

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

REALTEK SEMICONDUCTOR CORP.,
Petitioner,

v.

ATI TECHNOLOGIES ULC
Patent Owner.

Case No. IPR2023-00922
U.S. Patent No. 8,760,454

**PATENT OWNER'S SUR-REPLY TO PETITIONER
REALTEK SEMICONDUCTOR CORP.'S REPLY TO PATENT OWNER'S
PRELIMINARY RESPONSE**

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Ex. No	Reference Name
EX 2001	Declaration of William Mangione-Smith and CV
EX 2002	IPR2015-00325, Declaration of Dr Wolfe, Sept. 9, 2015
EX 2003	IPR2015-00325, Declaration of Calvin Watson, Sept. 9, 2015
EX 2004	IPR2015-00325, Declaration of Lefebvre, Sept. 9, 2015
EX 2005	IPR2015-00325,-00326, and-00330, Deposition Transcript of Calvin Watson, November 4, 2015
EX 2006	IPR2015-00325, -00326, and -00330, Deposition Transcript of Dr. Wolfe, Nov. 10, 2015
EX 2007	IPR2015-00325,-00326, and -00330, Deposition Transcript of Laurent Lefebvre, Nov.13, 2015
EX 2008	Gruber et al, R400 Shader Processor 2001, Oct. 9, 2015
EX 2009	R400 Document Library Folder History, November 1, 2000 through April 8, 2005
EX 2010	R400 Sequencer Specification (Version 0 4), August 14, 2001
EX 2011	R400 Sequencer Specification (Version 2 0), September 24, 2001
EX 2012	R400 Shader Processor (Version 0 1), Jan. 23, 2001
EX 2013	R400 Top Level Specification (Version 0 2), March 11, 2001
EX 2014	R400 Program Logs
EX 2015	Microsoft Site Visit (Feb. 2003)
EX 2016	Log of Exhibits and File Location
EX 2017	R400 Program Review Documentation (Feb. 2003)
EX 2018	R400 MM Software Status (Feb. 2003)
EX 2019	R400 I/O Presentation (Feb. 2003)
EX 2020	R400 I/O Presentation (Feb. 2003)
EX 2021	R400 August Program Review
EX 2022	Executive Review - R400 (Oct. 2002)
EX 2023	R400 Area Estimate
EX 2024	R400 Executive Review (Sept. 2002)
EX 2025	GFIXIP 9x SX Micro-Architecture Specification
EX 2026	WD/IA VGT Micro-Architecture Specification
EX 2027	GX9 SPI Specification

Ex. No	Reference Name
EX 2028	R400 Top Level Specification (Version 0.2)
EX 2029	R400 Folder History Log
EX 2030	R400 Folder History Log
EX 2031	R400 Folder History Log
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EX 2033	R400 Review PowerPoint
EX 2034	R400 Development and Documentation
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EX 2037	R400 Primitive Assembly
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EX 2054	TV Specification
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EX 2059	R400 Program Review

Ex. No	Reference Name
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EX 2114	IPR2015-00326, EX 2001 - EX2002
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I. INTRODUCTION

Far from being “irrelevan[t]” (Reply at 1), the Federal Circuit holding in *ATI Techs. ULC v. Iancu* that (1) “the record is clear that ATI exercised the requisite reasonably continuous diligence” regarding the R400 project at issue here, and (2) the R400 project establishes conception and reduction to practice by ATI before the critical date of the Lindholm ’913 patent, June 27, 2003, is controlling here. *Id.*, 920 F.3d 1362, 1374 (Fed. Cir. 2019).

Realtek’s argument is that the Federal Circuit ruling does not apply to the ’454 patent because the ’454 patent contains additional claim limitations not present in the ’871, ’369, or ’053 patents that the Federal Circuit held were invented before Lindholm ’913 (the first two being parents of the ’454 patent). Reply at 1. Realtek argues that (1) a feature called dynamic register allocation is required to show conception and reduction to practice of the claims of the ’454 patent, and (2) that feature was not conceived of or reduced to practice during the R400 project. *Id.*

Realtek’s arguments fail for at least three reasons. **First**, Realtek ignores the evidence put forth by ATI and Dr. Mangione-Smith, which establishes invention of the ’454 patent claims before the date of the Lindholm patents, and instead alleges something else is required, without supporting its allegation or explaining why ATI’s evidence is insufficient. **Second**, if Realtek were correct that dynamic register allocation is required to meet the claims of the ’454 patent, Realtek’s petition fails,

because it does not allege, much less prove, that that functionality is in its asserted references. *Third*, Realtek's own evidence—which it goes to great lengths to argue ATI maliciously suppressed from the Board—demonstrates conception and reduction to practice of dynamic register allocation in the R400 project, under questioning from Realtek's counsel in this case that sought leave to file a reply brief:

5	Q. Was the dynamic mode of the register	01:26
6	file allocation method ever functional in the	01:26
7	R400?	01:26
8	A. I believe it had some bugs associated	01:26
9	with it. I mean, it was basically functional,	01:27
10	but I'm not sure it was completely functional.	01:27
11	Q. What bugs were associated with the	01:27
12	dynamic register file allocation method in the	01:27
13	R400?	01:27
14	A. I'd have to look at the bug log to	01:27
15	tell you. I recall that there were bugs, but I	01:27
16	don't recall the details of the bugs.	01:27
17	Q. Were the issues related to these bugs	01:27
18	ever resolved?	01:27
19	MR. FAHRENKROG: Object to the form.	01:27
20	A. Yes. The basic design was proven to	01:27
21	work.	01:27

Ex. 1017 (932 Inv. Gruber Depo. Tr.) at 103:5-21.

Realtek's other argument, that Judge Pender in the 337-TA-932 investigation found that '454 patent was not owed a priority date before the Linholm references, is erroneous. The '454 patent was not at issue in that case, nor was conception and reduction to practice of its claims analyzed or discussed in any way.

ATI has proven, consistent with Federal Circuit ruling, that the claims of the '454 patent were invented before the Lindholm patents' critical dates.

II. ARGUMENT

A. ATI Demonstrated Conception and Diligent Reduction to Practice, Which Realtek Ignores

Realtek argues the limitations “performing vertex operations on the vertex data by a processor within the unified shader *unless the general purpose register block does not have enough available space therein to store incoming vertex data*” and “continuing pixel calculation operations that are to be or are currently being performed by the processor based on instructions maintained in an instruction store *until enough registers within the general purpose register block become available,*” claim 1 of the '454 patent were not conceived of or reduced to practice in the R400.

Realtek ignores the evidence from ATI and Dr. Mangione-Smith, including technical specifications starting August 2001 stating that the sequencer of the R400 “arbitrates between Pixel FIFO and Vertex FIFO – when there are no vertices pending OR *there is no space left in the register files for vertices*, the Pixel FIFO is selected.” Ex. 2010 (Aug. 24, 2001) at 18; *id.* at 4 (“The sequencer will not start the next vector until the needed space is available.”), 17 (“[T]he arbiter is not going to select a vector to be transformed if the parameter cache is full.”); Ex. 2011 (April 19, 2022) at 26 (“There are actually two sets of arbitration -- one for pixels and one for vertices. . . . ALU arbitration is a little more complicated. . . .these threads are

further filtered based on whether space is available.”); Ex. 2119 (Sequencer Spec, ver. 2.11, Aug. 29, 2003) at 1281-82 (same); Ex. 2001 (M-S Decl.) at ¶¶ 83, 127, 139; Ex. 2003 (Watson Decl.) at ¶¶ 33-35, 85-87, 118-120. These documents and others in the expert declaration show that ATI conceived of and developed in the R400 project features that meet the challenged claim limitations in the ’454 patent.

Substantial evidence from the Preliminary Response and expert declaration also demonstrate diligence regarding the R400 sequencer. Mr. Lefebvre, the architectural lead of the sequencer, testified that he “updated the R400 Sequencer Specification approximately every two to three weeks.” Ex. 2118 (Lefebvre Decl.) ¶ 36. He and his colleagues also “continuously developed, tested, and debugged emulation code and RTL code for the R400 . . . between late 2001 and the end of 2003.” *Id.* ¶¶ 38-43. Updates to program reviews and the testing and emulation of source code show the same. *See, e.g.*, Ex. 2001 ¶¶ 195-210, 227-244. ATI thus established diligence from conception in August 2001 until constructive reduction to practice, on November 20, 2003, with the filing of the parent ’871 patent.

The Federal Circuit also held that “the record is clear that ATI exercised the requisite ‘reasonably continuous diligence’” regarding the R400. *ATI Techs.*, 920 F.3d at 1370. It found compelling the activities described by Mr. Lefebvre, including his declaration, Ex. 2118, “describ[ing] his and the other inventors’ and other ATI employees’ activities on th[e R400] project . . . accompanied by ‘almost

1300’ pages of documentary records showing the work done and by whom and when, including metadata, document logs, and folder histories.” *Id.* at 1370. “ATI assigned over one hundred project managers/designers to implement and test the R400 and at least one person on the R400 project team worked on the R400 design every non-holiday business day.” *Id.* These activities spanned from October 9, 2001 to at least November 20, 2003. *Id.* The same documents and activities found by the Federal Circuit to establish diligence, in addition to numerous other documents, are relied on to support diligence here.

Realtek argues that Dr. Mangione-Smith did not analyze RTL code. Reply at 4. But the Federal Circuit did not rely on any code analysis in finding prior invention and none is required here, especially when the documentary evidence is so extensive. *ATI Techs.*, 920 F.3d at 1370-72 (relying on inventor declaration and documents, including metadata to conclude diligence). Nor does proving conception or diligence require a taping out to the actual “GPU,” as Realtek implies. *See id.* Realtek also mistakenly claims there were “‘substantial changes’ in the R500 and R600,” *i.e.*, between the R400 and the later projects—Mr. Gruber testified there were “substantial changes *from* the R500 *to* the R600.” Ex. 1017 at 8:5-11. Mr. Gruber testified on the very same page that “the internals [of Xenos and the R600] were largely based on the R400 *unchanged*.” *Id.* at 7:23-8:4, 7:13-19 (“The R400 project was remained [sic: renamed] the R500 project.”). And Realtek does not identify any

changes, whether they are relevant to the '454 patent, or why any alleged change from one product to another refutes conception and diligent reduction to practice.

Lastly, Realtek argues without citation that the Wolfe declaration in the '871 patent proceeding concluded that the R400 has a fixed priority vertex scheme. Reply at 5-6. Even if true, it does not negate the evidence above. Indeed, claim 1 of the '454 patent recites “performing vertex operations . . . unless the general purpose register block does not have enough available space,” in which case “continuing pixel operations . . . until enough registers . . . become available” for vertex processing, indicating that a fixed vertex priority is compatible with the '454 patent.

B. If Realtek Is Correct That The Claims Require Dynamic Register Allocation, Its Petition Fails For Failure of Proof

Realtek does not explain what it means by the term “dynamic register allocation.” What it appears to mean is the ability to change, during runtime, what portion of storage is dedicated to one type of data (*e.g.*, vertex) versus another (*e.g.*, pixel). Reply at 7 (“[A] fixed register system . . . is not the dynamic method in the Challenged Claims.”). Whether or not Realtek is correct that that is a claim requirement, its petition does not allege it to be a requirement, nor does the petition identify where in the prior art such functionality is found. Thus, if Realtek is correct regarding what the claims require, its petition should be denied for failure of proof.

C. Dynamic Resource Allocation Was Conceived Of and Diligently Reduced To Practice in the R400 Project

For all Realtek's allegations that ATI hid information from the Board, Realtek is proven wrong by the exhibit it alleges ATI suppressed. Realtek's core argument is that ATI neither conceived nor reduced to practice dynamic register allocation in the R400. Reply at 2 ("the failure of ATI to conceive of or reduce to practice the 'dynamic register allocation' in the R400"). But the transcript of inventor Andrew Gruber's deposition that Realtek bases its arguments on says the opposite.

On the very preceding page to the quote that Realtek relies on, Mr. Gruber testified the "dynamic mode of the register file allocation method" was "basically functional" and "the basic design was proven to work" in the R400. Ex. 1017 at 103:5-21. This shows conception and actual reduction to practice. How Realtek can ignore that key testimony and simultaneously accuse ATI of misleading the Board is unclear. And the sequencer specification confirms Mr. Gruber's testimony. Ex. 2010 at 3 ("Added the *dynamic allocation method for register file* and an example . . . of the flow of pixels/vertices in the sequencer."), 13; Ex. 2001 at ¶ 73; Ex. 2119 at 1284; Ex. 2003 at ¶ 120. Realtek argues that only a 50-50 resource split was in the code for the R400. Reply at 7. But that is irrelevant, as that relates to the "default hardware setting" applied before system startup that he was questioned about. Ex. 1017 at 106:14-107:1. Dynamic register allocation, as Realtek apparently argues, relates to changing the allocation during runtime, not the initial setup. And so the

fact that the inventors had not yet found the optimal starting conditions is irrelevant.

D. Realtek’s Reply Mischaracterizes Mr. Gruber’s Testimony

Mr. Gruber did not testify that he “cannot provide a date” of conception of the dynamic register allocation. Reply at 7-8. Mr. Gruber was asked when the “*entirety* of the invention” was conceived of. Ex. 1017 at 116:3-8 (emphasis added). That Mr. Gruber could not provide a specific date for the entirety of an invention nearly 15 years prior and for which he was one of four inventors is unsurprising and irrelevant. Mr. Gruber actually testified that the “fundamental aspects,” which by Realtek’s own arguments would include dynamic file allocation, “were designed *prior to 2002* certainly,” consistent with the above discussion. *Id.* at 115:19-116:2.

E. The 932 Investigation Is Irrelevant

The question addressed in 337-TA-932, a case that did not involve ATI or any related entity, was whether “under Section 102(g)(2) the ATI Unified Shader anticipates claims 1 and 15 of the [Lindholm] ’685 patent.” Ex. 1015 (Inv. 932 Init. Det.) at 142. That case came before the Federal Circuit decision and did not address conception and diligent reduction to practice of the ’454 patent or the ’871 patent. Judge Pender found requirements of Lindholm ’685—that are not present in the ’454 patent—were not shown in the ATI product prior to the relevant date, largely because the evidence was from 2002 onward and respondents sought a conception date in 2000. *Id.* at 141-145. The evidence here does not suffer from that flaw.

Dated: October 20, 2023

Respectfully submitted,

/William A. Meunier/

William A. Meunier (Reg. No. 41,193)

Michael T. Renaud (Reg. No. 44,299)

Adam S. Rizk (Reg. No. 66,867)

MINTZ, LEVIN, COHN, FERRIS,

GLOVSKY AND POPEO, P.C.

One Financial Center

Boston, MA 02111

Telephone: 617-542-6000

Facsimile: 617-542-2241

WAMeunier@mintz.com;

MTRenaud@mintz.com

ARizk@mintz.com

Reza Dokhanchy (Reg. No. 62,795)

MINTZ, LEVIN, COHN, FERRIS,

GLOVSKY AND POPEO, P.C.

3580 Carmel Mountain Road, Suite 300

San Diego, CA 92130

Telephone: 858-314-1596

RDokhanchy@mintz.com

CERTIFICATE OF SERVICE

I certify that a copy of Patent Owner's Sur-Reply to Petitioner's Reply to Patent Owner's Preliminary Response is being served by electronic mail on the following counsel of record:

Lead Counsel

Jeffrey Johnson
Reg. No. 53,078
ORRICK, HERRINGTON &
SUTCLIFFE, LLP
609 Main Street, 40th Floor
Houston, TX 77002-3106
Telephone: (713) 658-6400
Facsimile: (713) 658-6401
Email: 3J6PTABDocket@orrick.com;
Realtek-AMD_OHS@orrick.com

Backup Counsel

Christopher J. Higgins
Reg. No. 66,422
ORRICK, HERRINGTON &
SUTCLIFFE, LLP
1152 15th Street, N.W.
Washington, DC 20005-1706
Telephone: (202) 339-8400
Facsimile: (202) 339-8500
Email: OCHPTABDocket@orrick.com;
Realtek-AMD_OHS@orrick.com

Steve Baik
Reg. No. 42,281
WHITE HAT LEGAL
P. O. Box 382
San Jose, CA 95002
Telephone: (650) 618-5282
Email: sbaik@whitehat.legal

Dated: October 20, 2023

/William A. Meunier/

William A. Meunier (Reg. No. 41,193)