

International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

G.722

Amendment 2
(03/2011)

SERIES G: TRANSMISSION SYSTEMS AND MEDIA,
DIGITAL SYSTEMS AND NETWORKS

Digital terminal equipments – Coding of voice and audio
signals

7 kHz audio-coding within 64 kbit/s

**Amendment 2: New Appendix V extending
Annex B superwideband for mid-side stereo**

Recommendation ITU-T G.722 (1988) – Amendment 2



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For further details, please refer to the list of ITU-T Recommendations.

Recommendation ITU-T G.722

7 kHz audio-coding within 64 kbit/s

Amendment 2

New Appendix V extending Annex B superwideband for mid-side stereo

Summary

Appendix V defines a coding scheme for mid-side (MS) stereo using Recommendation ITU-T G.722 Annex B (G.722-SWB). By introducing the mid-side stereo coding into stereo terminals, interoperability with the monaural devices could be obtained in very low complexity.

The basic coding scheme is as follows;

- a) Two channels of the left-right (LR) stereo are converted to those of the mid-side stereo and then the signals of each channel are independently encoded using ITU-T G.722 Annex B,
- b) At the decoder side, the mid-side channels of the bitstream from the encoder are decoded respectively and then the decoded signals of the mid-side channels are reversed to those of the LR channels.

The LR-MS conversion and its inverse are conducted in a conventional way. On the encoder side, two additional arithmetic operations per sample are required for the LR-MS conversion and one operator for the MS-LR conversion in the decoder. In an STL2009 [b-ITU-T G.191] basic operator implementation, the conversion complexity amounts to about 0.2 WMOPS in total. The coding algorithm for each channel is identical to the one in Recommendation ITU-T G.722 Annex B.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T G.722	1987-02-28	XVIII
2.0	ITU-T G.722	1988-11-25	
2.1	ITU-T G.722 (1988) App. II	1988-11-25	
2.2	ITU-T G.722 (1988) Annex A	1993-03-12	XV
2.3	ITU-T G.722 (1988) App. III	2006-11-24	16
2.3	ITU-T G.722 (1988) App. IV	2006-11-24	16
2.4	ITU-T G.722 (1988) App. IV	2007-07-06	16
2.5	ITU-T G.722 (1988) App. IV	2009-11-06	16
2.6	ITU-T G.722 (1988) Amend. 1	2010-11-13	16
2.7	ITU-T G.722 (1988) Amend. 2	2011-03-25	16

FOREWORD

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

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As of the date of approval of this Recommendation, ITU had received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at <http://www.itu.int/ITU-T/ipr/>.

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Recommendation ITU-T G.722

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New Appendix V extending Annex B superwideband for mid-side stereo

Appendix V

Mid-side stereo coding

V.1 Scope

This appendix defines a stereo encoding scheme for ITU-T G.722 Annex B (ITU-T G.722-SWB) mid-side (MS) stereo. By using MS stereo, very low transcoding or down-mix effort between MS-stereo bitstreams and monaural bitstreams is achieved. To ensure interoperability, out-of-band signalling should be separately defined to differentiate MS stereo implementations.

V.2 Description of the mid-side stereo coding

V.2.1 Encoding scheme

The mid-side stereo encoding is realized by left-right (LR) to MS conversion and two ITU-T G.722-SWB encoders, as shown in Figure V.1.

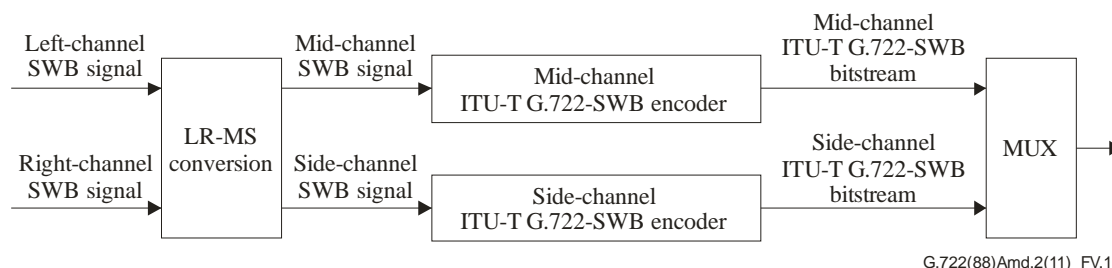


Figure V.1 – Encoder block diagram of MS stereo using G.722-SWB

The LR stereo signal is converted into MS stereo using LR-MS conversion and then those two channels are encoded using mid- and side-channel ITU-T G.722-SWB encoders. Those two encoders are identical instances of what is defined in ITU-T G.722 Annex B.

The LR-MS conversion uses the following two equations.

$$s_{SWB}^M(n) = \frac{s_{SWB}^L(n) + s_{SWB}^R(n)}{2} \quad n = 0, \dots, 159. \quad (V-1)$$

$$s_{SWB}^S(n) = \frac{s_{SWB}^L(n) - s_{SWB}^R(n)}{2}$$

The multiplexer places the mid- and side-channel G.722-SWB bitstreams in the order given in Figure V.2.

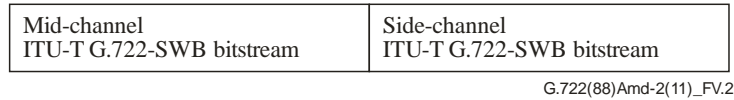


Figure V.2 – Bitstream order of G.722-SWB MS stereo

V.2.2 Decoding scheme

The mid-side stereo decoding is realized by MS to LR conversion and two ITU-T G.722-SWB decoders, as shown in Figure V.3.

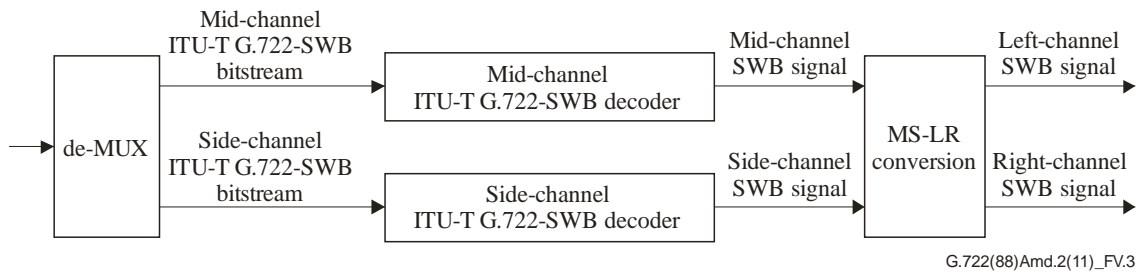


Figure V.3 – Decoder block diagram of MS stereo using G.722-SWB

Mid- and side-channel bitstreams are fed to mid- and side-channel ITU-T G.722-SWB decoders and the obtained mid- and side-channel superwideband signals are converted into LR stereo signals using MS-LR conversion. Again, the two decoders are identical instances of what is defined in ITU-T G.722 Annex B.

The MS-LR conversion uses the following two equations:

$$s_{SWB}^L(n) = s_{SWB}^M(n) + s_{SWB}^S(n) \quad n = 0, \dots, 159. \quad (V-2)$$

$$s_{SWB}^R(n) = s_{SWB}^M(n) - s_{SWB}^S(n)$$

V.3 Computational complexity

The LR-MS conversion in the encoding, described above, requires two arithmetic operations per sample and the MS-LR conversion in the decoding also needs one operation. In an STL2009 [b-ITU-T G.191] basic operator implementation, the conversion complexity amounts to about 0.2 WMOPS in total.

Bibliography

- [b-ITU-T G.191] Recommendation ITU-T G.191 (2010), *Software tools for speech and audio coding standardization*.

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