

# 2018 WBU-IMCG HEVC INTEROPERABILITY TESTING RESULTS

## Program Test Streams

## 2018 WBU-IMCG HEVC Interoperability Test Streams

### Standard Transport Streams

TS#		Video Format	TS Bit Rate (Mbps)	Chroma	Bit Depth	HEVC Profile/Level/Tier	Audio Format/Bit Rate
1	HD	720P 59.94	15	4:2:0	8	Main 420 4.1 High	MPL2 256Kbps
2		1080i 59.94	15	4:2:0	8	Main 420 4.1 High	MPL2 256Kbps
3		1080i 50	15	4:2:0	8	Main 420 4.1 High	MPL2 256Kbps
4		720P 59.94	30	4:2:2	10	Main 422 4.1 High	MPL2 256Kbps
5		1080i 59.94	30	4:2:2	10	Main 422 4.1 High	MPL2 256Kbps
6		1080i 50	30	4:2:2	10	Main 422 4.1 High	MPL2 256Kbps
7	4K	2160P 59.94	40	4:2:0	10 or 8	Main 420 5.1 High	MPEG 2 AAC 2ch 384Kbps
8		2160P 50	40	4:2:0	10 or 8	Main 420 5.1 High	MPEG 2 AAC 2ch 384Kbps
9		2160P 59.94	60	4:2:2	10	Main 422 5.1 High	Dolby E 2ch
10		2160P 50	60	4:2:2	10	Main 422 5.1 High	Dolby E 2ch
11		2160P 59.94	80	4:2:2	10	Main 422 5.1 High	PCM 6ch (5.1 surround discrete)
12		2160P 50	80	4:2:2	10	Main 422 5.1 High	PCM 6ch (5.1 surround discrete)

### Lip Sync Transport Streams

4	HD	720P 59.94	30	4:2:2	10	Main 422 4.1 High	MPL2 256Kbps
5		1080i 59.94	30	4:2:2	10	Main 422 4.1 High	MPL2 256Kbps
6		1080i 50	30	4:2:2	10	Main 422 4.1 High	MPL2 256Kbps
9	4K	2160P 59.94	60	4:2:2	10	Main 422 5.1 High	Dolby E 2ch
10		2160P 50	60	4:2:2	10	Main 422 5.1 High	Dolby E 2ch
11		2160P 59.94	80	4:2:2	10	Main 422 5.1 High	PCM 6ch (5.1 surround discrete)
12		2160P 50	80	4:2:2	10	Main 422 5.1 High	PCM 6ch (5.1 surround discrete)

# 2018 WBU-IMCG HEVC INTEROPERABILITY TESTING RESULTS

Submitted Streams

## 2018 WBU-IMCG HEVC Interoperability Submitted Test Streams

**Standard Transport Streams** **Updated 10/2/18**

Vendor	ATEME <sup>1</sup>		MediaKind (Ericsson)		Harmonic		NEC		NTT	
TS#	Submitted	Validated	Submitted	Validated	Submitted	Validated	Submitted	Validated	Submitted	Validated
1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
5	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
6	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
7	x	x	Y	Y	Y	Y	Y	Y	Y	Y
8	x	x	Y	Y	Y	Y	Y	Y	Y	Y
9	x	x	Y	Y	Y	Y	Y	Y	Y	Y
10	x	x	Y	Y	Y	Y	Y	Y	Y	Y
11	x	x	x	x	Y	Y	Y	Y	Y	Y
12	x	x	x	x	Y	Y	Y	Y	Y	Y

## Lip Sync Transport Streams

4	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
5	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
6	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
9	x	x	Y	Y	Y	Y	Y	Y	Y	Y
10	x	x	Y	Y	Y	Y	Y	Y	Y	Y
11	x	x	x	x	Y	Y	Y	Y	Y	Y
12	x	x	x	x	Y	Y	Y	Y	Y	Y

x

 No TS submitted

<sup>1</sup> While ATEME utilized HD HEVC codecs for the tests, ATEME now has 4K codecs commercially available.

# 2018 WBU-IMCG HEVC INTEROPERABILITY TESTING RESULTS

## Vendor Hardware Information



# 2018 WBU-IMCG HEVC INTEROPERABILITY TESTING RESULTS

## Results Legend

## Video and Audio Results

Vendor	Encoder Vendor
Vendor	Decoder Vendor
x	No measurement performed or stream submitted.
#	Indicates a note related to the test at the bottom of the table.
PASS	Indicates no interoperability issues noted.
PASS #	Indicates no interoperability issues noted but a note is available at the bottom of the tab
FAIL	Potential interoperability issue.
FAIL #	Potential interoperability issue with a note at the bottom of the table.

## Lip Sync Results

Vendor	Encoder Vendor
Vendor	Decoder Vendor
x	No measurement performed or stream submitted.
-#.#	Negative number indicating the audio is leading the video
#.#	Positive number indicating the audio is lagging the video
#.# <sup>1</sup>	Measurement value with a note available at the bottom of the table



# 2018 WBU-IMCG HEVC INTEROPERABILITY TESTING RESULTS

## Transport Stream Validation Information

**2018 WBU-IMCG HEVC Transport Stream Validation**

**Standard Transport Streams Updated 9/12/18**

Vendor	ATEME	MediaKind (Ericsson)	Harmonic	NEC	NTT
<b>TS 1</b>					
Resolution	1280x720p	1280x720p	1280x720p	1280x720p	1280x720p
Frame Rate	59.94	59.94	59.94	59.94	59.94
Bit Rate (Mbps)	15	15	16	15	15
Chroma	4:2:0	4:2:0	4:2:0	4:2:0	4:2:0
Bit Depth	8	8	8	8	8
Audio Format	MPL2	MPL2	MPL2	MPL2	MPL2
Audio Bit Rate (kbps)	256	256	256	256	256
Sample Rate (kHz)	48	48	48	48	48
Packet Size (bytes)	188	188	188	188	188
<b>TS 2</b>					
Resolution	1920x1080i	1920x1080i	1920x1080i	1920x1080i	1920x1080i
Frame Rate	59.94	59.94	59.94	59.94	59.94
Bit Rate (Mbps)	15	15	16	15	15
Chroma	4:2:0	4:2:0	4:2:0	4:2:0	4:2:0
Bit Depth	8	8	8	8	8
Audio Format	MPL2	MPL2	MPL2	MPL2	MPL2
Audio Bit Rate (kbps)	256	256	256	256	256
Sample Rate (kHz)	48	48	48	48	48
Packet Size (bytes)	188	188	188	188	188
<b>TS 3</b>					
Resolution	1920x1080i	1920x1080i	1920x1080i	1920x1080i	1920x1080i
Frame Rate	50	50	50	50	50
Bit Rate (Mbps)	15	15	16	15	15
Chroma	4:2:0	4:2:0	4:2:0	4:2:0	4:2:0
Bit Depth	8	8	8	8	8
Audio Format	MPL2	MPL2	MPL2	MPL2	MPL2
Audio Bit Rate (kbps)	256	256	256	256	256
Sample Rate (kHz)	48	48	48	48	48
Packet Size (bytes)	188	188	188	188	188
<b>TS 4</b>					
Resolution	1280x720p	1280x720p	1280x720p	1280x720p	1280x720p
Frame Rate	59.94	59.94	59.94	59.94	59.94
Bit Rate (Mbps)	30	30	32	30	30
Chroma	4:2:2	4:2:2	4:2:2	4:2:2	4:2:2
Bit Depth	10	10	10	10	10
Audio Format	MPL2	MPL2	MPL2	MPL2	MPL2
Audio Bit Rate (kbps)	256	256	256	256	256
Sample Rate (kHz)	48	48	48	48	48
Packet Size (bytes)	188	188	188	188	188
<b>TS 5</b>					
Resolution	1920x1080i	1920x1080i	1920x1080i	1920x1080i	1920x1080i
Frame Rate	59.94	59.94	59.94	59.94	59.94
Bit Rate (Mbps)	30	30	32	30	30
Chroma	4:2:2	4:2:2	4:2:2	4:2:2	4:2:2
Bit Depth	10	10	10	10	10
Audio Format	MPL2	MPL2	MPL2	MPL2	MPL2
Audio Bit Rate (kbps)	256	256	256	256	256
Sample Rate (kHz)	48	48	48	48	48
Packet Size (bytes)	188	188	188	188	188
<b>TS 6</b>					
Resolution	1920x1080i	1920x1080i	1920x1080i	1920x1080i	1920x1080i
Frame Rate	50	50	50	50	50
Bit Rate (Mbps)	30	30	32	30	30
Chroma	4:2:2	4:2:2	4:2:2	4:2:2	4:2:2
Bit Depth	10	10	10	10	10
Audio Format	MPL2	MPL2	MPL2	MPL2	MPL2
Audio Bit Rate (kbps)	256	256	256	256	256
Sample Rate (kHz)	48	48	48	48	48
Packet Size (bytes)	188	188	188	188	188

x	No TS submitted
	Value outside of expected
Unknown*	TS Analyzer not licensed for Dolby and indicated Private data elementary stream

<b>TS 7</b>					
Resolution	x	3840x2160p	3840x2160p	3840x2160p	3840x2160p
Frame Rate	x	59.94	59.94	59.94	59.94
Bit Rate (Mbps)	x	40	42	40	40
Chroma	x	4:2:0	4:2:0	4:2:0	4:2:0
Bit Depth	x	10	8	10	10
Audio Format	x	AAC	AAC	AAC	AAC
Audio Bit Rate (kbps)	x	200	167	422	422
Sample Rate (kHz)	x	48	48	48	48
Packet Size (bytes)	x	188	188	188	188
<b>TS 8</b>					
Resolution	x	3840x2160p	3840x2160p	3840x2160p	3840x2160p
Frame Rate	x	50	50	50	50
Bit Rate (Mbps)	x	40	41	40	40
Chroma	x	4:2:0	4:2:0	4:2:0	4:2:0
Bit Depth	x	10	8	10	10
Audio Format	x	AAC	AAC	AAC	AAC
Audio Bit Rate (kbps)	x	200	167	422	422
Sample Rate (kHz)	x	48	48	48	48
Packet Size (bytes)	x	188	188	188	188
<b>TS 9</b>					
Resolution	x	3840x2160p	3840x2160p	3840x2160p	3840x2160p
Frame Rate	x	59.94	59.94	59.94	59.94
Bit Rate (Mbps)	x	60	64	60	60
Chroma	x	4:2:2	4:2:2	4:2:2	4:2:2
Bit Depth	x	10	10	10	10
Audio Format	x	Unknown*	Unknown*	Unknown*	Unknown*
Audio Bit Rate (kbps)	x	2400	2400	2400	2400
Sample Rate (kHz)	x	Unknown*	Unknown*	Unknown*	Unknown*
Packet Size (bytes)	x	188	188	188	188
<b>TS 10</b>					
Resolution	x	3840x2160p	3840x2160p	3840x2160p	3840x2160p
Frame Rate	x	50	50	50	50
Bit Rate (Mbps)	x	60	64	60	60
Chroma	x	4:2:2	4:2:2	4:2:2	4:2:2
Bit Depth	x	10	10	10	10
Audio Format	x	Unknown*	Unknown*	Unknown*	Unknown*
Audio Bit Rate (kbps)	x	2400	2400	2400	2400
Sample Rate (kHz)	x	Unknown*	Unknown*	Unknown*	Unknown*
Packet Size (bytes)	x	188	188	188	188
<b>TS 11</b>					
Resolution	x	x	3840x2160p	3840x2160p	3840x2160p
Frame Rate	x	x	59.94	59.94	59.94
Bit Rate (Mbps)	x	x	84	80	80
Chroma	x	x	4:2:2	4:2:2	4:2:2
Bit Depth	x	x	10	10	10
Audio Format	x	x	Unknown*	Unknown*	Unknown*
Audio Bit Rate (kbps)	x	x	2400	1900	2400
Sample Rate (kHz)	x	x	Unknown*	Unknown*	Unknown*
Packet Size (bytes)	x	x	188	188	188
<b>TS 12</b>					
Resolution	x	x	3840x2160p	3840x2160p	3840x2160p
Frame Rate	x	x	50	50	50
Bit Rate (Mbps)	x	x	84	80	80
Chroma	x	x	4:2:2	4:2:2	4:2:2
Bit Depth	x	x	10	10	10
Audio Format	x	x	Unknown*	Unknown*	Unknown*
Audio Bit Rate (kbps)	x	x	2400	2000	2400
Sample Rate (kHz)	x	x	Unknown*	Unknown*	Unknown*
Packet Size (bytes)	x	x	188	188	188

# 2018 WBU-IMCG HEVC INTEROPERABILITY TESTING RESULTS

## VIDEO RESULTS

## 2018 WBU-IMCG HEVC Interoperability Video Results

TS1	Decoder	ATEME	MediaKind (Ericsson)	Harmonic	NEC	NTT
Encoder						
ATEME		PASS	PASS	PASS	PASS	PASS
MediaKind (Ericsson)		PASS	PASS	PASS	PASS	PASS
Harmonic		PASS	PASS	PASS	PASS	PASS
NEC		PASS	PASS	PASS	PASS	PASS
NTT		PASS	PASS	PASS	PASS	PASS

TS2	Decoder	ATEME	MediaKind (Ericsson)	Harmonic	NEC	NTT
Encoder						
ATEME		PASS	PASS	PASS	PASS	PASS
MediaKind (Ericsson)		PASS	PASS	PASS	PASS	PASS
Harmonic		PASS	PASS	PASS	PASS	PASS
NEC		FAIL <sup>1</sup>	PASS	PASS	PASS	PASS
NTT		PASS	PASS	PASS	PASS	PASS

<sup>1</sup> Macroblocking

TS3	Decoder	ATEME	MediaKind (Ericsson)	Harmonic	NEC	NTT
Encoder						
ATEME		PASS	PASS	PASS	PASS	PASS
MediaKind (Ericsson)		PASS	PASS	PASS	PASS	PASS
Harmonic		PASS	FAIL <sup>1</sup>	PASS	PASS	PASS
NEC		PASS	PASS	PASS	PASS	PASS
NTT		PASS	PASS	PASS	PASS	PASS

<sup>1</sup> Video hit noted

TS4	Decoder	ATEME	MediaKind (Ericsson)	Harmonic	NEC	NTT
Encoder						
ATEME		PASS	PASS	PASS	PASS	PASS
MediaKind (Ericsson)		PASS	PASS	PASS	PASS	PASS
Harmonic		PASS	PASS	PASS	PASS	PASS
NEC		PASS	PASS	PASS	PASS	PASS
NTT		PASS	PASS	PASS	PASS	PASS

TS5	Decoder	ATEME	MediaKind (Ericsson)	Harmonic	NEC	NTT
Encoder						
ATEME		PASS	PASS	PASS	PASS	PASS
MediaKind (Ericsson)		PASS	PASS	PASS <sup>3</sup>	PASS	PASS
Harmonic		PASS <sup>1</sup>	PASS <sup>2</sup>	PASS	PASS	PASS
NEC		PASS	PASS	PASS	PASS	PASS
NTT		PASS	PASS	PASS	PASS	PASS

<sup>1</sup> One video hit noted

<sup>2</sup> Video hit noted after source transition

<sup>3</sup> Video stutter noted

TS6	Decoder	ATEME	MediaKind (Ericsson)	Harmonic	NEC	NTT
Encoder						
ATEME		PASS	PASS	PASS	PASS	PASS
MediaKind (Ericsson)		PASS	PASS	PASS	PASS	PASS
Harmonic		PASS	PASS <sup>1</sup>	PASS	PASS	PASS
NEC		PASS	PASS	PASS	PASS	PASS
NTT		PASS	PASS	PASS	PASS	PASS

<sup>1</sup> Video hit noted at the same spot in source stream

TS7	Decoder	ATEME	MediaKind (Ericsson)	Harmonic	NEC	NTT
Encoder						
ATEME		x	x	x	x	x
MediaKind (Ericsson)		x	PASS	PASS	PASS	PASS
Harmonic		x	PASS	PASS	PASS	PASS
NEC		x	PASS	PASS	PASS	PASS
NTT		x	PASS	PASS	PASS	PASS

TS8	Decoder	ATEME	MediaKind (Ericsson)	Harmonic	NEC	NTT
Encoder						
ATEME		x	x	x	x	x
MediaKind (Ericsson)		x	PASS <sup>1</sup>	PASS <sup>2</sup>	PASS	PASS
Harmonic		x	PASS	PASS	PASS	PASS <sup>3</sup>
NEC		x	PASS	PASS	PASS	PASS
NTT		x	PASS	PASS	PASS	PASS

<sup>1</sup> Some minimal blocking noted

<sup>2</sup> Video stutter noted

<sup>3</sup> Slight motion artifacts observed



TS9	Decoder	ATEME	MediaKind (Ericsson)	Harmonic	NEC	NTT
Encoder						
ATEME		x	x	x <sup>2</sup>	x	x
MediaKind (Ericsson)		x	PASS	x <sup>2</sup>	PASS	PASS
Harmonic		x <sup>1</sup>	x <sup>1</sup>	x <sup>1,2</sup>	x <sup>1</sup>	x <sup>1</sup>
NEC		x	PASS	x <sup>2</sup>	PASS	PASS
NTT		x	PASS	x <sup>2</sup>	PASS	PASS

<sup>1</sup> Non-compliant stream

<sup>2</sup> Dolby pass-through not available on decoder

TS10	Decoder	ATEME	MediaKind (Ericsson)	Harmonic	NEC	NTT
Encoder						
ATEME		x	x	x <sup>2</sup>	x	x
MediaKind (Ericsson)		x	PASS	x <sup>2</sup>	PASS	PASS
Harmonic		x <sup>1</sup>	x <sup>1</sup>	x <sup>1,2</sup>	x <sup>1</sup>	x <sup>1</sup>
NEC		x	PASS	x <sup>2</sup>	PASS	PASS
NTT		x	PASS	x <sup>2</sup>	PASS	PASS

<sup>1</sup> Non-compliant stream

<sup>2</sup> Dolby pass-through not available on decoder

TS11	Decoder	ATEME	MediaKind (Ericsson)	Harmonic	NEC	NTT
Encoder						
ATEME		x	x	x	x	x
MediaKind (Ericsson)		x	x	x	x	x
Harmonic		x	PASS <sup>1</sup>	PASS	PASS	FAIL <sup>2</sup>
NEC		x	PASS	PASS	PASS	PASS
NTT		x	PASS	PASS	PASS	PASS

<sup>1</sup> One video hit noted. Subsequent analysis showed discontinuities of the encoded Transport Stream at the failure points.

<sup>2</sup> Loss of video noted. Subsequent analysis showed discontinuities of the encoded Transport Stream at the failure points.

TS12	Decoder	ATEME	MediaKind (Ericsson)	Harmonic	NEC	NTT
Encoder						
ATEME		x	x	x	x	x
MediaKind (Ericsson)		x	x	x	x	x
Harmonic		x	PASS	PASS	PASS	PASS
NEC		x	PASS <sup>1</sup>	PASS	PASS	PASS
NTT		x	PASS	PASS	PASS	PASS

<sup>1</sup> Decoder required a restart of service

# 2018 WBU-IMCG HEVC INTEROPERABILITY TESTING RESULTS

## AUDIO RESULTS

**2018 WBU-IMCG HEVC Interoperability Audio Results**

TS1	Decoder	AEME	MediaKind (Ericsson)	Harmonic	NEC	NTT
Encoder						
AEME		PASS	PASS	PASS	PASS	PASS
MediaKind (Ericsson)		PASS	PASS	PASS	PASS	PASS
Harmonic		PASS	PASS	PASS	PASS	PASS
NEC		PASS	PASS	PASS	PASS	PASS
NTT		PASS	PASS	PASS	PASS	PASS

TS2	Decoder	AEME	MediaKind (Ericsson)	Harmonic	NEC	NTT
Encoder						
AEME		PASS	PASS	PASS	PASS	PASS
MediaKind (Ericsson)		PASS	PASS	PASS	PASS	PASS
Harmonic		PASS	PASS	PASS	PASS	PASS
NEC		PASS	PASS	PASS	PASS	PASS
NTT		PASS	PASS	PASS	PASS	PASS

TS3	Decoder	ATEME	MediaKind (Ericsson)	Harmonic	NEC	NTT
Encoder						
ATEME		PASS	PASS	PASS	PASS	PASS
MediaKind (Ericsson)		PASS	PASS	PASS <sup>1</sup>	PASS	PASS
Harmonic		PASS	PASS	PASS <sup>1</sup>	PASS	PASS
NEC		PASS	PASS	PASS <sup>2</sup>	PASS	PASS
NTT		PASS	PASS	PASS <sup>2</sup>	PASS	PASS

<sup>1</sup> Audio hits at regular intervals noted

<sup>2</sup> Audio stutter noted

TS4	Decoder	ATEME	MediaKind (Ericsson)	Harmonic	NEC	NTT
Encoder						
ATEME		PASS	PASS	PASS	PASS	PASS
MediaKind (Ericsson)		PASS	PASS	PASS	PASS	PASS
Harmonic		PASS	PASS	PASS	PASS	PASS
NEC		PASS	PASS	PASS	PASS	PASS
NTT		PASS	PASS	PASS	PASS	PASS

TS5	Decoder	ATEME	MediaKind (Ericsson)	Harmonic	NEC	NTT
Encoder						
ATEME		PASS	PASS	PASS	PASS	PASS
MediaKind (Ericsson)		PASS	PASS	PASS	PASS	PASS
Harmonic		PASS	PASS	PASS	PASS	PASS
NEC		PASS	PASS	PASS	PASS	PASS
NTT		PASS	PASS	PASS	PASS	PASS

TS6	Decoder	ATEME	MediaKind (Ericsson)	Harmonic	NEC	NTT
Encoder						
ATEME		PASS	PASS	PASS	PASS	PASS
MediaKind (Ericsson)		PASS	PASS	PASS	PASS	PASS
Harmonic		PASS	PASS	PASS	PASS	PASS
NEC		PASS	PASS	PASS	PASS	PASS
NTT		PASS	PASS	PASS	PASS	PASS

TS7	Decoder	ATEME	MediaKind (Ericsson)	Harmonic	NEC	NTT
Encoder						
ATEME		x	x	x	x	x
MediaKind (Ericsson)		x	PASS	PASS	PASS	PASS
Harmonic		x	PASS	FAIL	PASS	PASS
NEC		x	PASS	PASS	PASS	PASS
NTT		x	PASS	PASS	PASS	PASS

TS8	Decoder	ATEME	MediaKind (Ericsson)	Harmonic	NEC	NTT
Encoder						
ATEME		x	x	x	x	x
MediaKind (Ericsson)		x	PASS	PASS	PASS	PASS
Harmonic		x	PASS	FAIL	PASS	PASS
NEC		x	PASS	PASS	PASS	PASS
NTT		x	PASS	PASS	PASS	PASS

TS9	Decoder	ATEME	MediaKind (Ericsson)	Harmonic	NEC	NTT
Encoder						
ATEME		x	x	x <sup>2</sup>	x	x
MediaKind (Ericsson)		x	PASS	x <sup>2</sup>	PASS	PASS
Harmonic		x <sup>1</sup>	x <sup>1</sup>	x <sup>1,2</sup>	x <sup>1</sup>	x <sup>1</sup>
NEC		x	PASS	x <sup>2</sup>	PASS	PASS
NTT		x	PASS	x <sup>2</sup>	PASS	PASS

<sup>1</sup> Non-compliant stream

<sup>2</sup> Dolby pass-through not available on decoder

TS10	Decoder	ATEME	MediaKind (Ericsson)	Harmonic	NEC	NTT
Encoder						
ATEME		x	x	x <sup>2</sup>	x	x
MediaKind (Ericsson)		x	PASS	x <sup>2</sup>	PASS	PASS
Harmonic		x <sup>1</sup>	x <sup>1</sup>	x <sup>1,2</sup>	x <sup>1</sup>	x <sup>1</sup>
NEC		x	PASS	x <sup>2</sup>	PASS	PASS
NTT		x	PASS	x <sup>2</sup>	PASS	PASS

<sup>1</sup> Non-compliant stream

<sup>2</sup> Dolby pass-through not available on decoder



TS11	Decoder	ATEME	MediaKind (Ericsson)	Harmonic	NEC	NTT
Encoder						
ATEME		x	x	x	x	x
MediaKind (Ericsson)		x	x	x	x	x
Harmonic		x	PASS	PASS	FAIL <sup>1</sup>	FAIL <sup>2</sup>
NEC		x	PASS	PASS	PASS	PASS
NTT		x	PASS	PASS	PASS	PASS

<sup>1</sup> Audio dropped out for approximately 2 seconds. Subsequent analysis showed discontinuities of the encoded Transport Stream at the failure points.

<sup>2</sup> Audio break up. Subsequent analysis showed discontinuities of the encoded Transport Stream at the failure points.

TS12	Decoder	ATEME	MediaKind (Ericsson)	Harmonic	NEC	NTT
Encoder						
ATEME		x	x	x	x	x
MediaKind (Ericsson)		x	x	x	x	x
Harmonic		x	PASS	PASS	PASS	PASS
NEC		x	PASS	PASS	PASS	PASS
NTT		x	PASS	PASS	PASS	PASS

# 2018 WBU-IMCG HEVC INTEROPERABILITY TESTING RESULTS

## LIP SYNC RESULTS

**2018 WBU-IMCG HEVC Interoperability Lip Sync Results**

TS4	Decoder	ATEME		MediaKind (Ericsson)		Harmonic		NEC		NTT	
		CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2
Encoder											
ATEME		0.5	0.5	5.5	5.5	14.4	14.4	7.8	7.8	5.1	5.1
MediaKind (Ericsson)		-4.8	-4.8	-0.1	0.0	-17.6	-17.6	2.4	2.4	0.0	0.0
Harmonic		-5.2	-5.1	-0.2	-0.1	-4.6	-4.5	2.1	2.2	-0.5	-0.5
NEC		-6.3	-6.3	-1.4	-1.3	-5.7	-5.7	0.9	0.9	-1.5	-1.5
NTT		-4.6	-4.5	0.4	0.4	-3.9	-3.9	2.7	2.7	0.3	0.3

TS5	Decoder	ATEME		MediaKind (Ericsson)		Harmonic		NEC		NTT	
		CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2
Encoder											
ATEME		0.4	0.5	5.4	5.5	4.4	4.4	6.2	6.3	5.1	5.1
MediaKind (Ericsson)		-5.3	-5.3	-0.5	-0.5	-34.7	-34.7	0.5	0.5	-0.5	-0.5
Harmonic		-5.3	-5.2	-0.3	-0.2	-10.9	-10.9	0.6	0.6	-0.4	-0.4
NEC		-4.9	-4.9	0.1	0.1	-20.9	-20.9	0.9	0.9	0.0	0.0
NTT		-4.6	-4.6	0.3	0.4	-3.9	-3.9	2.7	2.7	0.1	0.2

TS6	Decoder	ATEME		MediaKind (Ericsson)		Harmonic		NEC		NTT	
		CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2
Encoder											
ATEME		0.5	0.5	5.5	5.5	x <sup>1</sup>	4.4	7.2	7.3	5.1	5.1
MediaKind (Ericsson)		-4.9	-4.8	-0.1	-0.1	-0.9	-0.9	1.9	2.0	0.0	0.0
Harmonic		-5.2	-5.2	-0.3	-0.2	x <sup>1</sup>	-37.3	-2.4	-2.3	-0.4	-0.4
NEC		-6.1	-6.1	-1.1	-1.1	-38.1	-38.1	0.9	0.9	-1.2	-1.2
NTT		-4.6	-4.6	0.4	0.4	x <sup>1</sup>	x <sup>1</sup>	2.3	2.3	0.1	0.1

<sup>1</sup> Matchbox reader not able to get a valid measurement

TS9	Decoder	ATEME		MediaKind (Ericsson)		Harmonic <sup>1</sup>		NEC		NTT	
		CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2
Encoder											
ATEME		x	x	x	x	x	x	x	x	x	x
MediaKind (Ericsson)		x	x	0.0	0.0	x	x	1.1	1.1	0.0	0.0
Harmonic		x	x	x	x	x	x	x	x	x	x
NEC		x	x	-15.9	-15.9	x	x	16.1	16.1	-16.7	-16.7
NTT		x	x	-32.8	-32.8	x	x	-33.9	-33.9	-34.3	-34.3

<sup>1</sup> Decoder does not support Dolby pass-through

TS10	Decoder	ATEME		MediaKind (Ericsson)		Harmonic <sup>1</sup>		NEC		NTT	
		CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2
Encoder											
ATEME		x	x	x	x	x	x	x	x	x	x
MediaKind (Ericsson)		x	x	-0.1	-0.1	x	x	-1.2	-1.2	-0.2	-0.2
Harmonic		x	x	x	x	x	x	x	x	x	x
NEC		x	x	-9.4	-9.4	x	x	0.0	0.0	-0.2	-0.2
NTT		x	x	-30.1	-30.1	x	x	22.0	21.9	-20.2	-20.2

<sup>1</sup> Decoder does not support Dolby pass-through

TS11	Decoder	ATEME		MediaKind (Ericsson)		Harmonic		NEC		NTT	
		CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2
Encoder											
ATEME		x	x	x	x	x	x	x	x	x	x
MediaKind (Ericsson)		x	x	x	x	x	x	x	x	x	x
Harmonic		x	x	-0.5 <sup>1</sup>	-0.5 <sup>1</sup>	-18.3	-18.3	-1.5 <sup>1</sup>	-1.5 <sup>1</sup>	-0.6	-0.6
NEC		x	x	-15.3	-15.2	-9.8	-9.7	16.3	16.3	-15.5	-15.4
NTT		x	x	-33.0	-33.0	-34.1	-34.1	-34.0	-34.0	-33.1	-33.1

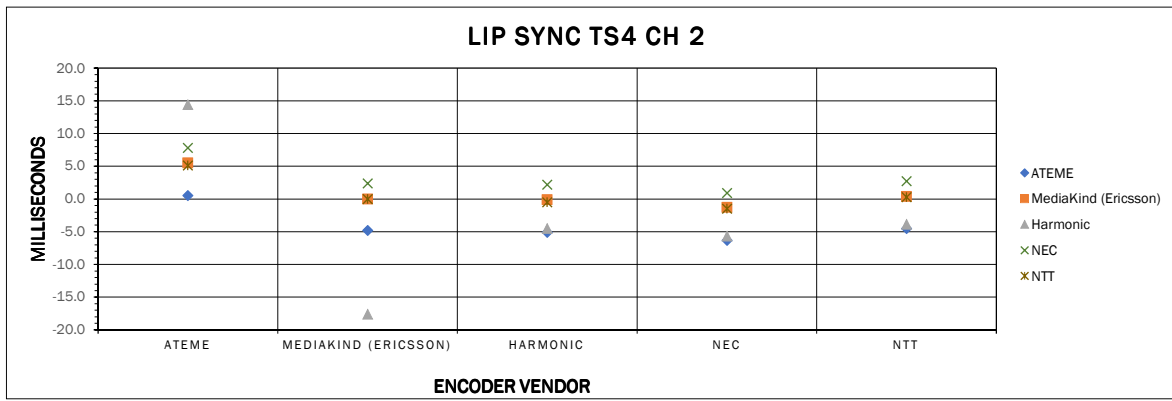
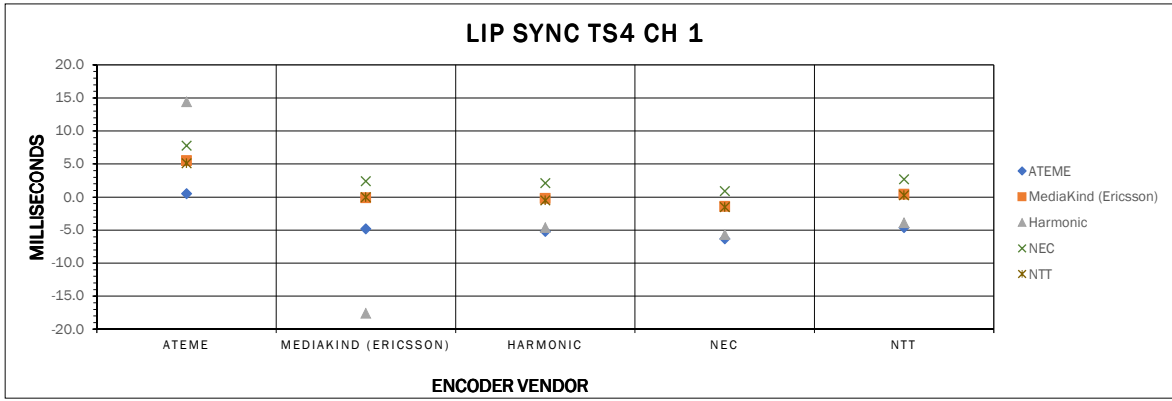
<sup>1</sup> First audio PID (258) was non-compliant had to lock decoder to second audio PID (259) in stream

TS12	Decoder	ATEME		MediaKind (Ericsson)		Harmonic		NEC		NTT	
		CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2
Encoder											
ATEME		x	x	x	x	x	x	x	x	x	x
MediaKind (Ericsson)		x	x	x	x	x	x	x	x	x	x
Harmonic		x	x	-0.4 <sup>1</sup>	-0.4 <sup>1</sup>	-1.7	-1.6	-1.6 <sup>1</sup>	-1.6 <sup>1</sup>	-0.7	-0.7
NEC		x	x	1.1	1.1	-9.8	-9.7	0.1	0.1	0.8	0.8
NTT		x	x	-19.1	-19.1	-32.3	-32.3	-20.2	-20.2	-19.4	-19.4

<sup>1</sup> First audio PID was non-compliant had to lock decoder to second audio PID

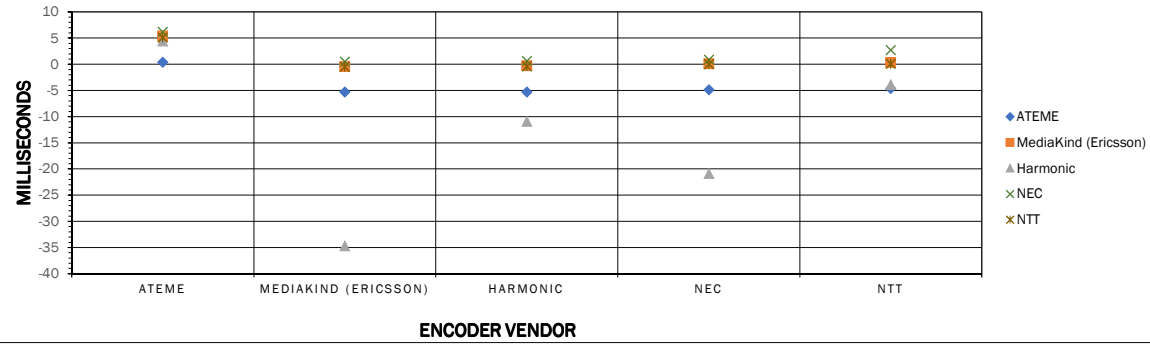
# 2018 WBU-IMCG HEVC INTEROPERABILITY TESTING RESULTS

## LIP SYNC RESULTS CHARTS

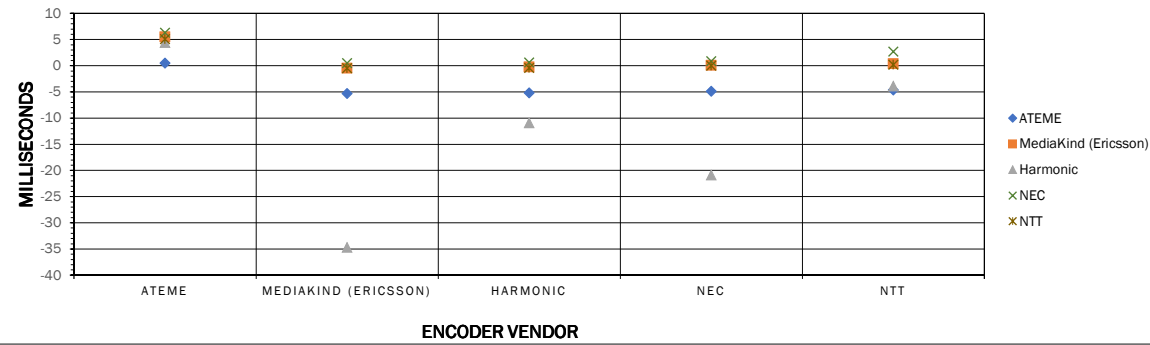




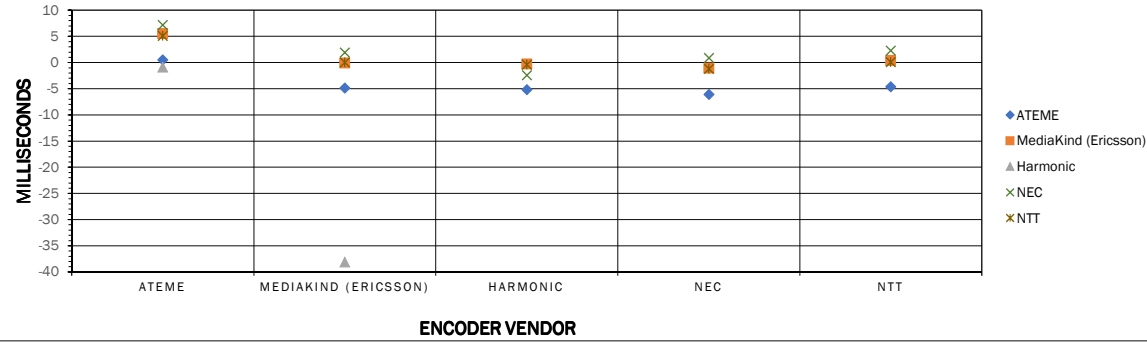
### LIP SYNC TS5 CH 1



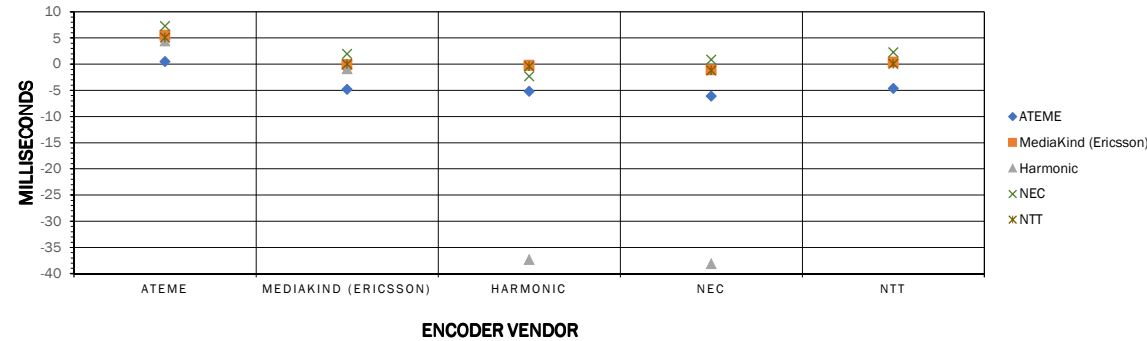
### LIP SYNC TS5 CH 2

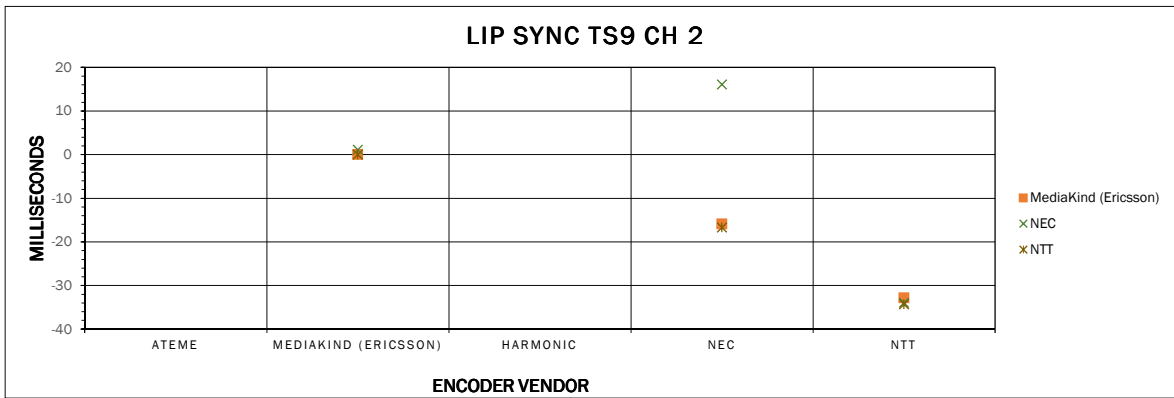
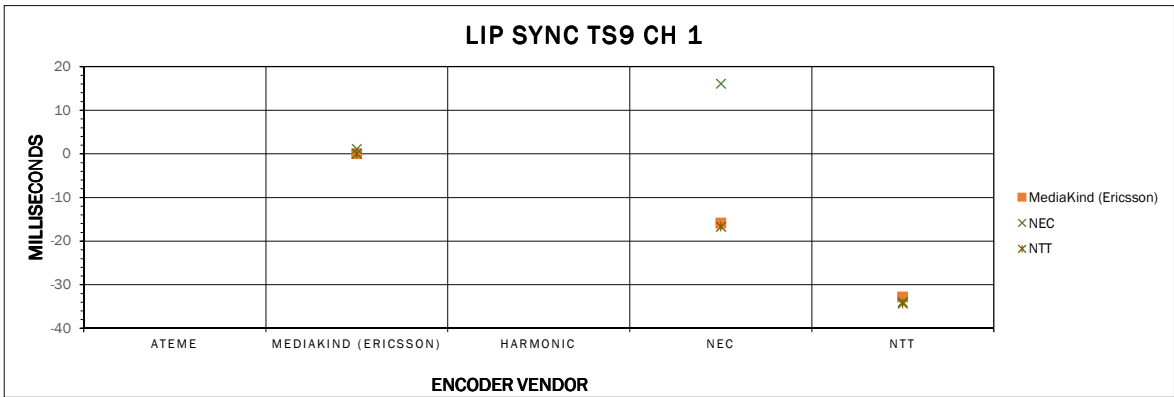


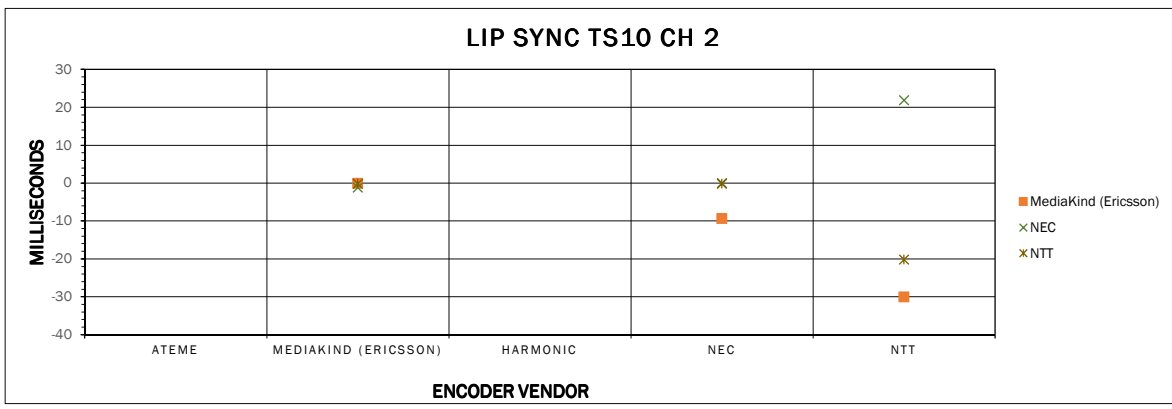
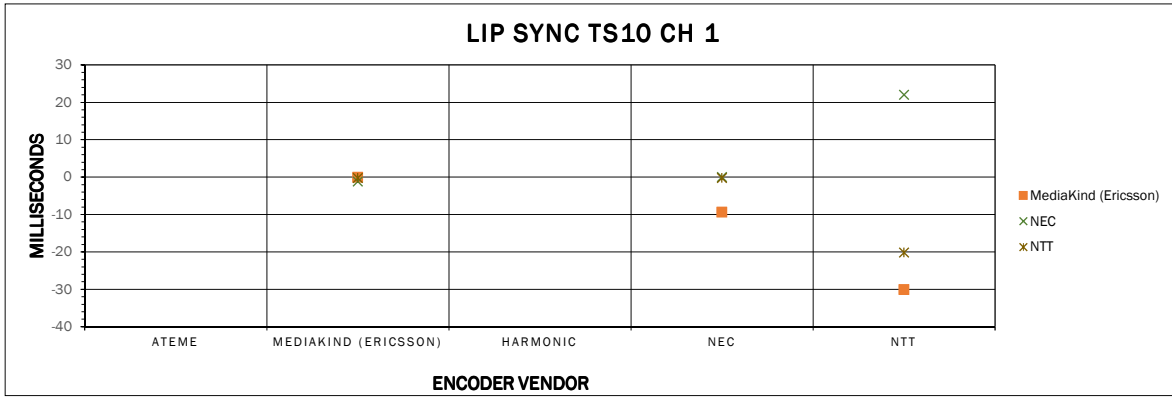
LIP SYNC TS6 CH 1

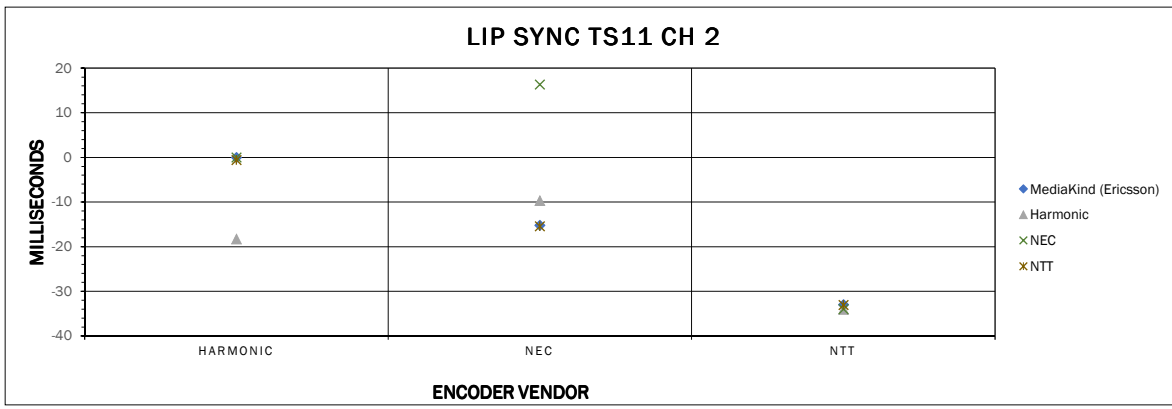
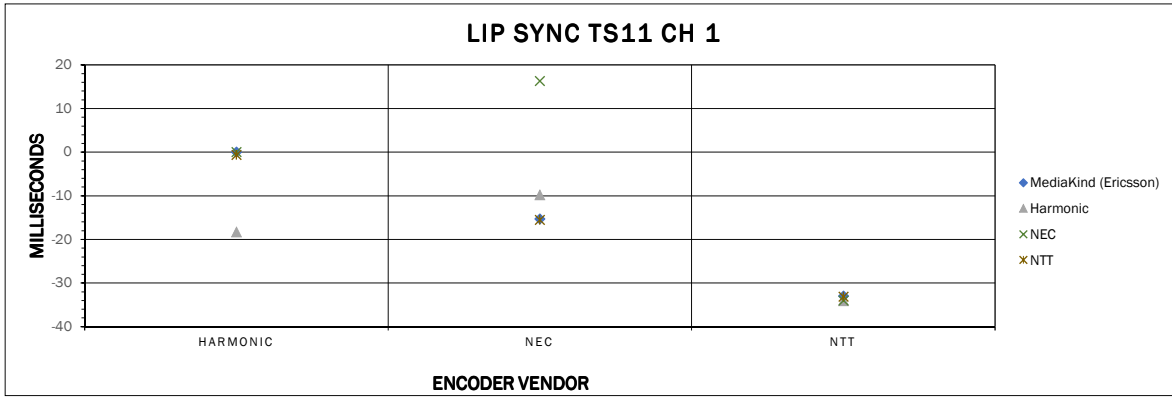


LIP SYNC TS6 CH 2

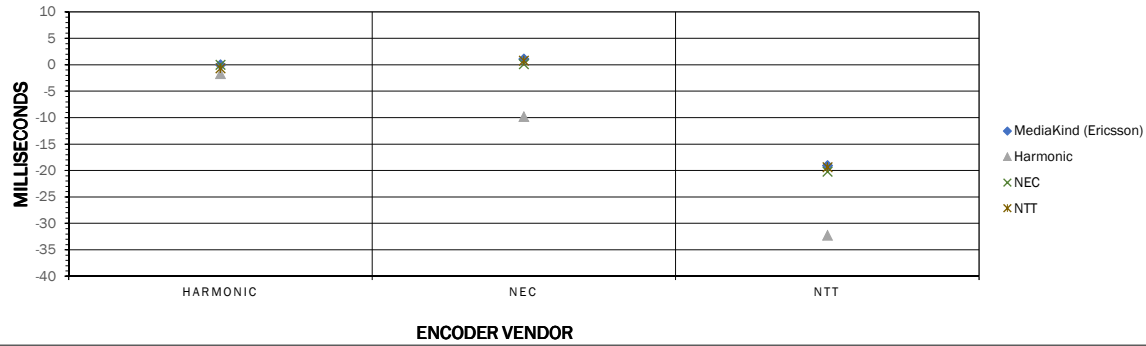




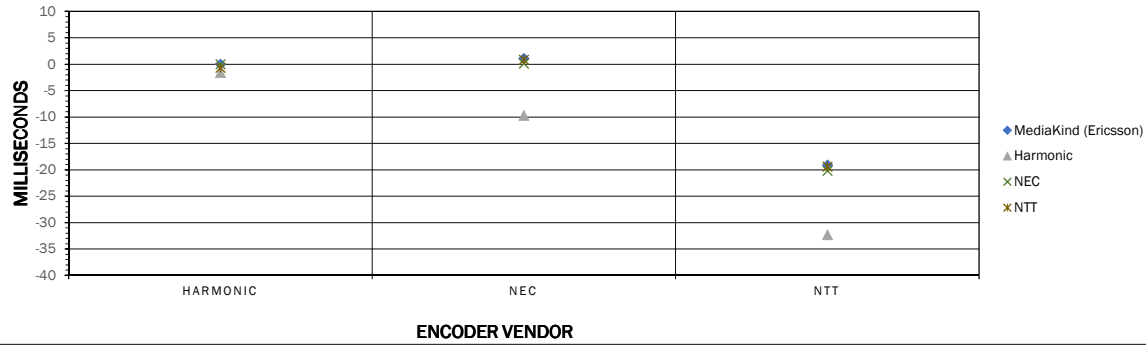




LIP SYNC TS12 CH 1



LIP SYNC TS12 CH 2



# 2018 WBU-IMCG HEVC INTEROPERABILITY TESTING RESULTS

## LIP SYNC TRANSPORT STREAM VALIDATION

**2018 WBU-IMCG HEVC Transport Stream Validation**

**Lip Sync Transport Streams Updated 9/12/18**

Vendor	ATEME	MediaKind (Ericsson)	Harmonic	NEC	NTT
<b>TS 4</b>					
Resolution	1280x720p	1280x720p	1280x720p	1280x720p	1280x720p
Frame Rate	59.94	59.94	59.94	59.94	59.94
Bit Rate (Mbps)	30	30	32	30	30
Chroma	4:2:2	4:2:2	4:2:2	4:2:2	4:2:2
Bit Depth	10	10	10	10	10
Audio Format	MPL2	MPL2	MPL2	MPL2	MPL2
Audio Bit Rate (kbps)	256	256	256	256	256
Sample Rate (kHz)	48	48	48	48	48
Packet Size (bytes)	188	188	188	188	188
<b>TS 5</b>					
Resolution	1920x1080i	1920x1080i	1920x1080i	1920x1080i	1920x1080i
Frame Rate	59.94	59.94	59.94	59.94	59.94
Bit Rate (Mbps)	30	30	32	30	30
Chroma	4:2:2	4:2:2	4:2:2	4:2:2	4:2:2
Bit Depth	10	10	10	10	10
Audio Format	MPL2	MPL2	MPL2	MPL2	MPL2
Audio Bit Rate (kbps)	256	256	256	256	256
Sample Rate (kHz)	48	48	48	48	48
Packet Size (bytes)	188	188	188	188	188
<b>TS 6</b>					
Resolution	1920x1080i	1920x1080i	1920x1080i	1920x1080i	1920x1080i
Frame Rate	50	50	50	50	50
Bit Rate (Mbps)	30	30	32	30	30
Chroma	4:2:2	4:2:2	4:2:2	4:2:2	4:2:2
Bit Depth	10	10	10	10	10
Audio Format	MPL2	MPL2	MPL2	MPL2	MPL2
Audio Bit Rate (kbps)	256	256	256	256	256
Sample Rate (kHz)	48	48	48	48	48
Packet Size (bytes)	188	188	188	188	188
<b>TS 9</b>					
Resolution	x	3840x2160p	3840x2160p	3840x2160p	3840x2160p
Frame Rate	x	59.94	59.94	59.94	59.94
Bit Rate (Mbps)	x	60	64	60	60
Chroma	x	4:2:0	4:2:2	4:2:2	4:2:2
Bit Depth	x	10	10	10	10
Audio Format	x	Unknown*	Unkown*	Unknown*	Unknown*
Audio Bit Rate (kbps)	x	2400	2400	2400	2400
Sample Rate (kHz)	x	Unknown*	Unkown*	Unknown*	Unknown*
Packet Size (bytes)	x	188	188	188	188
<b>TS 10</b>					
Resolution	x	3840x2160p	3840x2160p	3840x2160p	3840x2160p
Frame Rate	x	50	50	50	50
Bit Rate (Mbps)	x	63.5	64	60	60
Chroma	x	4:2:2	4:2:2	4:2:2	4:2:2
Bit Depth	x	10	10	10	10
Audio Format	x	Unknown*	Unkown*	Unknown*	Unknown*
Audio Bit Rate (kbps)	x	2400	2400	2400	2400
Sample Rate (kHz)	x	Unknown*	Unkown*	Unknown*	Unknown*
Packet Size (bytes)	x	188	188	188	188
<b>TS 11</b>					
Resolution	x	x	3840x2160p	3840x2160p	3840x2160p
Frame Rate	x	x	59.94	59.94	59.94
Bit Rate (Mbps)	x	x	84	80	80
Chroma	x	x	4:2:2	4:2:2	4:2:2
Bit Depth	x	x	10	10	10
Audio Format	x	x	Unkown*	Unknown*	Unknown*
Audio Bit Rate (kbps)	x	x	2400	2000	2400
Sample Rate (kHz)	x	x	Unkown*	Unknown*	Unknown*
Packet Size (bytes)	x	x	188	188	188
<b>TS 12</b>					
Resolution	x	x	3840x2160p	3840x2160p	3840x2160p
Frame Rate	x	x	50	50	50
Bit Rate (Mbps)	x	x	84	80	80
Chroma	x	x	4:2:2	4:2:2	4:2:2
Bit Depth	x	x	10	10	10
Audio Format	x	x	Unkown*	Unknown*	Unknown*
Audio Bit Rate (kbps)	x	x	2400	2000	2400
Sample Rate (kHz)	x	x	Unkown*	Unknown*	Unknown*
Packet Size (bytes)	x	x	188	188	188

x	No TS submitted
	Value outside of expected
Unknown*	TS Analyzer not licensed for Dolby and indicated Private data elementary stream