EMWIN-N Document 2

EMWIN Receive Station Specifications

This specification specifies the requirements for an EMWIN receiver station that will be able to receive the next generation GOES-N EMWIN signal. It also includes a general description of the Data Link Libraries (DLL) or software that NOAA will provide to perform the more complex demodulation and decoding functions of the receiver. These DLL's are also designed to demodulate the existing GOES-I EMWIN signal to facilitate the user's transition from GOES-I broadcasts to GOES-N broadcasts. More detailed descriptions of the DLL's are provided in additional documentation.

EMWIN-N Document 2

EMWIN Receive Station Specifications

Introduction

The EMWIN Receive Station described herein is a dual purpose station that should satisfy both existing (i.e., GOES I-M) and future (i.e., GOES N-P) broadcast requirements and is designed to facilitate transition from EMWIN-I to EMWIN-N. The user data format, content and basic capacity will not change appreciably. The major EMWIN receiver characteristics for the existing and new systems (i.e. EMWIN-I and EMWIN-N) are summarized in the following table.

Major EMWIN Receiver Characteristics

Characteristic	EMWIN I-M	EMWIN N-P	Comment	
Receive Frequency	1690.725 MHz	1692.700 MHz	Dual frequency capability should facilitate operational cutover during the transition phase	
G/T	-0.3 dB	-0.3 dB	Since this characteristic has not changed, the existing antenna, and perhaps the LNA, should be reusable	
Modulation	DFSK	BPSK	Dual modulation capability should facilitate operational cutover during the transition phase	
Coding	None	R-S, ½ Rate Convolutional	Conforms to CCSDS	

Technical Description

The EMWIN receiver should perform the typical "front end" RF and IF functions as well as the demodulation and data recovery functions required to receive and display GOES EMWIN Geostationary satellite broadcast data. The objective for the Energy per symbol (E_S) to Noise (N_O) ratio (E_S/N_O) is at least 11.5 dB.

NOAA will provide Data Link Libraries (DLL's) to perform the demodulation and data recovery functions. These DLL's will be manually configurable to demodulate both the digital GOES-I DFSK

signal and the GOES-N BPSK signal. For EMWIN-I operations the DLL's will generate the original EMWIN bit stream. For EMWIN-N operations the DLL's will decode the Forward Error Correction (FEC) coded signal to recover and then generate the original EMWIN bit stream. The DLL's are designed to run on a conventional PC (e.g, Pentium IV) running Windows NT/2000/XP and will leave sufficient capacity to run additional EMWIN display and data management software.

Utilization of the NOAA provided DLL's will require an A/D converter to interface with the RF/IF front end. This A/D converter should convert the analogue IF data to a digital format. The converter should have a nominal passband of 50 KHz and minimum sampling rate of 96 kilosymbols per second (Ksps) with 16 bits/sample. Typical PC sound cards should meet this requirement.

RF/IF Performance Objectives

The EMWIN RF section should be designed to receive, filter, amplify and downconvert the 50 KHz EMWIN L-band signal. The G/T of the antenna should be at least -0.3 dB which is the same requirement for both EMWIN -I and EMWIN-N. The optimal preselector filter should closely match the efficient filter characteristics of the uplink which are similar to a Square Root Raised Cosine (SRRC) filter pattern. The low noise amplifier (LNA) should have a noise figure less then 2 dB. The LNA RF output should then be downconverted to an appropriate IF frequency

The EMWIN IF section should amplify the IF frequency sufficiently to interface with the Analogue to Digital (A/D) converter. It should have a frequency stability of at least 5 ppm.

The RF Section of the receiver requires an 11.5 Es/No and a "matched" (e.g., SRRC or approximate equivalent) preselect filter for optimal performance.

Coding and Data Format

The Convolutional Code follows the CCSDS recommendation and has been selected to be the same as the LRIT broadcast. The code parameters are: Rate = ½, Constraint Length = 7, no G2 Symbol Inversion.

The Interleave Depth follows the CCSDS recommendation and has been selected to be the same as the LRIT broadcast. The Interleave is depth is 4.

The Reed-Solomon Code Descriptors and Symbol Size Code follow the CCSDS recommendation and have been selected to be the same as the GOES LRIT broadcast. The CCSDS Reed-Solomon (255, 223) corrects 16 symbol errors per interleave. There are 255 total Bytes per interleave (prior to virtual fill), 223 input Bytes (prior to coding) per interleave, and 32 Reed-Solomon check symbols per interleave. The CADU contains 8192 bits (including 32 bits ASM and 1024 Reed-Solomon check symbols); 4 interleaves with 892 data and 128 check symbols.

EMWIN-N Document 2

Data Link Library (DLL) Input Summary

A/D Converter (e.g., sound card)
- Sample rate of > 96 Ksps
- 16 bits per sample
- TCP/IP socket output
- 50 KHz bandwidth
- -10 dBm nominal output level

Data Link Library (DLL) Output Summary

DFSK:
- Output Data (demodulated DFSK bitstream)
- TCP/IP Socket (data only, no start/stop bits)
- RS-232 Serial Output (V.35, 9600 baud, 8, N, 1)
- Effective Data Rate: 7680 bps

BPSK:
- Output Data (demodulated, CCSDS processed bitstream)
- CCSDS Error Detection and Correction
- CCSDS CADU, VCDU, BPDU Wrapper removed
- TCP/IP Socket (data only, no encapsulation)
- RS-232 Serial Output (V.35, 19200 baud, 8, N, 1, gaps inserted)
- Effective Data Rate: 9537 bps