# Intel/Sony Joint EMI Testing on 1394 CE to PC Interconnect

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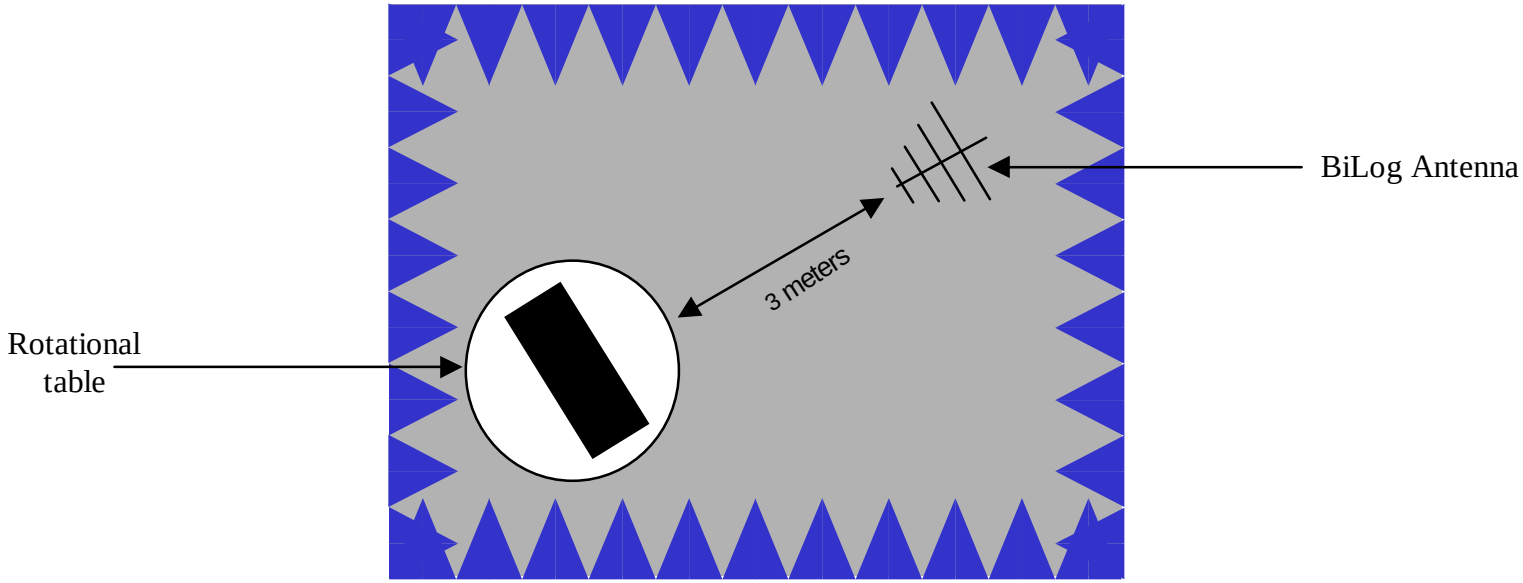
# Three Meter Anechoic Chamber

- Room completely shielded from outside radiation
- Carbon Absorber Cones used to absorb radiation produced from Device Under Test ( DUT )
- BiLOG antenna used to receive Device Emissions
- Antenna positioned three meters from DUT

# Three Meter Anechoic Chamber

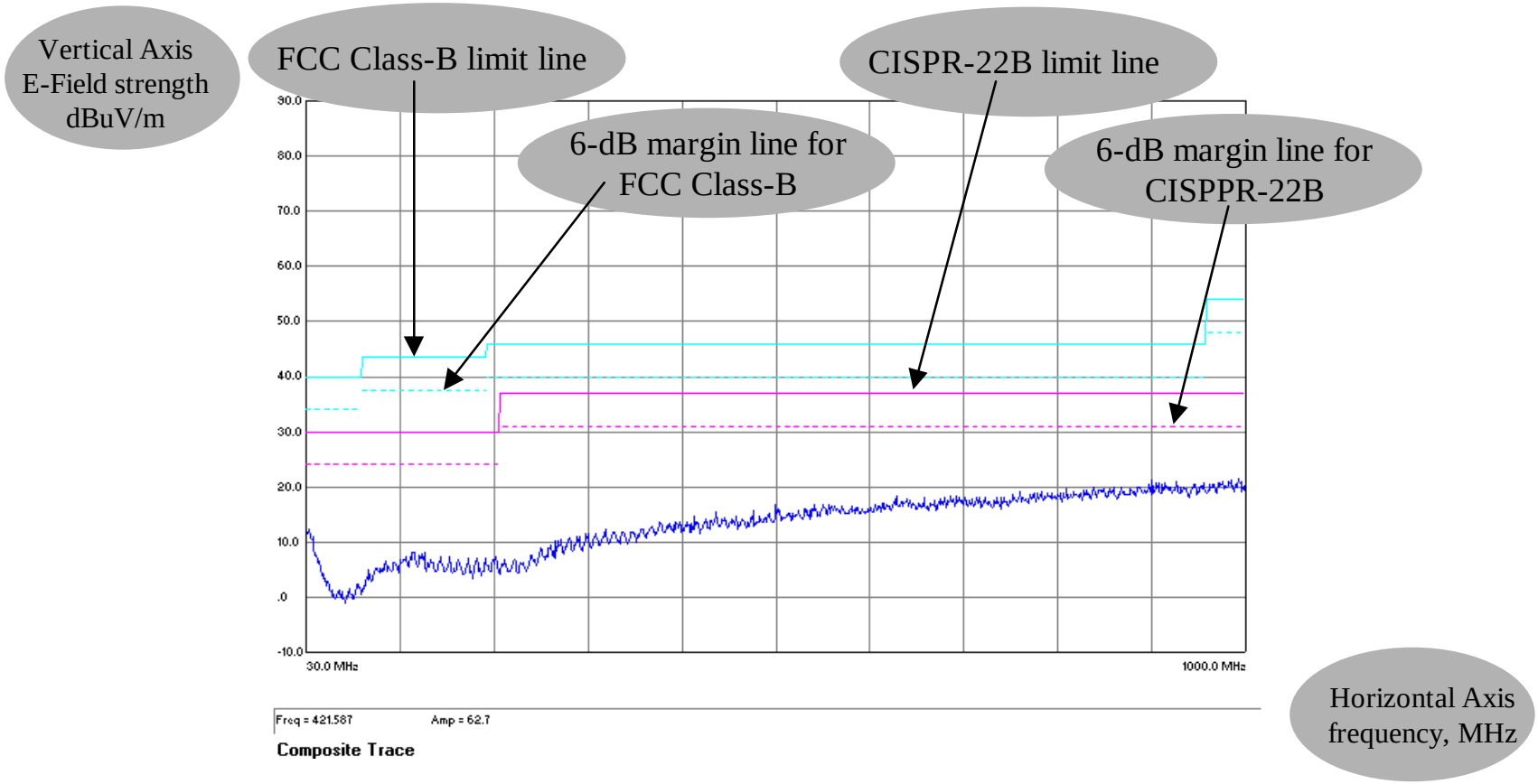
## Floor Layout



# FCC and CISPR-22B Limits

| **FCC Class B Radiated Limits** | | | **CISPR-22 Class B limits** | | |
|---|---|---|---|---|---|
| Frequency (MHz) | Distance ( meters ) | Field Strength DBuV/m | Frequency (MHz) | Distance ( meters ) | Field Strength DBuV/m |
| 30 - 88 | 3 | 40 | 30 - 230 | 10 | 30 ( 36 ) |
| 88 - 216 | 3 | 43.52 | 230 - 1000 | 10 | 37 ( 43 ) |
| 216 - 960 | 3 | 46.02 | N/A | N/A | N/A |
| 960 - 2000 | 3 | 53.92 | N/A | N/A | N/A |

# Interpreting emissions graph

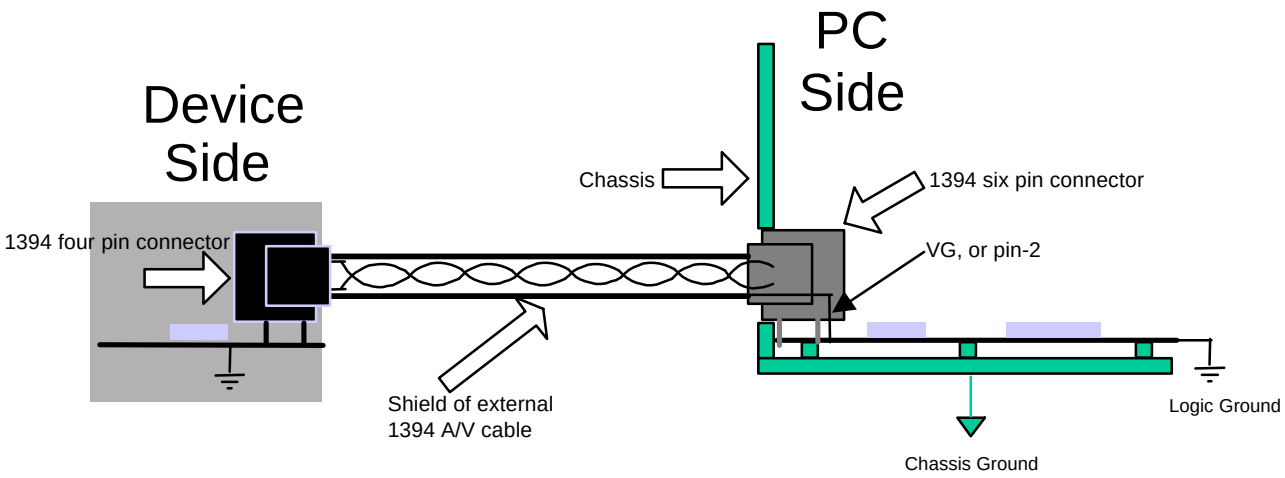


# Original 1394 4-to-6 pin A/V cable

- Shield connects to VG (pin-2) of the six pin receptacle; connects to shell of four pin plug
- EMI unfriendly for PCs
  - When attached to a motherboard, radiation close to or above the FCC limit is inevitable

# 1394 4-to-6 pin A/V cable environment for CE to PC interconnect

## Original A/V cable

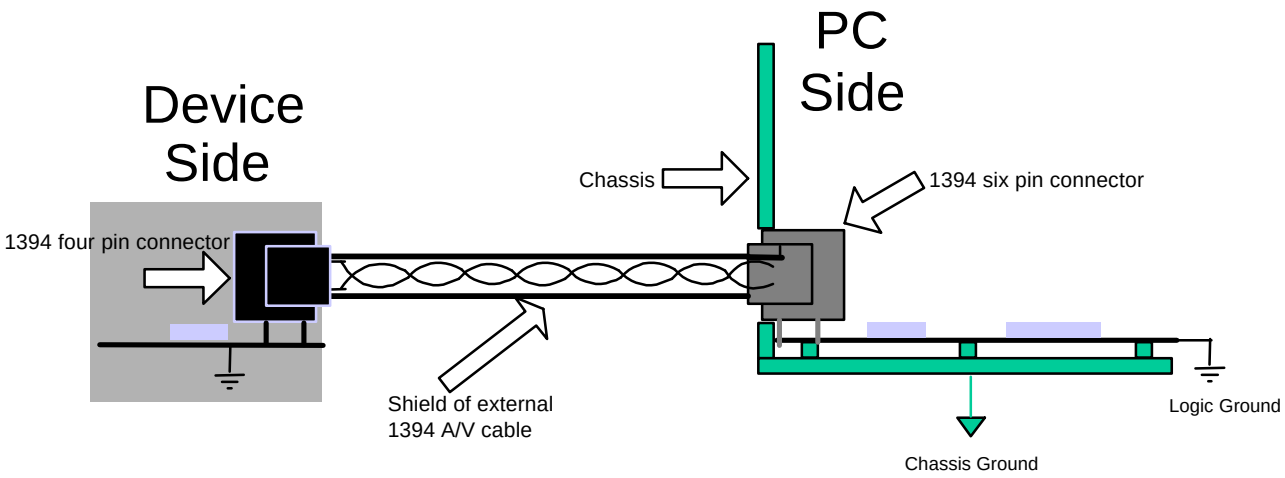


# S100-only 1394 4-to-6 pin A/V cable

- Shield connects to shell of both the six and four pin plugs
- Supports only S100 as there is no return path for the common mode speed signal

# 1394 4-to-6 pin A/V cable environment for CE to PC interconnect

## S100-only A/V cable

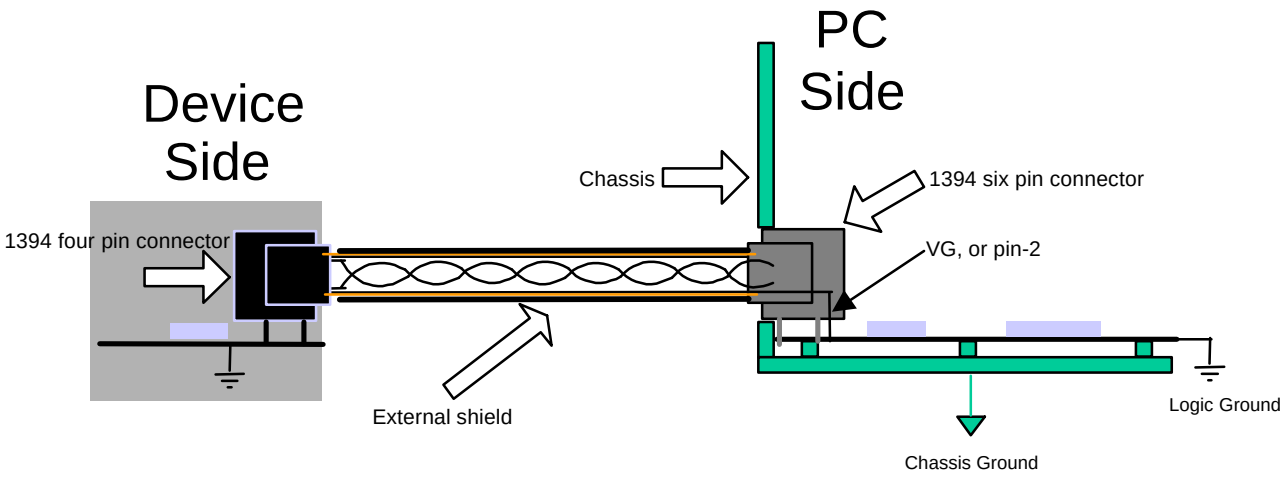


# 1394A/V cable proposed for S100-S400

- Cable construction closely resembles six conductor cable
- Foil shield wrapped around each pair
  - foil shield connects to VG of six-pin receptacle
- Braided shield terminates at shell of six pin plug
  - provides an AC return path for stray currents traveling on the outer surface of the foil shield which results in reduced emissions
- Braided shield is left unterminated at four-pin plug

# 1394 4-to-6 pin A/V cable environment for CE to PC interconnect

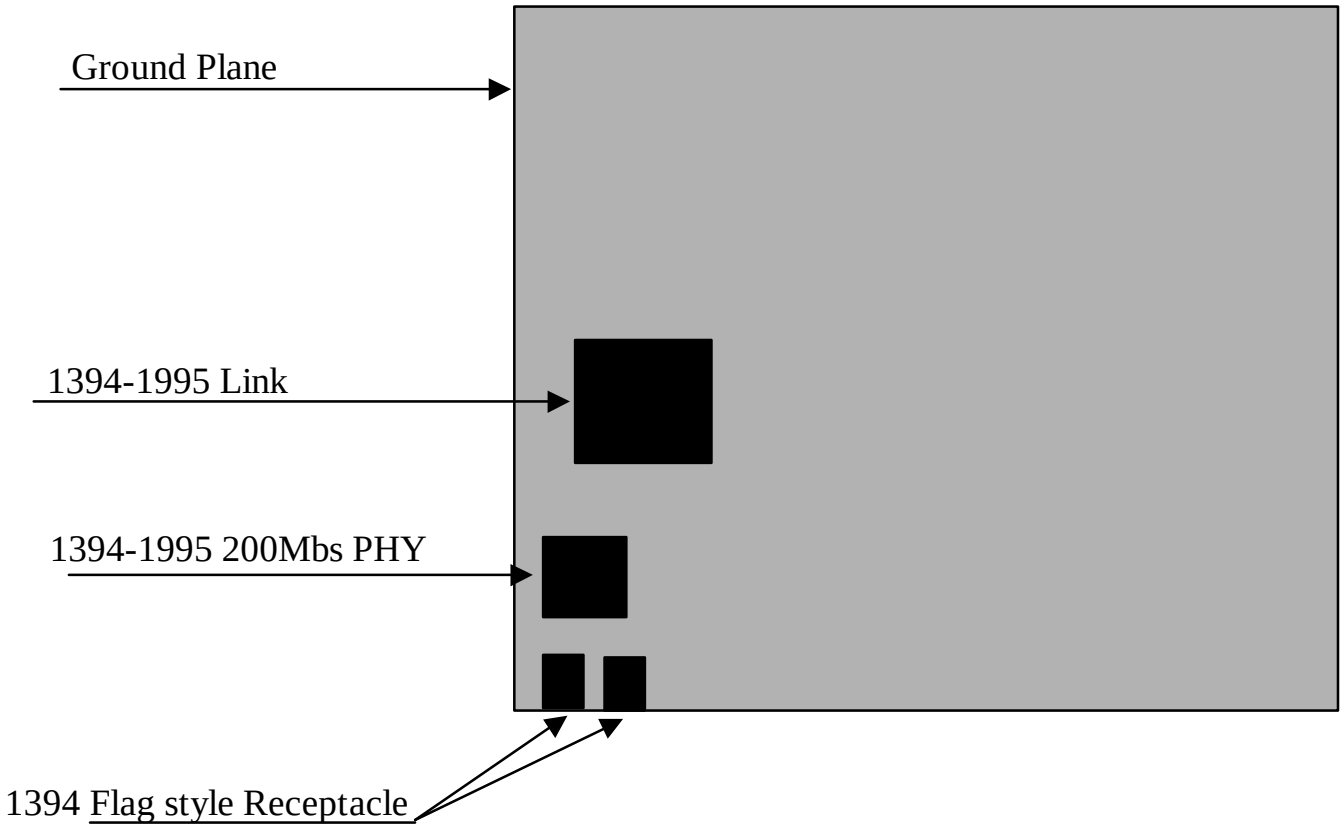
## Proposed 1394 A/V cable



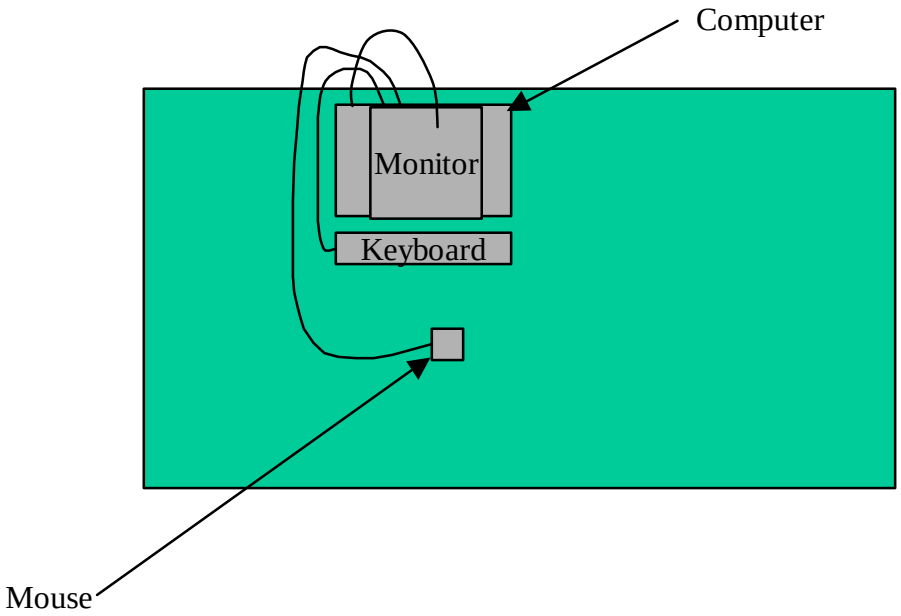
# Systems Under Test

- 1394-Test Vehicle Platform build by Intel®
  - 1394-1995 Link and PHY chip laid out on mother board
  - PHY/Link DC Coupled - both chips share ground plane with the rest of the system
  - Sticky fingers allow for various points of contact between the chassis and the receptacle.
- Sony® Camcorder
  - Incorporates four-pin connector
- Sony® Conferencing camera
  - Incorporates six-pin connector

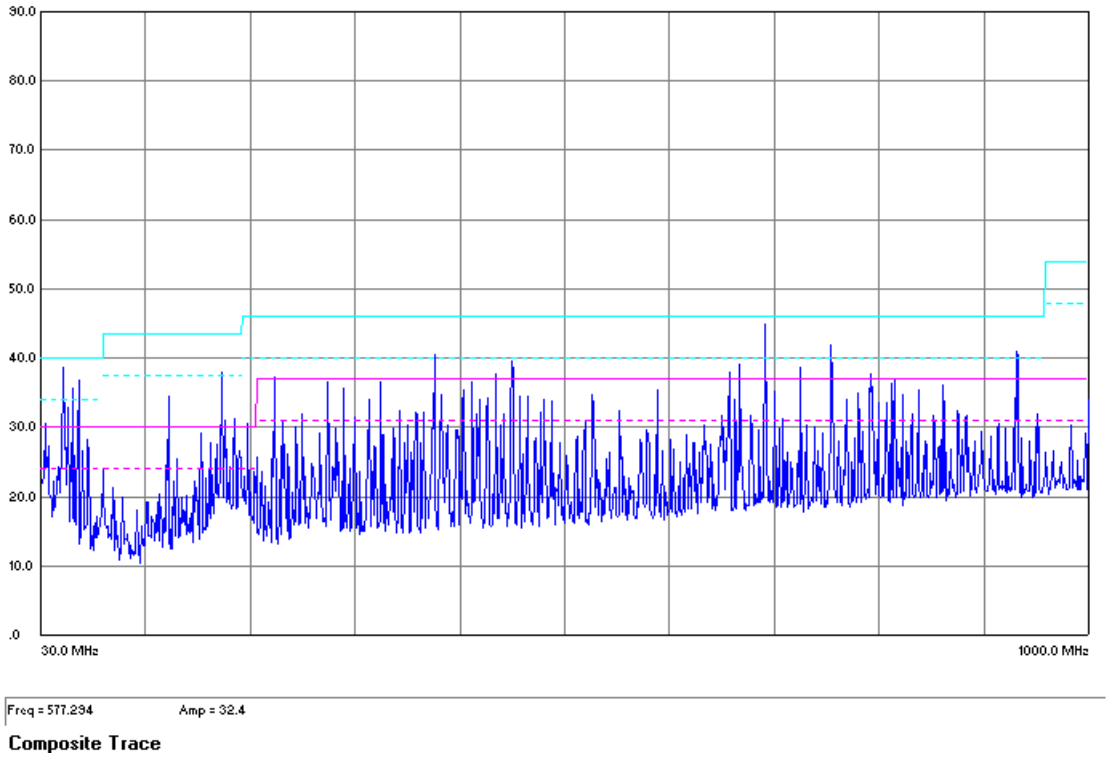
# 1394 Platform Grounding Scheme



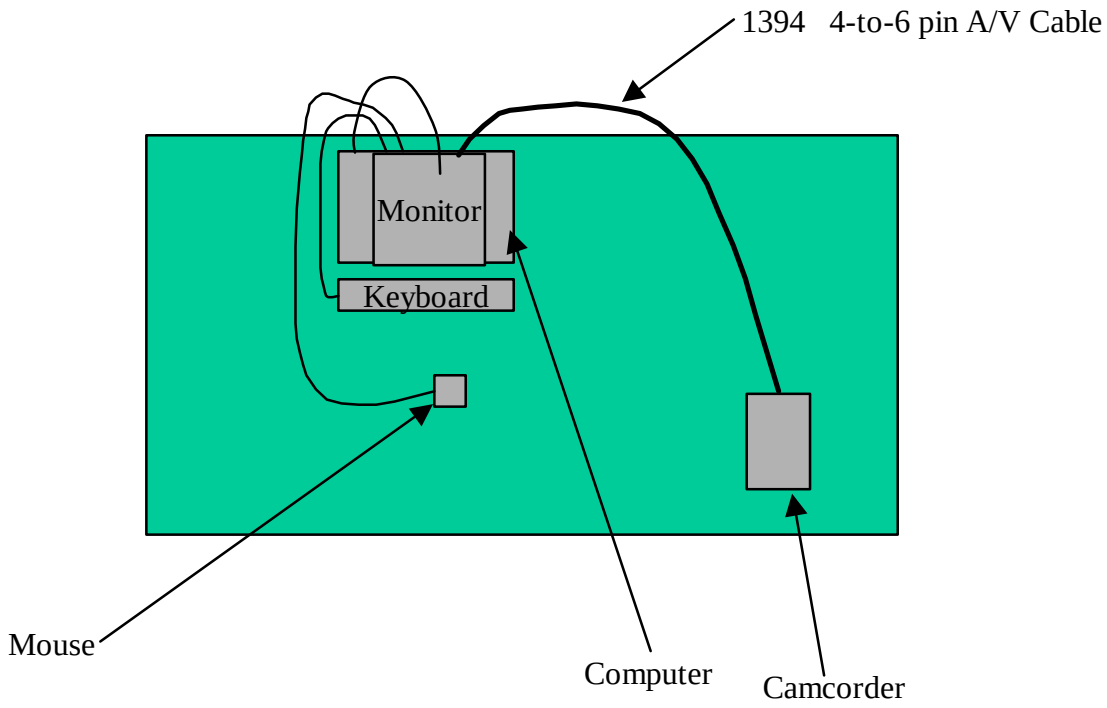
# Table Layout for baseline of 1394-System



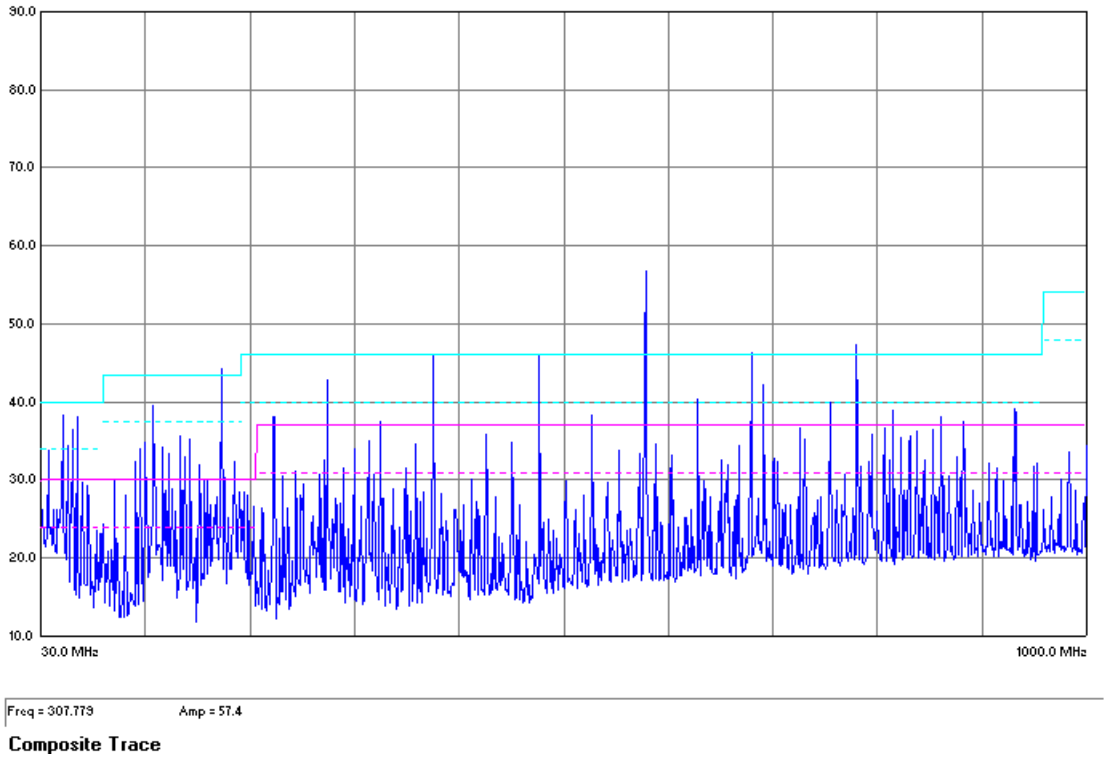
# Baseline scan of 1394 platform



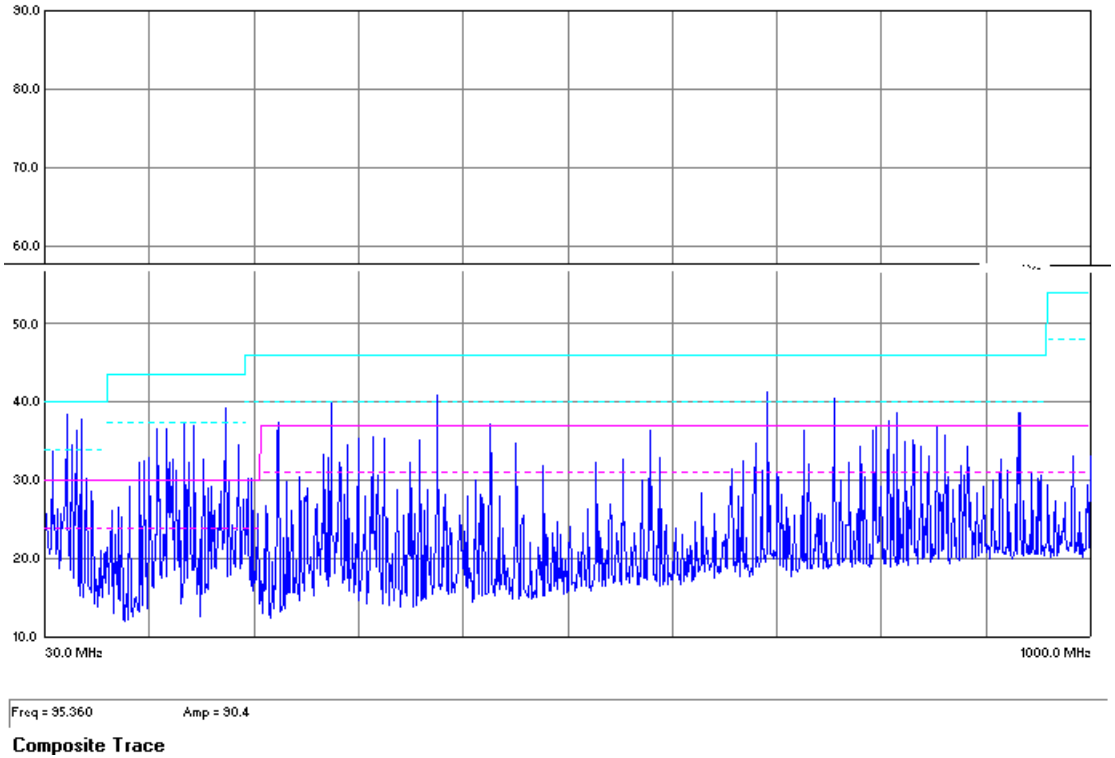
# Table Layout for System plus Camcorder



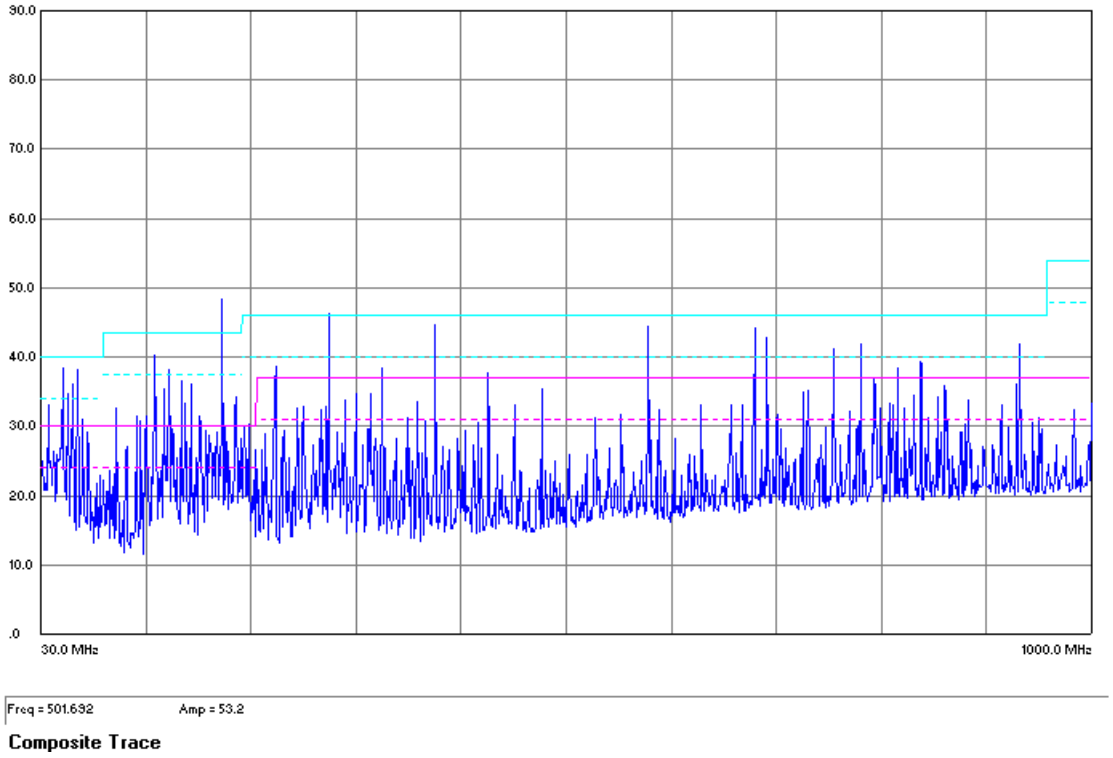
# Emissions of 1394-System plus camcorder utilizing original A/V cable



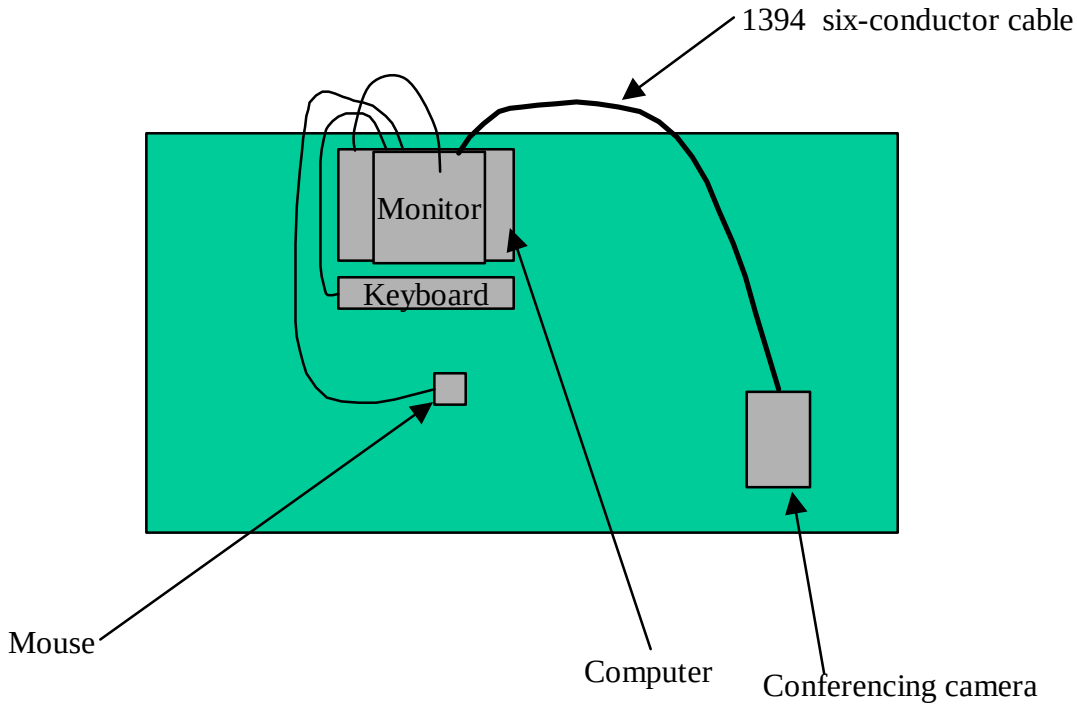
# Emissions of 1394-System plus camcorder utilizing S100-only A/V cable



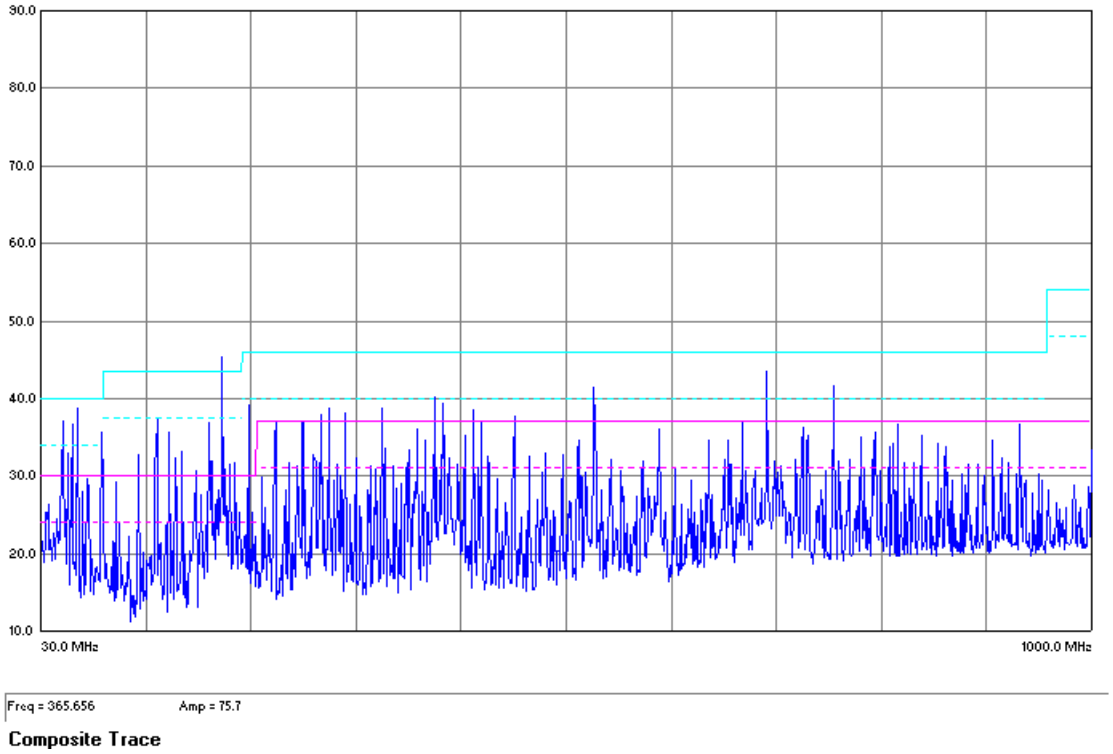
# Emissions of 1394-System plus camcorder utilizing Proposed A/V cable



# Table Layout for System plus conferencing camera



# Emissions of 1394-System plus conferencing camera utilizing six-conductor cable




The emissions from this configuration shouldn't be considered as a valid comparison with the previous configurations as the conferencing camera introduces a second variable.

# Conclusions

- Original A/V cable produces emissions above or at the FCC limit at several frequencies
- There are seven discrete spectral lines that either approach or fail the FCC limit
- These discrete spectral lines are reduced by and average of 3.6 dB when the proposed A/V is used.