SSEEM SYSTEM

Benefits

Due to the large number of satellites, it is increasingly difficult to find an interference-free orbital slot, particularly in Ku band. Consequently, the opportunity to carry out the measurement of the radiation pattern using a CW, which is the traditional method, is limited. Instead, the features of the proposed Spread Spectrum (SS) modulation ensure both up-link and down-link interference can be tolerated and provide a real benefit compared with the use of the CW signal.

Finally, it is worth nothing that the SSEEM system comes with a smart web-based graphical user interface and that the TX Modem, that is typically delivered to the location of the SUT, is compact, easy to install and can be fully managed from remote. In fact, it can automatically create a VPN with the reference station via a local internet connection, such as using the tethering function of the smartphone of the SUT operator or a WIFI hotspot.

Comparison between radiation patterns measured with SSEEM System (blue) and CW (red)

SSEEM SYSTEM

mbi

The SSEEM (Spread SpEctrum Esva Measurement) System allows Satellite Operators to measure the co- and crosspolar radiation pattern of the transmit/receive antennas of ground stations during Earth Station Verification and Assistance (ESVA) tests. It is a compact and innovative product based on a spread spectrum approach.

SSEEM SYSTEM

Key Features

● Possibility to perform the measurement of the radiation pattern of the System Under Test (SUT) antenna also using satellite transponder already in use by commercial carriers, such as DVB.

● Ability to operate in the presence of very high interference, with negative values of C/N, thanks to the use of the new spread-spectrum signal, namely H3SB (Highly Spread Spectrum Slotted Burst).

● The H3SB protocol is an evolution of the Enhanced Spread-Spectrum Aloha (ESSA) waveform that allows the system to be operated with values of power up to 56 dB lower than the power of the noise or of the carrier (i.e. DVB) that is already using the transponder or, more generally, than the power level of an interfering signal.

● Opportunity to measure the linearity of the communication channel and, if necessary, to perform its linearization.

● Full management of the platform via a smart web-based graphical user interface. The developed platform also has embedded post-processing software tools which process the collected data.

● A compact SDR-based form factor. The TX Modem can be remotely controlled by the Reference Station staff via a VPN that is automatically setup by the TX Modem using the Internet connection of the smartphone of the SUT operator.

H3SB Protocol Specifications

In addition to 72 MHz one, the following bandwidths are available (MHz): 36, 18, 9, 4.5, 2.25, 1.125, 0.563, 0.281 and 0.141MHz. Assuming 72 MHz bandwidth, the main features of the H3SB protocol are as follows:

● C/N min= -56,5 dB meaning an overall processing gain of 62,6 dB
● Overall Spreading Factor=524.288
● SRRC shaping with roll-off = 0,125
● SEEM measurement rate: adjustable from 5,425 to 54,25 measure/s

Form Factor

SSEEM is based on an SDR-GPU architecture composed of commercial hardware. The main components are the TX Modem (one tower PC and an SDR device) to which a power meter is connected and the RX Modem (a rack-mountable server and an SDR device).

Hardware architecture
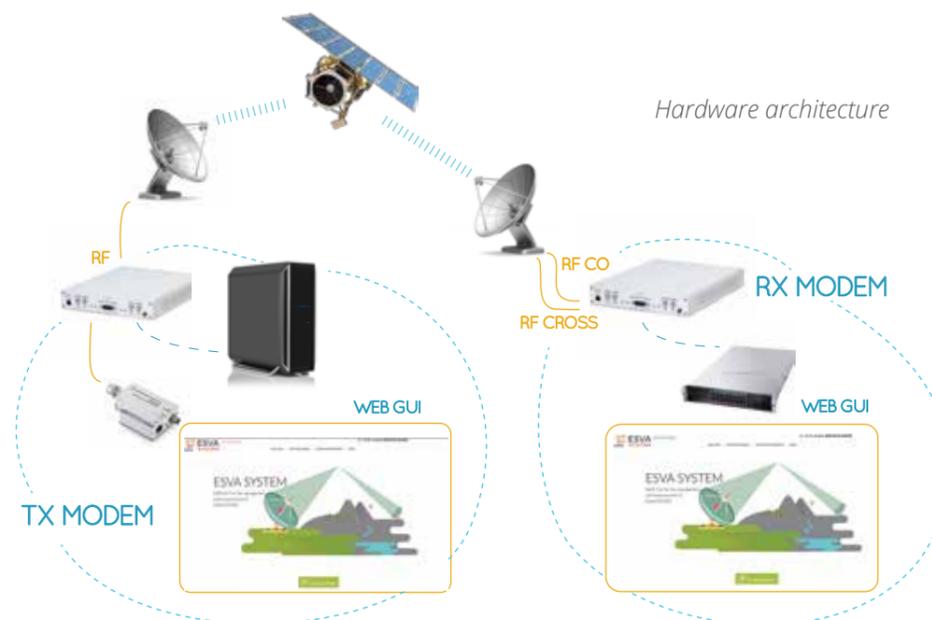
Real Use cases

Here are the results of a measurement performed using the SSEEM System deployed at the ERS station located at Aflenz (Austria). The SSEEM system was used to measure the TX radiation pattern of a 6.1 m satellite antenna using co- and cross polar transponders of the Eutelsat satellite E21B, already used by a 15 MHz DVB carrier. Both the SSEEM signal and the DVB carrier were emitted and received from Aflenz with the following EIRP: the DVB carrier 64 dBW and the SSEEM signal 52,5 dBW.

The SSEEM system used a bandwidth of 18 MHz and was received by the SSEEM receiver with a power level approximately 12 dB lower than that of the DVB. Finally, the Tx power of the SSEEM system was increased by 27 dB when the SUT antenna was slewed more than ± 0,5°. Despite the fact that the SSEEM signal was not visible on the spectrum of the DVB carrier, it was possible to measure the radiation pattern of the antenna in great detail, performing the antenna mapping up to ± 20°.

Radiation patterns measured with SSEEM System below DVB signal; co-polar (blue) and cross-polar (red)