**3GPP TSG-S4 Meeting #115e**

**, – 27th August 2021**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.1* | | | | | | | | |
| **Pseudo CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  |  | **CR** |  | **rev** |  | **Current version:** |  |  |
|  | | | | | | | | |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
|  | | | | | | | | |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network |  | Core Network |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | | |
| ***Title:*** |  | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Ericsson LM, BBC, EBU, Sennheiser, Dolby | | | | | | | | | |
| ***Source to TSG:*** | S4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | FS\_NPN4AVProd | | | | |  | ***Date:*** | | | <Res\_date> |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **<Cat>** |  | | | | | ***Release:*** | | | <Release> |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | The current version of the technical report only contains some few potential key issues. The intention of this contribution is to extend the list of potential key issues with a audio channel configuration related key issues, which should be studied in more detail. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | A new potential key issue is proposed, focusing on configurable audio channels. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  |  | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  |  | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  |  | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

\*\*\*\* First Change \*\*\*\*

#### 5.2.5.8 Key Issue #7: Configurable Audio Channels

Editor’s Note: This clause should describe implications on protocol usage, when a predefined number of audio channels (as in MADI or SDI) is allocated, independently on its needs. In SDI, always 32 audio channels are allocated. Unused audio channels are “muted”. See ST 299 for more details. (https://tech.ebu.ch/docs/techreports/tr002.pdf)

* 1. Are muted audio channels used for other purposes in SDI / MADI, which should be considered for 5G deployments?
  2. Is it needed to send audio frames with “many null payload bytes“? What is the practice in ST 2110, which also supports separated A & V?
  3. Would all audio channel perceive same quality/QoS? Or can some audio channels require low latency while other audio channels are “embedded with video”?

Editor’s Note: This clause should describe the possibility of configuring audio channels on a need basis.

Tier one productions may deploy protocols such as Multiple Audio Digital Interface (MADI) [38] supporting [serial digital transmission](https://en.wikipedia.org/wiki/Serial_transmission" \o "Serial transmission) over [coaxial cable](https://en.wikipedia.org/wiki/Coaxial_cable" \o "Audio bit depth) or optical [fibre](https://en.wikipedia.org/wiki/Fibre-optic" \o "Fibre-optic) lines of 28, 56, 32, or 64 channels; and [sampling rates](https://en.wikipedia.org/wiki/Sampling_rate" \o "Sampling rate) to 96 kHz and beyond with an [audio bit depth](https://en.wikipedia.org/wiki/Audio_bit_depth" \o ") of up to 24 bits per channel. Where encapsulated audio and video are used then fewer channels are likely to be deployed. As a minimum, this should consist of two audio channels.

5G System resources are shared among devices and radio resources should preferably not allocated and left idle. This key issue should study, how in particular audio channels are allocated in existing media productions and how 5G based media productions can interwork with existing media productions, when a more dynamic allocation of audio channels is used on 5G Systems.

Audio may be carried as an encapsulated signal multiplexed with video and data, or as a separate set of streams. For tier one or audio-only productions, the audio is treated as separate discrete streams per channel. For tier two and three productions and contribution workflows, it may be desirable to carry audio and video multiplexed with the video.

A channel is usually a mono signal. An audio channel can be considered as

- *Active* or *inactive:* Not all channels (allocated in MADI or SDI) may be required for all applications so it should be possible to describe a channel as either active or inactive so as to make more efficient use of available bandwidth.

- *Muted* or *unmuted*: An active channel may be temporary muted where it may be required but the UE is not transmitting any data.

- *Silent:* A silent channel is active and unmuted but with a low-level audio signal. This may be used to provide atomospherhic or spot effects.

Editor’s Note: It should be checked, whether there is a DVB or SMPTE threshold definition for “silence”.

Communication channels are usually speech-only and of a lower quality than main programme audio but do require low-latency solutions. There is also a requirement for one-to-many solutions so that a director can speak to multiple end users at the same time.

SDI (Serial Digital Interface) [Z] is a family of standards widely used in the media production domain to transport uncompressed video signals. Various SDI interface (SD-SDI, HD-SDI, 3G-SDI, 6G-SDI, 12G-SDI and 24G-SDI) are available to support from standard definition up to ultra high definition resolutions.

SDI can carry also embedded audio.

3G-SDI, known as the 3Gbit/s interface, defined different mapping levels (A, B-DL, B-DS) for the carriage of 1080-line image formats and associated ancillary data. With respect to the audio, 3G-SDI may contain up to 16 audio channels or 32 if dual-link applications are considered or SMPTE ST 299-2 is used.

Note: 3G-SDI and later supports 32 channels but in practice it is limited to 16 channels as it is rare to find products that support more than 16 channels. In fact many products only support 8 channels.

In Tier one scenarios, in general, the audio signals come from the microphones installed in the studio/location (and not from the cameras) while in Tier two and Tier three productions, especially for contribution links, embedded audio is transmitted multiplexed with the video.When the audio is embedded, MPEG-2 Transport Stream might be used over RTP/UDP/IP instead of native RTP carriage.For ST 2110-30 scenarios, six conformance levels are defined [40]. Level A is the only mandatory conformance level to be supported by all compliant equipment and is defined as follows:

- Linear 24-bit PCM encoding.

- 48 kHz sampling frequency (media clock).

- 1 to 8 channels per stream.

- 1 ms packet time (48 audio samples per channel in each packet).

\*\*\*\* Next Change \*\*\*\*

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 22.261: "Service requirements for the 5G system".

[3] 3GPP TS 22.263: "Service requirements for Video, Imaging and Audio for Professional Applications (VIAPA)".

[4] 3GPP TS 22.827: "Study on Audio-Visual Service Production".

[5] M.P. Sharabayko, M.A. Sharabayko, J. Dube, JS. Kim, JW. Kim: "The SRT Protocol", draft-sharabayko-mops-srt-01

[6] VSF: "Reliable Internet Stream Transport (RIST) Activity Group", https://www.videoservicesforum.org/RIST.shtml

[7] VSF TR 06-1: "Reliable Internet Stream Transport (RIST) Protocol Specification – Simple Profile", <https://vsf.tv/download/technical_recommendations/VSF_TR-06-1_2018_10_17.pdf>

[8] VSF TR 06-2, "Reliable Internet Stream Transport (RIST) Protocol Specification – Main Profile", [https://www.vsf.tv/download/technical\_recommendations/VSF\_TR-06-2\_2020\_03\_24.pdf](https://protect2.fireeye.com/v1/url?k=cc406e56-93db577d-cc402ecd-866038973a15-a3187c63f11b10f6&q=1&e=1f3c54ba-abd4-4509-b7b2-0816901e7741&u=https%3A%2F%2Fwww.vsf.tv%2Fdownload%2Ftechnical_recommendations%2FVSF_TR-06-2_2020_03_24.pdf)

[9] NewTek: "NDI Encoding/Decoding", <https://support.newtek.com/hc/en-us/articles/218109667-NDI-Encoding-Decoding>

[10] NewTek: "NDI Network Bandwidth, <https://support.newtek.com/hc/en-us/articles/217662708-NDI-Network-Bandwidth>

[11] David Aleksandersen: "What is NDI® (Network Device Interface)?", <https://newsandviews.dataton.com/what-is-ndi-network-device-interface>

[12] Kieran Kunhya and Ciro Noronha: "RIST and SRT: What’s the difference?", <https://www.tvbeurope.com/ip-migration/rist-and-srt-whats-the-difference>

[13] Tofik Sonono: "Interoperable Retransmission Protocols with Low Latency and Constrained Delay: A Performance Evaluation of RIST and SRT", Masters Thesis, KTH Stockholm, 2019, http://kth.diva-portal.org/smash/get/diva2:1335907/FULLTEXT01.pdf

[14] EBU: "Minimum User Requirements to Build and Manage an IP-Based Media Facility", 15 July 2020, <https://tech.ebu.ch/files/live/sites/tech/files/shared/tech/tech3371.pdf>.

[15] AMWA: "NMOS Overview", <https://www.amwa.tv/nmos-overview>.

[16] EBU: "The Technology Pyramid For Media Nodes", https://tech.ebu.ch/publications/technology\_pyramid\_for\_media\_nodes.

[17] EBU: "Technology Pyramid Media Node Maturity Checklist", September 2021, <https://tech.ebu.ch/publications/technology-pyramid-media-node-maturity-checklist?rec=1>.

[18] AMWA: "NMOS Technical Overview", <https://specs.amwa.tv/nmos/branches/main/docs/2.0._Technical_Overview.html>.

[19] AMWA: "Networked Media Systems – the Big Picture",  
<https://static.amwa.tv/networked-media-systems-big-picture-2021-03-05.pdf>.

[20] AMWA: "NMOS specification repository", <https://specs.amwa.tv/nmos>.

[21] SMPTE ST 2110: "Professional Media over Managed IP".

[22] IEEE 1588-2008: "Precision Time Protocol".

[23] SMPTE ST 2022-1:2007: "Forward Error Correction for Real-Time Video/Audio Transport Over IP Networks".

[24] SMPTE ST 2022-6:2012: "Transport of High Bit Rate Media Signals over IP Networks (HBRMT)",

[25] SMPTE ST 2022-7:2019: "Seamless Protection Switching of RTP Datagrams".

[26] SMPTE ST 2059-2:2015: "SMPTE Profile for Use of IEEE-1588 Precision Time Protocol in Professional Broadcast Applications".

[27] SMPTE ST 2110-10:2017: "Professional Media Over Managed IP Networks: System Timing and Definitions".

[28] SMPTE ST 2110-20:2017: "Professional Media Over Managed IP Networks: Uncompressed Active Video".

[29] SMPTE ST 2110-22:2019: "Professional Media Over Managed IP Networks: Constant Bit-Rate Compressed Video".

[30] SMPTE ST 2110-30:2017: "Professional Media Over Managed IP Networks: PCM Digital Audio".

[31] SMPTE ST 2110-31:2018: "Professional Media Over Managed IP Networks: AES3 Transparent Transport".

[32] IETF RFC 4585: "Extended RTP Profile for Real-time Transport Control Protocol (RTCP)-Based Feedback (RTP/AVPF)".

[33] IETF RFC 8086: "GRE-in-UDP Encapsulation".

[34] Ember+ control protocol, https://github.com/Lawo/ember-plus

[35] SMPTE ST 259:2008: "For Television — SDTV Digital Signal/Data — Serial Digital Interface".

[36] SMPTE ST 292-1:2012: "1.5 Gb/s Signal/Data Serial Interface".

[37] 3GPP TR 26.925: "Typical traffic characteristics of media services on 3GPP networks".

[38] Wikipedia, 2021, MADI, last modified 19th April 2021, <https://en.wikipedia.org/wiki/MADI>

[39] Wikipedia, 2021, Time-Sensitive Networking, last modified 23rd June 2021, <https://en.wikipedia.org/wiki/Time-Sensitive_Networking>

[40] AES67 / SMPTE ST 2110: "COMMONALITIES AND CONSTRAINTS", <https://aimsalliance.org/wp-content/uploads/2019/04/AES67-SMPTE-ST-2110-Commonalities-and-Constraints-Updated-April-2019.pdf>

[41] IETF RFC 5104: "Codec Control Messages in the RTP Audio-Visual Profile with Feedback (AVPF) ".

[42] IETF RFC 4585: "Extended RTP Profile for Real-time Transport Control Protocol (RTCP)-Based Feedback (RTP/AVPF) ".

\*\*\*\*Last Change \*\*\*\*