

**MASSACHUSETTS INSTITUTE OF TECHNOLOGY
HAYSTACK OBSERVATORY
WESTFORD, MASSACHUSETTS 01886**

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*Telephone: 617-715-5571**Fax: 617-715-0590*

To: EDGES Group
From: Alan E.E. Rogers
Subject: Estimates of RFI emissions from EDGES-3

1] Limit on emissions from 200-1400 MHz

Measurements made in the Haystack screen room using a broadband 30-1300 MHz disc cone antenna placed about 1 m from the EDGES-3 receiver box and connected to a Fieldfox N9917A spectrum analyzer with preamplifier turned on failed to detect any signal above the spectrum analyzer noise level of about -108 dBm. Figure 1 shows the setup and Figure 2 is the spectrum from 50-1400 MHz with 100 kHz resolution. The screen room has metal walls and ceiling without any absorber so almost all the RFI radiated by EDGES-3 should be picked by the antenna connected to the spectrum analyzer. In order to make any potential RFI more detectable the cover was left off the receiver box. Tests were made with the EDGES-3 spectrometer running. Figure 3 shows the spectrum with all EDGES electronics, fluorescent lights and battery charging electronics turned off. The emissions at about 290 MHz are from the N9917A spectrum analyzer which took the spectra. Other spikes and the step down at about 500 MHz are from the analyzer and are present when the antenna is disconnected.

2] Limits on emissions with the EDGES-3 VNA turned on and connected to EDGES-3 antenna.

Both EDGES-2 and EDGES-3 occasionally radiate for a few seconds a sweep from 5-200 MHz when the antenna S11 is measured with a VNA during a scheduled calibration. The VNA power is less than 10mW and since the EDGES beam is below -20 dBi at 1 degree elevation most radiated signal goes into the sky. The path loss between 2 EDGES antennas 100 m apart is estimated in memo to be 79 dB. Assuming an inverse square law the signal received at another antenna 10 km away will be below -119 dBm.

3] Field tests of EDGES-3

Field tests of EDGES-3 at West Forks Maine and Skull Creek Oregon in memos 306 and 310 show that there is no significant RFI being radiated in the 55-120 MHz band.

4] Shielding provided by outer box

A "spot" check of the shielding of the outer box was made by placing an Explorer Signal generator inside the antenna box connected to a wire antenna so that a comparison can be made of the signal strength. Difference between cover on and cover off. Measurements at 90, 200, 500 and 1000 MHz all exceeded 50 dB even without using all the screws. In practice, the out box of the EDGES-3 prototype with all screws tightened has about 80 dB shielding and the new EDGES-3 which is under construction will have even better shielding.

Summary of RFI emissions from EDGES-3

Limits from 50-1400 MHz

< - 110 dBm/100 KHz at 1 m

< -160 dBm/Hz at 1 m

With antenna box cover off and with cover on

< -210 dBm/Hz at 1 m

Based on measurements of box cover shielding > 50 dB from memo 299 and spot checks made at 200, 500 and 1000 MHz so that the RALI MS32 standard should be met a distance > 20 meters.



Figure 1. Set-up for tests of emissions from EDGES-3 electronics.

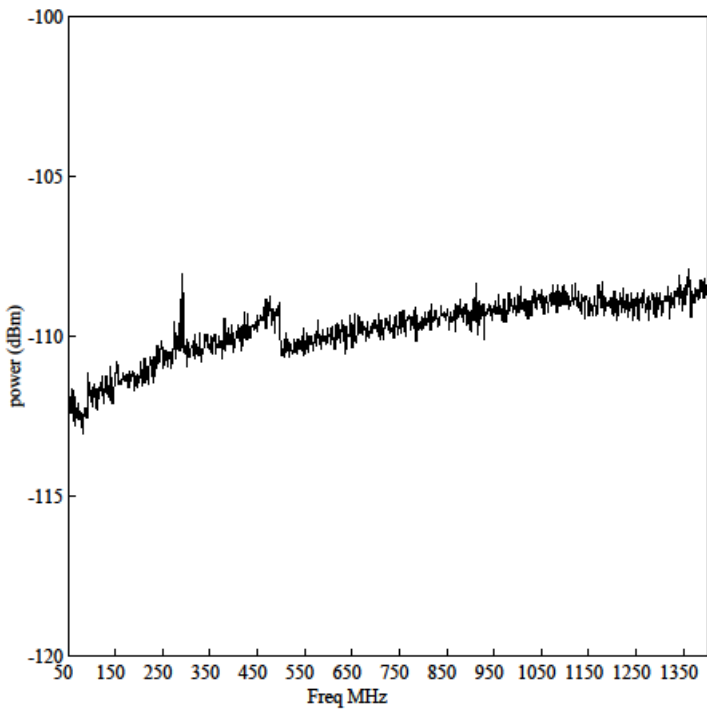


Figure 2. Spectrum with EDGES-3 spectrometer running.

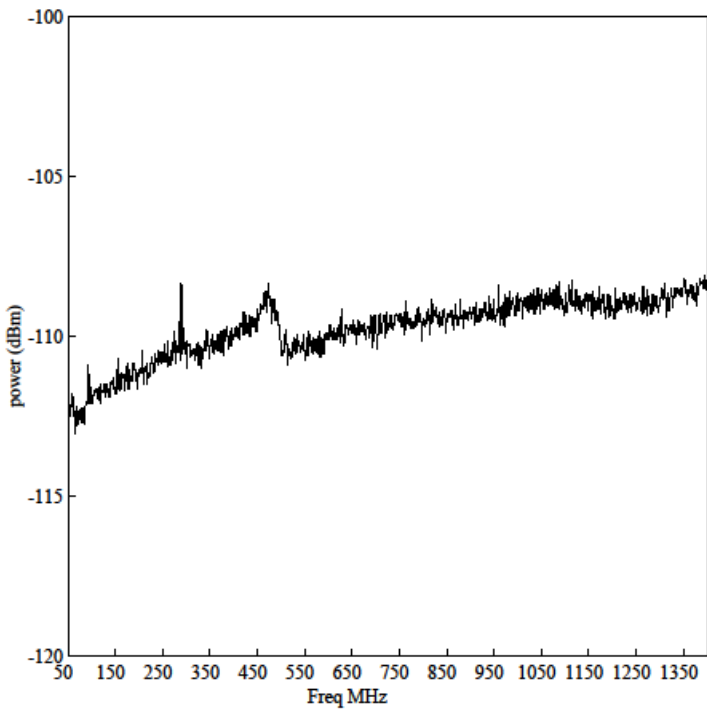


Figure 3. All EDGES electronics turned off.