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RBSP EFW ETU Instrument EMC Test Report

Using the EFW ETU IDPU and ETU SPB an EMC Test was performed on the Instrument power lines for CE-01, CE-03, CE-07.

Configuration as per RBSP EMECP

Due to some technical obstacles the plots on the spectrum analyzer stubbornly refused to be downloaded in digital format and so the test conductor had to resort to the old fashioned digitization method.

All CE01 and CE03 measurements are taken as per figure 5.4 page 41 of RBSP EMECP.

### CE01 Test Requirements

This test requirement is to demonstrate that the levels of low frequency conducted current emissions on input power and interface signal lines do not exceed the specified limits. The specified limits start at 50 Hz but measurements shall continue down to 10 Hz for information only. Be careful of 60 Hz and harmonic noise from the GSE coupling into the test system. Applicable test parameters and limits are as follows:

A) Differential currents are to be measured on the following lines:

1. Power input (single leg measurement)
2. Power input return (single leg measurement)
3. True differential current on power, only if 1 or 2 exceeds specification limit. This measurement is acquired by passing the return line outside the probe and looping it back inside the probe to cancel the common mode current, and then dividing the measured current by two.

B) Common mode currents are to be measured on the following lines:

1. Power input with return including heater circuits.
  2. All other interface lines collectively at each connector (except RF).
- C) Narrowband measurements are to be made with an effective bandwidth not exceeding 120Hz.  
D) No CE-01 broadband measurements are required.

E) Differential mode test limits are 80 dB $\mu$ A (10 mA rms) from 50 Hz to 10 kHz then decreasing to 70 dB $\mu$ A at 15 kHz.

F) Common mode test limits are 60 dB $\mu$ A (1.0 mA rms) from 50 Hz to 10 kHz then decreasing to 50 dB $\mu$ A at 15 kHz.

G) Refer to Figure 4.1&2.

### CE03 Test Requirements

This test requirement is to demonstrate that the levels of high frequency conducted current emissions on input power and interface signal lines do not exceed the specified limits. The specified limits stop at 1 MHz but measurements shall continue up to 50 MHz for information only. Applicable test parameters and limits are as follows:

A) Interface lines to be measured are the same as previously described for CE-01 for both differential and common mode measurements.

B) Differential mode narrowband test limits are 70 dB $\mu$ A (~3.1 mA rms) from 15 kHz decreasing to 60 dB $\mu$ A (1 mA rms) at 400 kHz from which it continues at that level to 1MHz.

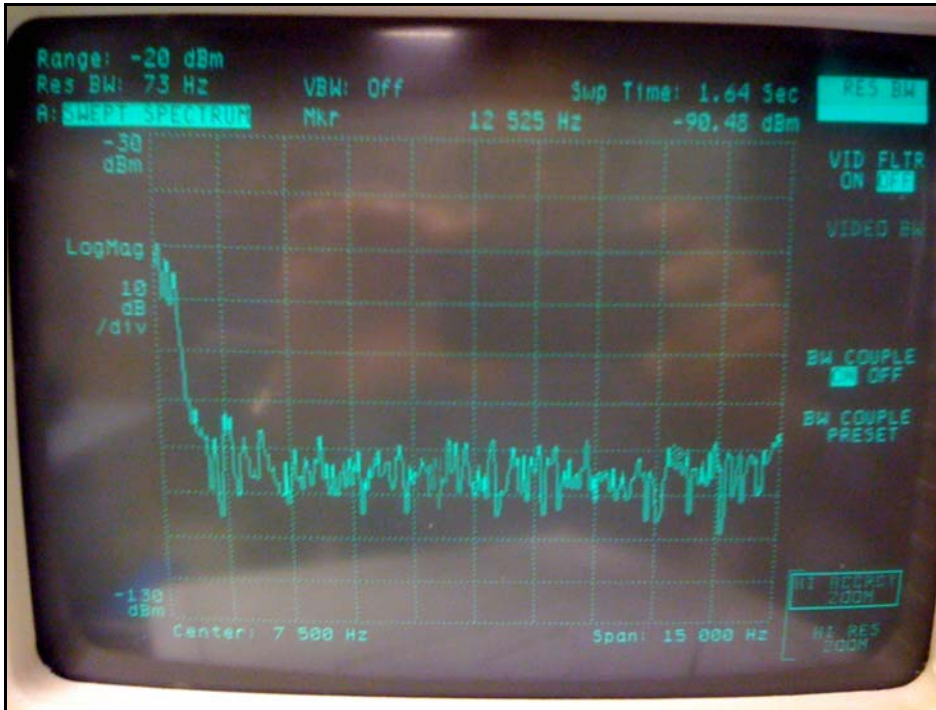
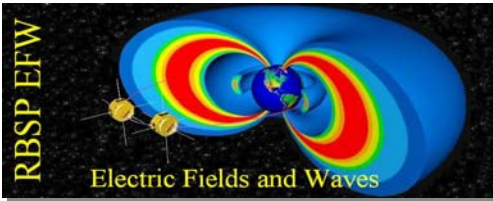
C) Common mode narrowband test limits are 50 dB $\mu$ A (~316 $\mu$ A rms) from 15 kHz decreasing to 40 dB $\mu$ A (100  $\mu$ A rms) at 400 kHz from which it continues at that level to 1MHz.

D) No CE-03 broadband measurements are required.

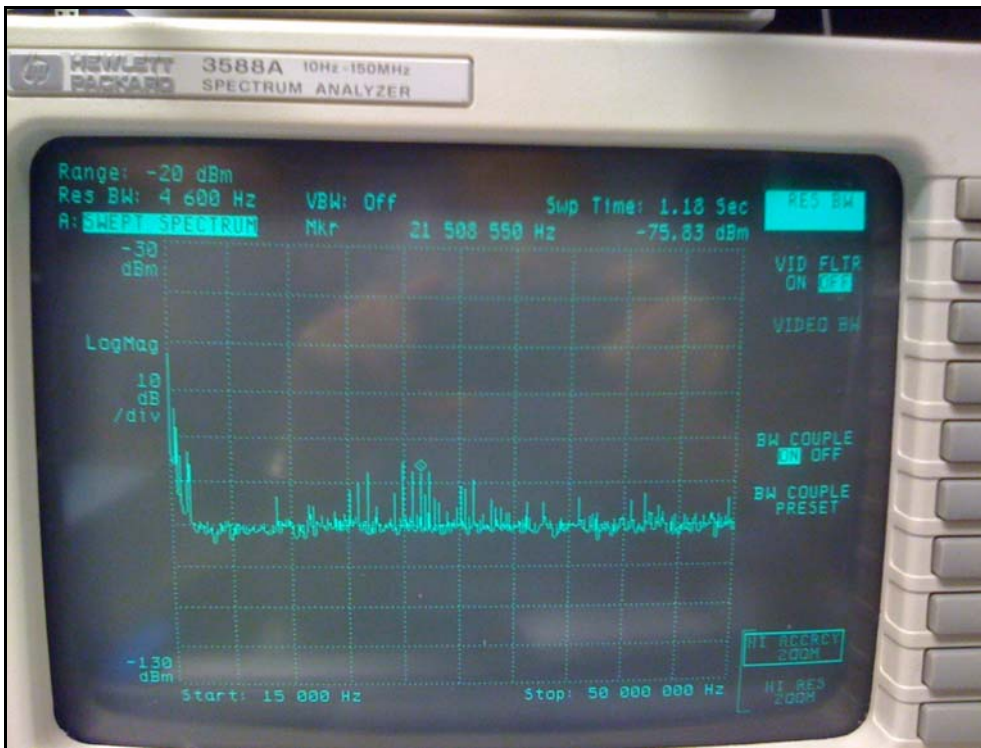
E) Refer to Figure 4.1&2.

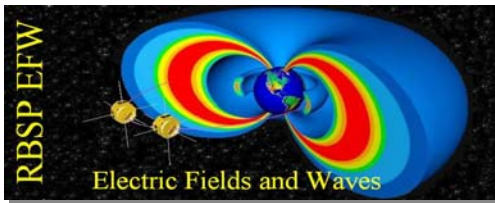
Instrument Power Line

CE01 10Hz to 15kHz

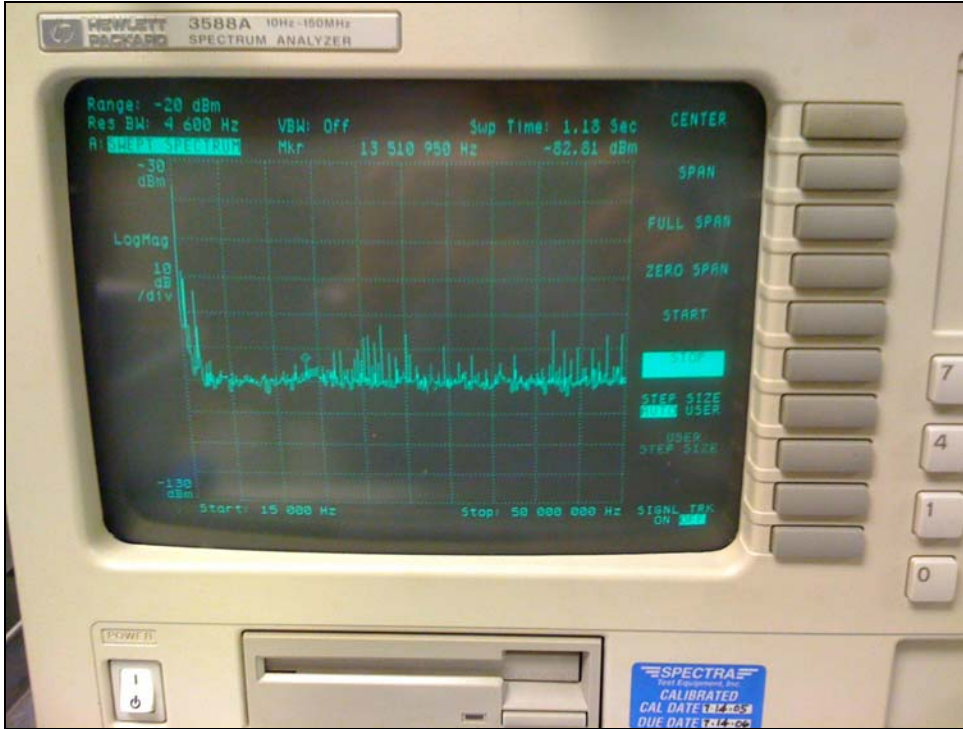


CE03 15kHz to 50MHz

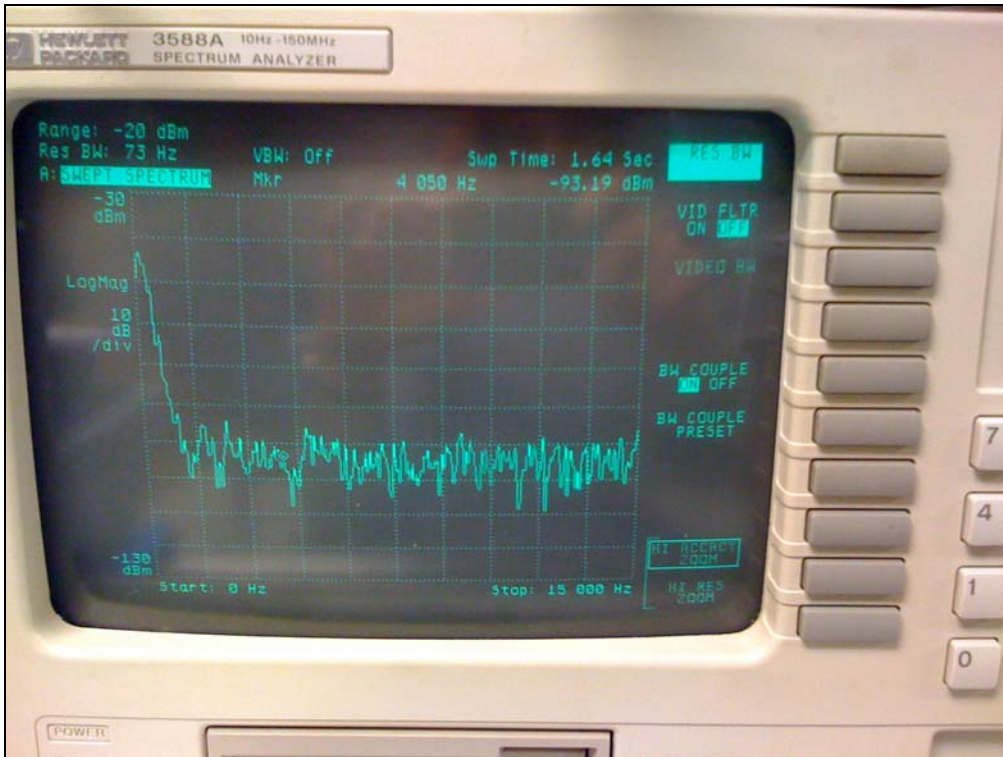


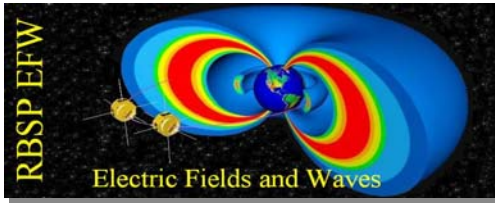


Instrument Power Return Line  
CE01

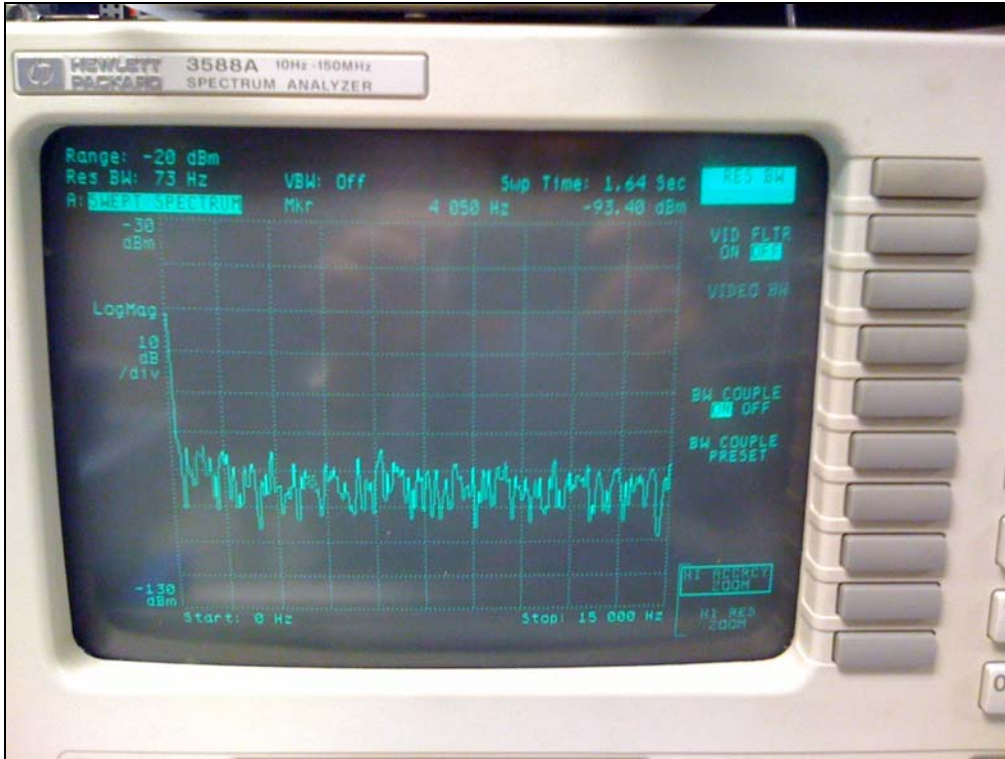


CE03

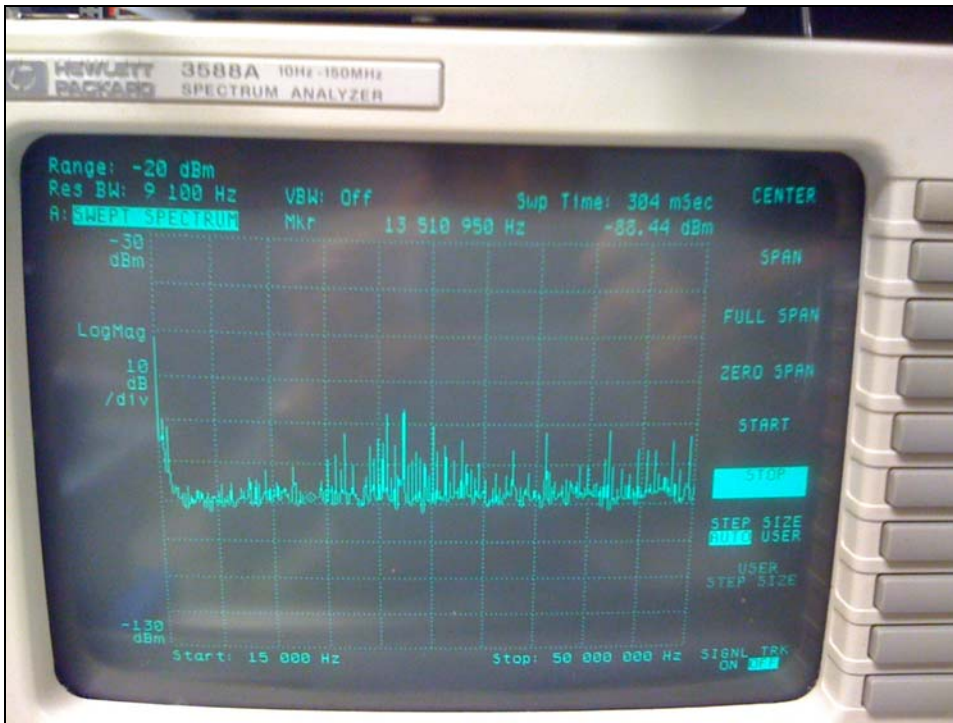
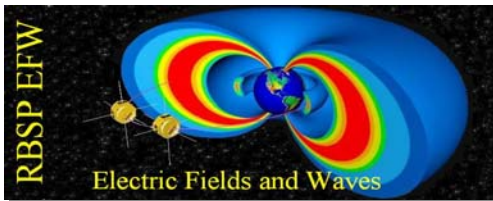




Differential Measurement.  
CE01



CE03



### Analysis

All measurements for CE01 are below -80dBm. This converts to less than -6dBuA. Therefore the measurements meets the specification.

All measurements fore CE03 are below -70dbm. This converts to about 3 dBuA. Therefore the measurements meet the specification.

### CE07 Time Domain Measurements

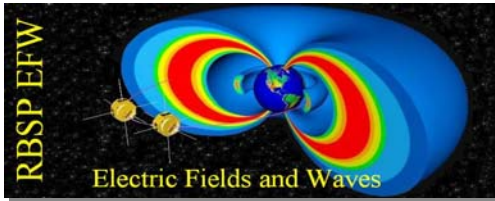
#### Test Requirement

This test requirement is to demonstrate that the broadband levels of conducted ripple and spikes (both voltage and current) on input power and interface signal lines do not exceed the specified limits as observed in the time domain. Turn on, turn off, and infrequent mode change transients are covered elsewhere. Applicable test parameters and limits are as follows:

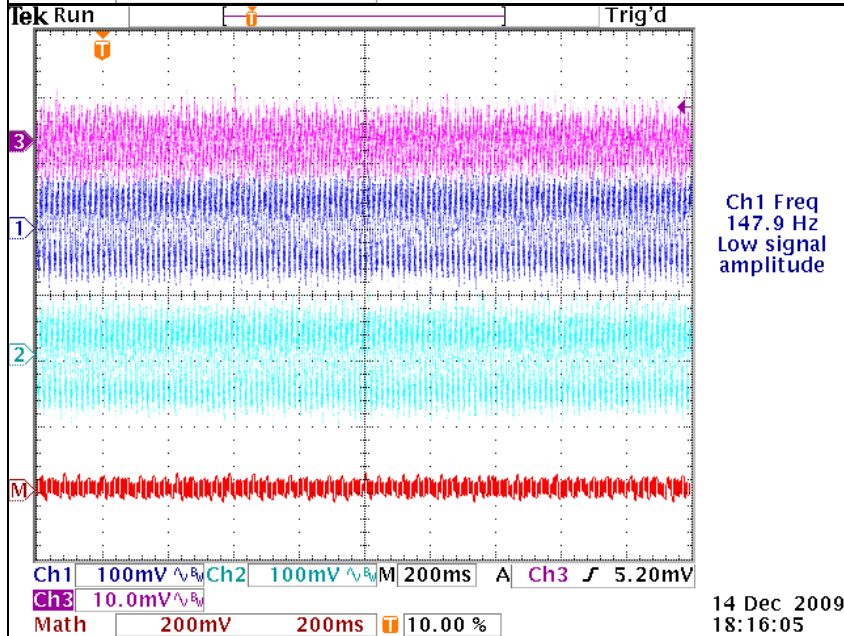
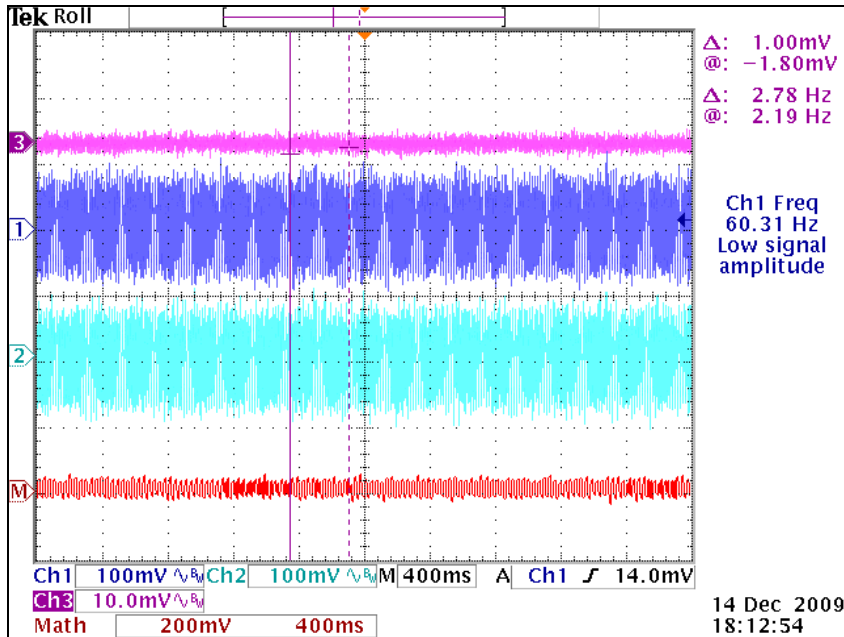
- A) Common and Differential Mode currents shall be measured on the power lines as described in section 4.1, and the bulk common mode current shall be measured on all interfaces. Differential voltage measurements are to be made between power input and return. Common mode voltage measurements are to be made between a) power input and chassis, and b) power input return and chassis.
- B) Measurements are to be performed with a current probe and oscilloscope which, when used together, provide an AC coupled bandwidth from at least 10 Hz to 12 MHz. Voltages are to be measured with a high impedance differential input oscilloscope with at least a 50 MHz AC coupled bandwidth.
- C) Time domain conducted voltage ripple shall not exceed 1.0 V peak-to-peak for differential measurements. Common mode voltage shall not exceed 500 mV peak-to-peak.
- D) Time domain conducted current ripple and spikes shall not exceed 300 mA peak-to-peak for differential measurements and 50 mA peak-to-peak for common mode measurements.

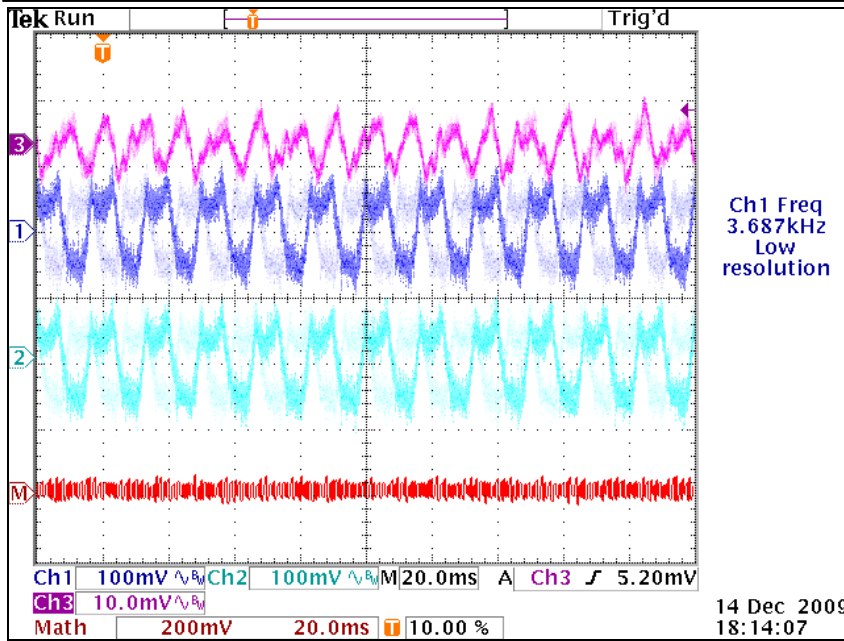
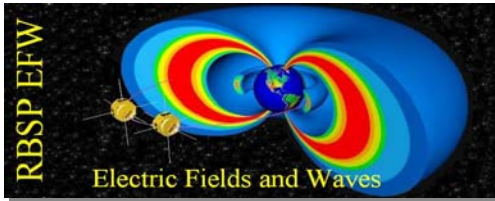
### Results

Channel 1 +ve Instrument Power Ripple



Channel 2 -ve Instrument Power Ripple  
 Channel M differential Instrument Power Ripple  
 Channel 3 Instrument Current Ripple Common Mode - probe set to 10mA/div





**Analysis of CE-07**  
**All quantities within specification as per RBSP EMCP.**