to PTP on both Fabric A and Fabric B network interfaces.
2. Devices must compare PTP sources using the Best Master Clock Algorithm (BMCA) defined in IEEE 1588-2008 to compare BC's on Fabric A and Fabric B and lock to the best BC.
3. In normal operation, the BC that an endpoint locks to on each of its network interfaces will be equal. In the event of a tie, the device shall use the BMCA algorithm defined in IEEE 1588-2008 to determine which interface to take time from.
4. Should a device lose lock to the BC it is currently syncing to, it must transparently failover to the PTP source on its other network interface and be capable of failing back when service is restored. This process must have zero impact on the performance of the endpoint from a user perspective.
5. A device which has lost connectivity to one fabric for a prolonged period (e.g. due to a leaf failure) will receive many routing requests during the outage, which it won't be able to fulfill on the failed link. On recovery of a failed network interface, a device shall re-acquire the current set of multicast groups to which it is subscribed. Historic subscription requests which were requested during the outage, and which have been superseded by newer requests shall be discarded. Historic route requests which have not been superseded shall be automatically acquired.
6. The possibility exists that a fault may arise which causes an endpoint to lose one flow from a logical group of flows (e.g. the audio, video or ancillary) on one or both network connections.
    a. If the route is still current, an endpoint must re-acquire the multicasts transparently when the flow(s) are reestablished.
    b. The loss and recovery process must not affect the stability of the endpoint. E.g. loss of the video flow shall mean that the endpoint shall display optionally black, freeze frame or another still image with the audio and any ancillary data continuing.
    c. Loss of an audio stream shall mute relevant channels, until such time as the flow is restored. Whilst audio must be restored as quickly as possible, this must not result in loud clicks or pops as the audio is reacquired.
7. The possibility exists that an endpoint may become flooded with multicast traffic. Once the flood is resolved, the endpoint must remain stable and recover all current multicast groups it should be subscribed to without user intervention.
8. Devices are not permitted to create a 1:1 relationship between a multicast receiver and a device input. NRK may wish to present the audio within a multicast to multiple device inputs simultaneously. It is not possible for a network interface to subscribe to the same multicast more than once. An endpoint which is capable of receiving multiple flows and presenting them to an application must also be capable of internally routing the same IP input stream to all application inputs. In

such a situation, all receivers must report the 'actual' sender, rather than an any internally replicated source which may be used to work around the limitations of multicast.

9. Endpoints must reliably exchange SMPTE ST 2110 compliant flows with endpoints from other manufacturers.
10. Devices must not place any restrictions on the multicast group address assignment. e.g. restricting to 239.x.x.x.
11. Devices must allow the TTL parameter to be user configurable.
12. Devices must support SSM.
13. It must be possible for a Receiver to subscribe to a multicast group that originates on the same interface (i.e. loopback).
14. Signal handling or processing performance should not be directly connected to the load on the API endpoints. I.e. excessive requests rates, malformed packages or other unexpected connections to the APIs should not interfere with the continuous operation of the device.

10. Control

1. Devices must be directly controllable via an NMOS API, rather than via separate API gateway server.
2. Devices shall support NMOS IS-04 v1.3 and IS-05 v1.1.
3. Devices shall support NMOS IS-07 v1.0.x.
4. Devices shall implement the BCP-002 `GroupHint` tag.
5. Devices shall support BCP-003 to provide secure communications.
6. Where in-band control is supported, devices shall allow NMOS control on both A and B NICs simultaneously. It is unacceptable for a device to bind NMOS control to one NIC or the other.
7. NMOS UIDs must not be derived from replaceable device components. For example, replacing a NIC should not result in the generation of new UIDs.

10.1. Device Performance

A logical source may consist of multiple Senders associated with multiple Devices / Nodes (typically a video, multiple audio and multiple data flows) and a logical destination may optionally select from flows from multiple Senders associated with multiple Devices / Nodes. In a ST 2110 based platform, a lot of messaging between systems must take place between systems to establish connectivity between a logical source and logical destination. To avoid unacceptably slow connection request response times, it is therefore important that control systems and devices process commands as quickly as possible and communicate with other systems efficiently.

Though other protocols are supported (RTP and MQTT), in practice the majority of NMOS implementations use the WebSockets protocol for message exchange. WebSocket connections are slow. Establishing a connection can take ~200ms and requests ~80ms to complete. It is therefore easy to see how (without careful optimisation) subscribing a device to multiple audio, video and data flows could take seconds to complete and a salvo to a multiviewer, vision mixer or audio mixer might take significantly longer.

1. Devices shall provide support for IS-05 “bulk” connection requests.
2. Devices shall process individual connection requests within a bulk connection request in parallel.
3. The Supplier shall state how long it takes a Receiver to process a bulk request containing ten connections.

10.2. Decvice Configuration

A large broadcaster can expect to deploy hundreds of thousands of Sender and Receiver endpoints on a ST 2110 based platform. To be able to effectively manage the configuration of a platform, it is a fundamental requirement for control systems to be able to accurately identify equipment which is added to the system. Presently there is currently no simple and standardised way within NMOS to identify which endpoints belong to which physical device. For example, if ten ingest servers are added to a rack and announce themselves to a registry, there is no simple way to identify which NMOS IDs belong to which server and to link device and endpoint IDs back into a wider platform configuration model.

Whilst some products populate Resource `Label` or Description properties with descriptive information there is no consistency between products (in some cases even when the products are from the same Supplier). Furthermore, information inserted in these properties is often unsuitable for linking NMOS IDs into a platform configuration model (Figure 1).

	SenderId	EthA	EthB	Info	GroupHint	DeviceId
aso	5a4e6ef8-2f7d-3ea1-b568-c9da1597b17f	eth0	eth1	OK -7		0aa80119-
dso	26a6f8c2-9a89-3d57-aa11-66e13bb487f9	eth0	eth1	OK -7		0aa80119-
aso	e143d307-9406-3516-9960-cebff109d6d8	eth0	eth1	OK -7		0aa80119-
aso	bc5a23bf-8131-3b5c-9e0b-a1eb5634b058	eth0	eth1	OK -7		6c30c75e-
dso	dc8c9587-7205-36e9-91c4-550c1fa86e92	eth0	eth1	OK -7		6c30c75e-
aso	fa16959e-2849-3d65-a4a7-b88d06609e14	eth0	eth1	OK -7		6c30c75e-
vso	fa516451-fb3c-3ce8-8779-4860460ba791	eth0	eth1	OK -7		22494c9e-
vso	e93c3e11-36e1-3728-98bc-7853a85c6db4	eth0	eth1	OK -7		0134281b-
aso	561800d5-950a-3e28-9c8d-1201b7cc629c	eth0	eth1	OK -7		c47eb114-
aso	f5e4d085-e681-3e26-8f3e-5717adf79213	eth0	eth1	OK -7		d78ce057-
dso	4f4dbc2d-e914-37ba-855b-e9a9b0c1bfdc	eth0	eth1	OK -7		d78ce057-
aso	08bfaf8b-cbb0-36c2-ac77-a1a3f3360d99	eth0	eth1	OK -7		d78ce057-
aso	04f2c5de-f16c-38bc-b382-9764b27d7ba0	eth0	eth1	OK -7		c2815054-
vso	232f3e7c-b3ba-32df-bd40-5412bdab1be7	eth0	eth1	OK -7		c2815054-
aso	42751aab-8bfe-3c12-8433-96b9239b3223	eth0	eth1	OK -7		7d0b2865-
dso	22747d92-64e1-3ef2-99bf-4ea6c48a97a5	eth0	eth1	OK -7		7d0b2865-
aso	71091196-74d7-3ebd-a8c4-3bc1e957081c	eth0	eth1	OK -7		7d0b2865-
vso	d0d60bab-d5af-3186-93db-942bcd807f0f	eth0	eth1	OK -7		7d0b2865-
vso	990ab9d5-927e-366e-b5cd-7f4f3bba8fb7	eth0	eth1	OK -7		7d0b2865-
aso	5f132a67-7446-3806-8a7d-ec90f9547ae8	eth0	eth1	OK -7		b3f0b973-
dso	ee25d763-29bf-34c3-87d9-137796c7680e	eth0	eth1	OK -7		b3f0b973-
aso	c25e574d-913c-3d11-af87-37340351bf5e	eth0	eth1	OK -7		b3f0b973-

Figure 1 - Meaningless endpoint identification

Fortunately, there is a simple way to resolve this, by adding a structured foreign key into the `Label` property of a Resource.

1. Devices shall support the insertion of a configurable foreign key into the Label property of a Resource (Figure 2). This might be via a Suppliers online configuration tool, or configuration file.

Label	SenderId	EthA	EthB	Info	GroupHint	DeviceId
17101/POENG/101_s02_a01	9b6881e4-980c-4aa4-947e-bb6f6196c67d	eth3	eth7	OK -7	17101/POENG/101_s02 - Sender:Audio 1	26b67972-7f80-4810-baa8-aca7c01c5141
17101/POENG/101_s02_a02	0798923a-9d63-4caf-827f-7b764013e244	eth3	eth7	OK -7	17101/POENG/101_s02 - Sender:Audio 2	26b67972-7f80-4810-baa8-aca7c01c5141
17101/POENG/101_s02_a03	b696757e-5b50-4274-bc15-f5c74fc8b77b	eth3	eth7	OK -7	17101/POENG/101_s02 - Sender:Audio 3	26b67972-7f80-4810-baa8-aca7c01c5141
17101/POENG/101_s02_a04	d44db727-9abc-42ff-acd8-77aec091b6f7	eth3	eth7	OK -7	17101/POENG/101_s02 - Sender:Audio 4	26b67972-7f80-4810-baa8-aca7c01c5141
17101/POENG/101_s02_a05	73ef2ea4-22b5-4655-88e1-fced7a3af6ef	eth3	eth7	OK -7	17101/POENG/101_s02 - Sender:Audio 5	26b67972-7f80-4810-baa8-aca7c01c5141
17101/POENG/101_s02_a06	600f9081-341e-4449-8a6a-0c9b218daffd	eth3	eth7	OK -7	17101/POENG/101_s02 - Sender:Audio 6	26b67972-7f80-4810-baa8-aca7c01c5141
17101/POENG/101_s02_a07	2fe2f82b-6540-41e4-a7dd-9002ebeadb0a	eth3	eth7	OK -7	17101/POENG/101_s02 - Sender:Audio 7	26b67972-7f80-4810-baa8-aca7c01c5141
17101/POENG/101_s02_a08	dcca84ea-36cf-4140-bb95-19bb8206c753	eth3	eth7	OK -7	17101/POENG/101_s02 - Sender:Audio 8	26b67972-7f80-4810-baa8-aca7c01c5141
17101/POENG/101_s02_a09	e9b78eb8-2afe-4b5f-aee7-3b9fa93130da	eth3	eth7	OK -7	17101/POENG/101_s02 - Sender:Audio 9	26b67972-7f80-4810-baa8-aca7c01c5141
17101/POENG/101_s02_a10	383b574d-ac52-4034-9659-5ad905b83206	eth3	eth7	OK -7	17101/POENG/101_s02 - Sender:Audio 10	26b67972-7f80-4810-baa8-aca7c01c5141
17101/POENG/101_s02_a11	f4d9fa3f-1991-4e5c-816c-49ccf257f8af	eth3	eth7	OK -7	17101/POENG/101_s02 - Sender:Audio 11	26b67972-7f80-4810-baa8-aca7c01c5141
17101/POENG/101_s02_a12	8f5e1f61-27a5-4ea8-b6aa-0c67e86ffb91	eth3	eth7	OK -7	17101/POENG/101_s02 - Sender:Audio 12	26b67972-7f80-4810-baa8-aca7c01c5141
17101/POENG/101_s02_a13	be8a3bac-75fa-49c8-93ad-5d85871e103e	eth3	eth7	OK -7	17101/POENG/101_s02 - Sender:Audio 13	26b67972-7f80-4810-baa8-aca7c01c5141
17101/POENG/101_s02_a14	53553dc0-f1a3-4a4d-9fd6-81cb70d8929f	eth3	eth7	OK -7	17101/POENG/101_s02 - Sender:Audio 14	26b67972-7f80-4810-baa8-aca7c01c5141
17101/POENG/101_s02_a15	fda783f1-b894-4bfb-9564-137e197352fb	eth3	eth7	OK -7	17101/POENG/101_s02 - Sender:Audio 15	26b67972-7f80-4810-baa8-aca7c01c5141
17101/POENG/101_s02_a16	b6f0cfbe-2bec-4164-ac86-9c6b55c4e435	eth3	eth7	OK -7	17101/POENG/101_s02 - Sender:Audio 16	26b67972-7f80-4810-baa8-aca7c01c5141
17101/POENG/101_s02_a17	0f74f29a-643d-4158-b024-0f82e7a94873	eth3	eth7	OK -7	17101/POENG/101_s02 - Sender:Audio 17	26b67972-7f80-4810-baa8-aca7c01c5141
17101/POENG/101_s02_a18	23db414c-bf04-40c4-bc87-176ae409f74e	eth3	eth7	OK -7	17101/POENG/101_s02 - Sender:Audio 18	26b67972-7f80-4810-baa8-aca7c01c5141
17101/POENG/101_s02_a19	ad962a23-e448-43de-a9a3-1fb2de7bed36	eth3	eth7	OK -7	17101/POENG/101_s02 - Sender:Audio 19	26b67972-7f80-4810-baa8-aca7c01c5141
17101/POENG/101_s02_a20	b95daaf4-f12c-4f27-a7a2-f27fbad16946	eth3	eth7	OK -7	17101/POENG/101_s02 - Sender:Audio 20	26b67972-7f80-4810-baa8-aca7c01c5141
17101/POENG/101_s02_a21	0ddc99d4-3042-4938-afb0-2910d6e9e01d	eth3	eth7	OK -7	17101/POENG/101_s02 - Sender:Audio 21	26b67972-7f80-4810-baa8-aca7c01c5141
17101/POENG/101_s02_a22	0e79eb7c-c338-4f50-a573-d653362aece4	eth3	eth7	OK -7	17101/POENG/101_s02 - Sender:Audio 22	26b67972-7f80-4810-baa8-aca7c01c5141

Figure 2 - Meaningful device identification, with configurable label field

The idea is that every Resource is labelled using a human-recognisable string, with all data in a single field. For example:
NMOS `Label` Format:
Node (Design ID)_NaturalGrouping (Endpoint Direction & Count)_MediaCounter (Media Type & Count)
Which translates to:
17101/POENG/235#01_r01_v01

It should be noted that the format of the string placed with the `Label` property may change between installations.

2. The device shall place no constraints of the structure of the `Label` property.
3. The device shall place no constraints on characters within the `Label` property
4. The `Label` property shall support string at least 32 characters wide.
5. The `Label` property shall persist between device reboots. Note that this applies to both virtual and physical devices.

10.3. Multiformat

One of the key benefits to broadcasters of the transition to IP is that the data transmission technology (the professional media network) is format agnostic, allowing rapid adoption of new media formats and multiple media formats to coexist on the same network fabric. Such flexibility requires care be taken when defining platform control system design and philosophy.

Increasingly, devices are becoming reconfigurable to be able to create and consume a broad range of compressed and uncompressed media formats, each with very different bandwidth requirements. Such flexibility presents challenges to platform management.

To ensure the correct operation of a large professional media network, it is critical that the opportunity for unsolicited flows to get onto the network is minimised. Furthermore, it is important to be able to detect and set correct Sender and Receiver format configuration.

1. The device shall provide an API call to report and set Sender and Receiver format configuration.
2. The Supplier shall explain how the device presents Senders and Receivers via NMOS when Sender / Receiver format/bandwidth is changed and how this relates to the internal processing capabilities of the device. For example, when switching between 1080i25/1080p50 and 2160p50 modes, several different behaviours have been observed, including:
    a. The device presents different sets of NMOS UIDs for UHD and 3G modes.
    b. Existing NMOS UIDs are retained but three out of four UIDs are invalidated.

11. Security

Suppliers must demonstrate that processes are in place to:

a. Minimise the risk of product / service vulnerabilities and;
b. Minimise the risk that of professional or support services exposing NRK to threats

Suppliers are expected to review EBU r143 and complete columns A and B of the R 143 Security Controls Assertation.