From: Wei Zhang
Date: 2018-06-12 05:02
To: sqe@dptel.com; Mueller, Luke
Subject: RE: Fw: Questions about crystal return to Croven

Jesse,

Sorry for the delayed email. Luke and I visited Dapu about 3 weeks ago. Originally we wanted to discuss various quality issues with Dapu's incoming quality control. However, we didn't meet any of your QA people.

1. Regarding your question about sleeping sickness

Sleeping sickness is a phenomenon that is very difficult to completely eliminate. Croven has done extensive test to study it but it's still not fruitful to find the actual root cause of each reject. All crystals at Croven have been tested for sleeping sickness at least 3 times. Two plug-in tests using Dapu's oscillator and one final test to screen out all electrical failures. When we cut crystal open, most of time we see nothing abnormal inside the crystal. That suggests it's a microscopic problem which may not be able to detect visually. Perhaps, the problem is inherent for 5MHz 3rd OT crystals which is heavy and may be harder to start oscillator than higher frequency design. It could also be a oscillator circuit design problem. Perhaps, Dapu oscillator needs higher power level to start the oscillation.

2. Regarding your question about frequency shift problem. So far as I can remember, you are talking about crystals we sold to Dapu in 2013 and later Dapu somehow "recycled" these crystals. Crystals naturally ages and external factors such as soldering and de-soldering will have further invisible impact to the frequency of the crystal and may have caused frequency shift lower. I will open a few more these 2013 crystals and try to observe inside but I don't expect much visible clues.

3. Regarding your question about leak rate. Croven leak test crystal according MIL-PRF-3098. Our leak test pass level is 1.5 E-8 atm-cc/sec Helium.

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From: sqe@dptel.com [mailto:sqe@dptel.com]
Sent: June-09-18 3:36 AM
To: Wei Zhang; Mueller, Luke
Cc: 晶体采购
Subject: Re: Fw: Questions about crystal return to Croven

张工：

你好，关于以下问题，我已经邮件与你反馈第三次了，现在还没有得到你的回复。我们电话沟通了，需要将晶体休眠与频率低的不良各拆解1PCS进行分析。
请确认是否在进行，并回复进度，谢谢！

1.晶体休眠问题：

我们想知道休眠的原因，涉及的不良数量较高，而且这种现象不容易被发现，存在较大的隐患，需要得到Croven的技术支持，找到原因，减少这种不良。

2.关于频率低问题：

导致频率低的不良因素，当时电话沟通，有说到过几个原因，受震动、老化率、或者内部损坏，这些因素我们都无法确认。所以希望贵司拆壳分析。

3. Croven的漏率标准是多少，因为我们测试漏气的产品，在Croven测试合格，显然我们标准不一致，
请提供你们的判定标准，谢谢！

Dapu Telecom Technology Co,.Ltd
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发件人： sqe@dptel.com
发送时间： 2018-05-30 16:38
收件人： wzhang; Luke Mueller
主题： Fw: 回复: Questions about crystal return to Croven

张先生：

你好，附件中的问题，贵司是否有在分析，请确认，并回复进度。
还有我们之前提到的Croven的漏率是按照那个标准，因为我们测试漏气的产品，在Croven测试合格，显然我们标准不一致，请提供你们的判定标准，谢谢！

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发件人： sqe@dptel.com
发送时间： 2018-05-17 16:28
收件人： wzhang
主题： 回复: RE: Questions about crystal return to Croven

张先生：
你好，在4月初我们电话沟通了附件中的不良问题，电话中你也提出了几项问题，已经给你回复，当时我这边要求贵司将2个失效问题拆壳进一步分析原因；

1.晶体休眠问题：

我们想知道休眠的原因，涉及的不良数量较高，而且这种现象不容易被发现，存在较大的隐患，需要得到Croven的技术支持，找到原因，减少这种不良。

2.关于频率低问题：
导致频率低的不良因素，当时电话沟通，有说到过几个原因，受震动、老化率、或者内部损坏，这些因素我们都无法确认。从而无法得到很好的改善。希望
贵司拆壳分析。

序号	Croven问题点	大普回复
1	低温启动测试2S内可以达到-300ppm，是怎样定义成的标准	根据晶体低温状态下的频率，采集一定的数据量制定的
2	为何需要做低温启动测试，测试目的是什么	检查产品低温状态下瞬间通电（通电2S)频率输出是否达到
3	其他供应商的是否有相同问题，不良率是多少？	其他供方近期（一年内）无类似问题发生
4	低温启动测试不良比率是多少？测试多少发现的不良。	投产1900pcs发现4pcs，不良率0.21%
5	回收的不良是否只有7PCS，是多少产品中发现的7PCS不良，不良率是多少？	投产464pcs发现7pcs不良，不良率1.5%
6	规格书没有要求测试低温启动，Croven也无法测试复现，因为需要成品测试。如果不良低是否可忽略不计。	需要跟进几批来料品质状况再做进一步分析。
7	气密性要求1E-9是依据什么标准来制定的，还需确认Crven气密性标准。	漏率标准按照国标《石英晶体元件总规范GB/T 12273.1-2.3.11 要求。
8	统计不良问题的失效率，不良趋势是否上升或下降，可以看出是否有改善，从而能监控重点问题点的改善。	关于起振无波形输出已用趋势图统计，不良一直是上升

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发件人： Wei Zhang
发送时间： 2018-04-12 05:11
收件人： sqe@dptel.com
主题： RE: Questions about crystal return to Croven

Hi Jesse,

We don't see any trend of worsening no-output or sleeping sickness rejects at our end. Please keep in mind that these 27 pcs crystals have tested sleeping sickness twice and one electrical test at Croven before shipped to Dapu. Thus the chance of no-output, in our opinion, is very small. The reason of the no-output rejects you found could be 1. False test result, 2 Crystals are damaged during flight to Dapu or at Dapu before your test, or 3. These are intermittent rejects which mean they sometimes are good and sometimes are bad.

We can't identify which one of the reasons is the root cause without looking at each crystals. So first please make sure you did test them correctly and they deem as no-output failures.

If they still have no output , please send them back to Croven together with the crystals that have damaged can for analysis.

Also when analyzing trend, please do use percentage rate or part per million to describe the rejects instead of absolute quantity which may or may not be a large number depending on the total size of test population.

Please let me know if you have any questions. Thank you.

Wei Zhang
Crystal Engineer
Croven Crystals
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From: sqe@dptel.com [mailto:sqe@dptel.com]
Sent: April-11-18 10:58 AM
To: Wei Zhang
Subject: RE: Questions about crystal return to Croven

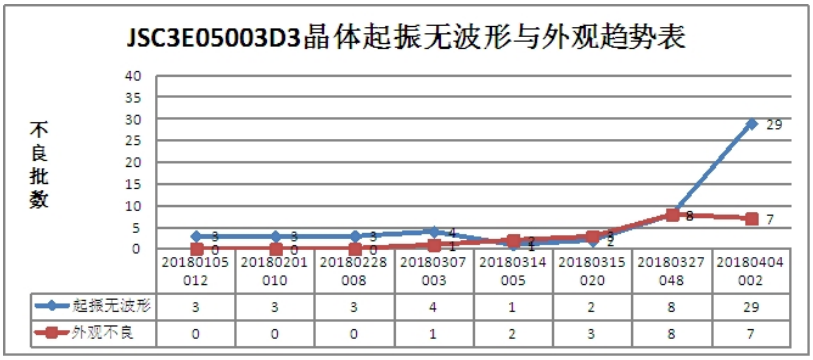
张工;
　你好，由于国内清明节放假3天，收集问题点有些耽误，抱歉，以下是上次内容的回复，请查收！我方还需要确认贵司的漏率标准是多少，
参照的什么标准。

另外我这边收集JSC3E05003D3晶体来料异常汇总时，发现起振无波形输出不良一直是上升趋势，在4月4日来料20180404002批次中，
来料数量2020PCS，我方IQC测试起振无波形输出高达29PCS，不良率1.43%，昨日到货又测试出7PCS无波形输出，请紧急确认最近为什么
会有这么多起振无波形输出的问题。贵司的制程中是否有相同问题发生。由于昨日到货产品还未检测完成，待测试完成后我再将不良汇总发出来。谢谢!

序号	Croven问题点	大普回复
1	低温启动测试2S内可以达到-300ppm，是怎样定义成的标准	根据晶体低温状态下的频率，采集一定的数据量制定的
2	为何需要做低温启动测试，测试目的是什么	检查产品低温状态下瞬间通电（通电2S)频率输出是否达到
3	其他供应商的是否有相同问题，不良率是多少？	其他供方近期（一年内）无类似问题发生
4	低温启动测试不良比率是多少？测试多少发现的不良。	投产1900pcs发现4pcs，不良率0.21%
5	回收的不良是否只有7PCS，是多少产品中发现的7PCS不良，不良率是多少？	投产464pcs发现7pcs不良，不良率1.5%
6	规格书没有要求测试低温启动，Croven也无法测试复现，因为需要成品测试。如果不良低是否可忽略不计。	需要跟进几批来料品质状况再做进一步分析。
7	气密性要求1E-9是依据什么标准来制定的，还需确认Crven气密性标准。	漏率标准按照国标《石英晶体元件总规范GB/T 12273.2.3.11 要求。
8	统计不良问题的失效率，不良趋势是否上升或下降，可以看出是否有改善，从而能监控重点问题点的改善。	关于起振无波形输出已用趋势图统计，不良一直是上

JSC3E05003D3晶体异常汇总

批次号	起振无波形	DLD不合格	外观不良	漏气
20180105012	3	0	0	0
20180201010	3	1	0	0
20180228008	3	1	0	0
20180307003	4	2	1	0
20180314005	1	0	2	1
20180315020	2	0	3	0
20180327048	8	1	8	0
20180404002	29	1	7	0



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发件人： Wei Zhang
发送时间： 2018-04-03 03:15
收件人： sqe
主题： RE: RE: Questions about crystal return to Croven

Hi Lily,

I will call you Tuesday at 8:30 am EST(8:30 pm Beijing time) to discuss our questions regarding your comments in your summary table-1 . Please let me know if this is a good time to call you. Thank you.

Wei Zhang
Crystal Engineer
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From: sqe [mailto:sqe@dptel.com]
Sent: March-29-18 4:41 AM
To: Mueller, Luke; Wei Zhang; Cathy Visniar
Cc: jtcq@dptel.com
Subject: 回复: RE: Questions about crystal return to Croven

Hello Luke

For the abnormal crystals found on the production line, I added the process of using these crystals in the attachment, and in th e table, I note the definition of start-up slowly at low temperature .Please check, thank you.

Actually, we want to know more specifically why these crystals are abnormal. As you said, these crystals passed at least five tes ts before entering the production line
（passed Croven testing minimum of 3 times and passed Dapu testing minimum two times ）.However, this part of crystals are abnormal in the production line. By
replacing the crystals We determine that there may be some problems inside the crystal during the production process.But Dapu can't know what is happening inside
the crystal. I believe croven is more professional than us in this area.

So we want croven to help us analyze why crystals cause abnormalities,For the crystals manufactured in 2013, we just wanted t o ask croven to help analyze the causes of the defects.
We think this will help us improve the quality of products in production.for your help we will be greatly appreciate.Finally, if yo u have any good suggestions please let us know ,thank you very much.

Dapu Telecom Technology Co,.Ltd
Contact person:Lily(黄丽媛）
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