

ATSC 8VSB

The Real Ensembles

Abstract

These are the relevant Ensembles that we have found to be of significant value when testing in the lab using ATSC generators for TV or STB manufacturers.

Introduction

Under lab conditions, we normally test with a clean signal from a generator. There are no interferences due to static or dynamic reflections. In the real world however, the situation is very different. The practical receiver, in the real world, never receives a clean off-air signal. Instead, the signal will be polluted by reflections from buildings as well as moving objects, causing spectral distortion to the incoming signal. These reflections are also known as multi-paths.

In the analog TV world, one would refer to this as 'ghosts' seen visually on you run-of-the-mill analog TV set. It is mostly tolerable even in a bad state as video is still seen and audio is still heard. For digital TV systems, such reflections can be damaging. This is due to the fact that it will mean that either the consumer will see a clear picture or none at all; no video, no audio.

To properly validate an ATSC 8VSB channel decoder, in those early days, would mean going to as many locations as possible and testing whether the technology works. From the effort spent on years of field-testing, various groups have managed to capture or approximate field conditions by separating the various reflection paths and recording them. With this record, and good 8VSB modulator equipment, one can very closely, approximate field conditions right in the lab itself by using these recorded reflection paths.

There are thousands of such ensembles available to the industry. To test them all would be impossible. With the industry now converging, we are now able to collect from each supplier as well as industry standards, ensembles that are considered to be 'problematic' and 'tough' to achieve.

Channel decoders, in the past always pride in their equalizer span. The equalizer span represents the delay of the reflection that the device can correct. Thus, the larger the equalizer-span; the better the channel decoder. However today, we have to take these claims with a pinch of salt. It's not necessarily true anymore.

Hence this report, our first task in truly testing the capability of the channel decoder itself, under simulated real-life 'problematic' scenarios. We are assuming the tuners used on the reference designs are as good any the other. Multi-path handling lies fully (well, almost) on the capability of the channel decoder itself.

The Ensembles



We've compiled a comprehensive list of formidable ensembles to test the channel decoders, all of which are 'infamous' for destroying the hopes of channel decoder manufacturers.

- The Brazillian Ensembles (these are the ensembles that basically delayed ATSC implementation in the US for over a year)
- Communications Research Centre (CRC) Ensemble (CRC is a highly regarded ATSC test centre based in Canada)
- ATSC A/74 Recommended Practices Ensembles (The A/74 document was finalized mid of 2004 to set the baseline for ATSC performance)
- ACATS (FCC's Advisory Committee on Advanced Television Service) Ensemble
- Chicago/Seoul Ensembles (LG provided this information, it will be interesting to test the other channel decoders with LG's most formidable ensemble collection)

The Ensembles

Ensemble Classification	MultiPath Ensemble	Channel Simulator Parameter	Path 1	Path 2	Path 3	Path 4	Path 5	Path 6	
Brazilian Ensembles	Brazil A	Delay (uS)	0	0.15	2.22	3.05	5.86	5.93	
		Attenuation (dB)	0	13.8	16.2	14.9	13.6	16.4	
		Phase (degrees)	0	0	0	0	0	0	
		Doppler (Hz)	-	-	-	-	-	-	
	Brazil B	Delay (uS)	0	0.3	3.5	4.4	9.5	12.7	
		Attenuation (dB)	0	12	4	7	15	22	
		Phase (degrees)	0	0	0	0	0	0	
		Doppler (Hz)	-	-	-	-	-	-	
	Brazil C	Delay (uS)	0	0.09	0.42	1.51	2.32	2.8	
		Attenuation (dB)	2.8	0	3.8	0.1	2.5	1.3	
		Phase (degrees)	0	0	0	0	0	0	
		Doppler (Hz)	-	-	-	-	-	-	
	Brazil D	Delay (uS)	0.15	0.63	2.22	3.05	5.86	5.93	
		Attenuation (dB)	0.1	3.8	2.6	1.3	0	2.8	
		Phase (degrees)	0	0	0	0	0	0	
		Doppler (Hz)	-	-	-	-	-	-	
	Brazil E	Delay (uS)	0	1	2	OFF	OFF	OFF	
		Attenuation (dB)	0	0	0				
		Phase (degrees)	0	0	0				
		Doppler (Hz)	-	-	-				
Special Brazil C	Delay (uS)	0	0.09	1.51	1.51	2.32	2.8		
	Attenuation (dB)	2.8	0	20	0	2.5	1.3		
	Phase (degrees)	0	0	-	0	0	0		
	Doppler (Hz)	-	-	0.05	-	-	-		
Modified Brazil C	Delay (uS)	0	0.09	0.42	1.51	2.32	2.8		
	Attenuation (dB)	2.8	0	3.8	Variable	2.5	1.3		
	Phase (degrees)	0	0	0	-	0	0		
	Doppler (Hz)	-	-	-	0.05	-	-		
Modified Brazil D	Delay (uS)	0.15	0.63	2.22	3.05	5.86	5.93		
	Attenuation (dB)	Variable	3.8	2.6	1.3	0	2.8		
	Phase (degrees)	-	0	0	0	0	0		
	Doppler (Hz)	0.05	-	-	-	-	-		
Communications Research Centre	CRC Dynamic	Delay (uS)	0	-1.8	0.15	1.8	5.7	35	
		Attenuation (dB)	#1	0	20	20	10	Variable	18
			#2	0	17	17	7		15
			#3	0	14	14	4		12
			#4	0	11	11	1		9
		Phase (degrees)	0	125	80	45	-	90	
Doppler (Hz)	-	-	-	-	-	1 or 5Hz	-		
A/74 Recommended Specific	A/74 ATSC R2.1 (similar to CRC Dynamic)	Delay (uS)	0	-1.8	0.15	1.8	5.7	35	
		Attenuation (dB)	#1	0	20	20	10	Variable	18
			#2	0	17	17	7		15

		#3	0	14	14	4		12
		#4	0	11	11	1		9
		Phase (degrees)	0	125	80	45	-	90
		Doppler (Hz)	-	-	-	-	0 to 5Hz	-
	A/74 ATSC R2.2	Delay (uS)	0	-1.8	0.15	1.8	5.7	39.8
	Attenuation (dB)	#1	0	15	15	7	7	15
		#2	0	8	3	4	3	12
		#3	0	3	1	1	3	9
	Phase (degrees)	0	125	80	45	5.7	90	
	Doppler (Hz)	0	-	-	-	0 to 5Hz	-	
ACATS	ACATS Ensemble A	Delay (uS)	0	-1.8	0.15	1.8	5.7	18
		Attenuation (dB)	0	20	20	10	Variable	18
		Phase (degrees)	0	∅+288	∅	∅ +72	∅ +144	∅ +216
		Doppler (Hz)	-	-	-	-	-	-
Chicago/Seoul Ensembles (Provided by LG)	Chicago/Seoul Ensemble 1	Delay (uS)	0.1	0.35	10.5	10.7	11.8	11.9
		Attenuation (dB)	1.5	1	0	0	0.5	0
		Phase (degrees)	0	0	0	0	0	0
		Doppler (Hz)	-	-	-	-	-	-
	Chicago/Seoul Ensemble 2	Delay (uS)	0	4	5	8	10	25
		Attenuation (dB)	2	1.5	2.5	0	1	2
		Phase (degrees)	0	0	0	0	0	0
		Doppler (Hz)	-	-	-	-	-	-
	Chicago/Seoul Ensemble 3	Delay (uS)	0	0.35	4.65	5.75	6.35	7.5
		Attenuation (dB)	2	1	1	0	0.5	0
		Phase (degrees)	0	0	0	0	0	0
		Doppler (Hz)	-	-	-	-	-	-
	Chicago/Seoul Ensemble 4	Delay (uS)	0	0.3	0.5	0.7	1.3	8
		Attenuation (dB)	1	1	0.5	1	0.5	0
		Phase (degrees)	0	0	0	0	0	0
		Doppler (Hz)	-	-	-	-	-	-
	Chicago/Seoul Ensemble 5	Delay (uS)	0	0.4	13	14	15	16
		Attenuation (dB)	1	0	1	1	1.5	1
		Phase (degrees)	0	0	0	0	0	0
		Doppler (Hz)	-	-	-	-	-	-

  Represents the rounded up figure to suit SFQ application