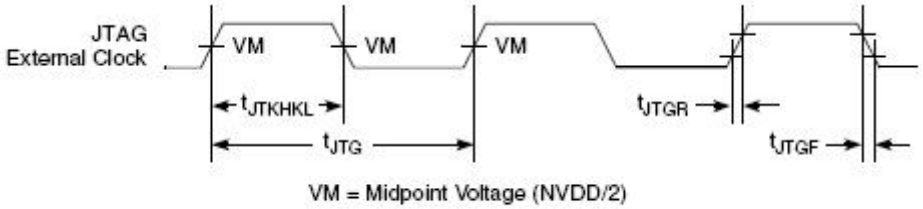
The Analysis Report USB-TAP cannot workable problem

Issue date: 2010/10/13
Report date: 2010/12/13
Problem description: There is a few USB-TAP cannot workable in COP RDB
Fail rate: < 1%
Effect boards: MPC8377E-RDB REV 2.1, MPC8315E-RDB REV A3
Root cause: It's a timing margin issue.
The EMI decoupling capacitor C118 (0.1uF) is too large to slowdown the falling time of TCK (JTAG signal). It makes the setup and hold time over IEEE1149.1 specification.

Analysis:

1. The Timing Specification



VM = Midpoint Voltage (NVDD/2)

Figure JTAG Clock Input Timing Diagram

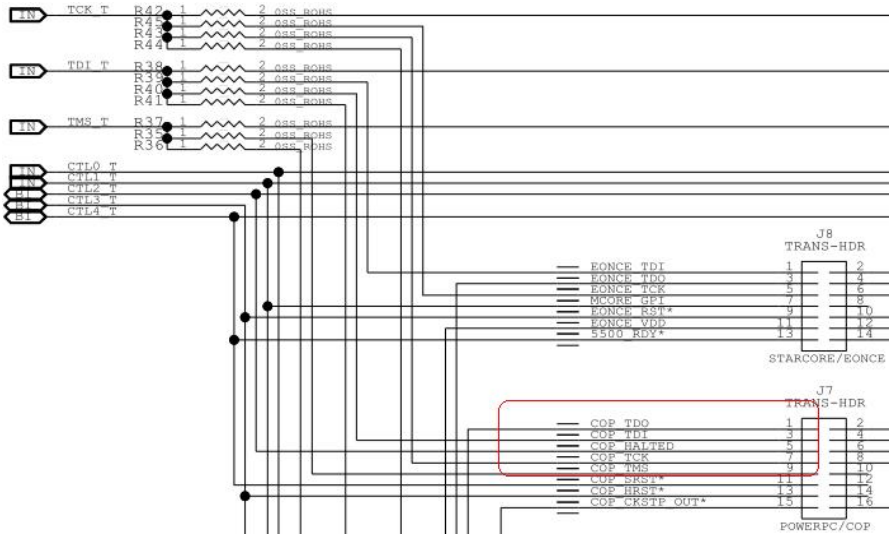
Parameter	Symbol [2]	Min	Max	Unit	Notes
JTAG external clock frequency of operation	f_{JTG}	0	33.3	MHz	—
JTAG external clock cycle time	t_{JTG}	30	—	ns	—
JTAG external clock pulse width measured at 1.4 V	t_{JTKHKL}	15	—	ns	—
JTAG external clock rise and fall times	t_{JTGR}, t_{JTGF}	0	2	ns	—

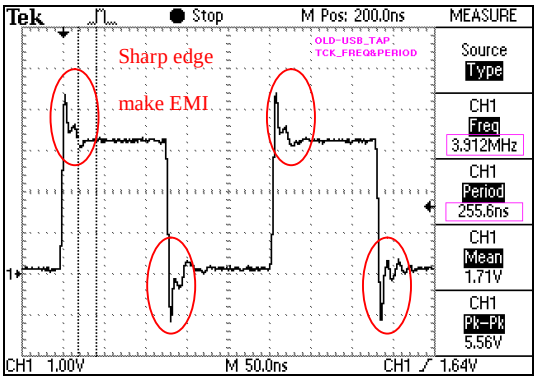
2. Original USB-TAP (Rev.C), no stuff 0.1uF in C118

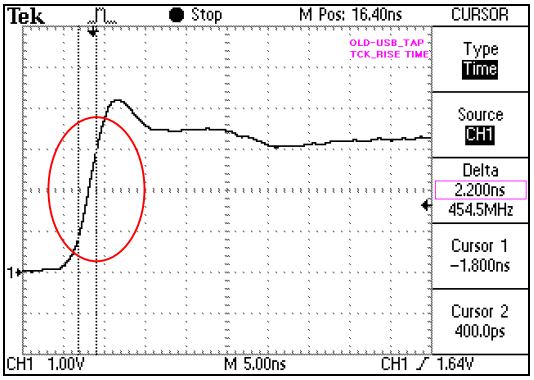
JTAG timing: $t_{JTGR=2.2nS}$, $t_{JTGF=2.2nS}$ meet spec $_{2ns}$ (note: probe Tek 116526 has lag)

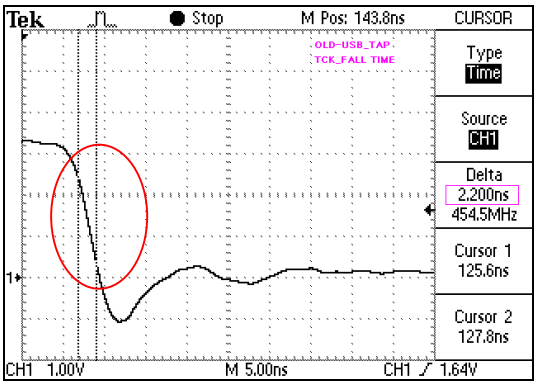
JTAG Functionality: PASS

EMI in CE/FCC: FAIL







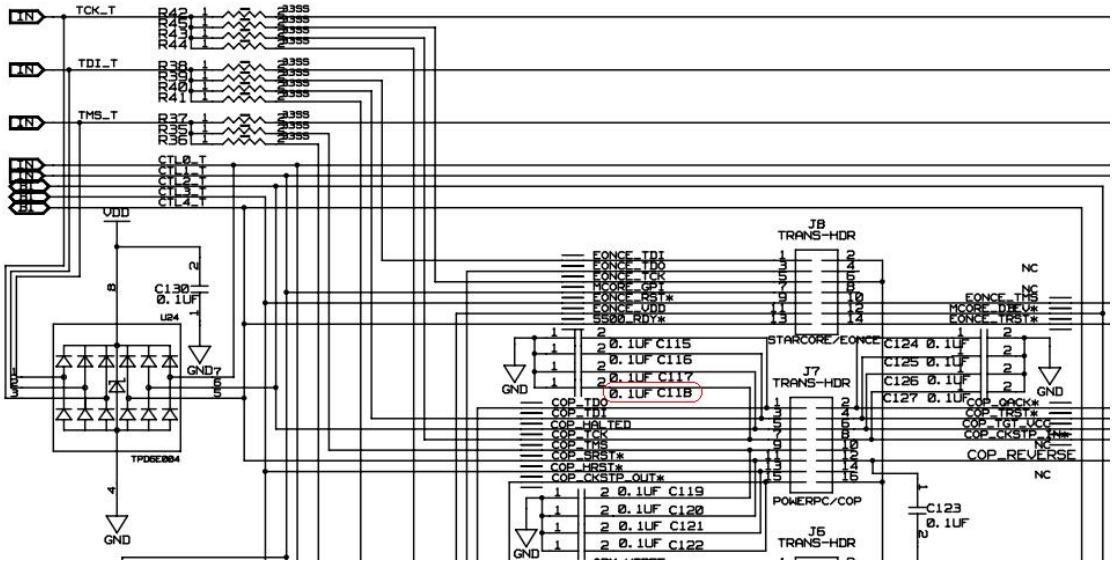


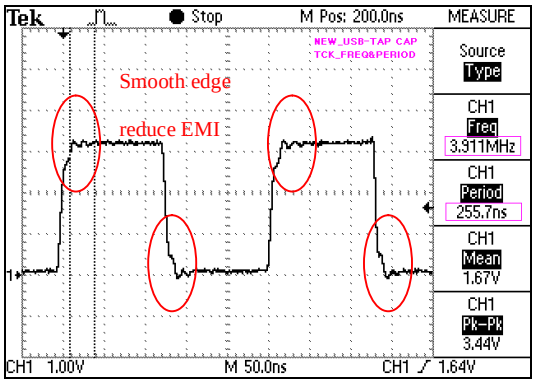
3. NEW USB-TAP (REV.D), C118 stuff 0.1uF

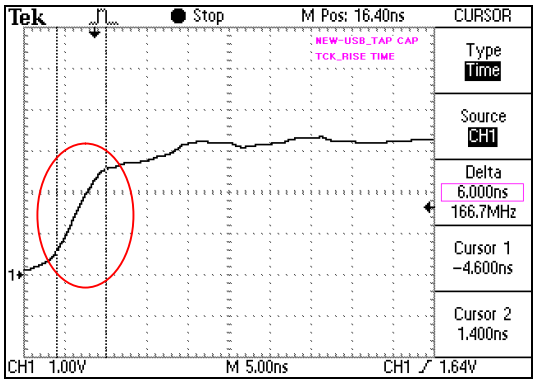
JTAG timing: $t_{JTGR=6nS}$, $t_{JTGF=11nS}$ over spec $_{2ns}$ (note: probe Tek 116526 has lag)

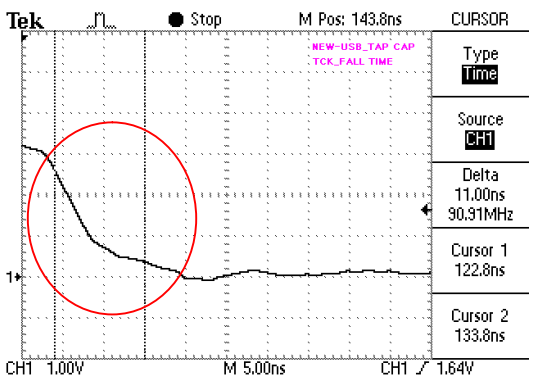
JTAG Functionality: Some models are fail

EMI in CE/FCC: PASS

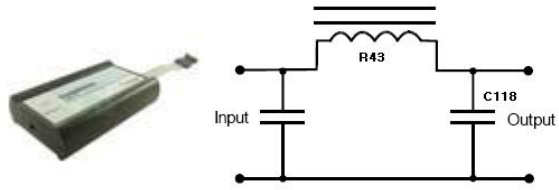


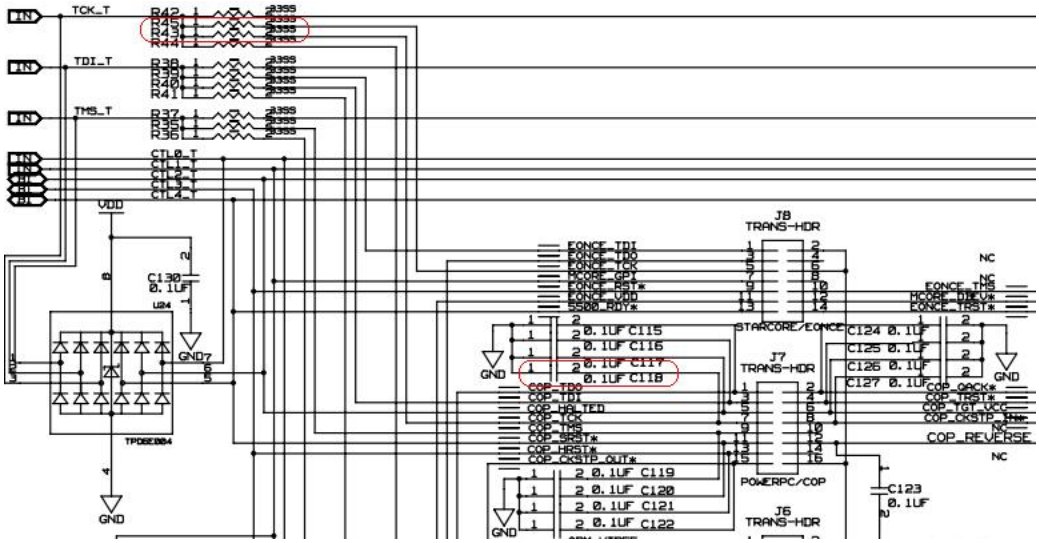


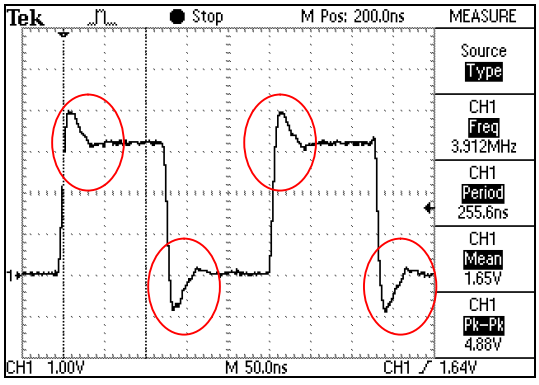


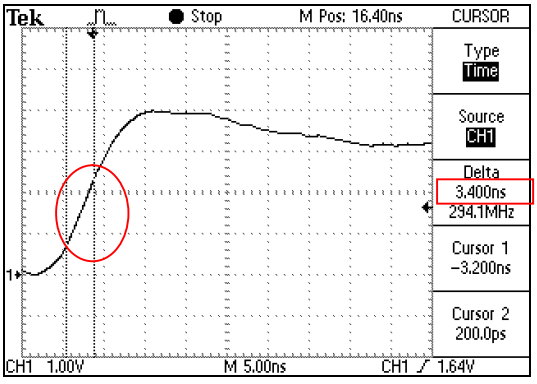


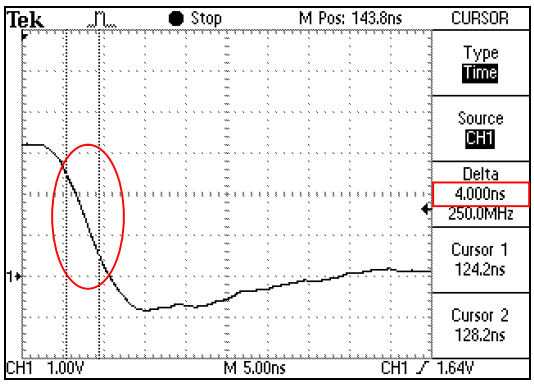
4. Rework NEW USB-TAP (REV.D) by stuff 47pF in C118 and 120OHM@100MHz bead in R43, The pi filter reduce EMI and no effect signal timing.
   JTAG timing: $t_{JTGR=3.4nS}$, $t_{JTGF=4nS}$ over spec $_{2ns}$ (note: probe Tek 116526 has lag)
   JTAG Functionality: PASS
   EMI in CE/FCC: PASS

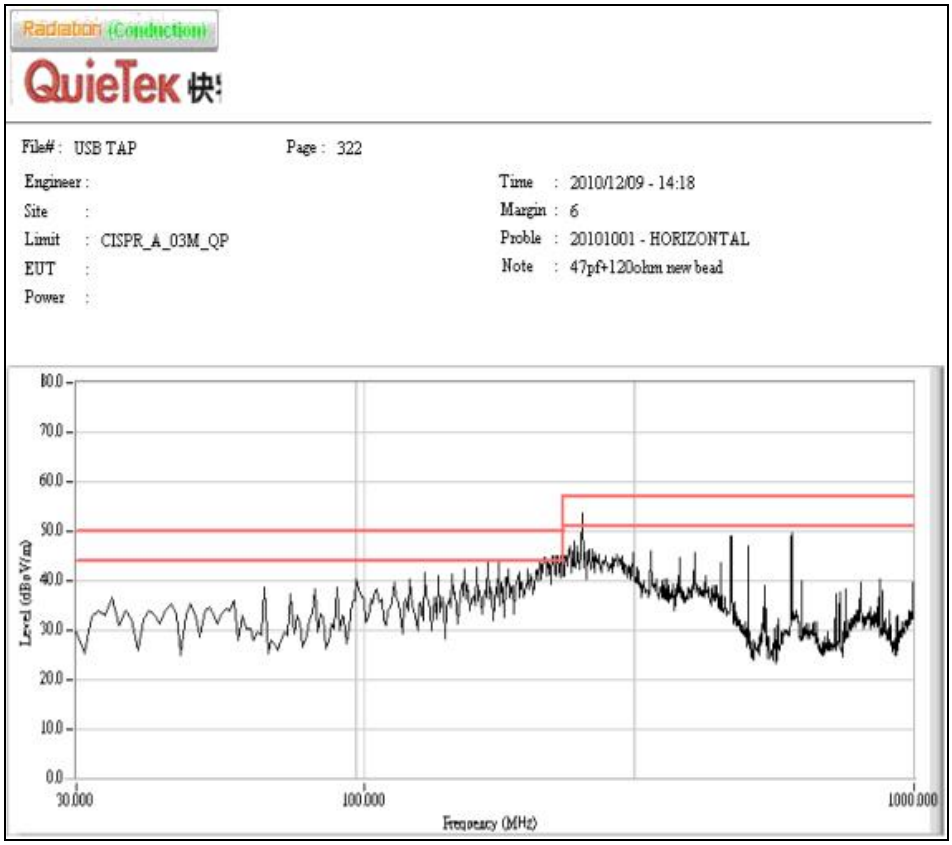











Radiation (Conduction)
QuieTek
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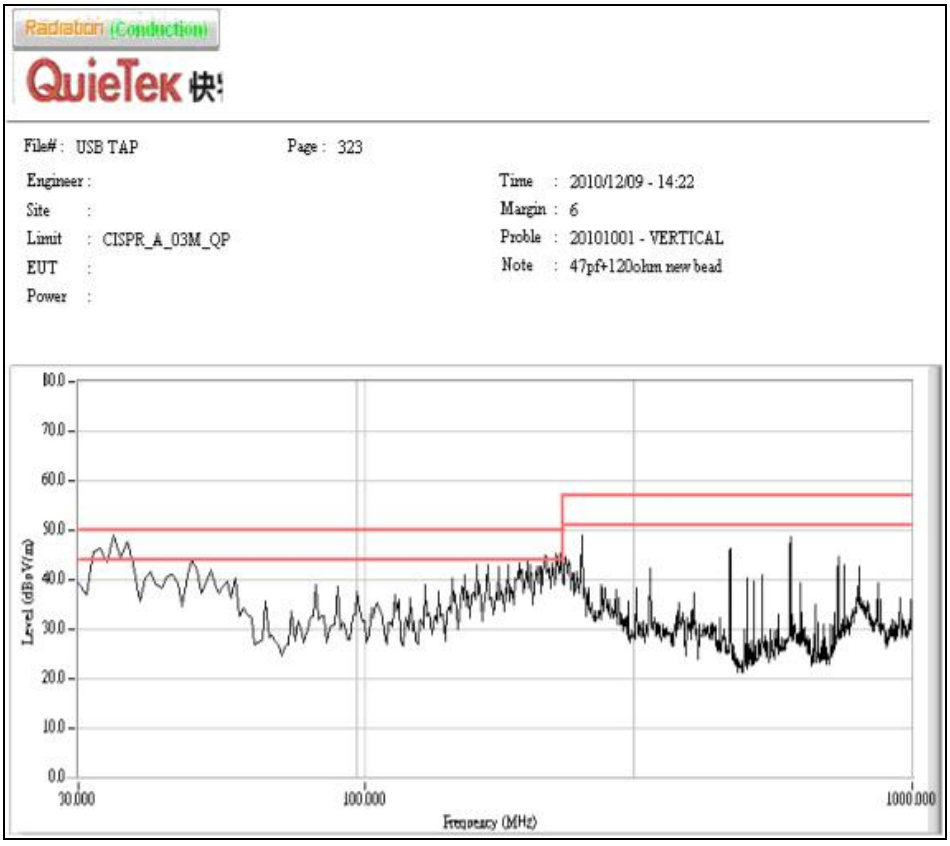
Page : 322
Engineer :
Site :
Limit : CISPR_A_03M_QP
EUT :
Power :
Time : 2010/12/09 - 14:18
Margin : 6
Proble : 20101001 - HORIZONTAL
Note : 47pf+120ohm new bead
Level (dBuV/m)
Frequency (MHz)


Radiation (Conduction)
QuieTek
File# : USB TAP
Page : 323
Engineer :
Site :
Limit : CISPR_A_03M_QP
EUT :
Power :
Time : 2010/12/09 - 14:22
Margin : 6
Proble : 20101001 - VERTICAL
Note : 47pf+120ohm new bead
Level (dBuV/m)
Frequency (MHz)