**Source: Editor[[1]](#footnote-2)**

**Title: IVAS BASOP Verification (IVAS-10)**

**Version: 0.1.1**

**Agenda Item: 7.5**

# **Scope**

This document outlines the planning, tools and results for the conversion of the IVAS floating point code in TS 26.258 to the BASOP version to become part of TS 26.251.

Additional information on the codec development project can be found in the other IVAS permanent documents, for which the latest versions can be found at:

<https://www.3gpp.org/ftp/tsg_sa/WG4_CODEC/IVAS_Permanent_Documents>.

# **Introduction**

The conversion of the IVAS floating point code to BASOP code is being done by Ittiam, under a contract issued by ETSI. The organization of this conversion is outlined in [1], which is also attached to the contract. Upon delivery of the code to ETSI, SA4 is expected to verify that the delivery meets the FL-to-FX requirements specified in [1]. The verification relies on objective measurement to cover a large set of operating points within a limited time but needs to be complemented with subjective listening tests. A more detailed time plan was provided in [2], now included in this document.

# **Key factors / requirements for IVAS FL-to-FX conversion**

## BASOPS

* Usage of BASOPs in IVAS FX code
* STL2023 BASOPs are used in IVAS FX code (64-bit and shorter).
* The EVS part of IVAS FX is reused from the “alternative” 64-bit FX EVS implementation (TS 26.452).
* Overflow and Carry flag used inside the BASOPs and written to global variables shall be avoided. In case Overflow or Carry would be required, new dedicated operators that expose those flags without the use of global variables shall be used.

To reflect this and potential other necessary improvements, some operators may need an update; this update will be provided by Audio SWG to Ittiam in time.

* Contribution to ITU-T on modified BASOPs will be desirable.

## Complexity

* Complexity (WMOPS) ratio between IVAS FX and IVAS FL should be no worse than the complexity ratio between EVS FX and EVS FL; the goal is that the design constraints are met with the FX code.
* Memory savings: always use the smallest data type (and respective BASOPs) as far as possible, in a reasonable balance with complexity.

## FX coding practices

* 3GPP Forge will be used as the platform of FX development, similarly to the development of FL code in Public Collaboration.
* Inclusion of 3rd party code or open-source code is not allowed; inclusion of code from generative AI tools is not allowed.
* Structure of FL code shall be preserved to the maximum extent to allow comparison between FL and FX code and easier maintainability of the two code bases. This includes the best preservation of function prototypes and comments in the code; file names shall remain unchanged. In addition, all variables converted to FX shall be marked with precision information (integer, fractional) in Q-notation; precision changes should be documented; the goal is that the original functions could be used interchangeably during development; function names of converted functions shall avoid symbol clashes during the development; the objective is to ultimately have maximum similarity to the FL code and eventually all variables and function names also in FX shall be unified to their FL counterpart.
* Interoperability between FX and FL codes shall be guaranteed; for example, valid FL bitstreams shall be decodable by the FX-decoder, related to certain quality requirements (no drop).
* Making test vectors available for conversion is responsibility of Audio SWG.

# **Time plan**

The time plan of the IVAS BASOP verification is covered in [3].

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# **References**

1. SA4aA240038, Organization of IVAS Characterization Phase rev 1, <https://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/3GPP_SA4_AHOC_MTGs/SA4_Audio/Docs/SA4aA240038.zip>
2. S4aA240056, On the status of the IVAS BASOP conversion, <https://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/3GPP_SA4_AHOC_MTGs/SA4_Audio/Docs/S4aA240056.zip>
3. IVAS Permanent document IVAS-2b: IVAS\_Codec\_Ph2 Project Plan

# **Revision history**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Date** | **Meeting** | **Subject/Comment** | **Old** | **New** |
| 2024-11-18 | SA4#130 | Initial version including requirements from SA4aA240038 and time plan from S4aA240056. | N/A | 0.0.1 |
| 2024-11-19 | SA4#130 | Included IVAS BASOP Decoder and Renderer from S4-242054 as Annex A. Updated time plan based on S4-242160. | 0.0.1 | 0.1.0 |
| 2025-02-20 | SA4#131 | Removal of time plan and refer to IVAS-2b. | 0.1.0 | 0.1.1 |

Verification of Decoder and Renderer

The report on the verification of the IVAS BASOP Decoder and Renderer can be found in the electronic attachment “IVAS-10 Annex A Verification\_of\_IVAS\_BASOP\_decoder\_and\_renderer.docx”

1. Erik Norvell – Ericsson LM [↑](#footnote-ref-2)