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Office of the Secretary

John Corstvet
3406 High Rd.
Middleton WI 53562-1021

jcorstvet@streamvu.biz
<http://streamvu.biz>
(608) 852-4887

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To: Federal Communications Commission

Petition for Rulemaking

With the television channel repacking and sharing of channels that will be the outcome of **Docket 12-268** - *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*

We need to utilize the available bandwidth in each television channel as efficiently as possible.

I propose 47CFR73.682 be amended to include the following or similar language:

Any television station sharing a digital broadcast channel transport stream with another station shall utilize progressive scan rather than interlaced scan as a High Definition digital broadcast television transmission standard.

I believe this rule is necessary because 720p can be encoded using significantly less bandwidth than 1080i for equivalent picture quality. When encoding with MPEG2 for broadcast in an ATSC 1.0 channel, bandwidth is at a premium. When two or more stations are sharing a 19.39 megabits/second channel, we can't afford to waste precious bandwidth on a technology that does not yield a definite viewable advantage.

Sharing facilities: combining two 19.39 megabit/second transport streams into one 19.39 mbit stream. It is obvious not all of the virtual channels supplied by the two stations will fit on the remaining channel. If one partner "hogs" a major part of the available 19.39 mbits/sec bandwidth for one 1080i video, the other partner will be negatively impacted. I believe this rule would put broadcast station partners on a level playing field and allow both to carry the maximum number of quality video services.

One important result of this rulemaking would be to encourage broadcast network entities to issue a rider to their affiliates' contractual agreement removing any mandate for having to use 1080i as the broadcast emission standard.

This petition should be acted upon as soon as possible since it will affect FCC required sharing agreements between stations.

A comprehensive article from Wikipedia that explains interlaced video can be found here:

http://en.wikipedia.org/wiki/Interlaced_video

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Two exhibits are provided to support this Petition for Rulemaking:

- Exhibit A – shows several broadcast transport streams which I’ve collected in my business, each with its video streams included in that transport stream. Audio, SI/PSIP and any miscellaneous data streams are not shown. This exhibit shows how 1080i is typically set to use more bandwidth than 720p. As an aside, it also shows how current model encoders can be set to lower bitrates than older encoders. The data for each video stream is as follows:
 - **Standard** shows what the video stream is: **1080i** indicates the High Definition stream is 1920 pixels wide by 1080 lines high and is interlace scanned. **720p** indicates the High Definition stream is 1280 pixels wide by 720 lines high and is progressive scanned (i.e. non-interlaced). **480i** indicates the standard definition stream is 704 visible pixels wide by 480 visible lines high and is interlaced.
 - **Packet Rate** is the bits-per-second average over the length (generally about 5 minutes) of the analyzed clip. This number will vary some from the bitrate configuration parameter in the encoder.
 - **T-STD Errors** indicates the accumulated, combined T-STD non-conformities over the length of the analyzed clip. Transport-System Target Decoder (T-STD), defined in ISO/IEC 13818-1 chapter 2.4.2, will generally show how hard the encoder is working in order to compress the video content in the clip to the specified bits-per-second rate (an encoder configuration parameter). I have found many video streams are not compliant with the T-STD. It depends on how severe the errors are whether a given consumer TV set can decode the stream without occasionally blinking black. The following T-STD errors are lumped together in the listing:
 - Decode time for an access unit exceeds 1000 milliseconds.
 - The Multiplexing Buffer overflowed.
 - The Multiplexing Buffer has not emptied for over 1000 milliseconds.
 - The Transport Buffer overflowed.
 - The Transport Buffer has not emptied for over 1000 milliseconds.
 - The Elementary Stream Buffer overflowed.

Each group of video streams is from a transport stream, with a blank line separating transport streams.

Standard	Packet Rate (Bits/Second)	T-STD Errors	Pgm Num	Comment
1080i	13,233,788	962,539	3	~10 yr. old encoder
480i	2,093,894	0	4	
480i	2,021,732	279	5	
1080i	15,020,257	206	3	~10 yr. old encoder
480i	2,597,087	51	4	

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1080i	17,315,907	0	4	
720p	13,385,602	0	3	Fox Network affiliate – Note 1
480p	2,257,553	0	4	
480i	2,197,413	0	5	
720p	10,362,483	0	3	~10 yr. old encoder
480i	4,218,188	0	4	
480i	2,737,762	0	5	
720p	9,355,803	0	3	Current model encoder
480i	2,435,866	0	4	
480i	2,435,052	0	5	
720p	7,758,557	5,660	3	Current model encoder
720p	6,471,492	18,258	4	
480i	2,326,336	0	5	
1080i	10,877,739	0	1	Current model encoder
480i	1,872,392	50	2	
720p	4,383,559	0	3	
1080i	11,222,013	0	1	Current model encoder
720p	4,465,753	10,127	2	
480i	1,458,413	2,682	3	

Note 1 – Fox Network encodes the network emission transport stream with 720p video which is sent via satellite to its affiliates. Each station re-multiplexes the Fox transport stream into their station transport stream, using stream splicing technique to switch to local breaks. Other networks feed compressed video over satellite to their affiliates which is then decoded back to SMPTE 259 (SD) or SMPTE 292 (HD) 1080i or 720p video, then handled in their plant the same as locally originated video.

- Exhibit B - The following 3 paragraphs are taken from page 10 and 11 of “Overview of the KLCS/KJLA Channel Sharing Pilot -A Technical Report”, available at the following URL:
<http://www.ctia.org/docs/default-source/fcc-filings/technical-report-of-the-klcs-kjla-channel-sharing-pilot.pdf>

There are two competing HD formats in use in the United States, 1080i and 720p. There are many arguments as to why one should use one over the other. Early users of HD chose 1080i primarily because it was the only equipment available. When 720p equipment became available, it ignited a debate about which format was "best" that continues today. Each format has its advantages and disadvantages and advocates exist for both formats. The major networks in the United States are divided in this as well. CBS and NBC have chosen 1080i, while ABC and Fox use 720p. PBS distributes in 1080i and their members use both 1080i and 720p for broadcast to the home.

Adding to the confusion is what happens at home. All screens have a native resolution whether it is 1080i, 720p or even 1080p which varies by manufacturer and model. No matter which format the broadcaster chooses, the receiver converts the signal to the screen's native resolution using a scaler device. Cable and satellite distribution further complicate the issue. Cable set top boxes can convert the signal, as well, to either 720p or 1080i, while satellite providers re-encode the signal to H.264 for delivery and their set-top box will convert it yet again. Most engineers are aware that they have little control over how their signals are displayed at home.

How does this affect channel sharing? Most broadcast encoder manufacturers are of the opinion that 720p can be encoded at lower bitrates, for a comparable Quality of Experience (QoE), than 1080i. Since broadcasters have no control over the final display format at home, it makes sense to use the most efficient encoding structure for final distribution over the air.

As we progress beyond ATSC 1.0, the Interlaced/progressive debate apparently will be rendered moot since new standards in place now and those being developed use only progressive scanning such as "4K" (approximately 4000 horizontal picture elements), one of which is UHD-1 3840 x 2160 pixels or 2160p, using the old designator methodology, are progressive scan. See http://en.wikipedia.org/wiki/Ultra-high-definition_television