



TAITIEN ELECTRONICS CO., LTD.

Crystal Matching Test Report

Report No.: SL12110005

Information List:

1. Customer : Atmel Corporation
2. Project Name. or Part No. : B/T
3. PCB Part No. : TB2 MEGA RF
4. Electronic Circuits : ☒ As attached ☐ No Provided
5. Crystal Part No.:
☒ TAITIEN P/N (Model): XXBBPLNANF 16.000000 MHZ
☐ Competitor:
6. Description: _____
7. Received Date: 2012 / 10 / 17

Tester:

Test Date: 2012 / 10 / 31
Test by: MelodyChen Department: RD
Phone Number: (02)2686-1287#801
E-Mail Address: melodychen@taitien.com.tw

Measured Equipments:

1. Network Analyzer:
☐ ADVANTEST R3754 ☒ ADVANTEST R3755 ☐ S&A 250B ☐ Others: _____
2. Counter:
☐ TAITIEN ITC-5 ☐ Agilent 53181A ☒ Agilent 53132A ☐ Others: _____
3. Power Supply: _____
4. Oscilloscope: Tektronix DPO 7354
5. Multi-meter: TES 2620
6. Active Probe: _____
7. Current Probe: ☐ Tek CT-1 ☒ Tek CT-6 ☐ others : _____
8. Others: _____



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Test Method and Result:

Measure load capacitance on the PCB

Q2 Freq. : 16.000000MHz , XX Type Crystal , CL : 9pF

C3 = 10pF , C4 = 10pF

1. Measuring crystal frequency on the PCB: (Test by Probe: Tek CT-6)

Frequency: 16.000140 MHz

Frequency: 8.75 ppm

2. Taking out the crystal from PCB, then measuring crystal parameters

base on crystal SPEC.: Load capacitance (CL₁) = 9 pF

Frequency (FL ₁ , MHz)	Frequency (FL ₁ , ppm)	C0 (pF)	C1 (fF)	Rs (ohm)	L1 (mH)	Q (K)	Ts (ppm/pF)
15.999977	-1.5	0.91	2.1	25.4	46.5	183.8	10.8

3. To measure load capacitance on the PCB, 1) use measured Crystal frequency from the PCB and 2) use Network Analyzer to conduct Crystal's load capacitance test.

Load Capacitance (CL₂) = 8 pF .

Frequency (FL ₂ , MHz)	Frequency (FL ₂ , ppm)	C0 (pF)	C1 (fF)	Rs (ohm)	L1 (mH)	Q (K)	Ts (ppm/pF)
16.000141	8.8	0.91	2.1	25.4	46.3	183.6	13.4

Measure Drive Level

Use AC current probe to conduct Vrms measuring (Tek CT-6, 50 ohms terminated)

Irms = Vrms / 5 (mA)

Measure Current: Vrms = 1.082 mV

Irms = 1.082 / 5 = 0.22 mA

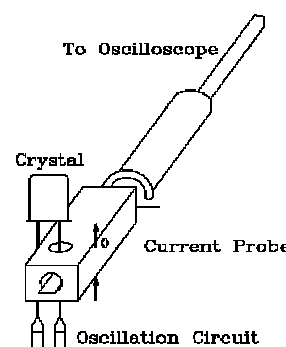
Calculation RL:

$$RL = R_s (1 + C_0 / CL)^2$$

$$= 25.40 * (1 + (0.91 / 8))^2 = 31.51 \text{ ohms}$$

Drive Level = Irms² * RL

$$= 0.22^2 * 31.51 = 1.48 \text{ uW}$$



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Measure negative impedance of oscillating circuits (-R or NR)

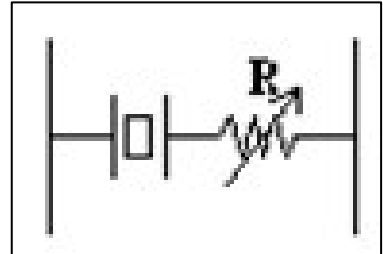
1. Checking the IC output waveform and using AC Current probe.
2. Adjusting variable resistor until oscillating circuit is not functioning. Writing down value of impedance.

$$R_n = R + R_L = \underline{1000} + \underline{31.51} \text{ ohms}$$

$$|NR| = |-R_n| = \underline{1031.51} \text{ ohms}$$

$$\text{E.S.R.} = \underline{80.0} \text{ ohms}$$

$$n = |NR| / \text{E.S.R.} = \underline{1031.51} / \underline{80.0} = \underline{12.89}$$



n:

Poor -R value: $n < 5$

Normal -R value: $5 < n < 10$

Good -R value: $n > 10$



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Conclusion:

Q2 Freq. : 16.000000MHz , XX Type Crystal , CL : 9pF
C3 = 10pF , C4 = 10pF

Frequency and CL Matching: ☐ Good ☐ Passable ☒ Not matching

On board frequency is 8.75ppm, and CL is 8pF.

The frequency and CL are not matching.

Drive Level: ☒ Good ☐ Passable ☐ Over range

The Driver Level is 1.48uW, and it is good.

NR: ☒ Good ☐ Passable ☐ Poor or Not enough

The n is 12.89, and it is good.