337-TA-359

In the Matter of

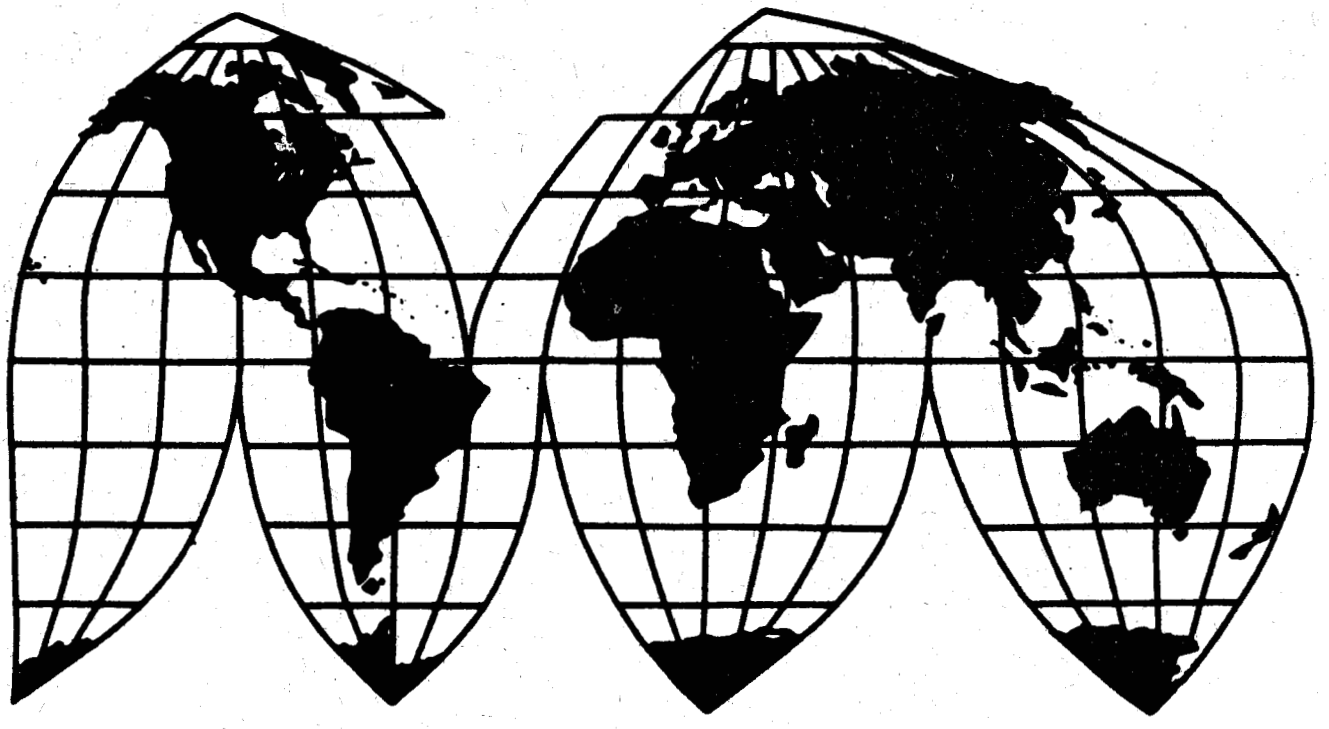
Certain Dielectric Miniature Microwave Filters and Multiplexers Containing Same

Investigation No. 337-TA-359

Temporary Relief Proceedings

Publication 2787 **June 1994**

U.S. International Trade Commission



Washington, DC 20436

U.S. International Trade Commission

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UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, DC 20436

In the Matter of	Investigation No. 337-TA-359
CERTAIN DIELECTRIC MINIATURE MICROWAVE FILTERS AND MULTIPLEXERS CONTAINING SAME	

NOTICE OF COMMISSION DETERMINATION TO MODIFY IN PART AND TO AFFIRM IN PART AN INITIAL DETERMINATION GRANTING TEMPORARY RELIEF AND TO ISSUE A LIMITED TEMPORARY EXCLUSION ORDER, SUBJECT TO THE POSTING OF BOND BY COMPLAINANT

AGENCY: U.S. International Trade Commission.

ACTION: Notice.

SUMMARY: Notice is hereby given that the U.S. International Trade Commission has determined to modify in part and affirm in part the presiding administrative law judge's (ALJ's) initial determination (ID) in the above-captioned investigation, and to issue a limited temporary exclusion order.

FOR FURTHER INFORMATION CONTACT: Matthew T. Bailey, Esq., Office of the General Counsel, U.S. International Trade Commission, telephone 202-205-3108.

SUPPLEMENTARY INFORMATION: On October 4, 1993, Space Systems/Loral, Inc. (SSL) filed a complaint and a motion for temporary relief with the Commission alleging violations of section 337 in the importation, the sale for importation, and the sale within the United States after importation of certain dielectric miniature microwave filters and multiplexers containing same. SSL's complaint alleged infringement of claims 1, 3, 7-11, and 14 of U.S. Letters Patent 4,489,293 (the '293 patent). The motion for temporary relief was limited to claims 1 and 14 of the '293 patent.

The Commission instituted an investigation into the allegations of SSL's complaint, and provisionally accepted SSL's motion for temporary relief, and published a notice to that effect in the Federal Register. 58 Fed. Reg. 60877-78 (November 18, 1993). The notice named Com Dev Ltd. (Com Dev) of Ontario, Canada as the only respondent.

The presiding administrative law judge (ALJ) held an evidentiary hearing on SSL's motion for temporary relief from January 12 to January 22, 1994. Com Dev actively participated in the hearing. The Commission received submissions on the issues of remedy, the public interest, and bonding, from all parties.

On March 17, 1994, the ALJ issued an initial determination (ID) granting SSL's motion for temporary relief. All parties filed written comments and responses to each other's comments.

The Commission, having considered the ID, the comments and responses of the parties, and the record in this investigation, determined to modify the ID in one minor respect, and to affirm the ID in all other respects.

The Commission, having determined that there is reason to believe that there is a violation of section 337 in the importation, sale for importation, or sale in the United States after importation of the accused miniature microwave filters, and having determined that temporary relief is warranted, considered the issues of the appropriate form of such relief, whether the public interest precludes issuance of such relief, complainant's bond, and respondent's bond during the period such relief is in effect. The Commission determined that a limited temporary exclusion order is the appropriate form of temporary relief. The Commission further determined that the statutory public interest factors do not preclude the issuance of such relief, that respondents' bond during the period of the temporary limited exclusion order shall be in the amount of $10,802 per imported miniature microwave filter, and that complainant's bond shall be in the amount of $100,000.

Commission interim rule 210.58(b)(3) sets forth the requirements for posting of complainant's bond. Commission interim rule 210.58(b)(7) requires that all bonds posted by complainant must be approved by the Commission Secretary before the temporary relief which the bond will secure will be issued. Consequently, issuance of the temporary relief described in the preceding paragraph is subject to the posting and approval of a complainant's bond in the amount of $100,000. Complainant is to file its bond with the Commission Secretary within seven (7) business days of publication of this notice in the Federal Register.

The authority for the Commission's determination is contained in section 337 of the Tariff Act of 1930 (19 U.S.C. § 1337), as amended, and in sections 210.24 and 210.58 of the Commission's Interim Rules of Practice and Procedure, 19 C.F.R. §§ 210.24 and 210.58.

Copies of the Commission's Order, the opinion in support thereof, the ALJ's ID, and all other nonconfidential documents filed in connection with this investigation are or will be available for inspection during official business hours (8:45 a.m. to 5:15 p.m.) in the Office of the Secretary, U.S. International Trade Commission, 500 E Street S.W., Washington, D.C. 20436, telephone 202-205-2000. Hearing-impaired persons are advised that information on the matter can be obtained by contacting the Commission's TDD terminal on 202-205-1810.

By order of the Commission.

Donna R. Koehnke

Donna R. Koehnke
Secretary

Issued: April 18, 1994

UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, D.C. 20436

In the Matter of	)	
	)	Investigation No. 337-TA-359
CERTAIN DIELECTRIC MINIATURE MICROWAVE FILTERS AND MULTIPLEXERS CONTAINING SAME	)	

ORDER

On October 4, 1993, Space Systems/Loral, Inc. (SSL) filed a complaint and a motion for temporary relief with the Commission alleging violations of section 337 in the importation, the sale for importation, and the sale within the United States after importation of certain dielectric miniature microwave filters and multiplexers containing same. SSL's complaint alleged infringement of claims 1, 3, 7-11, and 14 of U.S. Letters Patent 4,489,293 (the '293 patent). The motion for temporary relief was limited to claims 1 and 14 of the '293 patent.

Pursuant to subsection (b) of section 337, the Commission instituted an investigation into the allegations of SSL's complaint, and provisionally accepted SSL's motion for temporary relief pursuant to Commission interim rule 210.24(e)(8). The Commission published a notice to that effect in the Federal Register. 58 Fed. Reg. 60877-78 (November 18, 1993). The notice named Com Dev Ltd. (Com Dev) of Ontario, Canada as the only respondent.

The presiding administrative law judge (ALJ) held an evidentiary hearing on SSL's motion for temporary relief from January 12 to January 22, 1994. Com Dev actively participated in the hearing. The Commission received submissions on the issues of remedy, the public interest, and bonding, from all parties in accordance with Commission interim rule 210.24(e)(18)(ii).

On March 17, 1994, the ALJ issued his initial determination (ID) granting SSL's motion for temporary relief. All parties filed written

comments and responses to comments on the ID pursuant to Commission interim rule 210.24(e)(17)(iii).

The Commission, having considered the ID, the comments and responses of the parties, and the record in this investigation, has determined to modify the ID in one minor respect, and to affirm the ID in all other respects. In particular, with regard to the ID's analysis of the enablement issue under 35 U.S.C. § 112, the ID stated "[s]ince the invention that must be enabled is defined by the claims, and since there is no claim for a mounting means, Com Dev's argument must be rejected." ID at 39. That statement is not necessary to support the ID's determination, with which the Commission agrees, that the '293 patent satisfies the enablement requirement under 35 U.S.C. § 112. Accordingly, the Commission modifies the ID by deleting the above-quoted statement from the ID. The Commission affirms the remainder of the ID's analysis on the issue of enablement. The Commission also affirms the remainder of the ID supporting the ALJ's determination that there is reason to believe that there is a violation of section 337.

The Commission, having determined that there is reason to believe that there is a violation of section 337 in the importation, sale for importation, or sale in the United States after importation of the accused miniature microwave filters, and having determined that temporary relief is warranted, considered the issues of the appropriate form of such relief, whether the public interest precludes issuance of such relief, complainant's bond, and respondent's bond during the period that temporary relief is in effect. The Commission has determined that a limited temporary exclusion order is the appropriate form of temporary relief. The Commission has further determined that the statutory public interest factors do not preclude the issuance of such relief, and that respondent's bond during the period of the limited

temporary exclusion order shall be in the amount of $10,802 per imported miniature microwave filter. Finally, the Commission has determined that the complainant's bond shall be in the amount of $100,000.

Accordingly, it is hereby **ORDERED THAT** --

1. Miniature microwave filters and multiplexers containing same manufactured by Com Dev Ltd. of Ontario, Canada, or any of its affiliated companies, parents, subsidiaries, licensees, contractors, or other related entities, or their successors or assigns, that infringe claims 1 and/or 14 of U.S. Letters Patent 4,489,293 are excluded from entry into the United States during the pendency of USITC Investigation No. 337-TA-359, except under license of the patent owner.

2. The temporary relief described in the preceding paragraph of this **Order** is issued subject to the posting by complainant and approval by the Commission of a complainant's bond in the amount of $100,000.

3. In accordance with 19 U.S.C. § 1337(l), the provisions of this **Order** do not apply to miniature microwave filters and multiplexers containing same imported by or for the United States.

4. The articles identified in paragraph (1) of this **Order** are entitled to entry into the United States under bond in the amount of $10,802 per miniature microwave filter from the day after the Commission has approved complainant's posted bond until the day after the Commission issues its final determination in Investigation 337-TA-359, unless, pursuant to subsection (j)(3) of section 337 of the Tariff Act of 1930, the President notifies the Commission within 60 days after the date he receives this **Order**, that he disapproves this **Order**.

5. The Commission may amend this **Order** in accordance with the procedure described in section 211.57 of the Commission's Interim Rules of Practice and Procedure, 19 C.F.R. § 211.57.

6. A copy of this **Order** shall be served upon each party of record in this investigation.

7. Notice of this **Order** shall be published in the Federal Register.

By order of the Commission.

Donna R. Koehnke

Donna R. Koehnke
Secretary

Issued: April 18, 1994

PUBLIC VERSION

UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, DC 20436

In the Matter of	
CERTAIN DIELECTRIC MINIATURE MICROWAVE FILTERS AND MULTIPLEXERS CONTAINING SAME	Investigation No. 337-TA-359

COMMISSION OPINION ON MODIFICATION OF THE INITIAL DETERMINATION, AND ON THE REMEDY, THE PUBLIC INTEREST, AND COMPLAINANT'S AND RESPONDENT'S BOND

INTRODUCTION

On October 4, 1993, Space Systems/Loral, Inc. (SSL) filed a complaint and a motion for temporary relief with the Commission alleging violations of section 337 of the Tariff Act of 1930, 19 U.S.C. § 1337, in the importation, the sale for importation, and the sale within the United States after importation of certain dielectric miniature microwave filters and multiplexers containing same. SSL's complaint alleged infringement of claims 1, 3, 7-11, and 14 of U.S. Letters Patent 4,489,293 (the '293 patent). The motion for temporary relief was limited to claims 1 and 14 of the '293 patent.

The Commission instituted an investigation into the allegations of SSL's complaint, provisionally accepted SSL's motion for temporary relief, and published a notice to that effect in the Federal Register. 58 Fed. Reg. 60877-78 (November 18, 1993). The notice named Com Dev Ltd. (Com Dev) of Ontario, Canada as the only respondent.

From January 12 to January 22, 1994, the presiding administrative law judge (ALJ) held an evidentiary hearing on SSL's motion for temporary relief. Com Dev actively participated in the hearing. The Commission received submissions on the issues of remedy, the public interest, and bonding from all parties.

On March 17, 1994, the ALJ issued an initial determination (ID) granting SSL's motion for temporary relief. All parties filed written comments and responses to each other's comments with the Commission.

The Commission, having considered the ID, the comments and responses of the parties, and the record in this investigation, determined to modify the ID in one minor respect, and to affirm the ID in all other respects. The Commission, having determined that there is reason to believe that there is a violation of section 337 in the importation, sale for importation, or sale in the United States after importation of the accused

miniature microwave filters (MMFs), and having determined that temporary relief is warranted, considered the issues of the appropriate form of such relief, whether the public interest precludes issuance of such relief, complainant's bond, and respondent's bond during the period such relief is in effect. This opinion discusses in turn the modification of the ID, the remedy, the public interest, and bonding.

MODIFICATION OF THE ID

Claims 1 and 14 of the '293 patent were asserted by SSL, and each describe a microwave filter comprising a combination of elements. In particular, claim 1 recites, inter alia, a cavity resonator, and a dielectric resonator element which is disposed within said cavity resonator. Similarly, claim 14 recites, inter alia, a first cavity and a second cavity, and a first dielectric and a second dielectric disposed within the first and second cavities, respectively.

During the proceedings before the ALJ, Com Dev argued that the '293 patent was invalid for failing to meet the enablement requirement of 35 U.S.C. § 112. In particular, Com Dev argued that "[t]here is no clear description in the '293 patent sufficient to enable one of ordinary skill to know how to mount the dielectric resonator in the cavity."[1] The ALJ rejected Com Dev's argument, stating:

> Since the invention that must be enabled is defined by the claims, and since there is no claim for a mounting means, Com Dev's argument must be rejected. Nevertheless, the patent specification does refer to mounting the dielectric as follows:
>
> > Although not shown in Fig. 1, resonator elements 27 can be successfully mounted in cavities 3, 5, and 7 by a variety of insulative mounting means which generally take the form of pads of short columns of low-loss insulator material such as polystyrene or PTFE. However, the best performance has been obtained by the use of mountings made of a low-loss polystyrene foam.

ID at 39 (citations omitted).

In the comments filed before the Commission, the Commission investigative attorney supported the ALJ's ultimate conclusion that the '293 patent satisfies the enablement requirement, but argued that the enablement requirement is broader than that described by the ALJ in the ID. The Commission investigative attorney argued that to enable one of ordinary skill in the art to make and use the invention, the specification must disclose how to place the resonator in the cavity because the claims require that the dielectric be "disposed within" the cavity resonator.

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1. Com Dev's Post Hearing Brief at 27.

The enablement requirement of 35 U.S.C. § 112 requires that the specification teach any person skilled in the appropriate art how to make and use the invention. Frequently, the enablement requirement requires disclosure of methods or techniques not constituting elements of the claims.[2]

We agree with the ALJ's ultimate conclusion that the '293 patent satisfies the enablement requirement under 35 U.S.C. § 112. However, we believe that the ALJ described that requirement too narrowly. We are of the view that the ALJ's statement, "[s]ince the invention that must be enabled is defined by the claims, and since there is no claim for a mounting means, Com Dev's argument must be rejected," is erroneous as a matter of law. The next sentence in the ID, which points to specific language teaching several ways to mount the dielectric, is sufficient to dispose of the enablement issue. The description of how to mount the dielectric resonator within the cavity in the '293 specification (e.g., by using pads of short columns of low-loss insulator material such as polystyrene or PTFE) is clearly sufficient to satisfy the enablement requirement. Accordingly, we modify the ALJ's determination on the enablement issue by deleting the above-quoted sentence.

We find no other errors of law or matters warranting our policy consideration in the remainder of the ID regarding the issue of whether there is reason to believe a violation of section 337 has occurred, and accordingly adopt the reasoning and findings of the ID on that issue.

REMEDY AND THE PUBLIC INTEREST

With regard to remedy and the public interest, section 337(e)(1) provides in relevant part:

> [i]f, during the course of an investigation under this section, the Commission determines that there is reason to believe that there is a violation of this section, it may direct that the articles concerned, imported by any person with respect to whom there is reason to believe that such person is violating this section, be excluded from entry into the United States, unless, after considering the effect of such exclusion upon the public health and welfare, competitive conditions in the United States economy, the production of like or directly competitive articles in the United States, and United States consumers, it finds that such articles should not be excluded from entry.

Accordingly, this subsection directs the Commission to inquire into certain "public interest" factors if it determines that there is reason to believe a violation of section 337 has occurred. Section 337(e)(1) also provides that during the pendency of the investigation, the excluded articles "shall be entitled to entry under bond determined by the Commission and prescribed by the Secretary [of the Treasury]." That provision prevents the Commission's exclusion order from being an absolute bar to entry.

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2. See, e.g., In re Ghiron, 442 F.2d 985, 991 (C.C.P.A 1971) (The rejection of the U.S. Patent and Trademark Office of a method claim to a computer program was upheld by the U.S. Court of Customs and Patent Appeals because of lack of enablement since the specification did not adequately describe the computer apparatus necessary to practice the invention); see also, D. Chisum, Patents, § 7.03[7] at 7-71 (1993).

If the Commission finds reason to believe that a violation of section 337 has occurred and that the public interest factors do not prohibit a remedy, it may enter either a general temporary exclusion order, which covers goods irrespective of source, or a limited temporary exclusion order, which covers goods from only certain foreign sources. Since SSL did not prove the elements necessary for issuance of a general temporary exclusion order under the criteria announced by the Commission in Certain Airless Paint Spray Pumps and Components Thereof, Inv. No. 337-TA-90, USITC Pub. 1199 (Nov. 1981), and since Com Dev is the only known manufacturer of imported infringing MMFs, a general temporary exclusion order is not warranted in this investigation. Accordingly, we determined to enter a limited temporary exclusion order (TEO).

In fashioning the scope of the TEO, we have resolved a dispute among the parties concerning the scope of that order, viz., whether certain near term importations should be exempt from the TEO. Com Dev and the Commission investigative attorney supported such an exemption, but SSL opposed it.

In particular, Com Dev argued that any TEO should only apply to contracts awarded in the future. Com Dev is currently under contract to deliver MMFs to its U.S. customer, GE/Martin Marietta,[3] for the so-called [ ] program in [ ], and for the so-called [ ] satellite programs in [ ], respectively. In the event that any TEO applies to deliveries of MMFs under existing contracts, Com Dev acknowledged that it will make every effort to post bond for MMFs earmarked for existing contracts because it could incur massive penalties if those deliveries are delayed. Moreover, Com Dev asserted that SSL will not benefit from any bonds posted for existing contracts since those contracts are too far along to allow for substitution of SSL as the supplier. It contended that the amount of money required to bond MMFs for its existing contracts would [ ], and that the only purpose of a bond would be to impose a penalty on Com Dev without any corresponding benefit to SSL. With regard to the public interest factors, Com Dev argued that U.S. consumers would be substantially harmed by the issuance of a TEO because of GE/Martin Marietta's financial losses and the adverse impact on its reputation. Consequently, Com Dev maintained that any TEO should exempt from its scope (1) MMFs to be delivered pursuant to existing contracts (i.e., MMFs for [ ], and the [ ] programs), and (2) replacements for MMFs that have already been delivered, so as to avoid the disastrous

3. In 1993, Martin Marietta Corporation acquired GE Aerospace, the Astro-Space division of the General Electric Company, hereinafter referred to as GE/Martin Marietta. GE/Martin Marietta is a prime satellite contractor and has been in the business of making satellites in the United States since about 1964. ID Finding of Fact 390.

consequences that could result if an MMF needs to be replaced just prior to the launch of a multi-billion dollar satellite.

The Commission investigative attorney argued that the appropriate remedy is a limited temporary exclusion order directed to both individual MMFs and multiplexers that contain a network of MMFs. However, the Commission investigative attorney supported an exemption that would allow importation of MMFs without bond for the Intelsat flight 802 program because [ ], and non-exemption of MMFs for those satellites would be unduly disruptive to the affected satellite programs. She argued that the delay and cost to reconfigure this program to accommodate a different MMF would be excessive, and that program is at such an advanced stage that the importation of MMFs for that satellite, which were contracted for [ ], essentially represent past injury. The Commission investigative attorney also asserted that replacement MMFs for certain satellite programs for which MMFs have already been delivered be exempt from the order because a delay in procurement of a replacement MMF for those programs would result in delay of the delivery of the satellite and a monetary penalty. With regard to the public interest factors, the Commission investigative attorney stated that entry of a TEO would not adversely affect the public interest, provided the exemptions she proposes are incorporated into it.

Complainant SSL argued that a TEO is appropriate due to the irreparable harm that SSL has suffered and continues to suffer. SSL contended that it will be irreparably harmed because MMFs covered by the '293 patent have a short commercial life due to rapidly changing technology. In particular, SSL argued that Com Dev's development of [ ] could replace the dual-mode technology of the '293 patent in [ ], and that super-conducting technology will likely supplant the current technology prior to the expiration of the '293 patent in the year 2001. SSL argued that Com Dev is making and will continue to make "huge and unjust" inroads into the U.S. MMF market. It contended that before the Commission can enter permanent relief, the damage to SSL, absent temporary relief, will already have occurred. SSL also argued that its retention of critical core personnel is threatened by Com Dev's unfair competition. SSL's work force is comprised of highly skilled workers who cannot easily be replaced. Absent temporary relief, SSL asserted that it will be forced to lay off employees beginning in mid-April 1994 due to its shrinking workload. SSL contended that it will be unable to reunite its workforce once dispersed. It argued that it has been deprived of U.S. sales and market share by Com Dev's activities. SSL asserted that it should have 100 percent of the U.S. market since there are no other legitimate (i.e., licensed) manufacturers of MMFs covered by the '293 patent.

With regard to the public interest factors, SSL stated that it can meet all U.S. demand for MMFs and has expressed a willingness to continue to meet the market requirements for MMFs, including those sold to its competitors in the satellite industry (e.g., GE/Martin Marietta). It contended that domestic employment will be preserved by entry of a TEO, and that the [ ] that Com Dev contended will befall GE/Martin Marietta will never happen because Com Dev is accelerating its delivery schedule to beat any TEO, and both Com Dev and GE/Martin Marietta have stated that they [ ] to ensure timely delivery of MMFs. Accordingly, SSL argued that the only MMFs which will be affected by the TEO are the MMFs designated for the GE 1 and GE 2 satellite programs.

SSL also asserted that if GE/Martin Marietta does suffer any harm, that harm will be entirely self-inflicted. In November 1992, SSL contacted GE/Martin Marietta and notified it of the potential infringement of the '293 patent by Com Dev's MMFs. At that time SSL was willing and able to provide GE/Martin Marietta with all the necessary MMFs within schedule. GE/Martin Marietta went ahead and entered into an agreement with Com Dev. SSL argued that GE/Martin Marietta did not [ ].[4]

The public policy in enforcing valid U.S. intellectual property rights is especially relevant in this case because of the '293 patent's short market life due to rapidly changing technology, and the adverse consequences likely to befall SSL if Com Dev's apparent infringement is not stopped.[5] The patent owner's right to exclude others from making, using, or selling the patented invention in the United States is paramount in this case. Issuance of a TEO with exemptions would mean that SSL's right to exclude would have only a fraction of the value it should have, and would diminish SSL's incentive to engage in scientific and technological research.[6]

The ALJ discussed the possibility of SSL substituting its MMFs for Com Dev's, and concluded that SSL could provide MMFs for the GE 1 and GE 2 programs within the next 10 to 12 months. He found that GE/Martin Marietta and SSL have investigated the design changes that would be necessary for the incorporation of SSL's MMFs into the GE 1 and GE 2 programs would likely be relatively small and cost between [ ].[7] We believe that SSL should be given the opportunity to supply the MMFs for the GE 1 and

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4. SSL's Memorandum Concerning Remedy, the Public Interest and Respondent's Bond at 18.

5. Smith Int'l, Inc. v. Hughes Tool Co., 718 F.2d 1573, 1577-78 (Fed. Cir.) cert. denied 464 U.S. 996 (1983)

6. Id.

7. ID at 52.

GE 2 programs because of patent owner SSL's right of exclusivity. We do not believe that redesign costs required to substitute SSL's MMFs are significant in view of the overall cost of satellite programs, which can run into the hundreds of millions of dollars, and the typical average cost of MMFs per satellite program, which often amount to millions of dollars.[8] Accordingly, we determine that the MMF's intended for the GE 1 and GE 2 programs should not be exempted from the scope of the limited TEO.

With regard to the MMFs intended for Intelsat flight 802, since it is unlikely that SSL could provide MMFs for the Intelsat 802 program (with its [ ] delivery date) in a timely fashion, we must consider the possibility that U.S. consumers, i.e., GE/Martin Marietta, will be harmed by the exclusion of Com Dev's MMFs in determining whether to exempt those MMFs from the scope of the limited TEO. In that regard, we note that GE/Martin Marietta ignored SSL's claims of infringement until it was forced to confront them, by which time it was too late for GE/Martin Marietta to substitute SSL's MMFs. A letter of intent between Com Dev and GE/Martin Marietta regarding the contract for Intelsat flight 802 was signed in [ ], with the contract finalized in [ ].[9] GE/Martin Marietta was first alerted of SSL's infringement claim in November 1992, but took no action at that time despite constant contact with Com Dev.[10] Only after receiving a second letter from SSL did GE/Martin Marietta contact its supplier, Com Dev, in [ ].[11]

Moreover, GE/Martin Marietta's [ ].[12] In this case, GE/Martin Marietta did not request such an opinion regarding infringement of the '293 patent,[13] and therefore [ ].[14] From the testimony at the evidentiary hearing, it appears that GE/Martin Marietta only had "internal dialogue with internal counsel" with nothing reduced to writing.[15] If GE/Martin Marietta had reacted promptly to SSL's allegations of infringement, its present predicament could have been avoided.

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8. ID Finding of Fact 401.

9. Hrg. Tr. at 1237.

10. ID Finding of Fact 453-54.

11. ID Finding of Fact 457.

12. ID Finding of Fact 459.

13. ID Finding of Fact 458.

14. ID Finding of Fact 458-459.

15. ID Finding of Fact 458 and Hrg. Tr. at 1317-18.

Thus, we see few, if any, equities favoring GE/Martin Marietta. GE/Martin Marietta is a company with $6 billion in annual sales and has stated that it will [ ][16]. It would not be particularly burdensome for GE/Martin Marietta to post the comparatively small bond imposed in this case if Com Dev will not or cannot do so.

Accordingly, in view of the above analysis, we determined that the appropriate form of relief is a TEO without exemptions, and that none of the public interest factors recited in section 337(e)(1) precludes the Commission from issuing such a TEO. Additionally, we determined that replacement MMFs are not exempt from the TEO, and are only entitled to entry under bond. It appears that Com Dev can avoid any "disastrous" delays in completing it contracts by importing under bond a small surplus of MMFs for replacement purposes.

BONDING

Section 337(e)(2) provides that "[t]he Commission may require the complainant to post a bond as a prerequisite to the issuance of an order under this subsection." Interim rule 210.24(e)(1)(v) describes how the Commission is likely to compute the amount of the complainant's bond. That rule sets forth the factors to be considered:

> (A) The strength of the complainant's case;
>
> (B) Whether posting a bond would impose an undue hardship on the complainant;
>
> (C) Whether the respondent has responded to the motion for temporary relief;
>
> (D) Whether the respondent will be harmed by issuance of the temporary exclusion order sought by the complainant; and
>
> (E) Any legal, equitable, or public interest consideration that is relevant to whether complainant should be required to post a bond as a condition precedent to obtaining temporary relief (including the question of whether the complainant is using the temporary relief proceedings, or is likely to use a temporary exclusion order, to harass the respondents or for some other improper purpose).

Thus, the Commission's goal in computing the amount of complainant's bond is to set an amount that will be sufficient to deter complainant from misusing the temporary relief process or the TEO. Interim rule 210.24(e)(1)(v) also provides that "the amount of the bond is likely to be an amount ranging from 10 to 100 percent of the sales revenues and licensing royalties (if any) from the domestic product at issue." If complainant believes that no bond should be required, it has the burden of persuasion.

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16. ID Finding of Fact 448.

We note that the ALJ determined that SSL made a strong and convincing showing on the merits, and that the balance of harms tips in SSL's favor.[17] The equities weigh heavily in SSL's favor with respect to the posting of a bond. Consequently, we believe there is little likelihood that SSL has misused, or will misuse, the TEO process. However, SSL has not argued that it should not be required to post any bond, and Commission policy is to favor the posting of a bond in every case.

In view of SSL's strong showing on the merits, we determined that it should be required to post a bond of [ ]. In determining this amount, we have utilized the tiered schedule for complainant's bond set forth in the proposed final rule 210.52(e)[18] which states that the amount of complainant's bond will likely be a certain fixed dollar amount depending upon the complainant's sales and licensing royalties from the intellectual property right at issue. In this case, the ALJ found that SSL's 1992 gross sales for MMFs covered by the '293 patent were [ ],[19] and in accordance with the schedule contained in the proposed final rule, we determined that the appropriate complainant's bond in this case is [ ].

With regard to respondent's bond, the legislative history of section 337 states that in determining the amount of respondent's bond, "the Commission shall determine, to the extent possible, the amount which would offset any competitive advantage resulting from the unfair method of competition or unfair act enjoyed by persons benefiting from the importation of the article."[20] The interim rules provide that the Commission shall determine respondent's bond by "taking into account, among other things, the amount that would offset [respondent's] competitive advantage."[21] Typically, the Commission has compared the price differential between complainant's and respondent's products to calculate competitive advantage.[22]

SSL argued that Com Dev enjoys a distinct and unfair price advantage illustrated by the differing prices between SSL's MMFs and Com Dev's MMFs. SSL asserted that Com Dev's price was more than [ ] per MMF below SSL's price. SSL stated that a bond set at an amount sufficient to offset that

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17. ID at 53.

18. 57 Fed. Reg. 52839, 52886 (November 5, 1992).

19. ID Finding of Fact 460.

20. Senate Rep., Committee on Finance, on the Trade Act of 1974, No. 1298, 93d Cong., 2d Sess. 198.

21. Interim rule 210.58(a)(3), 19 C.F.R. 210.58(a)(3).

22. See, e.g., Inv. No. 337-TA-297, Certain Cellular Radiotelephones and Subassemblies, USITC Pub. 2361 at 8-13.

competitive advantage will allow it to continue to employ personnel that would otherwise be laid off. SSL requested a bond of $12,500 per MMF, and argued that ample support for that amount exists in the record.

The Commission investigative attorney argued that Com Dev should be required to post a bond of [ ] percent of the entered value of the MMFs, arrived at by calculating price differences for the GE 1 and GE 2 programs. The Commission investigative attorney asserted that SSL offered MMFs for the GE 1 and GE 2 programs at [ ], while Com Dev's price was [ ]. The difference in price is [ ], or [ ] percent of Com Dev's price.

Com Dev's position regarding the appropriate respondent's bond varies significantly from submission to submission. In its initial submission on remedy, the public interest, and bonding, Com Dev argued that SSL's average offered price was [ ] per MMF. In a "supplemental submission," Com Dev argued that SSL's quoted price is [ ] including "switches." Finally, in its reply comments on the ID, Com Dev argued that SSL's proposal price was [ ]. With regard to its MMFs, Com Dev asserted that its price per MMF is [ ].

We first note that the ALJ made a finding of fact[23] that Com Dev's price was [ ] per MMF.[24] In accordance with interim rule 210.24(e)(17)(ii), which states that the Commission will not review the ALJ decision for factual errors, the Commission may not disturb that finding of fact. With regard to SSL's price per MMF, we agree with the straightforward arguments and analysis provided by SSL and the Commission investigative attorney supporting a price of [ ] per MMF. We reject Com Dev's various proffered prices concerning SSL's MMFs. Accordingly, we determine that a respondent's bond is [ ] per MMF during the period of temporary relief is necessary to offset the competitive advantage enjoyed by Com Dev.

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23. ID Finding of Fact 461.

24. Our analysis of the pricing data considered only the data for the GE 1 and GE 2 programs since the parties have provided the most analysis of that data, and that data represents the most recent market conditions contained in the record.

PUBLIC VERSION

UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, D.C.

In the Matter of	)	
	)	
CERTAIN DIELECTRIC MINIATURE MICROWAVE FILTERS AND MULTIPLEXERS CONTAINING SAME	)	Investigation No. 337-TA-359
	)	

INITIAL DETERMINATION
Administrative Law Judge Sidney Harris

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Resp to pet. due
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Public comments due
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PUBLIC VERSION

UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, D.C.

In the Matter of	)	
	)	
CERTAIN DIELECTRIC MINIATURE MICROWAVE FILTERS AND MULTIPLEXERS CONTAINING SAME	)	Investigation No. 337-TA-359

INITIAL DETERMINATION
Administrative Law Judge Sidney Harris

Pursuant to the Notice of Investigation, 58 Fed. Reg. 60876 (November 18, 1993), this is the Administrative Law Judge's Initial Determination on temporary relief in the Matter of Certain Dielectric Miniature Microwave Filters and Multiplexers Containing Same, U.S. International Trade Commission Investigation No. 337-TA-359. 19 C.F.R. 210.53(a).

The Administrative Law Judge hereby determines that there is reason to believe that a violation of § 337 of the Tariff Act of 1930, as amended, has occurred in the importation of certain dielectric miniature microwave filters and multiplexers containing same by reason of infringement of claims 1 and 14 of U.S. Letters Patent 4,489,293, and that temporary relief is warranted.

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FINDINGS OF FACT PAGE

I. INTRODUCTION

By publication of a notice in the Federal Register on November 18, 1993, the Commission instituted an investigation under section 337 of the Tariff Act of 1930 as amended,[1] and gave notice of its provisional acceptance of a motion for temporary relief (Motion Docket No. 359-1) pursuant to a complaint filed by Space Systems/Loral, Inc., Palo Alto, California on October 4, 1993.[2]

The complaint, as supplemented, alleges violation of subsection (a)(1)(B)(i) of section 337 in the importation into the United States, the sale for importation, and the sale within the United States after importation of certain dielectric miniature microwave filters and multiplexers containing same by reason of alleged infringement of claims 1, 3, 7-11, and 14 of U.S. Letters Patent 4,489,293 ("the '293 patent") and that there exists an industry in the United States as required by subsection (a)(2) of section 337. 58 Fed. Reg. 60876 (November 18, 1993). The complaint requests that the Commission institute an investigation and, after a full investigation, issue a permanent general exclusion order and a permanent cease and desist order. Id. The motion for temporary relief requests that the Commission issue a temporary exclusion order and a temporary cease and desist order prohibiting the importation into and the sale within the United States after importation of infringing dielectric miniature microwave filters and multiplexers during the course of the Commission's investigation. Id.

Pursuant to the notice of investigation, it shall be determined whether

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[1] The Commission's Rules provide that "[t]he investigation shall be instituted by notice published in the Federal Register. Such notice will define the scope of the investigation." 19 C.F.R. § 210.12.

[2] A letter supplementing the complaint was filed on October 29, 1993.

there is a violation of subsection (a)(1)(B) of section 337 in the importation into the United States, the sale for importation, or the sale within the United States after importation of certain dielectric miniature microwave filters and multiplexers containing same by reason of alleged infringement of claims 1, 3, 7, 8, 9, 10, 11 or 14 of U.S. Letters Patent 4,489,293, and whether there exists an industry in the United States as required by subsection (a)(2) of section 337. Id.

The Commission named Space Systems/Loral, Inc. ("SSL" or "complainant") as the complainant and the following company as the respondent:

Com Dev Ltd.
Cambridge, Ontario
Canada

Mary Jane Boswell, Esq. Office of Unfair Import Investigations, was designated as the Commission Investigative Attorney.

Chief Administrative Law Judge Janet D. Saxon designated Administrative Law Judge Sidney Harris to preside over this investigation.

A preliminary conference in this investigation was conducted on November 24, 1993. Appearances were made on behalf of SSL, respondent Com Dev Ltd. ("Com Dev" or "respondent") and the Commission Investigative Staff ("Staff").

On November 23, 1993, SSL moved to amend the complaint and motion for temporary relief to amend the declarations of Michael Maloney and Anthony W. Karambelas. Motion Docket No. 359-2. Inasmuch as the motion is unopposed by Com Dev and the Staff, the motion is GRANTED.

On November 24, 1993, an Unopposed Motion to Designate the Investigation "More Complicated" for the Purpose of Adjudicating a Motion for Temporary Relief was filed. Motion Docket No. 359-3. The motion was granted in Order No. 3 (November 29, 1993).

The hearing on temporary relief in the matter of Certain Dielectric Miniature Microwave Filters and Multiplexers Containing Same commenced on January 12, 1994, and concluded on January 22, 1994.

On March 1, 1994, Com Dev filed a Motion to Submit Additional Legal Authority in Interpreting Means Plus Function Claims. Motion Docket No. 359-29. Motion No. 359-29 is GRANTED.

No party has contested the Commission's in personam jurisdiction or subject matter jurisdiction in this investigation. The Commission has in personam jurisdiction over SSL and Com Dev inasmuch as they appeared and participated in the hearing on temporary relief. Furthermore, the Commission has subject matter jurisdiction over this investigation into alleged unfair acts involving the importation and sale in the United States of the accused devices. FF 8-9.

This Initial Determination is based on the entire record of this proceeding. Proposed findings not herein adopted, either in form or in substance, are rejected as not being supported by the evidence or as involving immaterial matters.

The findings of fact include references to supporting evidentiary items in the record. Such references are intended to serve as guides to the depositions, exhibits, and testimony supporting the findings of fact; they do not necessarily represent complete summaries of the evidence supporting each finding. Some of the findings of fact are contained only in the opinion.

The following abbreviations are used in this Initial Determination:

CX - Complainant's Exhibit (followed by its number and the reference page(s)).

CPX - Complainant's Physical Exhibit

CDX - Complainant's Demonstrative Exhibit

RX - Respondent's Exhibit (followed by its number and the reference page(s)).

RPX - Respondent's Physical Exhibit

RDX - Respondent's Demonstrative Exhibit

SX - Staff Exhibit (followed by its number and the reference page(s)).

SPX - Staff Physical Exhibit

FF - Finding of Fact

Dep.- Deposition

Tr.- Transcript

II. STANDARDS GOVERNING THE GRANTING OF TEMPORARY RELIEF

Pursuant to 19 U.S.C. § 1337(e)(3), the analysis employed in determining whether to grant temporary relief is the same as that used by the Court of Appeals for the Federal Circuit in deciding whether or not to grant a preliminary injunction. That analysis requires the balancing of the following four factors:

1. Complainant's probability of success on the merits;

2. Threat of irreparable harm to the domestic industry in the absence of the requested relief;

3. The balance of harm between the parties; and

4. The effect, if any, that issuance of the requested temporary relief would have on the public interest.

Certain Circuit Board Testers, Inv. No. 337-TA-342, Commission Opinion at 4 (April 5, 1993).

In a patent-based section 337 investigation, a complainant's probability of success on the merits is established by showings that:

1. Respondent is not likely to succeed in proving that the patent at issue is invalid or unenforceable;

2. It is likely that respondent will be found to infringe the patent; and

3. It is likely that a domestic industry will be shown to exist or to be in the process of being established.

Certain Pressure Transmitters, Inv. No. 337-TA-304 (Temporary Relief Proceedings), Commission Opinion at 19 (April 2, 1990), aff'd sub. nom. Rosemount, Inc. v. U.S. Int'l Trade Comm'n, 910 F.2d 819 (Fed. Cir. 1990).

III. INFRINGEMENT

For purposes of the temporary relief phase of this investigation, SSL has put in issue claims 1 and 14 of the '293 patent. Post-Hearing Brief of Complainant at 1, 6-13.

A. Applicable Law of Patent Interpretation and Infringement

An analysis of validity and infringement allegations requires a proper construction of the patent claims at issue to determine their scope. Palumbo v. Don-Joy Co., 762 F.2d 969, 974 (Fed. Cir. 1985). Claims must be given the same meaning for validity and infringement analyses. White v. Dunbar, 119 U.S. 49, 51 (1886).

Claim interpretation is accomplished through an examination of particular claim language, the patent specification, the prosecution history, and other claims. SRI Int'l v. Matsushita Elec. Corp. of America, 775 F.2d 1107, 1118 (Fed. Cir. 1985). Claims are normally construed as they would be by one of ordinary skill in the art, Fromson v. Advance Offset Plate, Inc., 720 F.2d 1565, 1571 (Fed. Cir. 1983), unless it is apparent that the patentee used claim language differently, Enrivotech Corp. v. Al George, Inc., 730 F.2d 753, 759 (Fed. Cir. 1984). Courts may rely on expert testimony to determine how one of ordinary skill in the art would interpret claim language. Advanced Cardiovascular Sys. v. Scimed Life Sys., 887 F.2d 1070, 1073 (Fed. Cir. 1989);

Medtronic, Inc. v. Intermedics, Inc., 799 F.2d 734, 742 (Fed. Cir. 1989).

Claims 1 and 14 of the '293 patent are means-plus-function claims. As provided in the sixth paragraph of 35 U.S.C. § 112, such claims "shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof." This statutory provision "prevents an overly broad claim construction by requiring reference to the specification, and at the same time precludes an overly narrow construction that would restrict coverage solely to those means expressly disclosed in the specification." Symbol Technologies, Inc. v. Opticon, Inc., 935 F.2d 1569, 1575 (Fed. Cir. 1991).

In Intel Corp. v. U.S. Int'l Trade Comm'n, 946 F.2d 821, 841 (Fed. Cir. 1991), the Federal Circuit held that "[t]o meet a means-plus-function limitation literally an accused device must 1) perform the identical function claimed for the means element, and 2) perform that function using the structure disclosed in the specification or an equivalent structure."[3] See also Valmont Indus., Inc. v. Reinke Mfg. Co., 983 F.2d 1039, 1042 (Fed. Cir. 1993)("[F]or a means-plus-function limitation to read on an accused device,

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[3] In similar language, the Federal Circuit held that "to satisfy a means-plus-function claim literally, the accused device must perform the identical function required by the limitation and must incorporate the structure disclosed in the specification, or its substantial structural equivalent, as the means for performing that function." Intellicall, Inc. v. Phonometrics, Inc., 952 F.2d 1384, 1389 (Fed. Cir. 1992)(emphasis added).

For example, in Rite-Hite Corp v. Kelley Co., Inc., 819 F.2d 1120 (Fed. Cir. 1987), the Federal Circuit determined that a rack-and-pinion structure was the equivalent of a rachet-and-pawl structure, given the function delineated in the claim language at issue and the similarity of the structures with respect to that function. Thus, even though a rack-and-pinion structure will permit motion in various directions, while a rachet-and pawl structure permits motion in only one direction, the structures worked in a similar way to achieve a similar result with respect to the function at issue, i.e., that of "releasably retaining the hook in its operative position." Id. at 1124.

the accused device must employ means identical to or the equivalent of the structures, material, or acts described in the patent specification. The accused device must also perform the identical function as specified in the claims.")

Com Dev has taken the position, inter alia, that important differences between the embodiment disclosed in the specification of the '293 patent and the Com Dev filter preclude a finding of infringement because those differences reflect features of the Com Dev filter that are not structurally identical or equivalent to the means described in the '293 patent specification. See, e.g., Post-Hearing Brief of Respondent at 2-13; Respondent's Motion to Submit Additional Legal Authority at 1-2. Com Dev argues that it is error to construe claims based on whether modifications in claim elements are obvious to a person of ordinary skill in the art. See, e.g., Post-Hearing Reply Brief at 5. However, in every respect, with one possible exception, the Com Dev filter uses the identical structure shown in the '293 patent to perform the same function, and in the case of the exception, Com Dev's structure is substantially equivalent.[4] Further, contrary to the argument of Com Dev, since claims are interpreted as they would be by one of ordinary skill in the art, it is reasonable to incorporate this standard as part of determining equivalents when interpreting a means-plus-function claim.

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[4] A finding to the effect that an accused device performs the identical function claimed for a means element using a structure which is the equivalent to that disclosed in the specification is not the same as a finding of infringement under the doctrine of equivalents. D.M.I., Inc. v. Deere & Co., 755 F.2d 1570, 1575 (Fed. Cir. 1985); Pennwalt Corp. v. Durand-Wayland, Inc., 833 F.2d 931, 933-34 (Fed. Cir. 1987)(en banc), cert. denied, 485 U.S. 961 (1988).

Com Dev's argument that such a method of analysis is improper is not supported by In re Donaldson Co., Inc., No. 91-1386 (Fed. Cir. Feb. 14, 1994) which Com Dev has cited in a supplemental memorandum. This en banc decision lends no credence to Com Dev's argument, nor does it depart from the established law of interpretation of means-plus-function claims.[5]

In Texas Instruments, Inc. v. U.S. Int'l Trade Comm'n, 871 F.2d 1054, 1063, reh'g denied (Fed. Cir. 1989), the Commission found that certain accused devices infringed patent claims with a means-plus-function limitation. Many techniques were available to one skilled in the art for achieving the specified function. In upholding the Commission's finding of infringement, the Federal Circuit held that "[s]ince these equivalents were available in the art, [the infringer] had only to select a means after learning the principle from the [patent's] teaching." Id. at 1063. The evidence in this investigation shows that Com Dev has used knowledge not to modify the invention as Com Dev argues, but rather to select a means well known by one of ordinary skill in the art, for accomplishing the functions described in claims 1 and 14 of the '293 patent, after learning the principles of Dr. Fiedziuszko's invention.

The administrative law judge has utilized expert testimony describing the knowledge of one of ordinary skill in the microwave filter art[6] to determine the meaning of claim language, the extent of the disclosure of the '293 patent

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[5] The opinion deals in large part with whether the PTO must adhere to 35 U.S.C. § 112, par. 6 in issuing a patent.

[6] As discussed below in the section on validity, the experience and educational level of a person of ordinary skill in the microwave filter art is an individual with a masters degree in electrical engineering with several years of experience in the field of satellite communications filters. See also FF 267.

specification, and to determine structures equivalent to those disclosed in the specification of the '293 patent. Such a method of analysis is well within Federal Circuit precedent and does not impermissably modify the claim language at issue.

B. Interpretation of Claims 1 and 14 of the '293 Patent

1. Claim 1

Claim 1 of the '293 patent is directed toward "[a] miniaturized microwave filter comprising in combination" six elements, each of which are discussed below.

a. Element 1 requires:

> a first composite microwave resonator comprising a cavity resonator and, disposed within said cavity resonator, a dielectric element made of a material having a high electric constant ε and a high Q, said resonator element having a self-resonant frequency, the dimensions of said cavity resonator being selected so as to cause said composite resonator to have a first order resonance at a frequency near said self-resonant frequency.

The meanings of the terms and phrases in the first element of the '293 patent are not in dispute. FF 46.

b. Elements 2 and 3 require the following:

> first tuning means to tune said composite resonator to resonance at a first frequency along a first axis;
>
> second tuning means to tune said composite resonator to resonance at a second frequency along a second axis orthogonal to said first axis.

At the time the '293 patent issued, one skilled in the microwave filter art understood that a tuning means operates to tune, i.e. to adjust, the resonant frequency of a mode within a microwave cavity by using any of a number of devices, including a tuning screw inserted into the cavity thereby causing a perturbation of the electric field resonating in the cavity. FF 50,

53. Tuning screws may be placed in alternative locations within the cavity of the filter. As the tuning screw is inserted into the cavity, the resonant frequency is lowered. FF 50, 54.

In a composite microwave resonator as described in the '293 patent, the electric field of the first order resonant mode reaches maximum strength along or parallel to an axis, which specifies the "polarization" of the mode and is normally shown as an arrow, or vector. FF 49.

One of ordinary skill in the art would understand the third element's reference to resonance "along a second axis orthogonal to said first axis" to mean a second resonant mode whose polarization vector is perpendicular in three dimensional space to that of the first resonant mode. FF 51-52.

c. **Element 4 requires:**

> mode coupling means to cause mutual coupling between resonant energy on said first and second axes to thereby cause resonant energy on either of said axes to couple to and excite resonant energy on the other of said axes.

One of ordinary skill in the art would understand the fourth element of claim 1 to refer to the many structures that could be used to perform the stated mode coupling function, including the use of a metal screw, changing the shape of the cavity walls, or using dielectric rods or slugs in place of the metal screw. All those structures were well known in the prior art as of 1980. FF 56.

d. **Elements 5 and 6 require:**

> input means to couple microwave energy into said cavity resonator; and
>
> output means to couple a portion of said resonant energy on one of said axes out of said cavity resonator.

One skilled in the art would understand that the input and output structures required by the fifth and sixth elements could be capacitive

probes, or inductive irises, or any combination of the two. FF 60-61. Those choices are also stated in the specification of the '293 patent. FF 59.

2. Claim 14

Claim 14 is an independent claim the elements of which correspond directly to the elements in claim 1, except for one element. The construction of each of these corresponding elements in claim 14 is the same as that discussed previously in connection with claim 1. FF 63-64.

Claim 14 is directed to a combination of two composite element resonators (each of which includes the elements of claim 1) joined by a common iris wall that allows resonant energy from the first resonator to couple to the second resonator. FF 62. The one additional element in claim 14 (the tenth element) specifies that:

> said first and second resonators sharing a common wall, and, defined within said wall, an iris means for coupling resonant energy along one of said first and second axes from said first to said second resonator.

The specification of the '293 patent teaches that many different forms of iris can be used in the common wall between the two cavities, as it states that:

> [A]lthough irises 21 and 23 [in Figure 1] have been illustrated as cruciform in shape, such that they function as orthogonal slot irises to couple each of the two orthogonal modes in the respective cavities, other forms of iris could be used, depending on the nature of the intercavity coupling required by the filter function being realized.

FF 66. One of ordinary skill in the art in 1980 would understand the specification to mean the filter designer could select among a wide variety of iris couplings of various shapes that result in electric field coupling and/or magnetic field coupling, as required. FF 67.

C. Literal Infringement by the Com Dev Device

Com Dev uses a single design for its commercial dielectric-loaded dual-mode filters which have been and are being sold in the United States. FF 68. The Com Dev filter has four individual cavities, each of which contains a dielectric resonator element, two tuning screws, a mode coupling screw, an input mechanism and an output mechanism. FF 73. In addition, the Com Dev filter has three separate combinations of two adjacent cavities which share a common iris wall. FF 74. The configuration of the Com Dev filter differs from that of Figure 1 of the '293 patent in that the cavity configuration is coaxial, i.e. all of the dielectrics are lined up end to end, whereas in the Com Dev filter the dielectrics are parallel to each other. The '293 patent teaches explicitly the use of alternative configurations:

> [I]t will be obvious to those skilled in the art that many changes could be made and many apparently different embodiments thus derived without departing from the scope of the invention. For example, although the invention has been disclosed in an embodiment which utilizes cylindrical resonator elements, the invention is not limited to this geometry. In fact, other axially symmetrical configurations such as a square cross-sectional normal to the composite resonator axis could be used for either the dielectric resonator element or the cavity resonator or for both.

FF 75. As shown below, the configuration of the Com Dev filter does not prevent it from infringing claims 1 and 14 of the '293 patent.

1. Elements of Claim 1

a. Element 1

It is undisputed that each of the four cavities of the Com Dev filter contains the structure required by the first element of the '293 patent. FF 83; Post-Hearing Brief of Respondent at 4-5.

b. Elements 2 and 3

The structure described in the '293 patent used to effect the tuning means is a metal tuning screw. The '293 patent discloses that the tuning screws can be placed in alternative locations in the cavity walls. Indeed, it was well known to those of ordinary skill in the art in 1980 that tuning screws can be placed on the top, the bottom or the sides of a cavity resonator. FF 87-89.

Each of the four cavities of the Com Dev filter has metal tuning screws. FF 90. The location of the tuning screws in each cavity of the Com Dev filter with respect to the axis of symmetry of the dielectric resonator element is different than that shown in the '293 patent. FF 89, 91. Com Dev argues that its use of tuning screws constitutes a different and non-equivalent structure from that of the '293 patent because the Com Dev screws are parallel to each other and to the axis of the dielectric resonator. Brief of Respondent at 5-6. However, the claim language of the second and third elements of claim 1 does not make any reference to the axis of the dielectric resonator element. The claim language refers instead to the axis of the resonance being tuned. FF 51.

The orientation of the tuning screws in each cavity of the Com Dev filter with respect to the axis of the resonance being tuned is identical or substantially equivalent to the orientation shown in the '293 patent. FF 92, 94-99. In fact, it appears that the orientation of the tuning screws in each cavity of the Com Dev filter with respect to the maximum electric field of the resonance being tuned is exactly the same as in the '293 patent. FF 92-93.

Tuning screws, such as those in the '293 patent and the Com Dev filter, act by causing a perturbation of the electric field resonating in the cavity.

Com Dev takes the position that the tuning screws in its filter do not perform the same function as the tuning screws in the '293 patent in that the two tuning screws in the Com Dev filter are designed to be dependent on each other, and are not designed to tune independently. See, e.g., Post-Hearing Brief of Respondent at 6; FF 113.

The claim language in the second and third elements of claim 1 of the '293 patent only requires that each "tuning means" operates to tune one of the two perpendicular modes to resonance and does not exclude some other effect, whether incidental or deliberate, on the other mode. Furthermore, given the applicable laws of physics, it is apparent that any tuning screw will always have some effect on both modes simultaneously and no tuning screw is completely independent as to just one mode. FF 115. Indeed, the '293 patent discloses that the tuning screws can be placed in various locations. FF 116. It was understood that by selecting various locations, the screws will primarily tune one mode, yet cause a simultaneous effect on the other mode to varying degrees.[7] Moreover, the evidence presented at the hearing shows that tuning screws in both the '293 patent and in the Com Dev filter primarily tune only one of the two modes in the cavity. FF 118.[8] None of the changes made

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[7] Com Dev conceded that not all the tuning screws shown in the '293 patent are located at the electric field maximum, thus implying that there is some effect on the other resonance. FF 117.

[8] Com Dev admitted that in practice any filter that attempts to use two perpendicular modes simultaneously must have a tuning mechanism that provides reasonably independent control of the modes. FF 119. Furthermore, in a sworn patent application filed in 1984 for a patent which, according to Com Dev covers the Com Dev filter at issue, Com Dev engineers represented to the Patent and Trademark Office that in the '293 patent and the Com Dev design, "[t]he tuning screws perturb the electrical field of each orthogonal mode independently and decrease the cutoff frequency of the dielectric resonator in the plane of each screw." FF 120. Thus, while the tuning screws in the Com Dev filter have somewhat of a dependent relationship, each screw primarily tunes one of the resonances.

by Com Dev affects the way in which the tuning screws perform the tuning functions specified in the second and third elements of claim 1, or the results achieved in performing those specified functions. See FF 101.

c. Element 4

The mode coupling function is performed in each of the cavities of the Com Dev filter by a metal screw as it is in the embodiment disclosed in the '293 patent. FF 127. As required by the '293 patent, the mode coupling screw in each of the cavities of the Com Dev filter causes mutual coupling between resonant energy on the "first and second axes," i.e., the two perpendicular axes corresponding to the polarization vectors of the two resonances within the cavity, causing resonant energy on the first and second axes to couple and that each excites resonant energy on the other axis. FF 128-133.

Com Dev takes the position that the mode coupling means of claim 1 and claim 14 is limited to a coupling screw that projects into the cavity along an axis which is at 45° to the two tuning screws and is perpendicular to the axis of the dielectric resonator. Com Dev relies on dependent claim 11 of the '293 patent which requires "a mode coupling screw . . . along said third axis, and wherein said third axis is angularly spaced from each of said first and second axes by substantially 45°." Com Dev states that the "necessary result of the '293 coupling method is an 'axial' filter in which the end walls are coupled, and which is more difficult to mount and assemble." Post-Hearing Brief of Respondent at 8.

It is not proper to read into an independent claim, such as claim 1 or claim 14, a limitation set forth in another claim. D.M.I. Inc., 755 F.2d at 1574. Furthermore, there is nothing in the claim language of claim 1, or claim 14, or elsewhere in the patent specification that limits the placement

of the mode coupling means to the 45° between tuning screw locations within the cavity. The design choices that Com Dev has made for its filter may or may not yield advantages over the configuration that Com Dev believes to be required by claim 11, see Post-Hearing Brief of Respondent at 8-9, yet that does not alter the fact that the mode coupling means of the Com Dev filter is identical to the structure shown in the '293 patent and is therefore within the claim language of the fourth element of claim 1 of the '293 patent.[9]

d. Elements 5 and 6

The Com Dev filter has an input probe and an output probe, with slots or irises in the common walls of the cavities through which electromagnetic energy is coupled. FF 148-155.

Contrary to the position taken by Com Dev, the '293 patent covers the use of capacitive probes, or inductive irises, or any combination of the two. As discussed above in the section on claim interpretation, the '293 patent references the fact that such design choices could be made, and indeed such knowledge was well within the knowledge of one of ordinary skill in the art in 1980. See also FF 147, 163.

Com Dev argues that its filter uses capacitive (electric) irises to couple microwave energy into the cavity resonators, and that such coupling is not suggested or disclosed in the '293 patent.[10] Post-Hearing Brief of

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[9] It is well-settled that "an improvement upon a patent device does not necessarily avoid infringement." Carl Zeiss Stiftung v. Renishaw PLC, 945 F.2d 1173, 1179, reh'g denied (Fed. Cir. 1991). In fact, "the existence of one's own patent does not constitute a defense to infringement of someone else's patent." Vaupel Textilmaschinen KG V. Meccanica Euro Italia S.P.A., 944 F.2d 870, 879 n.4, reh'g denied (Fed. Cir. 1991).

[10] Com Dev describes the irises in its filter partially in terms of their size. Post-Hearing Brief of Respondent at 9, 11. However, the relative size of an iris or slot does not determine the function of either the input/output (continued...)

Respondent at 9-10. However, there has been no showing to support a limitation restricting the '293 patent to the use of only inductive irises between cavities.[11] Furthermore, in the Com Dev filter the single slot iris between cavities two and three was rotated 90° in comparison with the embodiment of the '293 patent because of other requirements, thereby changing the type of coupling from magnetic to electric. That difference in design did not affect the iris's basic function of coupling resonant energy out of cavity two and into cavity three. FF 164.

Consequently, since the Com Dev filter uses the same input and output structure, irises and probes to couple microwave energy into and out of the cavity resonator as shown in the '293 patent, elements 5 and 6 of claim 1 are present in the Com Dev filter.

2. Elements of Claim 14

The parties have relied on the same infringement analysis for claims 1 and 14, with the exception of the tenth element of claim 14, which is discussed above in the section on claim interpretation, and pertains to the common wall iris. See Post-Hearing Brief of Respondent at 4-13; Post-Hearing Brief of Complainant at 11; Posthearing Statement of the Staff at 30.

As required by the plain language of claim 14, each of the two adjacent combinations in the Com Dev filter includes an iris in the common wall that couples resonant energy along both modes in the first cavity to the second cavity. See FF 167. Com Dev admits that it uses magnetic coupling at least

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[10](...continued)
means or the iris means specified in the claim language of claim 1 or claim 14 of the '293 patent. FF 145.

[11] There is evidence that the Com Dev filter does not couple resonant energy using only the electric field. FF 156.

to some extent; however, it argues that it also couples electric energy, and that claim 14 requires the use of only magnetic coupling. FF 172-173; Post-Hearing Brief of Respondent at 12.

Com Dev would read into claim 14 a limitation for which it has not provided adequate support. The evidence shows it was well known to those of ordinary skill in the art in 1980 that two cavities could be coupled together by an aperture in a common wall that couples magnetic field energy, electric field energy, or both types of fields. FF 171. As a matter of choice, a designer could achieve electric field coupling through a capacitive slot which can be added to and/or substituted for magnetic field coupling through an inductive slot. FF 174. Therefore, the structure in the Com Dev filter, inductive and capacitive irises for coupling microwave energy between cavity resonators is identical to that provided for in the '293 patent. The design choices made by Com Dev for its filter do not avoid infringement of claim 14.

D. Conclusion on Infringement

SSL has strongly and convincingly[12] demonstrated that it is likely to prove that the Com Dev device infringes claims 1 and 14 of the '293 patent.

IV. VALIDITY

Com Dev has asserted that the '293 patent is invalid under the following statutory provisions: 1) 35 U.S.C. § 103 due to obviousness; 2) 35 U.S.C. §

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[12] The evidence submitted by SSL concerning temporary relief is, at least at this stage of the investigation, of a convincing nature due to its detail and quality. This Initial Determination is not based merely on the arguments of the parties or affidavits that were not subject to cross-examination. It is based upon a record which was assembled in a hearing held over the course of 11 calendar days (seven days of testimony) during which hundreds of exhibits were received into evidence with opportunities for objections, and during which all witnesses who testified were subject to cross-examination. The hearing was preceded by an expedited yet extensive discovery phase which included many depositions.

112 for failure to disclose the best mode, insufficient enablement and failure to describe; and 3) 35 U.S.C. § 102(f) due to prior inventorship.

A. The Allocation of Burden in the Temporary Relief Phase

Section 282 of the Patent Act provides that a patent is presumed to be valid. 35 U.S.C. § 282. The presumption of patent validity can only be overcome by clear and convincing evidence. Loctite Corp. v. Ultraseal Ltd., 781 F.2d 861, 872 (Fed. Cir. 1985).

The party attacking the validity of a patent has the burden of going forward and the ultimate burden of persuasion at trial. 35 U.S.C. § 282; Nutrition 21 v. United States, 930 F.2d 867, 869 (Fed. Cir. 1991). Furthermore, a determination must be made at this juncture whether respondent is likely to be successful in proving the patent at issue to be invalid or unenforceable. That determination cannot be made by merely placing the burden wholly on respondent to prove its case at this phase of the investigation. Determinations on temporary relief are governed by the standards applicable to the granting of preliminary injunctions in federal courts, and the Federal Circuit has held due to the extraordinary nature of the relief that may be provided at the preliminary injunction stage of litigation, that the patentee carries the burden of showing the likelihood of success on the merits with respect to the patent's validity and enforceability, the same as with infringement. Nutrition 21, 930 F.2d at 869.

B. Section 103

1. Applicable Law Concerning Obviousness

Section 103 of the Patent Act provides that a patent may not be obtained for an invention "if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would

have been obvious at the time the invention was made to a person having ordinary skill in the art. . . ." 35 U.S.C. § 103.

Although the ultimate question of patent validity is one of law, a determination of validity under section 103 requires several factual determinations. Graham v. John Deere Co., 383 U.S. 1, 17 (1966). In order to make a determination as to the validity of a patent under section 103, the Supreme Court has held that "the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of skill in the pertinent art resolved." Id.

When the prior art relied on by the party attacking validity was previously considered by the PTO examiner, deference is due the decision to issue the patent, and the burden of persuasion is difficult to carry. American Hoist and Derrick Co. v. Sowa and Sons, Inc., 725 F.2d 1350, 1360 (Fed. Cir.), cert. denied, 469 U.S. 821 (1984). The burden of proof is not reduced when prior art is relied upon which was not considered by the PTO. However, "reliance upon such art when that art is more pertinent than the art considered by the PTO may facilitate meeting the burden of proving invalidity." Uniroyal, Inc. v. Rudkin-Wiley Corp., 837 F.2d 1044, 1050 (Fed. Cir.), cert. denied, 488 U.S. 825 (1988)(emphasis added).

The Federal Circuit has cautioned that when prior art references require selective combination to render obvious a subsequent invention, there must be some reason for the combination other than the hindsight gleaned from the invention itself. Id. at 1051. Indeed, "[s]omething in the prior art as a whole must suggest the desirability, and thus the obviousness, of making the combination." Id. See also ASC Hospital Systems, Inc. v. Montefiore Hospital, 732 F.2d 1572 (Fed. Cir. 1984)("Obviousness cannot be established by

combining the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion supporting the combination. Id. at 1577).

"Secondary considerations" such as "commercial success, long felt but unsolved needs, failure of others, etc." may be used to understand the origin of the subject matter at issue, and may be relevant as indicia of obviousness or nonobviousness. Graham v. John Deere Co., 383 U.S. at 17-18.[13] The secondary considerations are also referred to as "objective evidence of nonobviousness," and may include other factors, relied on by SSL in this investigation, such as copying by others, prior art teaching away, and professional acclaim. See Perkin-Elmer Corp v. Computervision Corp., 732 F.2d 888, 894 (Fed. Cir. 1984); Avia Group Int'l, Inc. v. L.A. Gear Cal., 853 F.2d 1557, 1564 (Fed. Cir. 1988)(copying by others); In re Hedges, 783 F.2d 1038, 1041 (Fed. Cir. 1986)(prior art teaching away; proceeding contrary to accepted wisdom); Kloster Speedsteel AB v. Crucible Inc., 793 F.2d 1565 (Fed. Cir. 1986)(wide acceptance and recognition of the invention). The Federal Circuit has observed that in some cases, objective indicia may constitute the most important evidence available when making the determination as to obviousness. Simmons Fastener, 739 F.2d at 1575.

2. Scope and Content of the Prior Art

Evidence was received at the hearing concerning numerous pieces of prior

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[13] The Federal Circuit has held that:

> The section 103 test of obviousness set forth in Graham is a four part inquiry comprising, not only the three familiar elements . . . but also evidence of secondary considerations when such evidence is, of course, present.

Simmons Fastener Corp. v. Illinois Tool Works, Inc., 739 F.2d 1573, 1575 (Fed. Cir. 1984).

art, some of which were before the PTO examiner during prosecution of the '293 patent, as well as some which were not. These prior art references are listed and described below. A detailed discussion of these references is contained in the section on differences between the prior art and the claims at issue.

The prior art references which were before the examiner, and which were focussed on during the hearing, are:

> J.K. Plourde et al., "Microwave Dielectric Resonator Filter Utilizing $Ba_2Ti_9O_{20}$ Ceramics" (the "1977 Plourde article"), which discloses microwave filters which use single-mode dielectric resonator elements made from low-loss, temperature stable ceramic material; and
>
> U.S. Patent No. 3,679,898 to Blachier et al. ("the Blachier patent"), which discloses a multiple-cavity, dual-mode, air-loaded waveguide filter, which includes tuning screws, coupling screws, input and output mechanisms, and a common iris wall between the cavities.

FF 181-183, 190.

The prior art references which were not before the examiner, and which were focussed on during the hearing, are:

> S.B. Cohn, "Microwave Bandpass Filters Containing High-Q Dielectric Resonators" (the "1968 Cohn article"), which discloses microwave bandpass filters using dielectric disks operating in a single mode. FF 191;
>
> W.H. Harrison, "A Miniature High-Q Bandpass Filter Employing Dielectric Resonators (the "Harrison article"), which appeared at the same time as the 1968 Cohn article, and relates to single-mode dielectric filters. FF 193;
>
> S.B. Cohn et al. Rantec Report No. 7 concerning an "Investigation of Microwave Dielectric-Resonator Filters" [covering the period March 1 - May 31, 1965] ("Rantec Report No. 7"), which contains a suggestion that one or more dielectric resonator disks might be configured as a "directional filter" in which each disk would support a pair of orthogonal modes "with no coupling or interaction between them;" and Rantec Report No. 8 [the final report concerning the investigation covering the period June 1 - December 31, 1965] ("Rantec Report No. 8"), which, inter alia, reports the results of Dr. Cohn's efforts to construct a directional filter using dielectric disks. FF 195, 196;
>
> P. Guillon, "Accurate Resonant Frequencies of Dielectric Resonators" (the "1977 Guillon article"), in which Professor Guillon (then a graduate student) disclosed a "shielded cylindrical resonator"

structure in which a dielectric resonator element was affixed to a substrate between two unbounded metal plates. FF 215;

P. Guillon's 1978 doctoral thesis (the "1978 Guillon thesis"), which repeats an earlier suggestion in the 1977 Guillon article concerning the possible use of an unpolarized TE-011 mode and an HE-111 mode. FF 223;

P. Guillon et al., "Dielectric Resonator Filters" (the "1980 AEU Guillon article"), which discloses certain single-mode dielectric resonator filters. FF 227;

Professor Guillon's brief letter article entitled "Dielectric Resonator Dual Modes Filter" (the "August 1980 Guillon article") disclosing in extremely sketchy form a single cavity with a dual HE-111 mode resonance in it. FF 230;

Plourde and Linn, "$Ba_2Ti_9O_{20}$ as a Microwave Dielectric Resonator" (1975)(the "1975 Plourde article"), which describes a new temperature-stable dielectric material with a passing reference to its use in practical microwave filters. FF 238; and

R. Levy, "Six Eras Comprise Filter Development" (the "1980 Levy survey article"), surveying 30 to 40 years of developments in the field of microwave filters. FF 241.

3. Differences Between the Prior Art and the Claims at Issue

The references that were considered by the patent examiner during the prosecution of the '293 patent reflect the state of the art that existed at the time of Dr. Fiedziuszko's invention of the subject matter of that patent. FF 175-177.

The Blachier patent discloses a multiple-cavity, dual-mode, air-loaded waveguide filter, which includes tuning screws, coupling screws, input and output mechanisms, and a common iris wall between the cavities. Com Dev argues that the '293 invention is an obvious combination of the Blachier device and dual-mode dielectric resonators. However, there is no suggestion in the Blachier patent to use dual-mode dielectric resonators. FF 182.

The 1977 Plourde article discloses microwave filters which use single-mode dielectric resonator elements made from low-loss,

temperature-stable ceramic material. The article contains several sections, the first of which concerns "Stripline to Resonator Coupling." The second section discusses a band reject filter which uses a stripline structure that runs underneath the dielectric resonators. The third section discusses a bandpass filter that uses striplines to couple microwave energy to two of the three dielectric resonators which are contained in a single housing and not in individual coupled cavities. FF 184-187.

The 1977 Plourde article shows typical prior art single-mode dielectric resonator filters. In its introduction, it contains a suggestion that "higher order modes or multiple modes may be used," however it does not teach how such a use might be accomplished, and it only discloses the use of a single unpolarized mode. FF 179. There is no suggestion in the 1977 Plourde article that a dielectric resonator element could be successfully combined with a Blachier-type filter design. See FF 189. Indeed, the 1977 Plourde article was considered by the patent examiner during prosecution of the '293 patent, along with the Blachier patent, and the '293 patent issued over both references. FF 183, 190.

Earlier, the 1975 Plourde article described $Ba_2Ti_9O_{20}$ as a new temperature-stable dielectric material, with a passing reference to its use in practical microwave filters. FF 238. The 1975 Plourde article was not before the PTO examiner during prosecution of the '293 patent. However, the 1977 Plourde article was before the patent examiner, and the 1975 article is cumulative with respect to the information contained in the 1977 Plourde article. FF 239-240.

The 1968 Cohn article discloses microwave bandpass filters using dielectric disks. However, the article discloses a filter operating in a

single mode. The article does not contain any mention or suggestion of the possible use of a dual-mode dielectric resonator. FF 191-192. The same is true of the Harrison article, which appeared at the same time. FF 193-194.

Rantec Report No. 7 suggests that one or more dielectric resonator disks might be configured as a "directional filter" in which each disk would support a pair of orthogonal modes "with no coupling or interaction between them." Rantec Report No. 8 reports, inter alia, the results of Dr. Cohn's efforts to construct a directional filter using dielectric disks. FF 195, 196.

A directional filter, as referred to in the Rantec Reports, differs fundamentally from the filter of the '293 patent. A directional filter as pioneered by Dr. Cohn is two separate but identical filters which are constructed in a single physical structure. It is a four port device with four arms, each containing one of the ports. Any coupling between the two orthogonal modes must be eliminated to the maximum extent possible.[14] FF 198-200. In contrast to a directional filter, the "dual-mode" filter, such as that of the '293 patent or the design of the Blachier patent, requires strong coupling between the two orthogonal modes in each resonator. FF 201.

The filters described in Dr. Cohn's Rantec Reports happen to use two modes in their operation. Thus, Dr. Cohn's Rantec Reports make reference to the use of so-called "dual modes" in a directional filter. FF 203. However, Rantec Report No. 7 does not teach or suggest a mode coupling means to cause mutual coupling between resonant energy in a cavity filter as required in the

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[14] In a directional filter, it is only possible to achieve a "1-pole" filter response for each resonator; e.g., a three resonator directional filter produces only a 3-pole response. FF 206. In contrast to a directional filter, a "dual mode" filter of the '293 patent or of the Blachier design achieves a "2-pole" response for each resonator. FF 207.

'293 patent. FF 202. By 1980 when Dr. Fiedziuszko made his invention, the term "dual-mode" was understood by those skilled in the art to mean a Blachier-type filter with two resonant modes in a single cavity that are intentionally coupled together. FF 204.[15]

In Rantec Report No. 8, Dr. Cohn reported that he was able to obtain satisfactory directional filter performance using a single dielectric disk. When he attempted to construct a directional filter using two dielectric disks, Dr. Cohn reported that "a simultaneous condition of good performance on all parameters could not be achieved with a reasonable amount of effort." FF 209, 210.

Com Dev takes the position that the negative results obtained by Dr. Cohn were due to a lack of adequate materials. However, Dr. Cohn's conclusions, including the statement that "[t]he n=2 dual-mode [directional filter] configuration was especially difficult, and may be too complex to be practical," does not appear to relate to the quality of dielectric materials. See FF 211. The results reported in Rantec Report No. 8 concerning the difficulties in attempting to introduce a dielectric resonator element into a directional filter would have discouraged one of ordinary skill in the art from similar efforts, especially given the fact that Dr. Cohn was recognized as one of extraordinary skill in the art. FF 212.

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[15] For example, an article written in 1980 by Dr. C.M. Kudsia of Com Dev confirms that a "dual mode" Blachier-type filter and "circular waveguide directional filter" of the type discussed by Dr. Cohn in the Rantec Reports were understood to be different and mutually exclusive. FF 205.

Dr. Fiedziuszko described the Rantec Reports in a communication to his patent counsel as describing dual-mode dielectric resonators in directional filters with a principle of operation that is quite different from that used in his invention. FF 208. See, infra at 42-43, the discussion of this communication as it pertains to Com Dev's allegations of inequitable conduct.

The 1977 Guillon article disclosed a "shielded cylindrical resonator" structure in which a dielectric resonator element was affixed to a substrate between two unbounded metal plates. The article does not disclose a composite resonator comprising a dielectric resonator element within a cavity resonator as taught by the '293 patent. FF 216.

The 1977 Guillon article states that when the ratio of the diameter to the height of the shielded cylindrical resonator is set at a certain critical value, the unpolarized TE-011 mode and an HE-111 mode will "overlap" and it would be possible "to use a single dielectric resonator as a dual-mode resonator in order to do two-pole bandpass filtering for wider bandwidths." FF 217.

However, the 1977 Guillon article would not have been understood as disclosing the kind of dual-mode operation as shown in the '293 patent. One of ordinary skill in the art would recognize the combination of modes suggested in the 1977 Guillon article to be significantly different from the use of dual modes discussed in the '293 patent, which teaches the use of two perpendicularly polarized modes. FF 218-220. The two modes suggested in the 1977 Guillon article cannot be used together to achieve anything known to be of a practical nature. FF 221. The suggestion to use the unpolarized TE-011 mode (which is circularly symmetric) and the HE-111 mode (which is a polarized mode with a maximum electric strength along a particular axis) is at best academic speculation for which there are no known practical results. FF 222.

The 1978 Guillon thesis repeats the earlier suggestion in the 1977 Guillon article concerning the possible use of an unpolarized TE-011 mode and an HE-111 mode. FF 223. The 1978 Guillon thesis appeared to clarify that the possible overlap of the unpolarized TE-011 mode and the HE-111 mode occurs

"whenever the resonator is fixed to the substrate of a microstrip structure," and does not contain any suggestion that such overlap would occur if the dielectric resonator element were enclosed in a cavity resonator to form a composite resonator as taught in the '293 patent. FF 224.

The statements in the 1978 Guillon thesis about fixing the dielectric resonator to the substrate of a microstrip structure are confusing, and should be understood as the speculation of a student. FF 225. Indeed, no one has ever been known to be able to make a workable filter using the unpolarized TE-011 mode and a HE-111 mode as suggested in the 1977 Guillon article or the 1978 Guillon thesis. FF 226.

The 1980 AEU Guillon article disclosing single-mode dielectric resonator filters does not mention dual modes, does not suggest any possible use of the HE-111 modes, does not discuss obtaining a two-pole response from only a single resonator, and contains no suggestion to combine a dielectric resonator element with a Blachier-type design. FF 228. The 1980 AEU Guillon article is cumulative of the 1977 Plourde article that was considered by the patent examiner, and had it been considered by the patent examiner, it would have added nothing with respect to the appropriate state-of-the-art. FF 229.

The August 1980 Guillon article disclosed in extremely sketchy form a single cavity with a dual HE-111 mode resonance in it. FF 230. In any event, the article was published after Dr. Fiedziuszko had conceived and reduced to practice the invention (the middle of March 1980 at the latest) which is the subject matter of the '293 patent. FF 231. Furthermore, expert testimony at the hearing confirmed that the drawing in the August 1980 Guillon article of a crude single cavity filter is so poorly executed so as to have been worthless

as a teaching to one of ordinary skill in the art. See FF 232.[16]

The 1980 Levy survey article covered 30 to 40 years of developments in the field of microwave filters It is a survey paper which addressed a broad selection of different areas. In one section, the article discussed "dual mode" filters of the Blachier-type design. In a separate section entitled "Dielectrics Promise Future," the article reported results during the 1970s pertaining to the use of single-mode dielectric resonator filters. FF 241-244. There is no suggestion in the article that a dielectric resonator element could be successfully combined with a Blachier-type filter as taught in the '293 patent. FF 245.

Com Dev takes the position that putting a dielectric resonator in a dual-mode filter as in the '293 patent is something that had close to a 100% probability of success to one of ordinary skill in the art in 1980. See, e.g., Post-Hearing Brief of Respondent at 21. However, the prior art, while disclosing the design of a dual-mode filter such as that of the Blachier patent, as well as the use of dielectric material as a resonator, did not disclose a combination of the two, or specifically suggest the practical use of dielectric material in such a filter. Indeed, the general teachings of the prior art, and especially the Rantec Reports, left one of ordinary skill in the art with the impression that experimentation in that area might be

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[16] In a book published in 1986, Professor Guillon included another drawing roughly corresponding to the crude single cavity filter described in the August 1980 Guillon article. The drawing in the 1986 book would essentially operate as only a 1-pole filter and will not work as a "dual mode" filter as taught in the '293 patent. FF 233, 234.

Notably, in September 1985, Professor Guillon published an article that actually describes a dielectric-loaded dual-mode filter of the type taught in the '293 patent, crediting Dr. Fiedziuszko for originating the concept of the dielectric-loaded dual-mode filter. The September 1985 paper does not mention the August 1980 Guillon article. FF 235-236.

extremely difficult and impractical.

Com Dev credits much of the invention of the '293 patent to the availability of thermally stable dielectric materials. See, e.g., Id. at 20. However, the evidence presented at the hearing established that materials adequate for experimental and commercial purposes, including the reduction to practice of the invention of the '293 patent, had been available long before Dr. Fiedziuszko made his invention.

In the mid-1960s, Dr. Cohn suggested that once dielectric materials were developed with a specified level of temperature stability, they would be useful in microwave applications. In response to that suggestion, the U.S. Army Signal Corp. sponsored research in the late 1960s by Raytheon Corporation ("Raytheon") to develop temperature-stable dielectric materials. FF 247, 248. Raytheon was quickly successful in producing a material that met Dr. Cohn's benchmark criterion and published an article in 1971 describing the new material. FF 249. The Raytheon-type material was commercially available from Trans-tech, Inc. as of August 1, 1972. FF 250.

In November 1972, General Electric ("GE") researchers published an article describing the actual construction of working microwave filters using another new temperature-stable, low-loss dielectric material. The dielectric material described by GE would have an excellent Q of 16,500 in C-band applications, and would provide a stable frequency response over a typical satellite's working temperature range. The material was very acceptable for use in 1972, and is also acceptable by current standards. FF 251-254.

In 1974, researchers at Bell Labs reported yet another new high quality, temperature-stable dielectric material suitable for use in microwave filters. This material was subsequently reported on again in the 1975 Plourde article.

FF 255. Also, beginning in 1974, Japanese researchers published numerous articles describing the development of many additional types of high quality, temperature-stable dielectric materials. FF 256.

In 1977, Bell Labs researchers published a trade journal article announcing that it would consider making the dielectric material described in the 1975 Plourde article available on a cross-licensing basis. FF 257. In early 1978, suppliers were calling on companies engaged in the manufacture of microwave filters and offering to produce and sell the dielectric material described in the 1975 Plourde article on a commercial basis. FF 258.

It is sometimes possible to develop a concept using less than optimal material and thereby help stimulate the availability of better material. FF 264. In an industry such as satellite communications, availability of dielectric material on a sample basis, as opposed to commercial quantities, is all that is necessary to advance the state of the art and create a market that would accelerate full-scale commercial availability. FF 265. Nevertheless, by the mid-1970s it was well recognized that the dielectric resonator had already become practical. FF 259, 261. Consequently, Dr. Fiedziuszko purchased some dielectric temperature-stable material made by Trans-tech which had been commercially available since 1972. He used material purchased from a Trans-tech catalog to reduce to practice the invention described in the '293 patent. FF 262. In 1979, Dr. Fiedziuszko was also able to purchase high-quality, temperature-stable dielectric material from the catalog of a well known Japanese company, Murata, which he also used in reducing to practice the invention described in the '293 patent. FF 263.

While using the Trans-tech material available in 1972, researchers could anticipate that proof of a new breakthrough design concept would stimulate and

hasten the availability of even better materials with higher Q and even greater temperature stability. FF 266. Nevertheless, the materials used by Dr. Fiedziuszko to reduce his invention to practice were available to anyone working in the field of microwave filters for several years prior to the time of the reduction to practice of the '293 patent.

4. Level of Ordinary Skill in the Art

The experience and educational level of a person of ordinary skill in the microwave filter art is an individual with a masters degree in electrical engineering with several years of experience in the field of satellite communications filters. FF 267.

5. Objective Evidence of Nonobviousness

a. Long-Felt Need

It is imperative in the communications satellite business to direct research and development efforts towards reducing the mass and volume of components such as input multiplexers. FF 269. Reduced volume of the input multiplexers allows for greater flexibility in the layout of the satellite and permits increased satellite capacity, allowing for more filters on-board, and thus for more channels. FF 271. Reducing the weight of the filters allows the satellite to carry additional fuel which extends the useful life of the satellite. FF 272.[17]

Early communications satellites used single-mode, rectangular waveguide filters which were large and heavy. FF 273. Then, in 1970, researchers at COMSAT Laboratories developed a breakthrough dual-mode air-loaded waveguide filter design which was referred to as the "Blachier" filter, and the Blachier

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[17] Currently, one kilogram of mass saved on a spacecraft corresponds to a dollar value savings between $40,000 and $50,000. FF 270.

design became the industry standard. FF 274. The introduction of the Blachier filter also stimulated a large amount of research to improve this design. FF 275. Many companies and researchers around the world were working in the 1970s to improve the Blachier filter by reducing its mass and volume, including COMSAT Labs, Hughes Aircraft Company, Ford Aerospace, Com Dev, and other foreign companies. Many of these companies which engaged in research to improve upon the Blachier design and reduce its size and weight had extensive experience with microwave filter innovation and design, and were working at a level of expertise well above that of a person of ordinary skill in the microwave filter art. FF 276-311.

Therefore, there was a long-felt need to reduce the size and weight of microwave filters before the invention of the '293 patent. See FF 312. After the introduction of the Blachier design, the next major advance in reducing the size and weight of filters was the introduction of dual-mode dielectric filters by Dr. Fiedziuszko. FF 313. The invention of the `293 patent allowed for tremendous mass and volume reductions. FF 314.

b. Commercial Success

Dual-mode dielectric-loaded filters such as that disclosed in the '293 patent have become the industry standard for C-Band input multiplexers. FF 315. SSL has adopted the dual-mode dielectric filter design for all of its C-band input multiplexers and most of its KU-band input multiplexers. FF 316, 317.

Similarly, Com Dev has replaced the Blachier air-loaded filters with dual-mode dielectric filters for C-band input multiplexers for sale within the United States. FF 318. Com Dev has supplied dual-mode dielectric filters for the Telstar IV and Asiasat programs, and is supplying dual-mode dielectric

filters for the Intelsat VIII and GE 1 and GE 2 programs. FF 319.

It is also known that Matra Marconi, a European satellite manufacturer, is manufacturing dual-mode dielectric filters. FF 320.

c. Copying By Others

SSL presented persuasive evidence at the hearing that Com Dev copied the invention of the '293 patent.

Com Dev did not begin working in the area of dual-mode dielectric filters until the summer of 1982, after Com Dev engineers heard Dr. Fiedziuszko's presentation concerning the subject matter of the `293 patent at an Institute of Electrical and Electronics Engineers ("IEEE") symposium in Dallas, Texas. FF 321. Com Dev engineers received a copy of Dr. Fiedziuszko's proceeding paper concerning the invention of the `293 patent at the IEEE conference in Dallas. FF 322.

A Com Dev engineer, H. Gordon McDonald, wrote Dr. Fiedziuszko in July of 1982 to obtain an advance copy of an article concerning the invention of the `293 patent to be published in September of 1982. Dr. Fiedziuszko sent an advance typed copy of an article concerning the invention of the `293 patent to Mr. McDonald in August of 1982. FF 323, 324. After learning of Dr. Fiedziuszko's dual-mode dielectric-loaded filter, Com Dev engineers tried to duplicate the results of Dr. Fiedziuszko's work. FF 326. A Com Dev engineer, Adrian Collins, had a copy of Dr. Fiedziuszko's paper with him at the time he was doing some of the early work on dielectric filters at Com Dev. FF 325. The filter developed by Com Dev was copied from Dr. Fiedziuszko's work.

d. Prior Art Teaching Away

Some of the prior art actually taught away from Dr. Fiedziuszko's

invention. The Rantec Reports are of particular note.

The Rantec Reports relate to directional filter configurations in which coupling between the modes must be minimized, whereas in the invention of the '293 patent strong coupling between modes is required. Furthermore, Rantec Report No. 8 reported unsuccessful results when Dr. Cohn attempted to incorporate more than one dielectric disk into his filter configuration. See FF 327-329.

e. Professional Acclaim

The invention of the `293 Patent was very well received by the microwave industry and was understood to be a significant advancement in the state of the art. Dr. Fiedziuszko's presentation of the invention of the `293 Patent generated a great deal of interest in the microwave industry, and generated a significant amount of research on the topic of dual-mode dielectric-loaded filters. FF 330, 331.

Authors publishing papers on dual-mode dielectric filters after 1982 inevitably cite or refer to Dr. Fiedziuszko's 1982 paper because it is the prime reference in the art. FF 333. For example, in a 1990 paper, Com Dev engineers referred to Dr. Fiedziuszko's 1982 paper, which first described the invention of the `293 Patent, in the following manner: "In 1982, a paper was published describing a dual-mode axially mounted dielectric resonator loaded cavity filter. It nearly matched the performance of dual-mode air-loaded waveguide filters and set the scene for the potential use of dielectric loaded multiplexers for space application." FF 334.

The highest level of membership in the Institute of Electrical and Electronics Engineers is the honorary level of Fellow, and thus it is difficult to become a fellow of the IEEE. FF 335, 336.

Dr. Fiedziuszko was named a Fellow in the IEEE because of his contributions in the advancement of dielectric resonator filters and multiplexers especially for satellite applications, and thus in part for his '293 patent. FF 337, 338. Dr. Fiedziuszko's Fellow nomination form first lists "the invention and development of dual mode dielectric resonator filters" under the heading "S. Jerry Fiedziuszko's most significant contributions." FF 339.

6. Conclusion on the Obviousness Issue

SSL has strongly and convincingly established that it is likely it will prevail on the issue of whether claim 1 and claim 14 of the '293 patent would have been obvious to one of ordinary skill in the art.

C. Section 112

Com Dev asserts invalidity of the '293 patent under 35 U.S.C. § 112 for failure to disclose the best mode, insufficient enablement and failure to describe.

1. Best Mode Requirement

Section 112 of the Patent Act provides, inter alia, that the patent specification "shall set forth the best mode contemplated by the inventor of carrying out his invention." 35 U.S.C. § 112, ¶ 1.

In Engel Industries, Inc. v. The Lockformer Co., 946 F.2d 1528 (Fed. Cir. 1991), the Federal Circuit held that:

> Patent invalidity for failure to set forth the best mode requires that (1) the inventors knew of a better mode of carrying out the claimed invention than they disclosed in the specification, and (2) the inventors concealed that better mode. Failure of compliance must be proved by clear and convincing evidence. Determination of whether the best mode requirement has been met is a question of fact . . . .

946 F.2d at 1531 (citations omitted). The patent specification need not

include "technical details apparent to a person of ordinary skill . . . ." Engel, 946 F.2d at 1532.

The dielectric resonators in the dual-mode filter of the '293 patent must be mounted properly, especially for use in satellites, to ensure good mechanical and temperature stability. FF 339. Com Dev takes the position that the '293 patent does not disclose how to mount the dielectric resonator, the best mounting material, or the optimal dimensions for the cavity resonator. Post-Hearing Brief of Respondent at 24-27.

In Engel, 946 F.2d at 1531, the Federal Circuit held that "[t]he best mode inquiry is directed to what the applicant regards as the invention, which in turn is measured by the claims. Unclaimed subject matter is not subject to the disclosure requirements of § 112 . . . ." Although SSL has not disputed that the mounting of the dielectric resonator is part of the claimed invention, it appears that the mounting of the dielectric resonator is not part of the invention. Neither claim 1 nor claim 14 includes an element providing for mounting means of the dielectric resonator. The only possible claim language which relates to the mounting of the dielectric is the first element of claim 1, which states as follows: "disposed within said cavity resonator, [is] a dielectric resonator element." This is not a claim for a mounting means, but merely a statement that the dielectric is placed within the cavity resonator. In fact, the patent suggests that the mounting means is known in the prior art. Com Dev for purposes of this hearing did not contest the meaning of this claim language in claim 1. Tr. 1871-1872.

Nevertheless, the evidence shows that at the time of making his application, Dr. Fiedziuszko believed that the best mode of mounting the dielectric resonator was complete encapsulation of the dielectric resonator

with foam. Com Dev's expert, Dr. Levy, testified that complete encapsulation would be obvious for a good engineer to try, and Dr. Fiedziuszko testified that complete encapsulation with foam was well known in the art. Levy, Tr. 1846; Fiedziuszko, Tr. 2084. Also, prior to the date on which the original application for the '293 patent was filed, there were numerous publications and patents disclosing how to mount dielectric resonators in a filter structure using columns or pads. FF 354.

Since it appears that a mounting means was not included in the claims of the '293 patent, any failure to specify mounting means in the patent could not constitute a basis for denying temporary relief.

Com Dev also asserts that although Dr. Fiedziuszko considered Eccofoam to be the best mounting material at the time he submitted his patent application, it was not disclosed therein. Post-Hearing Brief of Respondent at 25. Similarly, it does not appear that part of the invention of the '293 patent in claims 1 or 14 includes the particular mounting material.

Nevertheless, the '293 patent specification refers to the use of polystyrene foam. FF 340. Even if this were part of the claim language, which it is not, one of ordinary skill in the art would have been capable of determining that polystyrene foam includes Eccofoam. FF 342-345.

Finally, Com Dev takes the position that the '293 patent specification fails to disclose the optimal dimensions for the cavity resonator. Post-Hearing Brief of Respondent at 26-27. However, in the '293 patent, Dr. Fiedziuszko provided ample information on the dimensions for the dielectric resonator. One of ordinary skill in the art would be able to determine the appropriate dimensions of the cavity for his design, given the equations

provided in the patent. FF 356, 357.[18]

SSL has strongly and convincingly shown that it is likely to prevail on the best mode validity issue.

2. Enablement Requirement

Com Dev asserts that "[t]here is no clear description in the '293 patent sufficient to enable one of ordinary skill to know how to mount the dielectric resonator in the cavity." Post-Hearing Brief of Respondent at 27. Since the invention that must be enabled is defined by the claims, and since there is no claim for a mounting means, Com Dev's argument must be rejected. See D. Chisum, Patents, § 7.03[1] at 7-9 n.1 (1993), and the cases cited therein. Nevertheless, the patent specification does refer to mounting the dielectric as follows:

> Although not shown in Fig. 1, resonator elements 27 can be successfully mounted in cavities 3, 5, and 7 by a variety of insulative mounting means which generally take the form of pads or short columns of low-loss insulator material such as polystyrene or PTFE. However, the best performance has been obtained by the use of mountings made of a low-loss polystyrene foam.

FF 340. See FF 345, 348, 353.

3. Description Requirement

Com Dev also raised the description requirement of the first paragraph of section 112. Post-Hearing Brief of Respondent at 27-28. There is a lack of

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[18] As additional evidence of the sufficiency of the '293 patent, it was shown that neither the '630 patent (CX 57) nor the '843 patent (CX 6), both issued to Mr. Tang and others, and assigned to Com Dev, provide dimensions for the cavity that surrounds the dielectric resonator or formulas to determine such dimensions. Nevertheless, Mr. Tang testified that the disclosures in both the patents teach one skilled in the art how to practice the invention of each. Mr. Tang testified that it was not necessary to provide information relating to the dimensions of the housing and resonator in the '843 patent (CX 6) because the '843 patent referred to Dr. Fiedziuszko's '293 patent which contained the necessary information. FF 358-360.

evidence showing that the '293 patent fails to meet this requirement.

D. Section 102(f) and Inventorship

Com Dev asserts that the '293 patent is invalid under section 102(f) of the Patent Act, alleging that Dr. Fiedziuszko did not invent the subject matter sought to be patented in the '293 patent. Com Dev bases its position on a document from Ford Aerospace[19] which pre-dates the time that Dr. Fiedziuszko identified as the date of conception of his invention as well as the first date on which he disclosed his invention to anyone else. See RX 12 (invention disclosure form). The Ford Aerospace document discusses development efforts to be directed toward, inter alia, dual-mode filters using dielectric resonators. Post-Hearing Brief of Respondent at 28.

In the 1980s, Ford Aerospace was involved in independent research and development that was partially monitored by the United States government. As part of this program, Ford Aerospace would provide a confidential general "R&D brochure" to the government. FF 361-362. The preparation of the R&D brochure, which is the document relied on by Com Dev, occurred in early 1980, and was distributed on March 31, 1980. FF 367.

In early 1980, Dr. Fiedziuszko provided the input to the R&D brochure that relates to dual-mode dielectric filters. FF 364. Although the period in which Dr. Fiedziuszko provided this information precedes the date he identified on his invention disclosure for the conception of his invention and the first time that he disclosed his invention to anyone else, the evidence shows that Dr. Fiedziuszko is not sure exactly when he conceived of his

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[19] SSL was formerly part of Ford Aerospace Corporation ("Ford Aerospace"), previously Ford Aerospace and Communications Corporation, then a subsidiary of Ford Motor Company. FF 3.

invention or first talked about it with someone else. It is possible that Dr. Fiedziuszko conceived of his invention before March 1980. FF 365. Com Dev has failed to adduce any evidence to show that Dr. Fiedziuszko is not the inventor of the '293 patent.

SSL has strongly shown that it is likely that Dr. Fiedziuszko was correctly named as the inventor of the '293 patent.

V. INEQUITABLE CONDUCT

A. Prosecution of the '293 Patent and Disclosure of Prior Art

Com Dev takes the position that the '293 patent is unenforceable, alleging that as part of a pattern of inequitable conduct, there was a failure to cite to the PTO material prior art known to Dr. Fiedziuszko, and that there was an initial withholding and later misleading description of the Plourde 1977 article.

The ultimate question of whether inequitable conduct occurred is equitable in nature. Kingsdown Medical Consultants, Ltd. v. Hollister Inc., 863 F.2d 867, 876 (1988), cert. denied, 490 U.S. 1067 (1989). The Federal Circuit has held that "[i]nequitable conduct resides in failure to disclose material information, or submission of false information, with an intent to deceive, and those two elements, materiality and intent, must be proven by clear and convincing evidence."[20] Kingsdown, 863 F.2d at 872. Even a finding of gross negligence is not enough to infer intent to deceive. The conduct at issue, viewed in light of all the evidence, including evidence of good faith,

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[20] However, during the temporary relief phase of an investigation, the patentee carries the burden of showing likelihood of success on the merits with respect to the patent's enforceability. See Nutrition 21, 930 F.2d at 869.

must indicate sufficient culpability to require a finding of intent to deceive. Id. at 876. If it has been determined that inequitable conduct occurred with respect to one or more claims during prosecution, the entire patent is rendered unenforceable. Id. at 877.

Prior to the application being filed, a patentability search was conducted with respect to the invention of the '293 patent. FF 369. Dr. Fiedziuszko provided comments to the patent attorneys regarding the references discovered in the patentability search and he provided additional references to his patent attorneys. FF 370. Dr. Fiedziuszko believed that he provided all pertinent art to the patent examiner. FF 368. Nevertheless, Com Dev asserts that Dr. Fiedziuszko failed to cite to the PTO: the Rantec Reports, especially Nos. 7 and 8; the 1980 Levy survey article; the 1977 Guillon article; the 1968 Cohn article and the Harrison article; the 1975 Plourde article; and the 1980 AEU Guillon article. Post-Hearing Brief of Respondent at 31.

Information is material if there is a substantial likelihood that a reasonable examiner would have considered it important in deciding whether to allow the application to issue as a patent. LaBounty Mfg., Inc. v. U.S. Int'l Trade Comm'n, 958 F.2d 1066, 1074 (Fed. Cir. 1992). References need not be disclosed when they are cumulative with respect to other art before the examiner. Rolls-Royce Ltd. v. GTE Valeron Corp., 800 F.2d 1101, 1106-07 (Fed. Cir. 1986). None of the references raised by Com Dev is material.[21] At least the 1975 Plourde article and the 1980 AEU Guillon article were merely cumulative of art that was before the patent examiner, if not otherwise

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[21] The references raised by Com Dev in connection with its unenforceability arguments were discussed in detail, supra, in the section on obviousness.

lacking in materiality. The remaining references do not concern the subject matter of Dr. Fiedziuszko's invention, or actually teach away from it.

Com Dev places special emphasis on the Rantec Reports. However, the evidence surrounding Dr. Fiedziuszko's awareness of those reports highlights his belief in their immateriality, and indeed the lack of any intent to deceive on his part or on his behalf.

For example, in December 1980, Dr. Fiedziuszko filled out a form provided by Ford Aerospace entitled "Patent Application Information." Under the heading "Additional pertinent prior art of which I am aware (if none so state)", Dr. Fiedziuszko listed, inter alia, Rantec Report No. 7 and Rantec Report No. 8. Even though Dr. Fiedziuszko did not believe the Rantec Reports to be pertinent to his invention, he informed his patent attorney about them out of an abundance of caution. Dr. Fiedziuszko listed the Rantec Reports under the aforementioned heading because there was no alternative on the form. Dr. Fiedziuszko then attached a cover letter to the form explaining as follows:

> Sections of the Rantec reports describe application of dual mode dielectric resonators in directional filters. Principle of operation is quite different in this case - coupling between two orthogonal modes is minimized and circular polarization principle (resulting from existence of two orthogonal modes) is utilized.

FF 373 (emphasis added). Furthermore, in a report written at Ford Aerospace in December, 1980, Dr. Fiedziuszko concluded that in contrast to his invention, the Rantec Reports reflect difficulty in controlling two modes, and further that the results reported were not encouraging. FF 372.

The 1977 Plourde article was brought to the examiner's attention as a result of the examination of a corresponding application at the European Patent Office. The 1977 Plourde article in its entirety was then before the

patent examiner, who issued the '293 patent over it. FF 377.[22]

Com Dev asserts that when it was cited to the patent examiner, the 1977 Plourde article was mischaracterized. Although the remarks concerning the 1977 Plourde article may not have been entirely accurate, there is no evidence of an intent to deceive, and there is no evidence that any inaccuracy in the description of the 1977 Plourde article affected the prosecution of the '293 patent. FF 375, 376, 378, 379.

B. Conclusion as to Inequitable Conduct

SSL has strongly shown that it is likely to prevail on the inequitable conduct issue.

VI. DOMESTIC INDUSTRY

It is undisputed that SSL practices the '293 patent and that there exists an industry in the United States as required by subsection (a)(2) of section 337. See also FF 380-385.

VII. IRREPARABLE HARM TO THE DOMESTIC INDUSTRY

A. The Presumption of Irreparable Harm

A complainant is entitled to a presumption of irreparable harm when there has been a strong preliminary showing of validity and infringement. Rosemount, 910 F.2d at 821-22; Atlas Powder Co. v. Ireco Chemicals, 773 F.2d 1230, 1233 (Fed. Cir. 1985).

The Commission has held that "[i]rreparable harm may be demonstrated either by a factual showing or by an unrebutted presumption based on clear showings of patent validity and patent infringement." Certain Pressure

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[22] It is noted that at the European Patent Office, the 1977 Plourde article was cited as only "technological background." FF 379.

Transmitters, Commission Opinion at 18. See Roper Corp. v. Litton Systems, Inc., 757 F.2d 1266, 1271 (Fed. Cir. 1985). SSL has strongly and convincingly shown that it is likely to prevail on all of the patent issues in this investigation. Therefore, it is presumed that SSL will suffer irreparable harm in the absence of temporary relief. This presumption is of course rebuttable, but as is shown below, Com Dev has failed to rebut the presumption.

The evidence is also strong that Com Dev has engaged in wilful infringement, deliberately copying the '293 patent, starting after Dr. Fiedziuszko in 1982 disclosed his invention to the industry. See FF 321-326, 411. Com Dev sold the resultant commercial product, without seeking a patent infringement opinion from counsel. Furthermore, while it is Com Dev's common practice to advise all its customers of its range of products, it did not apprise SSL, a customer of Com Dev, of its capability to manufacture dual-mode dielectric C-band input multiplexers. FF 412-418. Later in 1993, after SSL learned of Com Dev's importations of input miniature microwave filters ("MMFs"), Com Dev apparently requested an infringement opinion from U.S. counsel as part of its negotiations with SSL, but failed to disclose that opinion to SSL or produce it in evidence in this proceeding. FF 427, 428. Com Dev also contracted for the supply of accused MMFs in the United States after SSL filed its complaint and motion for temporary relief and is continuing to solicit sales and to import the offending MMFs. See FF 397, 432.

Because the principal value of a patent is the right to exclude others

from making and selling the product[23], monetary damages will not always prove to be an adequate remedy. Hybritech, Inc. v. Abbott Labs., 849 F.2d 1146, 1156-57 (Fed. Cir. 1988). This is certainly one clear instance where monetary damages, in this case a bond, will not recompense SSL for the damage which has been done and which will continue to be done if Com Dev continues to sell its input MMFs.

There are only three primary satellite prime contractors in the United States: SSL, Hughes and GE/Martin Marietta. FF 389. SSL and Com Dev are major competitors in the market for MMFs. FF 388.

SSL has lost sales of MMFS to Com Dev since 1992. See FF 393. Although SSL is entitled to 100% of the market for the patented filters, during the period that temporary relief would be operative Com Dev will make further inroads into the U.S. market for MMFs driving down further SSL's market share, and seriously reducing the backlog of work necessary to maintain SSL's critical personnel necessary to manufacture MMFs. FF 429-430.

GE/Martin Marietta is the prime contractor for the Intelsat VIII, GE 1 and GE 2 satellite programs.[24] FF 391. SSL offered to sell its MMFs to GE/Martin Marietta for the Intelsat VIII (flights 801 and 802), GE 1 and GE 2,

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[23] SSL has not licensed its MMF technology under the '293 patent or its foreign counterpart. FF 407.

[24] Com Dev argues that SSL lost the bid to be the prime contractor for Intelsat VIII because of overbidding and other factors. While it may be true that SSL would have had control over the construction of the satellites and the supply of MMFs for the Intelsat VIII program had it become the prime contractor, that does not answer the question as to the supply to GE/Martin Marietta of the MMFs for the Intelsat VIII as a subcontractor. As discussed below the fact is that all of the input MMFs are to be supplied by Com Dev. Thus, Com Dev's arguments with respect to why SSL lost its bid to be the prime contractor do not relate to the supply of input MMFs to GE/Martin Marietta, and thus do not rebut the presumption of irreparable harm to the domestic industry.

as well as the Asiasat program. FF 392. However, Com Dev was awarded the contracts to build the MMFs for each of these programs. FF 393. Com Dev is scheduled to deliver up to C to GE/Martin Marietta for the C C programs during the time that temporary relief would be in place.[25] FF 394. Furthermore, additional sales and deliveries of MMFs will occur in the period during which temporary relief could be in effect. Three more contracts for Intelsat VIII satellites, i.e., 803, 804 and 805, were to be awarded by the end of C and Com Dev has bid on them. FF 396. At least some of the MMF deliveries for the Intelsat 803, 804 and 805 may occur in the period during which temporary relief could be in effect.

By the time permanent relief can be granted, Com Dev will have shipped more than C infringing filters worth more than C FF 402-405. Temporary relief is needed to halt the substantial further inroads in the market for MMFs which COM Dev is poised to make. Certain Cellular Radiotelephones and Subassemblies and Component Parts Thereof, Inv. No. 337-TA-342, USITC Pub. No. 2361 at 145 (April 1993)(unreviewed Initial Determination). Further, Com Dev may be awarded additional contracts and make additional deliveries of likely infringing MMFs in the period during which temporary relief could be in effect. The presumption, together with these factors, results in at least a reasonable threat of irreparable harm to the SSL multiplexer laboratory in the absence of temporary relief.

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[25] Temporary relief would expire on November 18, 1994, unless this investigation is declared "more complicated," in which case temporary relief would be extended until May 18, 1995. It is noted that for the purpose of adjudicating the motion on temporary relief, this investigation was designated "more complicated." See Order No. 3. It is not known whether this investigation will be designated "more complicated" for the remaining phase on permanent relief.

B. Com Dev Has Failed to Rebut the Presumption of Irreparable Harm

Com Dev argues that SSL is a healthy company, but it bases its argument on a document that was prepared prior to SSL's knowledge of the extent to which Com Dev had secured contracts for the supply of the patented MMFs. FF 429-430. While SSL may not have established that it will go out of the business of manufacturing MMFs if temporary relief is not granted, the evidence shows that Com Dev has secured a very substantial amount of business, which may reach a critical stage in the absence of temporary relief.

Com Dev takes the position that SSL engaged in an unreasonable delay in bringing its complaint and motion for temporary relief. A delay by complainant in seeking temporary relief is one factor to be considered in determining whether complainant will suffer irreparable harm. See Hybritech, 849 F.2d at 1457. Although a showing of delay may be so significant as to preclude a determination of irreparable harm, a showing of delay does not, as a matter of law, dispose of the issue. Id. In this investigation, there has been no chargeable delay on SSL's part in seeking relief. As noted above, Com Dev concealed or at least failed to disclose to SSL its commercial solicitations for sale of MMFs. The period of time that elapsed between the point when SSL learned of Com Dev's importation of infringing MMFs[26] and when SSL filed its complaint and motion for temporary relief was not unreasonable under the circumstances.[27]

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[26] The mere production by Com Dev of devices covered by the claims of the '293 patent was not enough for SSL to bring a complaint under section 337 because there must be a nexus with importation as required by the statute.

[27] It is noted that although SSL does not consider Hughes a significant force in the MMF market at this time, SSL filed a patent infringement suit against Hughes on October 1, 1993. FF 406.

Com Dev first imported accused filters into the United States in April 1992. FF 419. SSL first learned of the importation of infringing filters in October 1992. FF 420. SSL did not file its complaint and motion for a temporary relief until approximately one year after it learned that Com Dev was importing MMFs believed to infringe the '293 patent. During a substantial portion of that period, SSL attempted to negotiate its conflict with Com Dev. SSL made a good faith attempt at resolution, but the same cannot be said about Com Dev. Com Dev first claimed that it wished to delay negotiations until it received an infringement opinion from counsel, and then refused to disclose it or discuss it with SSL. FF 422, 427.

The negotiation of conflicts between parties is generally encouraged as a matter of public policy, and often makes good business sense, as in this case, where there is a preexisting business relationship between SSL and Com Dev. FF 423. SSL should not be penalized for its reasonable efforts to avoid litigation.

VIII. HARM TO RESPONDENT

As of the time of the hearing on temporary relief, about C of Com Dev's business was in the sale of MMFs to GE/Martin Marietta. FF 433. The following satellite programs for which Com Dev in under contract to supply MMFs would be affected by the granting of temporary relief in this investigation: a) Telstar; b) Asiasat; c) Intelsat VIII (flights 801 and 802); and GE 1 and GE 2. FF 431. If Com Dev were unable to import its accused MMFs due to the granting of temporary relief, it would suffer substantial harm.

However, the amount of harm to Com Dev may be mitigated, and Com Dev is taking steps to do so. Delivery of the MMFs for the C satellite

was originally scheduled for C . Yet, actual delivery is anticipated to occur in C , and Com Dev will import the filters before C , C if at all possible, thus avoiding a possible temporary exclusion order which could be issued C . FF 435. If Com Dev were to import the MMFs for the remaining programs currently under contract, i.e., C , and a bond in the amount requested by SSL were to be required in order for those MMFs to be imported into the United States, the bond would be about C . C C [28] .

IX. BALANCE OF HARM BETWEEN THE PARTIES

Com Dev could be injured if SSL is granted the temporary relief it seeks. However, there is a substantial threat of irreparable injury to SSL if temporary relief is not granted. Especially in view of the fact that SSL has made a strong and convincing showing on the patent issues, and considering its right to exclude others from selling MMFs covered by the patent, the balance of harm rests decidedly in SSL's favor.

X. PUBLIC INTEREST CONSIDERATIONS

The focus of the public interest analysis in a patent-based proceeding for a preliminary injunction is whether there exists a critical public interest that would be injured by the granting of such relief. Hybritech, 849 F.2d at 1458. In this investigation, evidence was introduced concerning the impact that temporary relief could have on a non-party to this investigation,

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[28] A bond in the amount discussed by the Administrative Law Judge, infra in the section on bonding, would be substantially greater. However, the greater amount recommended by the Administrative Law Judge is intended to impose a greater risk on Com Dev, and is justified by competitive conditions.

GE/Martin Marietta.

As stated above, Com Dev will try to insure the importation of MMFs for the C program before temporary relief would likely be issued in April, 1994. Nevertheless, if it is not possible to expedite the delivery of the MMFs as expected, the importation of up to C additional MMFs may be affected. FF 441. Inasmuch as the design of the C satellite is near completion, reconfiguration of the C to accommodate SSL's MMFs would cause expensive delays to GE/Martin Marietta. FF 442, 443. Under the Commission's Rules, the Commission determines the form of temporary relief which is appropriate in light of several factors, including the public interest. 19 C.F.R. § 210.24(e)(18)(iii). Therefore, the Commission could determine to grant relief that allows for the importation of MMFs necessary for the completion of the C project.

In addition, C MMFs are due from Com Dev to GE/Martin Marietta for the C program in C . FF 444. GE/Martin Marietta has been assured by the president of Com Dev that Com Dev will do everything in its power to import the MMFs for the C Programs on time, even if that means posting a bond in order to import the MMFs. FF 446. If temporary relief issues, C

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C [29] FF 448. Consequently, it is likely that the C C programs could go forward, through importation under bond.

As an alternative to importation under bond, evidence was introduced to the effect that SSL could supply the MMFs for the C satellites

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[29] GE/Martin Marietta has sales of about $6 billion a year. FF 447.

within 10-12 months, and that SSL could supply the MMFs for the Intelsat 803, 804 and 805. FF 449. GE/Martin Marietta and SSL have investigated changes that would be necessary for the incorporation of SSL's MMFs into the Intelsat 803, 804 and 805 satellites. FF 450. Those changes appear to be relatively small, the cost of which is estimated to be between C . FF 451. It is likely that changes required to incorporate SSL MMFs into the C C satellites would be similar to the changes required in the Intelsat 803, 804 and 805. FF 452.

In determining whether the public interest requires that SSL be denied temporary relief based on evidence concerning GE/Martin Marietta's purchase of MMFs from Com Dev, it is appropriate to weigh evidence concerning GE/Martin Marietta's contracting practices vis-a-vis Com Dev and the '293 patent. GE/Martin Marietta was contacted by SSL in November, 1992 concerning the possible infringement by Com Dev. No action was taken by GE/Martin Marietta at that time despite constant contact with Com Dev concerning the Intelsat VIII program. FF 453-456. GE/Martin Marietta contacted Com Dev concerning the issue of infringement of the '293 patent in February, 1993 after GE/Martin Marietta received a second letter from SSL concerning the '293 patent. FF 457. GE/Martin Marietta has not requested an outside opinion concerning infringement of the '293 patent by Com Dev, not has it seen any opinion letters concerning infringement or validity of the '293 patent. FF 458.

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C . FF 459.

Given the above circumstances, it does not appear that any critical public interest would be served by the denial of temporary relief. Rather, the public interest would be best served by protecting the rights granted to

SSL by a valid United States patent.

XI. CONCLUSION ON THE FOUR FACTORS RELEVANT TO TEMPORARY RELIEF

SSL has made a strong and convincing showing that it is likely to prevail on the patent and domestic industry issues in this investigation. Although there could be harm to Com Dev if temporary relief is granted, it is outweighed by the harm that could be caused to SSL in the absence of such relief. No critical public interest has been shown that would be injured by the granting of temporary relief. Therefore, SSL should be granted the temporary relief that it has requested.

XII. BONDING

A. Complainant's Bond

The Commission's policy is to favor the posting of a bond by the complainant. A complainant that believes a bond should not be required has the burden of persuading the Commission of such. 19 C.F.R. § 210.24(e)(iii). The factors to be considered in determining whether to require the complainant to post a bond include the strength of the complainant's case, whether posting a bond would impose an undue hardship on the complainant, whether the respondent will be harmed by the issuance of the temporary relief sought by the complainant, and any other relevant legal, equitable, or public interest considerations. No single factor is to be determinative of the issue of complainant's bond. Id.

The policy expressed in the Commission's Rules is that in a case such as this, in which a domestic industry exists and domestic sales of the accused device have not been de minimis (Com Dev's sales have been substantial), the amount of the complainant's bond is likely to be an amount ranging from 10% to

100% of the sales revenues and licensing royalties (which in this case is none) from the domestic product at issue. See 19 C.F.R. § 210.24 (e)(v).

As discussed above, SSL has made a strong and convincing showing on the issues in this case. While Com Dev will be harmed substantially by the entry of temporary relief, the harm to Com Dev is outweighed by the harm to SSL. The equities weigh heavily in SSL's favor with respect to the posting of a bond. SSL has come to the Commission to halt the further erosion of the domestic industry under the '293 patent by a wilful infringer. Therefore, if a bond is required in order for SSL to obtain temporary relief, it should be, at the most, 10% of sales revenues in MMFs as per the bonding guidelines contained in the current Commission Rules, or half of that amount in recognition of the strong showing made by SSL in its favor thus far in the investigation. See Radiotelephones, Notice of Commission Decision Not to Modify or Vacate Initial Determination Granting Temporary Relief, and Issuance of a Limited Exclusion Order and Temporary Cease and Desist Orders, Subject to Posting of Bond by Complainant, 54 Fed. Reg. 37160 (1989)(five percent bond). Consequently, SSL would be required to post a bond of C which reflects an amount equal to 5% of SSL's gross sales of MMFs covered by the '293 patent in 1992.[30] See FF 460.

B. Respondent's Bond

The Initial Determination on temporary relief may, but is not required,

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[30] It is noted that the Commission's proposed Rules, whose issuance may be imminent, state that a bond of $100,000 is appropriate if the complainant's sales revenues of the product at issue are between $1 million and $10 million for the most recent fiscal year. 57 Fed. Reg. 52830, 52886 (1992). Thus, under the proposed Rules, SSL would be required to post a bond in the amount of $100,000. A bond in the amount of $100,000 would be favored by the Administrative Law Judge if the proposed rules were in effect.

to address bonding by the respondent. 19 C.F.R. § 210.24(e)(17)(i). Due to the strong showing made by SSL in the temporary relief phase of this investigation, including an unrebutted presumption of irreparable harm to the domestic industry, the Administrative Law Judge finds it appropriate to address the issue of respondent's bond.

In determining the amount of respondent's bond, the Commission is to determine, among other things, the amount that would offset any competitive advantage resulting from the alleged unfair methods of competition and unfair acts enjoyed by persons benefiting from importation of the articles in question. 19 C.F.R. § 210.58 (a)(3).

The amount of bond required of Com Dev cannot be considered any form of compensation for SSL because the bond, if it is forfeited, accrues to the benefit of the United States Treasury and not to SSL, which is the sole participant in the legitimate domestic industry under the '293 patent. In order to offset the competitive advantage that would accrue to Com Dev during the pendency of this investigation, Com Dev must be presented with a choice between a halt to its importations during the pendency of this proceeding, and the possible forfeiture of a sizable bond if it continues importation during the temporary relief period. This is an appropriate analysis under the Commission's Rules because of the strong and convincing showing of wilful and continuing infringement which threatens the domestic industry with irreparable harm. It is believed that the only amount of bond that would accomplish that goal, and thus have the potential for offsetting the benefits enjoyed by Com Dev during the period of temporary relief, is an amount that would discourage Com Dev from maintaining or expanding its market share through the importation of infringing MMFs. Com Dev may be willing to sacrifice profit temporarily in

order to preserve or further its market share. Consequently, the amount of bond required of Com Dev should reflect not only the amount of profit it makes on its domestic MMF sales, but also the amount which reflects its costs of producing and selling the accused devices that Com Dev is importing. Thus, the bond should be 100% of the price Com Dev charges for an MMF.

There is a high degree of certainty that at least the C sales will be affected by temporary relief. C C . FF 461. Therefore, Com Dev should be required to post a bond of C per MMF.

FINDINGS OF FACT

I. BACKGROUND

FF 1. The U.S. International Trade Commission has jurisdiction over the subject matter of this investigation and personal jurisdiction over Respondent, Com Dev Ltd. ("Com Dev"). See Notice of Investigation (Nov. 9, 1993); 19 U.S.C. § 1337. Furthermore, no party has contested jurisdiction.

FF 2. Space Systems/Loral, Inc. ("SSL") is a Delaware corporation with its principal place of business at 3825 Fabian Way, Palo Alto, California 94303-4697. RX 96; Complaint ¶ 2.1, at 2.

FF 3. SSL was formerly part of Ford Aerospace Corporation ("Ford Aerospace"), previously Ford Aerospace and Communications Corporation, then a subsidiary of Ford Motor Company. DeWitt, Tr. 26-27; RX 96; Complaint ¶ 2.1, at 2.

FF 4. The owners of SSL are Loral Corporation in New York, Shearson and Lehman, and the European companies, Aerospatiale, Alcatel, Alenia, and Deutsche Aerospace. DeWitt, Tr. 30; Musika Tr. 2014-2106.

FF 5. SSL has been a pioneer in space communications technology; a number of satellite programs have carried or will carry SSL technology into space. CX 24.

FF 6. Com Dev is a Canadian corporation having its principal place of business at 155 Sheldon Drive, Cambridge, Ontario, Canada N1R 7H6. Complaint ¶ 2.6, at 4; Com Dev Ltd. Response to Complaint ¶ 2.6, at 2.

FF 7. Com Dev has manufacturing facilities at this location and is involved in the manufacture of communications equipment, including miniature microwave filters ("MMFs"). Complaint ¶ 2.7, at 4; Com Dev Ltd. Response to

Complaint ¶ 2.7, at 3.

FF 8. Com Dev has shipped MMFs into the United States. CX 2 C.

FF 9. Com Dev has contracts to ship additional MMFs into the United States in 1994. CX 2 C.

FF 10. The '293 patent is entitled "Miniature Dual-Mode, Dielectric-Loaded Cavity Filter" and issued on December 18, 1984. The '293 patent is based on Application No. 466,180, a continuation of Serial No. 262,580, filed on May 11, 1981 and subsequently abandoned. CX 1.

FF 11. Slawomir J. Fiedziuszko is the named inventor of the invention claimed in the '293 patent. CX 1.

FF 12. SSL is the owner of the '293 patent. CX 1; DeWitt, Tr 26-27.

FF 13. The '293 patent is directed to a small, lightweight microwave filter that performs complex filter functions. CX 1, '293 patent col. 3, lines 14-21.

FF 14. The '293 patent has two independent claims (claims 1 and 14) and 12 dependent claims. CX 1.

FF 15. The term "pole" is used in circuit theory to describe the number of natural frequencies or oscillation frequencies. Thus, the range of a 2-pole filter over which there is low loss is much broader than a 1-pole filter. Bell, Tr. 207-208.

FF 16. The miniature microwave filter of the '293 patent is comprised of composite resonators that operate simultaneously in two orthogonal modes, each of which mode is tunable and coupled together can be used to realize a two-pole resonse from each resonator. See CX 1, '293 patent col. 3, lines 46-51.

FF 17. The composite resonators of the '293 patent comprise resonator

elements made of a high dielectric constant solid material together with a surrounding cavity resonator. Bell, Tr. 221; CX 1, '293 patent col. 3, lines 52-56.

FF 18. The foreign counterpart to the '293 patent issued in Canada as Canadian Patent No. 1,168,718. Karambelas, Tr. 623.

FF 19. Communication satellites relay electromagnetic signals from one or more earth transmitters to one or more earth receiving stations and amplify the signals for the transmission over long distances with repeaters. Complaint ¶ 3.2, at 4; Com Dev Ltd. Response to Complaint ¶ 3.2, at 3.

FF 20. A communications satellite is allotted a range of frequencies or spectrum, similar to the AM band or FM band in broadcast radio. Complaint ¶ 3.3, at 4; Com Dev Ltd. Response to Complaint ¶ 3.3, at 3.

FF 21. A filter, such as an MMF, enables a satellite to sort incoming microwave communications signals into individual "channels" within the frequency range allotted to the satellite. Id.

FF 22. This process is called "channelization" and enables the satellite to take a broad part of its assigned frequency range and separate this broad signal into different "channels," each with its own allotted narrower band of frequencies. Id.

FF 23. Channelization is accomplished with filters, such as MMFs, in the satellite. Complaint ¶ 3.4, at 5; Com Dev Ltd. Response to Complaint ¶ 3.4, at 3.

FF 24. A filter blocks or suppresses all of the signals except those within the narrow frequency range it is designed to pass. Id.

FF 25. Each filter must be carefully tuned so that only the desired frequencies pass through it. Id.

FF 26. A network of these filters is required to allow the various channels to be separated from the broad frequency range. Complaint ¶ 3.5, at 5; Com Dev Ltd. Response to Complaint ¶ 3.5, at 3.

FF 27. These networks of filters are referred to as multiplexers or "MUXES." Id.

FF 28. Communications satellites carry a large number of filters to perform this channelization. Complaint ¶ 3.6, at 5; Com Dev Ltd. Response to Complaint ¶ 3.6, at 4.

FF 29. Larger satellites using the 4 and 12-GHz bands can have more than 100 filters in their payload. Id.

FF 30. Since placing a satellite in orbit is very costly, each satellite must serve as many communication purposes and have as many channels as possible. Complaint ¶ 3.7, at 5; Com Dev Ltd. Response to Complaint ¶ 3.7, at 4.

FF 31. The '293 patent claims a smaller, lighter microwave filter that performs complex filter functions previously performed by larger, heavier filters. CX 1.

FF 32. CX 23 demonstrates the differences in size among a single cavity waveguide filter, a dual-mode circular cavity filter, and the dual-mode, dielectric filter covered by the '293 patent. CX 23.

FF 33. The MMFs covered by the claims of the '293 patent are comprised of dielectric resonators (slices of ceramic material) situated within dual-mode cavities. CX 1.

FF 34. Electromagnetic waves resonate within the cavities at a specific frequency, depending on the sizes of the cavities and the dielectrics. CX 1 (Col. 10, ll. 23-31).

FF 35. Tuning screws are used to provide fine adjustments to the cavity resonances, and openings in the walls between cavities, or irises, couple energy from cavity to cavity. CX 1 (Col. 5, lines 1-6, 47-56).

FF 36. Because the ceramic material concentrates the electromagnetic energy into a smaller volume as compared to air or a vacuum, comparable performance is achieved in a filter of substantially smaller size and weight. CX 1 (Col. 5, lines 30-36).

FF 37. The electromagnetic resonance of a cavity is analogous to the vibrational resonance of a piano string or the acoustical resonance of an organ pipe. Complaint ¶ 3.10, at 6-7; Com Dev Ltd. Response to Complaint ¶ 3.10, at 4.

FF 38. The resonant frequency of the cavities corresponds to the center frequency of the band or channel to be passed by the filter. Id.

FF 39. Signals at frequencies which are not at, or close to, the resonant frequency (i.e., which are not within the channel) are blocked or rejected by the filter and do not pass through; those signals are prevented from interfering with the signals within the channel. Id.

FF 40. Signals are also distorted to some extent in passing through the filter. Id.

FF 41. The amount of distortion is a characteristic of a specific filter's design, and is usually a tradeoff with the amount of interference rejection provided by the filter. Id.

FF 42. A satellite carrying filters covered by the '293 patent devotes less weight and volume to filter functions. Fiedziuszko, Tr. 746-747.

FF 43. The satellite, therefore, can have more channels, and/or carry more fuel and stay aloft for longer periods of time than previously possible.

Fiedziuszko, Tr. 750-752.

II. INFRINGEMENT

A. Claim Interpretation

1. Interpretation of Claim 1 of the '293 patent

FF 44. Claim 1 of the '293 patent is directed to a single dielectric-loaded cavity microwave filter and contains six elements. CX 1 (Col. 10, lines 21-46).

FF 45. The first element of claim 1 specifies "a first composite microwave resonator comprising a cavity resonator and, disposed within said cavity resonator, a dielectric resonator element made of a material having a high dielectric constant ε and a high Q, said resonator element having a self-resonant frequency, the dimensions of said cavity resonator being selected so as to cause said composite resonator to have a first order resonance at a frequency near said self-resonant frequency." CX 1 (Col. 10, lines 23-31).

FF 46. For the purpose of the hearing on temporary relief, the meanings of the various terms "cavity resonator," "dielectric resonator element," "composite microwave resonator," "high dielectric constant," "high Q," "self-resonant frequency," "first order resonance," and "first order resonance at a frequency near said self-resonant frequency," as understood by one of ordinary skill in the art, are not disputed. Bell, Tr. 216, 283-286; CX 126, ¶¶ 2-9; RX 317 C, ¶¶ 7-14; Tr. 1870-1872 (Com Dev counsel representation limiting elements in dispute).

FF 47. "Q" is short for "quality factor," which is a measure of the extent to which a cavity does not lose energy. A perfect cavity would have an infinite Q. Bell, Tr. 198.

FF 48. The second and third elements of claim 1 specify, respectively, a "first tuning means to tune said composite resonator to resonance at a frequency along a first axis" and a "second tuning means to tune said composite resonator to resonance at a second frequency along a second axis orthogonal to said first axis." CX 1 (Col. 10, lines 32-36).

FF 49. In a composite microwave resonator as described in the '293 patent, the electric field of the first order resonant mode reaches maximum strength along an axis, which specifies the "polarization" of the mode and is normally shown as an arrow or "vector." Bell, Tr. 192-94; Tang, Tr. 1110-11.

FF 50. One of ordinary skill in the art would understand that a tuning means operates to tune (i.e., adjust the resonant frequency of) one particular mode, by perturbing the electric field and lowering the resonant frequency of the composite resonator. One of ordinary skill in the art would understand that "resonance along an axis" refers to the resonant mode whose polarization vector is parallel to, or along, that axis. Bell, Tr. 283-86, 298; CX 126, ¶ 12; RX 317 C, ¶ 17; Tang, Tr. 1130, 1150.

FF 51. The terms "axis" or "axes" in claim 1 refer to the axes defined by the polarization or mode vector associated with each particular resonant mode that is being tuned, and do not refer to the "axis" of the dielectric resonator element that is disposed within the cavity resonator. Bell, Tr. 2134.

FF 52. One of ordinary skill in the art would understand the reference in the third element of claim 1 to resonance "along a second axis orthogonal to said first axis" to mean a second resonant mode whose polarization vector is perpendicular in three dimensional space to that of the first resonant mode. Bell, Tr. 283-286, 458-474, 2134; Levy, Tr. 1623; Tang, Tr. 1116-1117;

CX 126, ¶ 13; RX 317 C, ¶ 18.

FF 53. One of ordinary skill in the art would understand that many structures could be used to perform the stated tuning functions, including the use of metal tuning screws, moving or changing the shape of the cavity walls or the dielectric resonator, and using dielectric rods or slugs in place of metal tuning screws. Bell, Tr. 285-286; CX 126, ¶ 11; RX 317 C, ¶ 16; Tang, Tr. 1135-1137.

FF 54. It was well known to those of ordinary skill in the art by 1980 that tuning screws can be inserted into a composite cavity/dielectric resonator structure "from the top, from the bottom, or from the sides." Levy, Tr. 1775; Bell, Tr. 230, 297-299.

FF 55. The fourth element of claim 1 specifies a "mode coupling means to cause mutual coupling between resonant energy on said first and second axes to thereby cause resonant energy on either of said axes to couple to and excite resonant energy on the other of said axes." CX 1 (Col. 10, lines 37-42).

FF 56. One of ordinary skill in the art would understand that many structures could be used to perform the stated mode coupling function, including the use of a metal screw, changing the shape of the cavity walls, or using dielectric rods or slugs in place of the metal screw, all of which were well known in the prior art as of 1980. Bell, Tr. 285-286; CX 126, ¶ 14; RX 317 C, ¶ 19.

FF 57. It was well known to those of ordinary skill in the art in 1980 that mode coupling screws could be placed in many different locations in the sides, top or bottom of a cavity and would perform substantially the same mode coupling function. Bell, Tr. 317-318.

FF 58. The fifth and sixth elements of claim 1 specify, respectively, an

"input means to couple microwave energy into said cavity resonator" and an "output means to couple a portion of said resonant energy on one of said axes out of said cavity resonator." CX 1 (Col. 10, lines 42-46).

FF 59. The specification of the '293 patent teaches that the input and output structures can be "entirely capacitive probes, or inductive irises or any combination of the two." CX 1 (Col. 6, lines 48-60); Bell, Tr. 323-324.

FF 60. One of ordinary skill in the art would understand that many different types of structures could be used to perform the input and output functions, including probes, loops, capacitive and inductive slots or irises, all of which were well known in the prior art as of 1980. Bell, Tr. 195-96, 201, 2133-34; Levy, Tr. 1602, 1785, 1787-88.

FF 61. As Com Dev's expert testified, "there's no need to represent the input and output means in any microwave cavity filter because it's well known to people working in filters how to couple in and out of the filter" using probes, loops and various capacitive and/or inductive irises. Levy, 1785, 1787-88.

2. Intepretation of Claim 14 of the '293 Patent

FF 62. Claim 14 of the '293 patent is directed to a combination of two composite cavity/dielectric element resonators (each of which includes the elements of claim 1) joined by a common iris wall that allows resonant energy from the first resonator to couple to the second resonator. CX 1 (Col. 11, line 30 - Col. 12 line 37); RX 317 C, ¶ 26; Bell, Tr. 328-329; Levy, Tr. 1604.

FF 63. Claim 14 has eleven elements, all but one of which correspond directly to one of the elements in claim 1. Bell, Tr. 328-329.

FF 64. The construction of each of these corresponding elements in claim 14 is the same as that discussed previously in connection with claim 1. FF

44-61.

FF 65. The one additional element in claim 14 (the tenth element) specifies that "said first and second resonators sharing a common wall, and, defined within said wall, an iris means for coupling resonant energy along one of said first and second axes from said first to said second resonator." CX 1 (Col. 12, lines 31-35).

FF 66. The specification of the '293 patent teaches that many different forms of iris can be used in the common wall between the two cavities: "Further, although irises 21 and 23 [in Figure 1] have been illustrated as cruciform in shape, such that they function as orthogonal slot irises to couple each of the two orthogonal modes in the respective cavities, other forms of iris could be used, depending on the nature of the intercavity coupling required by the filter function being realized." CX 1 (Col. 6, lines 54-60).

FF 67. One of ordinary skill in the art in 1980 would understand this to mean that a wide variety of iris couplings of various shapes that allow the filter designer to achieve electric field coupling and/or magnetic field coupling, as required was known to one of ordinary skill in the art. Bell, Tr. 2133-34; Tang, Tr. 1016-19; Levy, Tr. 2169-70.

B. The Com Dev Filter

FF 68. Com Dev uses a single design for its commercial dielectric-loaded dual mode filters which have been and are being sold in the United States. Tang, Tr. 1146; Bell, Tr. 291.

FF 69. Physical Exhibits CPX3 C and CPX4 C are representative of that design. Tang, Tr. 1146; Bell Tr. 291; CX 190 (Kudsia Dep.) at 159.

FF 70. A pictorial diagram of the Com Dev design is set forth in CX 4 C.

Tang, Tr. 1146-1148; Bell, Tr. 291-292.

FF 71. The way that Com Dev builds its dielectric-loaded dual mode filters is reflected in the manufacturing drawings that have been admitted into evidence. Bell, Tr. 278-279; CX 7 C - 14 C.

FF 72. The design and operation of the Com Dev filter is described in various technical documents prepared by Com Dev for its customer, General Electric/Martin Marietta. Bell, Tr. 279-80; CX 14 C, 16 C, 19 C, 20 C, 96 C, 97 C.

FF 73. The Com Dev filter has four individual cavities, each of which contains a dielectric resonator element, two tuning screws, a mode coupling screw, an input mechanism and an output mechanism. E.g., CX 4 C; CPX 3 C; CPX 4; Tang, Tr. 1149, 1153.

FF 74. In addition, the Com Dev filter has three separate combinations of two adjacent cavities which share a common iris wall (i.e., cavities 1 and 2, cavities 2 and 3, and cavities 3 and 4). E.g., CX 4 C; Bell, Tr. 328-330.

FF 75. The specification of the '293 patent states that: "it will be obvious to those skilled in the art that many changes could be made and many apparently different embodiments thus derived without departing from the scope of the invention. For example, although the invention has been disclosed in an embodiment which utilizes cylindrical resonator elements, the invention is not limited to this geometry. In fact, other axially symmetrical configurations such as a square cross-sectional normal to the composite resonator axis could be used for either the dielectric resonator element or the cavity resonator or for both." CX 1 at col. 9 line 67 - col. 10 line 11.

FF 76. Com Dev's witnesses attempted to distinguished the Com Dev filter from the preferred embodiment of the '293 patent on grounds that the four

cavities in the Com Dev filter are joined at their "side" walls in a so-called "planar" design, while Figure 1 of the '293 patent shows multiple composite cavity resonators joined at their "end" walls in a so-called "coaxial" design. E.g., Tang, Tr. 1064.

FF 77. The claims of the '293 patent are not limited to cavities in a co-axial configuration. CX 1 (Col. 10, lines 2-10).

FF 78. Claim 14 of the '293 patent concerns two composite resonators "sharing a common wall," but does not contain any limitation concerning which common wall is shared. CX 1 (Col. 12, lines 31-33); Bell, Tr. 2140.

FF 79. It would have been a very simple matter to insert the word "end" immediately before the words "wall" in the claim language (Col. 12, line 32), if the inventor or the patent examiner had intended that claim 14 be limited solely to "coaxial" designs. Bell, Tr. 2140.

FF 80. It was well known to those of ordinary skill in the art by 1980 that a microwave filter could be constructed by joining cavity resonators at their end walls, at their side walls, or both. Bell, Tr. 528, 2140-2141; CX 94 (Figs. 3 & 5).

FF 81. The patent specification defines the phrase "composite resonator" to refer to a resonator consisting of a single cavity with the dielectric resonator material inside that cavity. Bell, Tr. 2141-43; CX1 at col. 3, lines 22-27.

FF 82. The language in the specification cited by Com Dev's expert "has no reference whatsoever with respect to whether that axis (i.e., the axis of symmetry of the composite resonator) is either collinear, meaning that we're in an end-to-end configuration or whether the axis of this resonator is parallel to an axis of an adjacent resonator." Id.

C. Literal Infringement Analysis of Claim 1

1. First Element (Composite Resonator)

FF 83. It is undisputed that each of the four cavities of the Com Dev filter satisfies the first element of claim 1. Bell, Tr. 293-97; Tang, Tr. 1148-49; Tr. 1870-72 (Com Dev counsel representation limiting elements in dispute).

2. Second and Third Elements (Tuning Means)

FF 84. The second and third elements of claim 1 are written in "means-plus-function" format. CX 1 (Col. 10, lines 32-36).

FF 85. The specified "function" performed by the "first tuning means" is "to tune said composite resonator to resonance at a first frequency along a first axis." Id.

FF 86. The specified "function" performed by the "second tuning means" is "to tune said composite resonator to resonance at a second frequency along a second axis orthogonal to said first axis." Id.

FF 87. The structure described in the '293 patent that performs each of these specified functions is a metal tuning screw. Bell, Tr. 297; Tang, Tr. 1130.

FF 88. The '293 patent discloses that the tuning screws can be placed in alternative locations in the cavity walls. Bell, Tr. 299, 2126-2127; Levy, Tr. 1879-80; CX 1 (Fig. 1).

FF 89. It was well known to those of ordinary skill in the art in 1980 that tuning screws can be placed on the top, the bottom or the sides of a cavity resonator. Levy, Tr. 1775; Bell, Tr. 297-99, 313, 559-61; Tang, Tr. 1128-29.

FF 90. Each of the four cavities in the Com Dev filter uses the same

structure, i.e., a metal tuning screw, to perform the tuning functions specified in the second and third elements of claim 1. Bell, Tr. 299, 309; Tang, Tr. 1130, 1149-60; CX 140 C (Kudsia Dep.) at 171-74.

FF 91. The location of the tuning screws in each cavity of the Com Dev filter with respect to the axis of symmetry of the dielectric resonator element is different than in the '293 patent. Tang, Tr. 1166-1167; CX 6 (Figs. 1 & 4); see Tr. 524.

FF 92. Nevertheless, the orientation of the tuning screws in each cavity of the Com Dev filter with respect to the "axis" of the resonance being tuned is substantially the same as in the '293 patent. Bell, Tr. 2135-2139; CDX 1; CX 5.

FF 93. The orientation of the tuning screws in each cavity of the Com Dev filter with respect to the maximum electric field of the resonance being tuned is exactly the same as in the '293 patent. Bell, Tr. 302; Tang, Tr. 1166-1170; CX 96 C (sheet 39).

FF 94. The claim language of the second and third elements of claim 1 does not make any reference to the axis of symmetry of the dielectric resonator element, but refers instead to the "axis" of the resonance being tuned. Bell, Tr. 2134; CX 1.

FF 95. Com Dev's '843 Patent shows two alternative orientations for the tuning screws in the left cavity and the right cavity of Figure 1. CX 6.

FF 96. The orientation of the tuning screws shown in the right cavity of Figure 1 of the '843 Patent is the same orientation as the tuning screws shown in Figure 1 of the '293 patent (hereinafter "the '293 Orientation"). Bell, Tr. 304-07; Tang, Tr. 1166-67; Levy, Tr. 1925-27.

FF 97. The orientation of the tuning screws shown in the left cavity of

Figure 1 of the '843 Patent is the same orientation as the tuning screws in the Com Dev commercial filter (hereinafter "the Com Dev Orientation"). Bell, Tr. 304-07; Tang, Tr. 1167.

FF 98. The tuning screws in both the '293 Orientation and the Com Dev Orientation work in the same way to perform the specified tuning function: i.e., each screw primarily perturbs the electric field of the resonant mode being tuned. Bell, Tr. 297-298, 300, 302-303, 314; Tang, Tr. 1130-31, 1150-1152.

FF 99. The tuning screws in both the '293 Orientation and the Com Dev Orientation achieve exactly the same results with respect to the specified tuning function: i.e., the distortion of the electric field effectively lengthens the resonator for the mode being tuned and lowers the resonant frequency of that mode. Bell, Tr. 298, 300, 302-303, 314; Tang, Tr. 1131-1132 ("No different from how we do it or how '293 do it. And this just physics."), Tang Tr. 1150-1153.

FF 100. Com Dev's witnesses attempted to distinguish the "tuning means" in the Com Dev filter from the "tuning means" described in the '293 patent based upon certain alleged electrical and mechanical advantages and disadvantages associated with the two alternative tuning screw orientations, including such factors as convenience of mounting, ease of tuning, degree of tuning screw penetration, high power handling capabilities, temperature stability, insertion loss, vibrational stability, and cavity size standardization. E.g., Tang, Tr. 1049-1053; Levy, Tr. 1575-1582.

FF 101. None of these factors changes or effects the way in which the tuning screw performs the tuning functions specified in the second and third elements of claim 1, or the results achieved in performing those specified

functions. Bell, Tr. 2120-2125.

FF 102. All of the advantages and disadvantages discussed by the Com Dev witnesses are design tradeoffs which a designer deals with in building a commercial filter. Bell, Tr. 561, 585-586, 2123-2124; Tang, Tr. 1008 (there are many design "tradeoff" and "[t]here's no one type of design that possibly can get all the best elements"), 1013-1014, 1123-1124; Levy, Tr. 1582 (many design choices affect temperature stability), 1600 (design tradeoffs relating to cavity standardization).

FF 103. The various design tradeoffs discussed by the Com Dev witnesses relate to a comparison between the Com Dev and SSL final commercial filter products. E.g., Tang, Tr. 1027-1028, 1040-1041.

FF 104. None of the Com Dev witnesses reviewed the actual commercial designs and performance characteristics of the SSL commercial filters that would provide a basis to assess the design advantages that can be achieved through optimized engineering of the preferred embodiment in the '293 patent. E.g., Levy, Tr. 1898, 1903-1904.

FF 105. There are well known engineering techniques and designer choices that allow one of ordinary skill in the art to deal with the advantages, disadvantages and other features that may be associated with alternative tuning screw locations in any particular filter design. Bell, Tr. 2119-2120, 2124-2125; Tang, Tr. 1132.

FF 106. The tuning means of the '293 patent includes a tuning screw inserted into the cavity of a filter that causes a perturbation of the electric field that is resonating in the cavity. Bell Tr. 298.

FF 107. According to the '293 patent, as the tuning screw is inserted into the cavity of the filter, the resonant frequency of the composite

resonator moves down in frequency, or shifts to a lower frequency. Bell Tr. 299.

FF 108. A tuning screw may be placed at various locations in the cavity of the '293 patent filter. Bell Tr. 299.

FF 109. Certain modes of resonance occur in a dielectric resonator that have a property of polarization where, along an axis of the resonator, the electric field will be maximum and aligned with that axis. Bell Tr. 217.

FF 110. Certain modes of resonance occur in dielectric resonators that have a property of circular symmetry, and will not exhibit a polarization property. Bell Tr. 217.

FF 111. The element "resonance at a first frequency along a first axis" in the '293 patent refers to a resonant mode whose polarization is parallel to a line or axis in three-dimensional space. Bell Tr. 298.

FF 112. The element "resonance at a second frequency along a second axis" in the '293 patent calls for a resonant mode whose polarization is parallel to a line or axis that is 90 degrees to the first axis. Bell Tr. 313.

FF 113. Com Dev's witnesses attempted to distinguish the "tuning means" in the Com Dev filter from the "tuning means" described in the '293 patent on grounds that each tuning screw in the '293 patent tunes one of the two modes in the dual mode resonator "independently," while each tuning screw in the Com Dev filter "tunes both modes." E.g., Levy, Tr. 1569.

FF 114. The claim language in the second and third elements of claim 1 of the '293 patent only requires that each "tuning means" operates to tune one of the two perpendicular modes to resonance and does not exclude some other effect, whether incidental or deliberate, on the other mode. Bell, Tr.

2125-2126; CX 1 (Col. 10, lines 32-36).

FF 115. As a matter of the laws of physics, any tuning screw will always have some effect on both modes simultaneously and no tuning screw is completely independent as to just one mode. Bell, Tr. 2126.

FF 116. The '293 patent discloses that the tuning screws can be placed in various alternative locations which, while primarily tuning one mode, will cause a varying simultaneous tuning effect on the other mode. Bell, Tr. 2126-2128; CX 1, Figure 1.

FF 117. Com Dev's witness Mr. Tang conceded that not all the tuning screws shown in the '293 patent are located at the electric field maximum. Tang, Tr. 1009.

FF 118. The tuning screws in both the '293 patent and in the Com Dev filter "primarily" tune only one of the two modes in the cavity. Bell, Tr. 2127-29; Tang, Tr. 1130; Levy, Tr. 1571; CX 140 C (Kudsia Dep.) at 173-74.

FF 119. The Com Dev witnesses admitted that in practice any filter that attempts to use two perpendicular modes simultaneously must have a tuning mechanism that provides reasonably independent control of the modes. Tang, Tr. 1005; Levy, Tr. 1632.

FF 120. In a sworn patent application filed in 1984, Mr. Tang and other Com Dev engineers represented to the PTO that, in both the '293 Orientation and in the alternative Com Dev Orientation, "[t]he tuning screws perturb the electrical field of each orthogonal mode <u>independently</u> and decrease the cutoff frequency of the dielectric resonator in the plane of each screw." CX 6, U.S. Patent No. 4,652,843 (the "'843 patent")(Col. 3, lines 46-56) (emphasis added).

FF 121. In a sworn patent application filed with the United States

Patent and Trademark Office ("PTO") in 1984, Mr. Tang and other Com Dev engineers expressly represented that the Com Dev Orientation of tuning screws "provides the same tuning effect" as the '293 Orientation of tuning screws. CX 6 (Col. 3, lines 64-67); Tang, Tr. 1171-1172; Bell, Tr. 304-308, 315.

FF 122. In that same sworn patent application, Mr. Tang and other Com Dev engineers represented to the PTO that the Com Dev orientation of the tuning screws works in the same way to achieve the same results as the '293 Orientation. CX 6 (Col. 3, line 67-Col. 4, line 3); Tang, Tr. 1171-1172; Bell, Tr. 304-08, 315.

3. Fourth Element (Mode Coupling Means)

FF 123. The fourth element of claim 1 is also written in "means-plus-function" format and the specified function to be performed by the "mode coupling means" is "to cause mutual coupling between resonant energy on said first and second axes to thereby cause resonant energy on either of said axes to couple to and excite resonant energy on the other of said axes." CX 1 (Col. 10, lines 37-41); Bell, Tr. 316-317.

FF 124. The structure described in the '293 patent that performs this specified function is a metal screw, called the mode coupling screw. Bell, Tr. 317.

FF 125. The '293 patent discloses that the mode coupling screw can be placed in several alternative locations in the cavity walls. Bell, Tr. 2126-2127; Levy, Tr. 1879-1880; CX 1 (Fig. 1).

FF 126. It was well known to those of ordinary skill in the art in 1980 that a mode coupling screw can be located in a variety of places on the filter. Bell, Tr. 230-231, 318.

FF 127. Each of the four cavities in the Com Dev filter uses the same

structure, i.e., a metal tuning screw, to perform the specified mode coupling function. Bell, Tr. 319; CX 140 C (Kudsia Dep.) at 174-76.

FF 128. The orientation of the mode coupling screw in the Com Dev filter with respect to the two perpendicular axes that correspond to the polarization vectors of the two resonances within the cavity is substantially the same as in the '293 patent. Bell, Tr. 2135-39; CDX 1; CX 5.

FF 129. In both the Com Dev filter and the '293 patent, the mode coupling screw is located in a position where it will substantially perturb the electric field of both perpendicular resonant modes within the cavity simultaneously. Bell, Tr. 319.

FF 130. The location of the mode coupling screw in each cavity of the Com Dev filter with respect to the axis of symmetry of the dielectric resonator element is different than in the '293 patent. Bell, Tr. 304-07; Tang, Tr. 1166-67.

FF 131. The claim language of the fourth element of claim 1 does not make any reference to the axis of symmetry of the dielectric resonator element, but refers instead to the two perpendicular axes that correspond to the polarization vectors of the two resonances within the cavity. Bell, Tr. 2134; CX 1.

FF 132. The mode coupling screw in both the '293 Orientation and the Com Dev Orientation works in the same way to perform the specified mode coupling function: i.e., in each case, the screw perturbs, simultaneously and substantially, the electric field of both perpendicular resonant modes within the cavity. Bell, Tr. 316-319; Levy, Tr. 1927-31.

FF 133. The mode coupling screw in both the '293 Orientation and the Com Dev Orientation achieve exactly the same results with respect to the specified

mode coupling function: i.e., the simultaneous distortion of the electric field of the two orthogonally polarized resonant modes causes mutual coupling of resonant energy between those two modes. Bell, Tr. 316-320; Levy, Tr. 1930-32.

FF 134. In a sworn patent application filed in 1984, Mr. Tang and other Com Dev engineers represented to the PTO that the Com Dev Orientation of the mode coupling screw operates in a similar way to achieve the same results as the '293 Orientation. CX 6 (Col. 3, line 67 - Col. 4, line 5).

4. Fifth and Sixth Elements (Input/Output Means)

FF 135. The fifth and sixth elements of claim 1 are also written in "means-plus-function" format and relate to the input and output of energy from the cavity resonator. CX 1 (Col. 10, lines 42-46).

FF 136. The specified "function" performed by the "input means" is "to couple microwave energy into said cavity resonator." Id.

FF 137. The specified "function" performed by the "output means" is "to couple a portion of said resonant energy on one of said axes out of said cavity resonator." Id.

FF 138. One of ordinary skill in the art would understand the terms "microwave energy" and "resonant energy" to refer to electromagnetic energy in the frequency range of 1-100 gigahertz. Bell, Tr. 182-183.

FF 139. One of ordinary skill in the art would recognize that electromagnetic energy is composed of both electric fields and magnetic fields. Bell, Tr. 183-184, 588-590; Tang, Tr. 1137.

FF 140. It was well known to those of ordinary skill in the art in 1980 that microwave energy could be coupled into or out of a cavity via the magnetic field, the electric field, or a combination of both fields. Bell,

Tr. 201-204; Tang, Tr. 1142; CX 94.

FF 141. The '293 patent describes a variety of structures that can be used to perform the specified input and output functions, including "capacitive probes, or inductive irises, or any combination of the two." CX 1 (Col. 6, lines 48-54); Bell, Tr. 323-326.

FF 142. A capacitive probe operates by coupling electric field energy into or out of a cavity. Bell, Tr. 591.

FF 143. It was well known to those of ordinary skill in the art in 1980 that, as an alternative to a capacitive probe, a microwave filter designer could readily use a capacitive slot or iris to couple electric field energy into or out of a cavity. Bell, Tr. 590-594.

FF 144. An inductive iris operates by coupling magnetic field energy into or out of a cavity. Levy, Tr. 1596-1597, 1945-1944.

FF 145. The relative size of an iris or slot has nothing to do with the function of either the input/output means or the iris means specified in the claim language of claim 1 or claim 14 of the '293 patent. Bell, Tr. 2119-2120.

FF 146. It was well known to those of ordinary skill in the art in 1980 that, as an alternative to an inductive iris, a microwave filter designer could readily use a "loop" structure to couple magnetic field energy into or out of a cavity. Levy, Tr. 1943-1944.

FF 147. It was well known to those of ordinary skill in the art by 1980 that the specified function of coupling microwave energy into or out of a cavity could be performed by using probes, loops, capacitive irises, inductive irises, or various combinations thereof. Bell, Tr. 195-196, 201, 2133-2134; Levy, Tr. 1602, 1785, 1787-1788, 1943-1944.

FF 148. The structure that performs the specified input function in the first cavity of the Com Dev filter is a probe. Bell, Tr. 324-325; Tang, Tr. 1154; CX 140 C (Kudsia Dep.) at 176.

FF 149. The second, third and fourth cavities of the Com Dev filter each contain an iris structure that couples microwave energy into the cavity. Bell, Tr. 325-326; CX 4 C; CX 140 C (Kudsia Dep.) at 176-179.

FF 150. The structure that couples microwave energy into the second and fourth cavities of the Com Dev filter is an inductive iris and a capacitive iris. Tang, Tr. 1057.

FF 151. The structure that couples microwave energy into the third cavity of the Com Dev filter is either an inductive slot or a capacitive slot. Tang, Tr. 1057-1059, 1063, 1158-1159.

FF 152. The structure that performs the specified output function in the fourth cavity of the Com Dev filter is a probe. Tang, Tr. 1164; CX 140 C (Kudsia Dep.) at 179.

FF 153. The second, third and fourth cavities of the Com Dev filter each contain a structure that couples a portion of the resonant energy along one or both of the mode vector axes out of the cavity. Bell, Tr. 326-328; CX 4 C; CX 140 C (Kudsia Dep.) at 176-179.

FF 154. The iris structure that couples a portion of the resonant energy along one or both of the mode vector axes out of the first and third cavities of the Com Dev filter is an inductive slot and a capacitive slot. Tang, Tr. 1057.

FF 155. The iris structure that couples a portion of the resonant energy along one or both of the mode vector axes out of the second cavity of the Com Dev filter is either an inductive slot or a capacitive slot. Tang, Tr.

1057-1059, 1063, 1158-1159.

FF 156. The Com Dev commercial filter does not have only one large capacitive iris between the cavities to couple resonant energy using only the electric field. Tang, Tr. 1057-1059.

FF 157. Com Dev's witnesses attempted to distinguish the "input means" and "output means" in the Com Dev filter from those described in the '293 patent on grounds that the '293 patent only shows resonant energy being coupled between cavities via the magnetic field, while the Com Dev filter couples resonant energy between cavities via both the magnetic field and the electric field. E.g., Levy, Tr. 1595-1596.

FF 158. The claim language of the fifth and sixth elements of claim 1 of the '293 patent does not make any distinction between magnetic field coupling and electric field coupling, but only requires the coupling of "microwave" or "resonant" energy. CX 1 (Col. 10, lines 42-46); Tang, Tr. 1138-1139.

FF 159. It is well known to those of ordinary skill in the art in 1980 that "microwave energy" and "resonant energy" are composed of both a magnetic and an electric field and that such energy can be readily coupled into and out of a cavity by either or both types of field. Bell, Tr. 548-551; Levy, Tr. 1944-1946; Tang, Tr. 1137; CX 94.

FF 160. The '293 patent describes the use of both capacitive probes, which couple microwave energy via the electric field, and inductive irises, which couple microwave energy via the magnetic field, and further states that a combination of such coupling mechanisms can be used. See FF 59.

FF 161. One of ordinary skill in the art in 1980 would understand that microwave energy can be coupled into or out of a cavity via the electric field through the use of a probe or a capacitive slot or, alternatively, via the

magnetic field through the use of a loop or an inductive slot. See FF 140, 143, 147.

162. One of ordinary skill in the art in 1980 would recognize that probes, loops, capacitive and inductive slots are mechanisms that can be used to couple microwave energy into and out of a cavity. See Bell, Tr. 195-196, 201, 2133-2134; Levy, Tr. 1602, 1785, 1787-1788, 1943-1944.

FF 163. As Com Dev's expert admitted, "there's no need to represent the input and output means in any microwave cavity filter because it's well known to people working in filters how to couple in and out of the filter," including the use of a probe, a loop, or an iris (i.e., a capacitive and/or inductive aperture). Levy, Tr. 1787.

FF 164. As a matter of designer's choice, electric field coupling through a capacitive slot can be substituted for magnetic field coupling through an inductive slot, as demonstrated by Com Dev's own filter in which the single slot iris between cavities two and three was rotated 90 degrees because of other design requirements, thereby changing the type of coupling from magnetic to electric without affecting the iris's basic function of coupling resonant energy out of cavity two and into cavity three. Tang, Tr. 1057-1059, 1063, 1158-1159.

FF 165. Com Dev witness Mr. Tang admitted that there is no real difference between electric field coupling via a probe (as described in the '293 patent) or via a capacitive slot (as used in the Com Dev filter together with an inductive slot); differences relating to cavity size standardization, vibrational stability, reliability, temperature stability and other design tradeoffs do not affect either the way or the results achieved in performing the specified function of coupling energy into or out of a cavity. Tang, Tr.

1017-18; Tang, Tr. 1057-1058. See Levy Tr. 1600-1601

D. Literal Infringement Analysis of Claim 14

FF 166. Each of the elements in claim 14, except the tenth element, corresponds directly to one of the elements in claim 1 and, is present in each of the three separate combinations of two adjacent cavities in the Com Dev filter. See FF 63; Section II C.

FF 167. Each of the two adjacent cavity combinations in the Com Dev filter share a common wall, as specified in the tenth element of claim 14. CX 4 C; Bell Tr. 328-30.

FF 168. The tenth element of claim 14 also requires an "iris means" defined within the common wall. CX 1 (Col. 12, lines 31-35).

FF 169. The specified "function" performed by the "iris means" is to couple "resonant energy along one of said first and second axes from said first to said second resonator." Id.

FF 170. A filter designer may select electric field coupling and/or magnetic field coupling as may be required to achieve a particular design specification. Tang, Tr. 1018-1019.

FF 171. It was well known to those of ordinary skill in the art in 1980 that two cavities could be coupled together by an aperture in a common wall that couples magnetic field energy, electric field energy, or both types of fields. Bell, Tr. 448-451, 593-594; Levy, Tr. 1944-1946; Tang, Tr. 1142; CX 94.

FF 172. Each of the two adjacent combinations in the Com Dev filter includes an iris in the common wall that couples resonant energy along one or both of the modes in the first cavity to the second cavity. Bell, Tr. 331-334; CX 140 C (Kudsia Dep.) at 193-195, 197-198, 202-203.

FF 173. The inter-cavity iris couplings in both the Com Dev filter and the preferred embodiment of the '293 patent couple energy between cavities magnetically. Levy, Tr. 1950; Bell, Tr. 594-595; Tang, Tr. 1155-57.

FF 174. As a matter of designer's choice, electric field coupling through a capacitive slot can be added to and/or substituted for magnetic field coupling through an inductive slot. See FF 170-171; Tang, Tr. 1063; Bell, Tr. 448-451, 593; CX 94.

III. VALIDITY AND ENFORCEABILITY

A. Prior Art

FF 175. The references that were considered by the patent examiner during the prosecution of the '293 patent adequately reflect the state of the art that existed at the time of Dr. Fiedziuszko's invention of the subject matter of that patent. Bell, Tr. 336.

FF 176. The references considered by the patent examiner include a number of patents and articles which show typical prior art single-mode dielectric resonator filters. Bell, Tr. 336-339; e.g., CX 87 (1977 Plourde Article).

FF 177. The references considered by the patent examiner also include patents and articles which show typical prior art "dual mode," air-loaded filters. Bell, Tr. 339-41; e.g., CX 84 (Blachier patent); see FF 204 (meaning of "dual mode" filter as of 1980).

FF 178. One of the references discussed in the specification of the '293 patent utilizes two modes in its operation, but does not teach how to control coupling to each of the modes that would permit a 2-pole response from only a single resonator. CX 1 (Col. 2, lines 31-44).

FF 179. Another reference considered by the patent examiner concerning

dielectric resonator filters contains a vague suggestion that "higher order modes or multiple modes may be used." However, it only discloses the use of a single unpolarized mode. CX 87 at 290; Bell, Tr. 222-224, 337-38.

FF 180. The '293 patent was issued by the PTO over these various references. CX 1.

1. Blachier Patent

FF 181. United States Patent No. 3,697,898 issued to Blachier, et al. on October 10, 1972 (the "Blachier patent") discloses a multiple-cavity, dual-mode, air-loaded waveguide filter, which includes tuning screws, coupling screws, input and output mechanisms, and a common iris wall between the cavities. CX 84.

FF 182. There is no suggestion in the Blachier patent to use a dual-mode dielectric resonator or to otherwise combine a dielectric resonator with the Blachier design. CX 84; Levy, Tr. 1740-1741.

FF 183. The Blachier patent was considered by the patent examiner during prosecution of the '293 patent and the '293 patent issued over the Blachier patent. CX 1.

2. 1977 Plourde Article

FF 184. A 1977 article by Plourde and Linn entitled "Microwave Dielectric Resonator Filter Utilizing $Ba_2Ti_9O_{20}$ Ceramics" (the "1977 Plourde article") discloses microwave filters which use single-mode dielectric resonator elements made from low loss, temperature stable ceramic material. CX 87.

FF 185. The 1977 Plourde article contains several sections, the first of which concerns "Stripline to Resonator Coupling." CX 87 at 290 & Fig. 1; Bell, Tr. 596-97.

FF 186. The second section of the 1977 Plourde article discusses a band reject filter which uses a stripline structure that runs underneath the dielectric resonators. CX 87 at 290 & Fig. 2; Bell, Tr. 597.

FF 187. The third section of the 1977 Plourde article discusses a band pass filter that uses striplines to couple microwave energy to two of the three dielectric resonators, which are contained in a single housing and not in individual coupled cavities. CX 87 at 290-91 & Fig. 4; Bell, Tr. 597-98.

FF 188. The 1977 Plourde article discloses the use of a single mode. CX 87 at 290; Bell, Tr. 223, 337-338.

FF 189. There is no suggestion in the 1977 Plourde article that a dielectric resonator element could be successfully combined with a Blachier-type filter design. CX 87; Bell, Tr. 379.

FF 190. The 1977 Plourde article was considered by the patent examiner during prosecution of the '293 patent, along with the Blachier patent, and the '293 patent issued over both references. CX 1.

3. The 1968 Cohn Article

FF 191. A 1968 article by Dr. Cohn entitled "Microwave Bandpass Filters Containing High-Q Dielectric Resonators" (the "1968 Cohn Article") discloses microwave bandpass filters using dielectric disks operating in a single mode. CX 91.

FF 192. The 1968 Cohn Article does not contain any mention or suggestion of the possible use of a dual-mode dielectric resonator. Bell, Tr. 595-96; Levy, Tr. 1738.

4. The Harrison Article

FF 193. A 1968 article by W.H. Harrison, "A Miniature High-Q Bandapss Filter Employing Dielectric Resonators" (the "Harrison article"), relates only

to single-mode dielectric filters. RX 18.

FF 194. The Harrision article makes no reference to dual-mode operation, nor does it suggest dual-mode operation. RX 18.

5. Rantec Reports 7 and 8

FF 195. Rantec Report No. 7 concerning an "Investigation of Microwave Dielectric-Resonator Filters" covering the period March 1 - May 31, 1965 ("Rantec Report No. 7") contains a suggestion that one or more dielectric resonator disks might be configured as a "directional filter" in which each disk would support a pair of orthogonal modes "with no coupling or interaction between them." RX 13.

FF 196. Rantec Report No. 8 is the final report concerning the investigation covering the period June 1 - December 31, 1965 ("Rantec Report No. 8") and, inter alia, reports the results of Dr. Cohn's efforts to construct a directional filter using dielectric disks. RX 14.

FF 197. Dr. Cohn was one of the pioneers in developing the directional filter in 1956. RX 159; Bell, Tr. 351.

FF 198. A directional filter is an assembly of hardware in which two separate but identical filters are constructed in a single physical structure. Bell, Tr. 351-357.

FF 199. A directional filter is a four port device and must have all four arms, each containing one of the ports, physically present in order to operate. Bell, Tr. 352-353; RX 159 (Fig. 6(a), (b)).

FF 200. In a directional filter, any coupling between the two orthogonal modes must be eliminated to the maximum extent possible. Bell, Tr. 356-357; RX 340 (Cohn Dep.) at 60-65.

FF 201. In contrast to a directional filter, the "dual mode" filter of

the '293 patent or of the Blachier design requires strong coupling between the two orthogonal modes in each resonator. Bell, Tr. 230-32.

FF 202. Rantec Report No. 7 does not teach or suggest a mode coupling means to cause mutual coupling between resonant energy in a cavity filter as required in the '293 patent. Bell, Tr. 360.

FF 203. The filters described in Dr. Cohn's 1965 Rantec Reports happen to use two modes in their operation. Thus, Dr. Cohn's 1965 Rantec Reports make reference to the use of so-called "dual modes" in a directional filter. RX 340 (Cohn Dep.) at 19.

FF 204. However, by 1980, the term "dual mode" was understood by those skilled in the art to mean a Blachier-type filter with two resonant modes in a single cavity that are intentionally coupled together. Bell, Tr. 606-608.

FF 205. An article written in 1980 by Dr. C.M. Kudsia of Com Dev confirms that a "dual mode" Blachier-type filter and "circular waveguide directional filter" of the type discussed by Dr. Cohn in the Rantec Reports were understood to be different and mutually exclusive. Bell, Tr. 607-11; CX 45 at 295.

FF 206. In a directional filter, it is only possible to achieve a "1-pole" filter response for each resonator; e.g., a three resonator directional filter produces only a 3-pole response. Bell, Tr. 354-356.

FF 207. In contrast to a directional filter, a "dual mode" filter of the '293 patent or of the Blachier design achieves a "2-pole" response for each resonator. Bell, Tr. 230-232.

FF 208. In a contemporaneous document, Dr. Fiedziuszko described the Rantec Reports to his patent counsel in the following manner: "Sections of the Rantec reports describe application of dual-mode dielectric resonators in

directional filters. Principle of operation is quite different in this case - coupling between two orthogonal modes is minimized and circular polarization principle (resulting from existence of two orthogonal modes) is utilized." CX 36.

FF 209. In Rantec Report No. 8, Dr. Cohn reported that he was able to obtain satisfactory directional filter performance using a single dielectric disk. RX 14 at 30.

FF 210. When he attempted to construct a directional filter using two dielectric disks, Dr. Cohn reported that "a simultaneous condition of good performance on all parameters could not be achieved with a reasonable amount of effort." RX 14 at 31.

FF 211. In the conclusions of Rantec Report No. 8, Dr. Cohn stated that "[t]he n=2 dual-mode [directional filter] configuration was especially difficult, and may be too complex to be practical." RX 14 at 45.

FF 212. Because Dr. Cohn was recognized as one of extraordinary skill in the art, the results reported in Rantec Report No. 8 concerning his difficulties in attempting to introduce a dielectric resonator element into a directional filter would discourage one of ordinary skill in the art from similar efforts. Bell, Tr. 362-64.

FF 213. Although Com Dev's expert characterized the results reported in Rantec Report No. 8 as "definitely encouraging," he admitted that he had "only glanced" at Report No. 8, that Report No. 8 "is just a rehash actually of Report Number 7," and that as far as he was concerned it was not important to know what the reported results were. Levy, Tr. 1741, 1753, 1760, 1765.

6. The Guillon References

FF 214. Professor Guillon in France began experimenting with dielectric

resonator microwave filters at least by 1976. CX 88 (RX 234).

FF 215. In a 1977 article entitled "Accurate Resonant Frequencies of Dielectric Resonators" (the "1977 Guillon article"), Professor Guillon (then a graduate student) disclosed a "shielded cylindrical resonator" structure in which a dielectric resonator element was affixed to a substrate between two unbounded metal plates. Bell, Tr. 365-366; CX 88 at 918 & Fig. 5.

FF 216. The 1977 Guillon article does not disclose a composite resonator comprising a dielectric resonator element within a cavity resonator as taught by the '293 patent. Bell, Tr. 366; CX 1.

FF 217. The 1977 Guillon article includes an observation that, when the ratio of the diameter to the height of the shielded cylindrical resonator was set at a certain critical value, the unpolarized TE-011 mode and an HE-111 mode would "overlap" and it would be possible "to use a single dielectric resonator as a dual-mode resonator in order to do two-pole bandpass filtering for wider bandwidths." CX 88 at 918; Bell, Tr. 366-367.

FF 218. The HE-111 mode is a polarized mode with a maximum electric strength along a particular axis, while a TE-011 mode is an unpolarized or circularly symmetrical mode. Bell, Tr. 366.

FF 219. Given a particular configuaration ratio of the diameter to the height of the dielectric resonator (as in the description in the 1977 Guillon article) the HE-111 mode and the TE-011 mode will have a resonance occurring at the same frequency. Bell, Tr. 366.

FF 220. The modes suggested in the 1977 Guillon article are "completely different kinds of modes" from those discussed in the '293 patent, which teaches the use of two perpendicularly polarized modes. Bell, Tr. 367.

FF 221. The two modes suggested in the 1977 Guillon article cannot be

used together to achieve anything known to be of a practical nature. Bell, Tr. 367, 2146-2147.

FF 222. The suggested use of the unpolarized TE-011 mode and a HE-111 mode in the 1977 Guillon article is academic speculation for which there are no known practical or fruitful results. Bell, Tr. 367; Levy, Tr. 1779-1780.

FF 223. Professor Guillon's 1978 doctoral thesis (the "1978 Guillon Thesis") repeats the earlier suggestion in the 1977 Guillon article concerning the possible use of an unpolarized TE-011 mode and a HE-111 mode. Bell, Tr. 367-368; Levy, Tr. 1780-1781; RX 336.

FF 224. The 1978 Guillon Thesis appeared to clarify that the possible overlap of the unpolarized TE-011 mode and the HE-111 mode occurs "whenever the resonator is fixed to the substrate of a microstrip structure," and does not contain any suggestion that such a phenomenon would occur if the dielectric resonator element were enclosed in a cavity resonator to form a composite resonator as taught in the '293 patent. RX-336; see Levy, Tr. 1783-1784.

FF 225. Com Dev's expert admitted that the statements in the 1978 Guillon Thesis concerning fixing the dielectric resonator to the substrate of a microstrip structure were confusing "remarks of [a] student" that cannot mean what they actually say. Levy, Tr. 1781-1782.

FF 226. No one has ever been known to be able to make a workable filter using the unpolarized TE-011 mode and a HE-111 mode as suggested in the 1977 Guillon article or the 1978 Guillon Thesis. Bell, Tr. 367; Levy, Tr. 1771-1772, 1779-1780.

FF 227. In February 1980, Professor Guillon co-authored an article entitled "Dielectric Resonator Filters" (the "1980 AEU Guillon article")

disclosing single-mode dielectric resonator filters. CX 86; Bell, Tr. 368-369; Levy, Tr. 1804.

FF 228. The 1980 AEU Guillon article does not mention dual modes, does not suggest any possible use of the HE-111 modes, does not discuss obtaining a two pole response from only a single resonator, and contains no suggestion to combine a dielectric resonator element with a Blachier-type design. Levy, Tr. 1804-1805; Bell, Tr. 368-369.

FF 229. The 1980 AEU Guillon article is cumulative of the 1977 Plourde article that was considered by the patent examiner in that it adds nothing with respect to the appropriate state-of-the-art. Bell, Tr. 369.

FF 230. In August 1980, Professor Guillon published a brief letter article entitled "Dielectric Resonator Dual Modes Filter" (the "August 1980 Guillon article") disclosing in extremely sketchy form a single cavity with a dual HE-111 mode resonance in it. RX 21; Bell, Tr. 369-370.

FF 231. The August 1980 Guillon article was published well after Dr. Fiedziuszko had conceived and reduced to practice the invention which is the subject matter of the '293 patent, which was the middle of March 1980 at the latest. Fiedziuszko, Tr. 857; CX 32; Bell, Tr. 369.

FF 232. According to Com Dev's expert, the drawing in the August 1980 Guillon article of a crude single cavity filter "is incorrect," is "a very poor figure drawn by a student," is "probably a waste of time even looking at," "doesn't make too much sense," and "is all messed up." Levy, Tr. 1785-1786.

FF 233. In a book published in 1986, Professor Guillon included another drawing roughly corresponding to the crude single cavity filter described in the August 1980 Guillon article. CX 122; Bell, Tr. 372-374.

FF 234. The drawing in the 1986 book would essentially operate as only a 1-pole filter and will not work as a "dual mode" filter as taught in the '293 patent. Bell, Tr. 373-374; Levy, Tr. 1789-1790.

FF 235. In September 1985, Professor Guillon published an article that actually describes a dielectric-loaded dual-mode filter of the type taught in the '293 patent. CX 121; Bell, Tr. 378.

FF 236. Professor Guillon's September 1985 paper credits Dr. Fiedziuszko for originating the concept of the dielectric-loaded dual-mode filter. CX 121; Bell, Tr. 378-379; Levy, Tr. 1791.

FF 237. Professor Guillon's September 1985 paper concerning a dielectric-loaded dual-mode filter does not mention the August 1980 Guillon article. CX 121; Bell, Tr. 378-379; Levy, Tr. 1792.

7. 1975 Plourde Article

FF 238. In 1975, Plourde and Linn published an article entitled "$Ba_2Ti_9O_{20}$ as a Microwave Dielectric Resonator" (the "1975 Plourde article") describing a new temperature-stable dielectric material with a passing reference to its use in practical microwave filters. CX 92; Bell, Tr. 379-380.

FF 239. The 1975 Plourde article was not before the PTO examiner during prosecution of the '293 patent. CX 1.

FF 240. The 1977 Plourde article, which was considered by the patent examiner, is cumulative of the information contained in the 1975 Plourde article. Bell, Tr. 380; Levy, Tr. 1795.

8. The 1980 Levy Survey Article

FF 241. In January 1980, Com Dev's expert Dr. Levy published an article entitled "Six Eras Comprise Filter Development" (the "1980 Levy Survey

Article") surveying 30 to 40 years of developments in the field of microwave filters. CX 46.

FF 242. The 1980 Levy Survey Article is a survey paper which covers a broad selection of different areas. Levy, Tr. 1817.

FF 243. The 1980 Levy Survey Article describes in one section entitled "Dual-and High-Order Era" what were then known as "dual mode" filters of the Blachier-type design. Bell, Tr. 349.

FF 244. In a separate section entitled "Dielectrics Promise Future," the 1980 Levy Survey Article reports results during the 1970s concerning the use of single-mode dielectric resonator filters. Bell, Tr. 350.

FF 245. There is no suggestion in the 1980 Levy Survey Article that a dielectric resonator element could be successfully combined with a Blachier-type filter as taught in the '293 patent. Bell, Tr. 350; Levy, Tr. 1819.

FF 246. When Dr. Levy wrote the 1980 Levy Survey Article, he was not concerned with dual mode filters. Levy Tr. 1818.

9. Availability of Temperature-Stable Dielectric Materials

FF 247. In the mid-1960s, Dr. Cohn suggested that once dielectric materials were developed with a temperature stability of 50 parts per million, they would be useful in microwave applications. Bell, Tr. 382-383.

FF 248. In response to Dr. Cohn's suggestion, the U.S. Army Signal Corp. sponsored research in the late 1960s by Raytheon Corporation ("Raytheon") to develop temperature stable dielectric materials. Bell, Tr. 383-384; RX 340 (Cohn Dep.) at 133.

FF 249. Raytheon was quickly successful in producing a material that met Dr. Cohn's benchmark criterion and published an article entitled "A New Low -

Loss High - K Temperature - Compensated Dielectric For Microwave Applications" in 1971 describing the new material. CX 47; Bell, Tr. 384; RX 340 (Cohn Dep.) at 133.

FF 250. The Raytheon type of material was commercially available from Trans-tech, Inc. (Gaithersburg, Maryland) as of August 1, 1972. Bell, Tr. 385; CX 135.

FF 251. In November 1972, General Electric researchers published an article entitled ""Temperature - Stable Low-Loss Microwave Filters Using Dielectric Resonators" (the "1972 GE Article") describing the actual construction of working microwave filters using another new temperature stable, low loss dielectric material. Bell, Tr. 2150; RX 172.

FF 252. The dielectric material described in the 1972 GE Article would have an excellent Q of 16,500 in C-band applications. Bell, Tr. 2151.

FF 253. The dielectric material described in the 1972 GE Article would provide a stable frequency response over a typical satellite working temperature range of "plus or minus one megahertz in a C-band satellite" which was very acceptable in 1972 and is so even today. Bell, Tr. 2151-2153.

FF 254. The dielectric material described in the 1972 GE Article was quite a good material and very usable in C-band satellite applications. Bell, Tr. 2153.

FF 255. In 1974, researchers at Bell Labs reported yet another new high quality, temperature stable dielectric material suitable for use in microwave filters, which was subsequently reported again in the 1975 Plourde Article. Bell, Tr. 380-381, 389; CX 49; CX 92.

FF 256. From 1974 on, Japanese researchers published numerous articles describing the development of many additional types of high quality,

temperature stable dielectric materials. Bell, Tr. 389, CX 49.

FF 257. In 1977, Bell Labs researchers published a trade journal article announcing that Bell Labs would consider making the dielectric material described in the 1975 Plourde article available on a cross-licensing basis. Bell, Tr. 500, 502-505, 605.

FF 258. In early 1978, suppliers were calling on companies engaged in the manufacture of microwave filters and offering to produce and sell the dielectric material described in the 1975 Plourde Article on a commercial basis. Bell, Tr. 503-505, 605-606.

FF 259. By the mid-1970s, it was recognized that a new element, the dielectric resonator, had become practical. Bell, Tr. 598-599; RX 25 at 103.

FF 260. As late as the mid-1980s, Dr. Fiedziuszko used barium titanate, the Trans-tech material, for a commercial application in a communications satellite. Fiedziuszko, Tr. 2109.

FF 261. In the 1980 Levy Survey Article, Com Dev's expert stated that, by the time that article was written in late 1979, the former problem with the availability of temperature-stable dielectric materials "has been overcome." CX 46; Levy, Tr. 1820.

FF 262. Dr. Fiedziuszko purchased some of the Transtech temperature-stable dielectric material, which had been commercially available since 1972, from a catalog and used that material to reduce to practice the invention described in the '293 patent. Fiedziuszko, Tr. 2091.

FF 263. In 1979, Dr. Fiedziuszko was also able to purchase high quality, temperature-stable dielectric material from a Murata catalog, which he also used in reducing to practice the invention described in the '293 patent. Fiedziuszko, Tr. 2110.

FF 264. It is sometimes possible to develop and prove out a concept using less than optimal material to help stimulate the availability of better material. Levy, Tr. 1810.

FF 265. In an industry such as satellite communications, availability of dielectric material on a sample basis, as opposed to commercial quantities, is all that is necessary to advance the state of the art and create a market that would accelerate full-scale commercial availability. Bell, Tr. 381-382, 599-600.

FF 266. Using the Transtech material available in 1972, researchers could anticipate a "chicken and egg" type response in which proof of a new breakthrough design concept would stimulate and hasten the availability of even better materials with higher Q and even greater temperature stability. Bell, Tr. 601-603.

B. Level of Ordinary Skill in the Art

FF 267. The experience and educational level of a person of ordinary skill in the microwave filter art is an individual with a masters degree in electrical engineering with several years of experience in the field of satellite communication filters. Levy, Tr. 1609; Bell, Tr. 335-336; RX 290 at 1-2.

FF 268. The following individuals are all recognized as experts in microwave filter technology and possessed a level of skill in the art during the late 1970s and early 1980s far beyond the ordinary: Dr. Cohn, Dr. Levy, Dr. Kudsia, Dr. Williams, Dr. Atia, Dr. Zaki, and Dr. Wakino. Bell, Tr. 343, 347, 348; Levy, Tr. 1728, 1730, 1810-1811.

C. Secondary Considerations

1. Long-Felt Need

FF 269. It is almost like a "religion" in the communications satellite business to direct research and development efforts towards reducing the mass and volume of components such as input multiplexers. CX 140 (Kudsia Dep.) at 25; Bell, Tr. 345; Fiedziuszko, Tr. 740.

FF 270. Currently, one kilogram of mass saved on a spacecraft corresponds to a dollar value savings between $40,000 and $50,000. Fiedziuszko, Tr. 749; Maloney, Tr. 916-917; CX 139C (Mabson Dep.) at 236-237.

FF 271. Reduced volume of the input multiplexers allows for greater flexibility in the layout of the satellite and permits increased satellite capacity (i.e., you can put more filters on-board to allow for more channels). Fiedziuszko, Tr. 750-751.

FF 272. Reducing the weight of the filters allows for the satellite to carry additional fuel which extends the useful life of the satellite. Fiedziuszko, Tr. 751-752.

FF 273. Early communications satellites used single-mode, rectangular waveguide filters which were large and heavy. Bell, Tr. 237-238; Levy, Tr. 1716-1717; CX 23.

FF 274. In 1970, researchers at Commications Satellite Corporation (COMSAT) Labs developed a new breakthrough dual-mode air-loaded waveguide filter design which was referred to as the "Blachier" filter, which became the industry standard. CX 84; Bell, Tr. 239; Levy, Tr. 1717.

FF 275. The introduction of the Blachier filter stimulated a large amount of research to improve this design. Bell, Tr. 240; Levy, Tr. 1717-1718.

FF 276. Many companies and researchers around the world were working in the 1970s to improve the Blachier filter by reducing its mass and volume, including COMSAT laboratories, Hughes Aircraft Company ("Hughes"), Ford Aerospace, Com Dev, and other foreign companies. Bell, Tr. 240, 341.

FF 277. Dr. Kudsia is currently Com Dev's chief scientist, and he was Com Dev's leading engineer/scientist in the 1970s who was working on input filters for space applications. Bell, Tr. 342.

FF 278. Dr. Kudsia is an individual who has a skill level quite a bit above that of ordinary skill in the art. Bell, Tr. 342.

FF 279. Dr. Kudsia and Com Dev had a commercial incentive to improve the designs of their input filters in the 1970s and early 1980s. Bell, Tr. 342.

FF 280. Dr. Kudsia was generally aware of the art relating to the use of dielectric resonators and filters. Bell, Tr. 342.

FF 281. Neither Dr. Kudsia nor any other Com Dev engineer published any article relating to dual-mode dielectric filters until after Dr. Fiedziuszko's work became public. Bell, Tr. 342-343.

FF 282. In 1980, Dr. Kudsia and other Com Dev engineers published an article listing various filter structures available to the a filter designer and did not list the possibility of a dual-mode dielectric filter. CX 45; Bell, Tr. 343-344.

FF 283. The Engineers at COMSAT, including Dr. Atia, Dr. Williams, and Dr. Bonetti, had a commercial incentive to improve the designs of their input filters in the 1970s and early 1980s. Bell, Tr. 345.

FF 284. Dr. Atia is an individual who possesses a skill level above that of ordinary skill in the art. Levy, Tr. 1728, 1730.

FF 285. Comsat Engineers introduced the concept of the Blachier

"dual-mode" air loaded filter design. Bell, Tr. 344.

FF 286. Dr. Atia and Dr. Williams were leaders in the design of the "dual-mode" air loaded filter design. Levy, Tr. 1730.

FF 287. The Comsat engineers were considered the "high priests" of filter design, and they were actively and creatively trying to improve all aspects of communication satellite hardware. Bell, Tr. 345.

FF 288. The Comsat engineers were actively involved in filter research work with single mode dielectric resonator designs. Bell, Tr. 346; CX 90; Levy, Tr. 1732-1733.

FF 289. Dr. Bonetti and Dr. Atia published an article in the fall of 1981 reporting on their research in the design of filters using dielectric resonators. CX 90. This article (CX 90) does not hint at or suggest the possibility of dual-mode dielectric-loaded resonators. CX 90; Bell, Tr. 346.

FF 290. Prior to the time that Dr. Fiedziuszko made his dual-mode dielectric-loaded resonator work public in 1982, engineers at COMSAT did not publish any material hinting at or suggesting the possibility of dual-mode dielectric-loaded resonator filters. Bell, Tr. 346.

FF 291. The engineers at Hughes had a commercial incentive to improve the designs of their input filters in the 1970s and early 1980s. Bell, Tr. 346-347.

FF 292. Microwave engineers from Hughes attended the 1979 conference on dielectrics chaired by Dr. Levy. Levy, Tr. 1809-1810.

FF 293. Prior to the time that Dr. Fiedziuszko made his dual-mode dielectric-loaded resonator work public in 1982, engineers at Hughes did not publish any material hinting at or suggesting the possibility of dual-mode dielectric-loaded resonator filters. Bell, Tr. 347.

FF 294. Dr. Cohn is an individual who has extraordinary skill in the art. Bell, Tr. 347-348.

FF 295. Dr. Cohn was extremely familiar with dielectric resonators and he had worked with dual-mode air-loaded cavity filters. Bell, Tr. 348.

FF 296. Dr. Cohn did not develop the invention of the `293 patent. Bell, Tr. 348, RX 340 (Cohn Dep.) at 145.

FF 297. Dr. Levy is an individual that has a skill level above that of ordinary skill in the art. Bell, Tr. 348.

FF 298. In January 1980, Dr. Levy published an article entitled "Six Eras Comprise Filter Development" surveying 30 to 40 years of developments in the field of microwave filters. CX 46.

FF 299. There is no suggestion in the 1980 Levy survey article that a dielectric resonator element could be successfully combined with a Blachier-type filter as taught in the `293 patent. Bell, Tr. 350, Levy, Tr. 1819.

FF 300. Dr. Wakino is an expert in filters. Levy, Tr. 1811.

FF 301. Dr. Wakino is an expert in ceramics. Levy, Tr. 1811.

FF 302. Dr. Wakino, who is employed by Murata, had the best ceramic materials available to him as early as the mid-1970s. Levy, Tr. 1811.

FF 303. Dr. Wakino attended the 1979 conference on dielectrics chaired by Dr. Levy. Levy, Tr. 1810-1811.

FF 304. Prior to the time that Dr. Fiedziuszko made his dual-mode dielectric-loaded resonator work public in 1982, Dr. Wakino did not publish any material suggesting the possibility of dual-mode dielectric-loaded resonator filters. Levy, Tr. 1811.

FF 305. Peter Latournette is an expert in the microwave field. Levy,

Tr. 1813.

FF 306. Peter Latournette attended the 1979 conference on dielectrics chaired by Dr. Levy. Levy, Tr. 1812.

FF 307. Prior to the time that Dr. Fiedziuszko made his dual-mode dielectric-loaded resonator work public in 1982, Peter Latournette did not publish any material suggesting the possibility of dual-mode dielectric-loaded resonator filters. Levy, Tr. 1813.

FF 308. Bell Labs employed many talented microwave engineers including Dr. Plourde. Levy, Tr. 1813-1814.

FF 309. Engineers from Bell Labs attended the 1979 conference on dielectrics chaired by Dr. Levy. Levy, Tr. 1813.

FF 310. The microwave engineers at Bell Labs had access to the best ceramic materials available. Levy, Tr. 1813-14.

FF 311. Prior to the time that Dr. Fiedziuszko made his dual-mode dielectric-loaded resonator work public in 1982, the engineers at Bell Labs did not publish any material relating to dual-mode dielectric-loaded resonator filters outside of the 1977 Plourde article that was before the patent examiner. Levy, Tr. 1814.

FF 312. There was a long-felt need for a smaller microwave filter before the invention of the '293 patent. Bell, Tr. 241-242.

FF 313. After the introduction of the Blachier design, the next major advance in reducing the size and weight of filters was the introduction of dual-mode dielectric filters by Dr. Fiedziuszko. Bell, Tr. 242.

FF 314. The invention of the `293 patent patent allowed for tremendous mass and volume reductions. Fiedziuszko, Tr. 746-747; CX 23.

2. Commercial Success

FF 315. Dual-mode dielectric-loaded filters have become the industry standard for C-Band input multiplexers. Bell, Tr. 249; see Levy, Tr. 1720.

FF 316. SSL has adopted the dual-mode dielectric filter design for all of its C-band input multiplexers and most of its KU-band input multiplexers. See Fiedziuszko, Tr. 764.

FF 317. SSL has installed filters covered by the `293 patent in the Arabsat, Superbird, Scs (two flights of Superbird), NStar, Goes, and Intelsat VII satellites; filters covered by the `293 Patent will also be utilized on the Tempo satellites. Fiedziuszko, Tr. 764.

FF 318. Com Dev has replaced the Blachier air-loaded filters with dual-mode dielectric filters for C-band input multiplexers for sale within the United States. Tang, Tr. 1099.

FF 319. Com Dev has supplied dual-mode dielectric filters for the Telstar IV and Asiasat programs, and is supplying dual-mode dielectric filters for the Intelsat VIII and GE 1 and GE 2 programs. CX 2 C; Tang, Tr. 1099.

FF 320. Matra Marconi, a European satellite manufacturer, is manufacturing dual-mode dielectric filters. Fiedziuszko, Tr. 767-768.

3. Copying By Others

FF 321. Com Dev did not begin working in the area of dual-mode dielectric filters until the summer of 1982, after Com Dev engineers heard Dr. Fiedziuszko's presentation concerning the subject matter of the `293 patent at an Institute of Electrical and Electronics Engineers ("IEEE") symposium in Dallas, Texas. Tang, Tr. 1091-1097.

FF 322. Com Dev engineers received a copy of Dr. Fiedziuszko's proceeding paper concerning the invention of the `293 patent at the IEEE

conference in June of 1982 in Dallas, Texas. Tang, Tr. 1091.

FF 323. A Com Dev engineer, H. Gordon McDonald, wrote Dr. Fiedziuszko in July of 1982 to obtain an advance copy of an article concerning the invention of the '293 patent to be published in the Transactions on Microwave Theory and Techniques in September of 1982. CX 123; Fiedziuszko, Tr. 758.

FF 324. Dr. Fiedziuszko sent an advance typed copy of an article concerning the invention of the '293 patent to Mr. McDonald in August of 1982. CX 124; Fiedziuszko, Tr. 758.

FF 325. A Com Dev engineer, Adrian Collins, had a copy of Dr. Fiedziuszko's paper with him at the time he was doing some of the early work on dielectric filters at Com Dev. CX 139C (Mabson Dep.) at 224.

FF 326. After learning of Dr. Fiedziuszko's dual-mode dielectric-loaded filter, Com Dev engineers tried to duplicate the results of Dr. Fiedziuszko's work. Tang, Tr. 1095.

4. Prior Art Teaching Away

FF 327. Dr. Cohn's Rantec reports relate to directional filter configurations in which coupling between the modes must be minimized, whereas in the invention of the '293 patent strong coupling between modes is required. RX 13; Bell, Tr. 230-231, 351-357, 607-611.

FF 328. Dr. Cohn did not report successful results when he attempted to incorporate more than one dielectric disk into his filter configuration. See, e.g., RX 14 at 31.

FF 329. The suggestion to use the two modes in the 1977 Guillon article was impratical. Furthermore, although Professor Guillon was working with dielector resonators and filters, and the HE-111 mode, he failed to conceive of the idea presented by Dr. Fiedziuszko. Bell, Tr. 367; Levy, Tr. 463-464.

5. Professional Acclaim

FF 330. The invention of the `293 patent was very well received by the microwave industry and was understood to be a significant advancement in the state of the art. Bell, Tr. 245.

FF 331. Dr. Fiedziuszko's presentation of the invention of the `293 patent generated a great deal of interest in the microwave industry. Levy, Tr. 1722.

FF 332. Dr. Fiedziuszko's presentation of the invention of the `293 patent generated a significant amount of research on the topic of dual-mode dielectric-loaded filters. Bell, Tr. 245; Levy, Tr. 1722.

FF 333. Any author publishing a paper on dual-mode dielectric filters after 1982 inevitably will cite or refer to Dr. Fiedziuszko's 1982 paper (CX 3) because it is the prime reference in the art. Levy, Tr. 1728.

FF 334. In a 1990 paper, Com Dev engineers referred to Dr. Fiedziuszko's 1982 paper, which first described the invention of the `293 patent, in the following manner: "In 1982, a paper was published describing a dual-mode axially mounted dielectric resonator loaded cavity filter. It nearly matched the performance of dual-mode air-loaded waveguide filters and set the scene for the potential use of dielectric loaded multiplexers for space application." CX 68 at 823.

FF 335. The highest level of membership in the IEEE is the honorary level of Fellow. Bell, Tr. 250.

FF 336. It is difficult to become a fellow of the IEEE. Fiedziuszko, Tr. 732-733; Bell, Tr. 250-251.

FF 337. Dr. Fiedziuszko was named a Fellow in the IEEE because of his contributions in the advancement of dielectric resonator filters and

multiplexers especially for satellite applications, and thus in part for his '293 patent. CX 28; Levy, Tr. 1736; Bell, Tr. 251; Fiedziuszko, Tr. 732.

FF 338. Dr. Fiedziuszko's Fellow nomination form first lists "the invention and development of dual mode dielectric resonator filters" under the heading "S. Jerry Fiedziuszko's most significant contributions." CX 28 at 3.

D. Section 112

FF 339. In 1985, Dr. Fiedziuszko wrote that:

> In a dual-mode, dielectric-resonator filter, the dielectric resonators are mounted in the center of circular evanescent-mode, metal cavities. Therefore, a mounting structure is necessary to support these resonators. The mounting has to be mechanically stable to ensure temperature stability and good vibration performance. Available materials for such supports have to meet specific criteria such as low loss, low dielectric constant, and excellent mechanical properties.

RX 25 at 106. Dr. Fiedziuszko continues to believe that that a low-loss, mechanically stable mounting is necessary to keep the dielectric resonator in the center of a small evanescent-mode cavity. Fiedziuszko, Tr. 2212-2213.

FF 340. With respect to the mounting of the resonator, the specification of the '293 patent states as follows:

> Although not shown in Fig. 1, resonator elements 27 can be succesfully mounted in cavities 3, 5, and 7 by a variety of insulative maounting means which generally take the form of pads or short columns of low-loss insulator material such as polystyrene or PTFE. However, the best performance has been obtained by the use of mountings made of a low-loss polystyrene foam.

CX 1 (col. 6, lines 27-33).

FF 341. At the time of making his application, Dr. Fiedziuszko believed, however, that the best mode of mounting the dielectric resonator was complete encapsulation of the dielectric resonator with foam. Fiedziuszko, Tr. 2113.

FF 342. Eccofoam, from Emerson & Cuming, Inc., is a low-loss polystyrene foam. CX 141; Fiedziuszko, Tr. 2083.

FF 343. Eccofoam is the most well-known polystyrene foam available. Fiedziuszko, Tr. 2083, 2114.

FF 344. At the time of the invention of the '293 patent, people of ordinary skill in the art and commercial specification sheets referred to the Eccofoam as a polystyrene foam. Fiedziuszko, Tr. 2083.

FF 345. One of ordinary skill in the art would have been capable of determining that a low-loss polystyrene foam for mounting dielectric materials includes Eccofoam. Fiedziuszko, Tr. 2083.

FF 346. PTFE is commonly known by its brand name TEFLON. Bell, Tr. 402.

FF 347. One of ordinary skill in the art would understand a reference to "polystyrene" to mean REXOLITE. Bell, Tr. 402-403.

FF 348. If one of ordinary skill in the art for some reason was not familiar with the term "polystyrene," he would be able to determine that REXOLITE (which is cross-linked) is the most commonly available and appropriate material from readily available reference material. CX 142; Bell, Tr. 2147-50.

FF 349. Mr. Tang, a Com Dev engineer, used REXOLITE as a mounting material for the dielectric resonator in his preliminary work on dual-mode dielectric-loaded filters in May of 1983. CX 69 C; Tang, Tr. 1193; Bell, Tr. 403-405.

FF 350. Mr. Tang testified that REXOLITE was the obvious choice for the mounting material for the dielectric resonator when he tried to duplicate Dr. Fiedziuszko's results reported in CX 3. Tang, Tr. 1193. See Bell, Tr. 403-405.

FF 351. Com Dev's '630 patent does not provide a specific description of the material to be used to mount the dielectric resonator. CX 57; Tang, Tr. 1191.

FF 352. The simplest method of mounting a dielectric resonator in a cavity with polystyrene foam is to fill the entire cavity with foam. Fiedziuszko, Tr. 2084.

FF 353. It would be obvious to one skilled in the art that a dielectric resonator could be mounted in a cavity with polystyrene foam by simply filling the cavity completely with foam. It had been done in the industry many times prior to 1980. Levy, Tr. at 1846; Fiedziuszko, Tr. 2084.

FF 354. Prior to May 11, 1981, there were numerous publications and patents disclosing how to mount dielectric resonators in a filter structure using columns or pads. Fiedziuszko, Tr. 2082.

FF 355. Cavity dimensions affect the resonant frequency of the resonator, although normally one would not rely on cavity dimensions as the only way of assuring that the resonance will be at the desired frequency. Bell, Tr. 196.

FF 356. In the '293 patent, Dr. Fiedziuszko provided dimensions for the dielectric resonator. CX 1. (Col. 8, line 60 - Col. 9, line 12).

FF 357. One of ordinary skill in the art would be able to determine the outside dimensions of the cavity from the equations provided in the patent. Fiedziuszko, Tr. 2086-2087; Bell, Tr. 406-407.

FF 358. Neither the '630 patent (CX 57) nor the '843 patent (CX 6) provide dimensions for the cavity that surrounds the dielectric resonator nor formulas to determine such dimensions. Tang, Tr. 1191-1192.

FF 359. Mr. Tang testified that the disclosures in both the '630 patent

(CX 57) and '843 patent (CX 6), teach one skilled in the art how to practice the invention of each. Tang, Tr. 1190.

FF 360. Mr. Tang testified that it was not necessary to provide information relating to the dimensions of the housing and resonator in the '843 patent (CX 6) because the '843 patent referred to Dr. Fiedziuszko's '293 patent (CX 1) which contained the necessary information. Tang, Tr. 1192-1193.

E. Section 102(f) and Inventorship

FF 361. In the 1980s Ford Aerospace (SSL) was involved in independent research and development that was partially monitored by the United States government. Fiedziuszko, Tr. 853.

FF 362. As part of this program Ford Aerospace would provide a confidential general "R&D brochure" to the government. Fiedziuszko, Tr. 853.

FF 363. The preparation of the R&D brochure (RX 314) occurred in early 1980. Fiedziuszko, Tr. 854.

FF 364. Dr. Fiedziuszko provided the input to this report that relates to dual-mode dielectric filters in early 1980. Fiedziuszko, Tr. 854-855.

FF 365. Dr. Fiedziuszko is not sure of exactly when he conceived of his invention or first disclosed it to someone else. It is possible that Dr. Fiedziuszko conceived of his invention before March 1980. Fiedziuszko, Tr. 848-857.

FF 366. Dr. Fiedziuszko knew of no one at Ford Aerospace involved in work on dielectric resonators in 1979 and early 1980 other than himself. Fiedziuszko, Tr. 740.

FF 367. RX 314 was distributed on March 31, 1980. RX 314; Fiedziuszko, Tr. 877-878.

F. Enforceability

FF 368. Dr. Fiedziuszko believed that he provided all pertinent art to the patent examiner. Fiedziuszko, Tr. 752-753.

FF 369. Prior to the application being filed, a patentability search was conducted with respect to the invention of the '293 patent. CX 35; Fiedziuszko, Tr. 752-753.

FF 370. Dr. Fiedziuszko provided comments to patent attorneys regarding the references discovered in the patentability search and he provided additional references to his patent attorneys. Fiedziuszko, Tr. 752-753; CX 33.

FF 371. Six additional references, including the 1977 Plourde article, were also brought to the examiner's attention as a result of the examination of the corresponding application before the European Patent Office. CX 37, part 17.

FF 372. In a December 1980 report at Ford Aerospace, Dr. Fiedziuszko wrote that:

> Mode HE_{111} occurs in a degenerate, orthogonal pair, and in the past because of dominant utilization of TE_{015} mode, it was considered as a hard to control spurious mode (especially in filter applications). The only attempt, (to the author's knowledge), was made by Cohn et al. Particular application was in this case circularly polarized directional filter designs. However, due to difficulty in controlling two modes, results were not encouraging.

RX 3 at 40.

FF 373. In December 1980, Dr. Fiedziuszko filled out a form provided by Ford Aerospace entitled "Patent Application Information." Under the heading "Additional pertinent prior art of which I am aware (if none so state)", Dr. Fiedziuszko listed, inter alia, Rantec Report No. 7 and Rantec Report No. 8. Even though Dr. Fiedziuszko did not believe the Rantec reports to be

pertinent to his invention, he informed his patent attorney about them out of an abundance of caution. Dr. Fiedziuszko listed the Rantec reports under the aforementioned heading because there was no alternatinve on the form. Dr. Fiedziuszko attached a cover letter to the form explaining as follows:

> Sections of the Rantec reports describe application of dual mode dielectric resonators in directional filters. Principle of operation is quite different in this case - coupling between two orthogonal modes is minimized and circular polarization principle (resulting from existance of two orthogonal modes) is utilized.

RX 43; Fiedziuszko, Tr. 824-826.

FF 374. The references before the patent office in connection with the prosecution of the '293 patent fully reflect the state of the prior art relative to the '293 patent. Bell, Tr. 336.

FF 375. The patent examiner of the '293 patent was a primary patent examiner, and was quite exerienced. Stout Tr. 1525-1526.

FF 376. A patent examiner is presumed to have read all references that are brought to his attention by the applicant. Stout, Tr. 1525.

FF 377. The 1977 Plourde article in its entirety was before the patent examiner. Stout, Tr. 1524.

FF 378. Com Dev's expert testified that when applicant makes a remark about a reference, it is like a "lightening rod," and the examiner will review the applicant's remarks as well as the reference, and make whatever decisions about the reference he believes proper. Stout, Tr. 1507.

FF 379. At the European Patent Office, the 1977 Plourde article was cited as in the category "technological backgound" in contrast, for example, to "particularly relevant if taken alone," "particularly relevant if combined with another document of the same category," or "theory or principple underlying the invention." RX 49 at SSL 1004600. See, Tr. 478 (reading the

European Search Report).

IV. DOMESTIC INDUSTRY

FF 380. The microwave laboratory in which the '293 filters are manufactured by SSL is approximately 16,000 square feet. De Witt Tr. 47.

FF 381. SSL has invested about C in electric testing equipment for the microwave laboratory. DeWitt, Tr. 47.

FF 382. SSL has invested about C dollars in a metal plating facility. DeWitt, Tr. 47.

FF 383. Approximately 40-45 people are employed in the microwave laboratory, and between 15 to 25 people from outside the laboratory are used to support manufacture of the MMFs. Dewitt, Tr. 48.

FF 384. The payroll for the microwave laboratory is about C C annually. DeWitt, Tr. 49.

FF 385. SSL has an independent research and development budget for the microwave laboratory for which SSL spent approximately C annually. De Witt, Tr. 49.

V. IMPORTATION AND SALE

FF 386. Com Dev's accused MMFs are made in Canada and imported into and sold in the United States. Tang, Tr. 1078-1079.

VI. IRREPARABLE HARM TO THE DOMESTIC INDUSTRY

FF 387. The '293 patent is scheduled to expire in 2001. CX 1.

FF 388. SSL and Com Dev are major competitors in the market for MMFs. McFall, Tr. 1233.

FF 389. There are three primary satellite prime contractors in the United States: SSL, Hughes and GE/Martin Marietta. Ainsworth, Tr. 1370.

FF 390. GE/Martin Marietta has been in the business of making satellites in the United States since about 1964. McFall, Tr. 1224.

FF 391. GE/Martin Marietta is the prime contractor for the Intelsat VIII, GE 1 and GE 2 satellite programs. McFall, Tr. 1233, 1247.

FF 392. SSL offered to sell its MMFs to GE/Martin Marietta for the Intelsat VIII (flights 801 and 802), GE 1 and GE 2, and Asiasat programs. Maloney, Tr. 893.

FF 393. Com Dev was awarded the contracts to build the MMFs for the Intelsat VIII (flights 801 and 802), GE 1 and GE 2, and Asiasat. Maloney, Tr. 894-895.

FF 394. Com Dev is scheduled to deliver C MMFs to GE/Martin Marietta for the Intelsat VIII, GE 1 and GE 2 programs from C C . McFall, Tr. 1243, 1248, 1249.

FF 395. The prior GE/Martin Marietta contracts for MMFs awarded to Com Dev that also were sought by SSL accounted for C of Com Dev's business. Ainsworth, Tr. 1418.

FF 396. Three more contracts for Intelsat VIII satellites (flights 803, 804 and 805) will be awarded by the end of C . McFall, Tr. 1264.

FF 397. Com Dev is bidding on the Intelsat 803, 804 and 805 contracts. Maloney, Tr. 896; McFall Tr. 1262-1263.

FF 398. Delivery of the MMFs for the Intelsat 803, 804 and 805 may occur C . McFall, Tr. 1264-1265.

FF 399. Com Dev has sold MMFs for the Telstar program for a total of more than C . CX 2 C.

FF 400. Since January 1993, Com Dev has received orders for over C

C in MMFs for the Asiasat, GE 1 and GE 2, and Intelsat VIII programs. CX 2 C.

FF 401. Com Dev has also sold MMFs for the Telstar program for a total of more than C . CX 2 C.

FF 402. The C MMFs for the Asiasat program were estimated to be delivered in C . RX 145 C; SPX 1; Ainsworth, Tr. 1459-1460; McFall, Tr. 1231-1232.

FF 403. The MMFs for flight 801 of the Intelsat VIII program were estimated to be delivered by C . SPX 1; Ainsworth, Tr. 1460; McFall, Tr. 1243, 1245-1246.

FF 404. C filters are included in the Intelsat VIII (flights 801 and 802) program. CX 2 C; SPX 1.

FF 405. The C MMFs for each of the GE 1 and GE 2 satellites are scheduled for delivery C , respectively. SPX 1; RX 306A C; Ainsworth, Tr. 1461; McFall, Tr. 1248-1249.

FF 406. Although SSL does not consider Hughes a significant force in the MMF market at this time, SSL filed a patent infringement suit against Hughes on October 1, 1993. DeWitt, Tr. 54.

FF 407. SSL has not licensed its MMF technology under the '293 patent or its foreign counterpart. DeWitt, Tr. 54; Karambelas, Tr. 623.

FF 408. SSL solicited a bid from Com Dev for the production of output microwave filters for the TEMPO satellite project in November 1993. RX 337; Maloney, Tr. 975.

FF 409. SSL almost always solicits bids from Com Dev for SSL satellite programs. Maloney, Tr. 943.

FF 410. After soliciting bids from vendors, SSL considers what impact

sending work outside would have on the Multiplexer Lab at SSL. Maloney , Tr. 942.

FF 411. Com Dev knew that Dr. Fiedziuszko had applied for a patent. Com Dev received a copy of the '293 patent shortly after it issued. Tang, Tr. 988. 1097.

FF 412. Com Dev did not get an opinion of counsel as to whether its MMFs infringe the '293 patent until the spring or summer of 1993. Ainsworth, Tr. 1437-1438.

FF 413. It is common practice for Com Dev to advise all of its customers about its range of available products. Ainsworth, Tr. 1452.

FF 414. Com Dev representatives tried to sell dual-mode dielectric C-band input multiplexers to Martin Marietta. Tang, Tr. 1104; Ainsworth, Tr. 1452.

FF 415. Com Dev has apprised Hughes of its capability to make dual-mode dielectric C-Band input multiplexers. Tang, Tr. 1105; CX 139 C (Mabson Dep.) at 27, 29-30; Ainsworth, Tr. 1452.

FF 416. Mr. Tang, who was in charge of all satellite programs for Com Dev from 1984 to 1992, is not aware whether anyone appraised SSL of Com Dev's capability to manufacture dual-mode dielectric C-band input multiplexers. Tang, Tr. 1105.

FF 417. Mr. Ainsworth, President of Com Dev, also cannot point to any evidence which indicates Com Dev offered dual-mode dielectric filters to SSL. Ainsworth, Tr. 1452.

FF 418. Mr. Mabson, Com Dev's Vice President in charge of Marketing, cannot recall apprising SSL of Com Dev's capability to manufacture dual-mode dielectric C-band input multiplexers. CX 139 C (Mabson Dep.) at 31-32.

FF 419. Com Dev first imported accused filters into the United States in April 1992. Tang, Tr. 1078-1080.

FF 420. SSL first learned of the importation of infringing filters in October 1992. Fiedziuszko, Tr. 769.

FF 421. SSL did not file its Complaint and Motion for a Temporary Exclusion Order until approximately one year after it learned that Com Dev was importing MMFs believed to infringe the '293 patent. Karambelas, Tr. 624.

FF 422. SSL actively pursued a resolution of the possible conflict with Com Dev during that one-year. Karambelas, Tr. 624-646.

FF 423. SSL attempted to settle the infringement issues with Com Dev prior to filing suit against Com Dev because of the business relationship between the two companies. Karambelas, Tr. 683.

FF 424. Dr. Kudsia, the designated negotiator for Com Dev could not meet with representatives of SSL until February 1993. Karambelas, Tr. 627.

FF 425. Com Dev led Mr. Karambelas to believe that Dr. Kudsia could dispose of the potential patent infringement conflict between SSL and Com Dev. Karambelas, Tr. 262.

FF 426. Dr. Kudsia did not tell Mr. Karambelas that he (Dr. Kudsia) could not negotiate a settlement until the August 1993 meeting between the two parties. Karambelas, Tr. 644.

FF 427. After representatives from SSL went to Canada, Com Dev said it could not negotiate without first getting an opinion from U.S. counsel. During the course of SSL's attempt to negotiate a settlement, Com Dev never mentioned to SSL the opinion letter(s) it had received from Bacon & Thomas. Tr. 619-620; Karambelas, Tr. 635-638; Tr. 693-698; Tang, Tr. 1181.

FF 428. Com Dev is not relying on opinion(s) of U.S. counsel as a

defense for the motion for temporary relief in this action. See Tr. 1442-1443.

FF 429. The projections made in the SSL's Strategic Plan for fiscal year 1994 (RX 65 C) are outdated. DeWitt, Tr. 138-139.

FF 430. SSL's chief financial officer testified that SSL's Strategic Plan for fiscal year 1994 "is a year old and it's dramatically changed in today's environment." He testified further that "[t]here have been substantial changes to the company. And I, as I indicated before, we do not have this optimistic view any longer." DeWitt, Tr. 24, 132, 138. In fact, inroads made by Com Dev during this investigation could seriously affect SSL's workload, and require personnel reductions, including reductions in the multiplexer laboratory. DeWitt, Tr. 57-64, 130-132.

VII. HARM TO RESPONDENT

FF 431. GE/Martin Marietta has asserted that the following satellite programs will be affected by a TEO in this investigation: a) Telstar; b) Asiasat; c) Intelsat VIII (flights 801 and 802); and GE-1 and GE-2. RPX 29 C.

FF 432. Com Dev entered into the C contract after SSL filed its complaint and motion for temporary relief. RX 306A C; McFall, Tr. 1346

FF 433. As of the time of the hearing on temporary relief, about C of Com Dev's business is the sale of MMFs to GE/Martin Marietta. Ainsworth, Tr. 1418.

FF 434. Delivery of the MMFs for the Intelsat 802 satellite was originally scheduled C , but actual delivery C C . McFall, Tr. 1244.

FF 435. The president of Com Dev testified that if Com Dev is able to import the filters C , it "absolutely will." Ainsworth,

Tr. 1461.

FF 436. If Com Dev were to import the MMFs for the remaining programs under contract now, i.e., C , and a bond in the amount requested by SSL were to be required in order for those MMFs to be imported into the United States, the bond would be about C . That amount is equal to C C . See Ainsworth, Tr. 1464.

FF 437. C C . Ainsworth, Tr. 1465.

FF 438. C C . Ainsworth, Tr. 1465.

FF 439. All MMFs for the C program have been delivered to GE/Martin Marietta (subject to testing), and the satellite has been built. CX 2 C; McFall Tr. 1326-1327.

FF 440. C are included in the Intelsat VIII (Flights 801 and 802) program. CX 2 C; SPX 1.

VIII. PUBLIC INTEREST CONSIDERATIONS

FF 441. During the period of April 18, 1994 to November 18, 1995, C MMFs are scheduled to be delivered by Com Dev to GE/Martin Marietta for the C satellite. McFall, Tr. 1245.

FF 442. The design of the C satellite is near completion. McFall, Tr. 1254-1255.

FF 443. To reconfigure the C to accommodate SSL MMFs would cause expensive delays to GE/Martin Marietta. McFall, Tr. 1254-1255.

FF 444. C MMFs are due from Com Dev to GE/Martin Marietta for the C program in C .

FF 445. C MMFs are due from Com Dev to GE/Martin Marietta for the C program in C . McFall, Tr. 1250.

FF 446. GE/Martin Marietta has been assured by the president of Com Dev that Com Dev will do everything in its power to import the MMFs for the C Programs on time, even if that means posting a bond in order to import the MMFs. McFall, Tr. 1268-1269; Ainsworth, Tr. 1462-1263.

FF 447. GE/Martin Marietta has sales of about $6 billion a year. McFall, Tr. 1310.

FF 448. If temporary relief issues, C

C

C . McFall Tr. 1329, 1335.

FF 449. SSL could supply the MMFs for the GE 1 and GE 2 satellites within 10-12 months. Fiedziuszko, Tr. 865.

FF 450. GE/Martin Marietta and SSL have investigated changes that would be necessary for the incorporation of SSL MMFs into the Intelsat 803, 804 and 805 satellites. Fiedziuszko, Tr. 862.

FF 451. The changes to the Intelsat 803, 804 and 805 satellites necessary for the incorporation of SSL MMFs appear to be relatively small, the cost of which is estimated to be between C . Fiedziuszko, Tr. 862; McFall, Tr. 1325.

FF 452. Dr. Fiedziuszko testified that he believed that changes required to incorporate SSL MMFs into the GE 1 and GE 2 satellites would be similar to the changes required in the Intelsat 803, 804 and 805. Fiedziuszko, Tr. 865.

FF 453. GE/Martin Marietta was contacted by SSL in November, 1992 concerning the possible infringement by Com Dev. CX 100.

FF 454. No action was taken by GE/Martin Marietta at that time despite

constant contact with Com Dev concerning the Intelsat VIII program. McFall, Tr. 1312-1317.

FF 455. After awarding the Intelsat program to Com Dev, it was discovered that C

C . McFall, Tr. 1237-1239.

FF 456. GE/Martin Marietta contacted SSL and asked SSL to bid on both the input and output filters after GE/Martin Marietta discovered that C

C . McFall Tr. 1237-1239.

FF 457. GE/Martin Marietta contacted Com Dev concerning the issue of infringement of the '293 patent in February, 1993 after GE/Martin Marietta received a second letter from SSL concerning the '293 patent. RX 156.

FF 458. GE/Martin Marietta has not requested an outside opinion concerning infringement of the '293 patent by Com Dev, nor has it seen any opinion letters concerning infringement or validity of the '293 patent. McFall, Tr. 1317.

FF 459. C

C . McFall, Tr. 1268.

IX. BONDING

FF 460. SSL's FY 1992 gross sales for microwave filters covered by the '293 patent were C . CX 105.

FF 461. Com Dev's sales price for the MMFs for the C satellites is C per MMF. CX 2.

CONCLUSIONS OF LAW

1. The U.S. International Trade Commission has jurisdiction over the subject matter of this investigation. 19 U.S.C. § 1337. Opn. at 3.

2. Complainant has made a strong and convincing showing that it is likely to prevail on the issue of whether the '293 patent is obvious under 35 U.S.C. § 103. Opn. at 36.

3. Complainant has made a strong and convincing showing that it is likely to prevail on the issue of whether the U.S. Patent No. 4,489,293 satisfies the best mode, enablement and description requirements under 35 U.S.C. § 112. Opn. at 39-40.

4. Complainant has made a strong and convincing showing that it is likely to prevail on the issue of inventorship under section 102(f). Opn at 40-41.

5. Complainant has made a strong and convincing showing that it is likely to prevail on the issue of whether the U.S. Patent 4,489,293 is enforceable. Opn. at 44.

6. Complainant has made a strong and convincing showing that it is likely to prove that respondent Com Dev Ltd.'s commercial miniature microwave filters infringe claims 1 and 14 of U.S. Patent No. 4,489,293. Opn. at 18.

7. Respondent has imported into the United States, sold for importation, or sold within the United States after importation the accused products. Opn. at 44-49.

8. A domestic industry exists with respect to U.S. Patent No. 4,489,293 patent. Opn. at 44.

9. There is reason to believe that a violation of section 337 of the

Tariff Act of 1930, as amended, has occurred in the importation of certain dielectric miniature microwave filters and multiplexers containing same by reason of infringement of U.S. Letters Patent No. 4,489,293. Conclusions of Law 1 - 8.

10. Complainant will suffer irreparable harm absent temporary relief. Opn. at 44-49.

11. Respondent will suffer harm if temporary relief is granted. Opn at 49-50.

12. The harm to complainant if temporary relief is not granted outweighs the harm to the respondent if temporary relief is granted. Opn at 50.

13. The public interest weighs in favor of the issuance of temporary relief in this investigation. Opn. at 50-52.

14. Complainant should be required to post a bond of C . Opn. at 53-54.

15. Respondent should be required to post a bond of C per MMF. Opn at 54-56.

16. The motion for temporary relief (Motion Docket No. 359-1) should be granted. Conclusions of Law 1 - 13.

INITIAL DETERMINATION AND ORDER

Based on the foregoing opinion, findings of fact, conclusions of law, the evidence, and the record as a whole, and having considered all pleadings and arguments as well as proposed findings of fact and conclusions of law, it is the Administrative Law Judge's INITIAL DETERMINATION that there is reason to believe that respondent has violated § 337 in the importation of certain dielectric miniature microwave filters and multiplexers containing same by reason of infringement of claims 1 and 14 of U.S. Letters Patent 4,489,293, and that temporary relief is warranted.

The Administrative Law Judge hereby CERTIFIES to the Commission this Initial Determination ("ID"), together with the record of the hearing in this investigation consisting of the following:

1. The transcript of the hearing, with appropriate corrections as may hereafter be ordered by the Administrative Law Judge; and further

2. The exhibits accepted into evidence in this investigation as listed in the attached exhibit lists.

In accordance with Commission Interim Rule 210.44(b), all material found to be confidential by the Administrative Law Judge under Rule 210.6 is to be given in camera treatment.

The Secretary shall serve a public version of this ID upon all parties of record and the confidential version upon counsel who are signatories to the protective order issued by the Administrative Law Judge in this investigation, and the Commission Investigative Attorney. To expedite service of the public version, counsel are hereby ordered to serve on the Administrative Law Judge by no later than March 25, 1994 a copy of this ID with those sections considered by the party to be confidential bracketed in red.

This ID shall become the determination of the Commission 30 days after its date of service unless the Commission within those 30 days modifies or vacates this ID on the basis of errors of law or for policy reasons articulated by the Commission. 19 C.F.R. § 210.24(e)(17)(ii).

Sidney Harris
Administrative Law Judge

Issued: March 17, 1994