VIRGINIA JOURNAL OF LAW & TECHNOLOGY

SPRING 2010 UNIVERSITY OF VIRGINIA VOL. 15, NO. 101

Patentable Subject Matter:
What is the Matter with Matter?

DOLLY Y. WU AND STEVEN M. GEISZLER[†‡]

ABSTRACT

It is well established that naturally occurring matter and intangibles such as algorithms are generally not patentable. Encoded electromagnetic ("EM") signals designed and manufactured by human beings, however, are not natural objects and should be patent-eligible subject matter. Unfortunately, there seems to be a misconception that such signals are "unusual," transient, intangible non-entities (non particles). Because of that misconception, EM signals have been held to be unpatentable. To the contrary, such signals can in fact be identified by humans and one skilled in the art can determine their longevity and tangibility precisely – i.e., to a scientist, the object is intransient enough to be tangible. Also, to a modern physicist, these signals are particles that exert pressure and constitute matter. As such, novel man-made encoded EM signals are inventions that should satisfy the requirements to be patentable subject matter.

† Ms. Wu is a patent agent and expects her J.D. in 2010 from Southern Methodist University. She received a Ph.D. in high-energy physics from California Institute of Technology and a B.A. from Columbia University. She was formerly a physicist on experiments at Fermilab and SLAC, a design engineer at Analog Devices, and a senior circuit design engineer and patent agent at Texas Instruments.

‡ Mr. Geiszler is an associate at Gibson, Dunn & Crutcher LLP, where he practices patent litigation. He received a J.D. from the University of Virginia and B.A. from Baylor University.

TABLE OF CONTENTS

I. INTRODUCTION

Humans often create applications from natural matter, and such inventive man-made matter may generally receive a United States patent.[1] For example, man-made, genetically engineered plants are matter, and they are patentable.[2] Man-made chemicals are matter, and they are patentable[3]—even chemicals that are undetected are patentable.[4]

[1] 35 U.S.C. § 101 (2006) ("Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title."); U. S. PATENT & TRADEMARK OFFICE, U.S. DEP'T OF COMMERCE, MANUAL OF PATENT EXAMINING PROCEDURE § 2106 (8th ed., 7th rev. 2008) [hereinafter MPEP], *available at* http://www.uspto.gov/web/offices/pac/mpep/mpep.htm (instructing the U.S. Patent Office Examiners on patent procedures and allowance of patents).

[2] 35 U.S.C. 161 (2006) ("Whoever invents or discovers and asexually reproduces any distinct and new variety of plant, including cultivated sports, mutants, hybrids, and newly found seedlings, other than a tuber propagated plant or a plant found in an uncultivated state, may obtain a patent therefor, subject to the conditions and requirements of this title."); MPEP, *supra* note 1, § 1601 ("Plants capable of sexual reproduction are not excluded from consideration if they have also been asexually reproduced.").

[3] Not only are man-made chemicals patentable, proof of enablement may be particularly lax, requiring merely stating the chemical formula. *See, e.g.*, MPEP, *supra* note 1, § 2163 subsec. II(2)(A)(3)(a) ("Possession may also be shown . . . in structural chemical formulas . . . ."). For an example of a patent

Man-made, encoded electromagnetic signals are no less "matter." Therefore, why should they not also be patentable?

Although the phrase "electromagnetic signals" ("electromagnetic radiation," "electromagnetism") may not be familiar, examples of such signals are very familiar. Sunlight is a naturally occurring example. Laser light shows, cell phone signals, and television broadcasts are three more examples of man-made electromagnetic signals[5] that travel through the air. In *In re Nuijten*, the United States Court of Appeals for the Federal Circuit ("CAFC") held that encoded electromagnetic signals do *not* constitute patent-eligible subject matter under 35 U.S.C. § 101.[6] The *Nuijten* court considered electromagnetic signals to be transitory and intangible (not perceptible)[7] and therefore not patent-eligible. The Court did so despite the fact that, based on their scientific properties, electromagnetic signals are actually intransient and tangible, and they exert pressure. Moreover, the signals at issue in *Nuijten* were not naturally occurring. Instead, they were man-made, manufactured physical particles, electromagnetic ("EM") signals[8] uniquely encoded with watermark[9] tones (another signal) embedded within them to deter piracy of

---

claim to a new organic molecule, see ROBERT C. FABER, LANDIS ON MECHANICS OF PATENT CLAIM DRAFTING VI-3 (5th ed. 2007) ("A compound having the formula: R-CH = N-S-X, wherein R is an alkyl group selected from the group consisting of methyl, ethyl and isopropyl; and X is a halogen selected from the group consisting of chlorine and bromine.").

[4] *In re* Breslow, 616 F.2d 516, 521–22 (C.C.P.A. 1980); *see infra* Parts III, IV.

[5] In a dictionary, the standalone word "signals" means "anything that serves to indicate . . . ." But, there is an *electronics* entry for the definition as well: "an electrical quantity or effect, as current, voltage, or electromagnetic waves, that can be varied in such a way as to convey signals." Dictionary.com, http://dictionary.reference.com/ (last visited Mar. 8, 2010) (citing RANDOM HOUSE DICTIONARY (2010)) (entry for "signal," fifth definition). The phrase "electromagnetic signals" is used synonymously with "electromagnetism" in this paper because the two events are inseparable. As already noted, the most well-known electromagnetic signal is from the sun: sunlight that people can see and feel.

[6] *In re* Nuijten, 500 F.3d 1346, 1348 (Fed. Cir. 2007). The U.S. Constitution promotes the U.S. Patent System, but does not specify the types of inventions that may be patented. U.S. CONST. art. I, § 8, cl. 8 ("To promote the Progress of Science and Useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries . . . ."); *id.* art. I, § 8, cl. 18 ("To make all Laws which shall be necessary and proper for carrying into Execution for the foregoing Powers . . . ."). Different Patent Acts since 1790 have specified categories of patentable subjects, including the Patent Act of 1952. 35 U.S.C. § 101 (2006); Patent Act of 1952, ch. 950, § 101 66 Stat. 792, 797 (current version at 35 U.S.C. § 101 (2006)); *see infra* note 178. Case law interprets the Patent Acts. *See, e.g., In re* Bergy, 596 F.2d 952, 958–60 (C.C.P.A. 1979) (citing clauses 8 and 18, and providing a thorough overview of the intent of the Constitution, the *Bergy* court modernized the language in the Constitution, stating that the present day equivalent of the term "useful arts" employed by the Founding Fathers is "technological arts"), *aff'd sub nom.* Diamond v. Chakrabarty, 447 U.S. 303, 307 (1980) (holding that oil-eating bacterium is patentable subject matter because it is man-made even though bacteria are natural objects, and discussing the historical purposes of the patent laws, the Supreme Court stated the "Constitution grants Congress broad power" to legislate patent laws and to "promote this progress by offering inventors exclusive rights for a limited period as an incentive for their inventiveness").

[7] *Nuijten*, 500 F.3d at 1357.

[8] *Id.*

[9] Paper money often has a special watermark embedded in the paper to foil forgeries. Transmitted signals such as for music or video may also have a special digital marking to foil copying.

digital music and video signals.[10] As such, they also comprised a useful technical art. Certiorari has already been denied, and thus the troubling *Nuijten* decision stands.[11]

The *Nuijten* decision created a "hole" in the U.S. patent law regarding patent-eligible statutory matter because the decision narrowed the concepts of "transitory," "tangible," "detectable," "articles," and "manufacture." *Nuijten* set further troubling legal precedent for concepts like "matter" and "energy" because the opinion's description of encoded EM signals is vague and scientifically imprecise, if not inaccurate. Subsequent to *Nuijten*, lower courts have even inferred that the CAFC narrowed the interpretation of "man-made."[12] All of these issues pose a problem to future inventors who seek patent protection in areas such as superconductivity, levitation, medical treatments, and so on. At the present time, *Nuijten* affects EM signals such as those used for telecommunications, entertainment, sensors, security, and data communication (transmission of information).[13] Given all these useful applications, man-made EM signals, clearly, are important to daily living. Therefore, it is worthwhile to revisit the legal issues and correct any scientific misconceptions.

There are several difficulties in patenting, or even describing, EM signals. This paper submits that portions of the *Nuijten* opinion reflect these difficulties. A first difficulty is that common words like "energy" and "matter" have plain meanings that are different from their scientifically precise meanings. For example, it is common to say "I am tired and do not have any energy." When someone says he lacks energy, it is imprecise because it is not quantified. It is also imprecise as to where the lack of energy occurs, in the muscles, in the nervous system, etc. It is further imprecise as to the kind of energy because "energy" is a nebulous concept in its plain meaning. But, in science, the word "energy" has precise descriptions such as $E = mc^2$ where "E" is energy, "m" is mass, and "c" is a constant, the speed of light. A second difficulty is that the scientific understanding of EM signals has evolved substantially over the last three centuries. Long ago, the scientific concepts of "matter" and "energy" were distinct. In modern physics, however, they are a distinction without a difference. Thus, when the *Nuijten* opinion states EM signals are only energy, or implies EM signals are not matter, this is not accurate scientifically. The harm *Nuijten* seemingly creates is that it is now imprecise as

[10] *Nuijten*, 500 F.3d at 1348–49 (discussing a patent for a signal such as for digital audio music that contained a special watermark to reduce the unwarranted copying of the music). Although the watermark resulted in extra tones in the music, the distortion to the original musical signal was minimized using Nuijten's invention. *Id.*

[11] Nuijten v. Dudas, 129 S.Ct. 70 (2008).

[12] Prometheus Labs. v. Mayo Collaborative Servs., 2008 WL 878910, at *7 (S.D. Cal. Mar. 28, 2008) (citing *In re Nuijten*, the court invalidated patent claims describing the correlations between thiopurine drug metabolite levels and therapeutic efficacy and toxicity, and took the correlations not to be "man-made").

[13] "Signals" may encompass many forms: smoke signals, deaf-mute signals, hand clapping. Interview with Raymond T. Chen, Deputy General Counsel for Intellectual Property Law and Solicitor, Patent and Trademark Office (Dec. 29, 2008) (suggesting that hand clapping is also a "signal" and that the signal itself is not patentable subject matter, although the method of making the signal is patentable, as well as the device used to send or receive the signals). Chen represented the U.S. Patent and Trademark Office in *In re Nuijten*. *Nuijten*, 500 F.3d at 1348. While these other forms are signals, some are not physical matter in a scientific sense. These other forms of signals are not the focus of this paper.

to what exactly is not patent-eligible. Which class of objects is not patent-eligible? Classes of energy? Classes of matter? Exactly which kinds of future inventions are not patent-eligible?

A third difficulty is that the scientific properties of EM signals are couched in one set of terminology, but the legal decision whether something constitutes patentable subject matter is couched in a different set of terminology. Worse still, the two sets of terminology occasionally contain the same word that may have both a scientific definition (that may have evolved) and a plain meaning definition. One such word is "matter." "Matter" has a plain meaning such as "substance," but it also has a scientific meaning, "objects having non-zero mass." [14] An EM signal's unique scientific property is that its mass is zero. Instead of considering the property "mass," the *Nuijten* court determined patentable subject matter based on other properties, including "tangibility" or "transience." Due to the practice of *stare decisis*, the court relied on past decisions that analyzed whether a claimed invention was "tangible" and "transitory." The *Nuijten* court did not consider a concept like "mass." However, utilizing the concept of "mass" would have defined very precisely what class of objects is not patent-eligible. It would have limited the scope of ineligibility rather than create a sizable "hole" and uncertainty as to subject matter patentability in the future. Finally, it would have avoided narrowing the concepts "intangible" and "transitory."

Inconsistencies in the interpretation of the invention and patent claims in *Nuijten* may have arisen because the decision did not always apply the viewpoint of the most-applicable "reasonable" person standard: the person of ordinary skill in the art ("POSA").[15] "The descriptions in patents are not addressed to the public generally, to lawyers or to judges, but . . . to those skilled in the art to which the invention pertains . . . ."[16] Although courts apply a POSA standard,[17] which POSA's viewpoint to use may be less clear, particularly for inventions in modern technologies. Since the rejected patent claim in *Nuijten* related to the electromagnetic signal itself, the correct viewpoint is from that of a physicist of ordinary skill in the art (physicist POSA), as this would be someone who understands what an EM signal is. The viewpoint from that of an electrical engineer of ordinary skill in the art (electrical engineer POSA) is also valuable in the part of the claim construction where electrical circuits are involved. However, the primary issue really pertains to the EM signal itself; therefore, a physicist POSA's viewpoint should

[14] The plain meaning of "substance" is imprecise because the word has various meanings that in turn are also imprecise: "substance" means: "1. that of which a thing consists; physical matter or material . . . 2. a species of matter of definite chemical composition . . . ." Dictionary.com, *supra* note 5. In contrast, the scientific meaning of "zero mass" is fairly precise because "mass" refers to "rest mass." "Rest mass" and "zero" in physics entail very precise quantities and calculations (definitions).

[15] *See infra* Part II.

[16] Phillips v. AWH Corp., 415 F.3d 1303, 1313 (Fed. Cir. 2005) (quoting *In re* Nelson, 280 F.2d 172, 181 (C.C.P.A. 1960)) (providing the most extensive review on claim construction in an opinion, the CAFC emphasized the importance of constructions based on the understanding of a person of ordinary skill in the art and the use of ordinary meanings to such a person unless the patent specification assigns special meanings).

[17] *Id.*

have been adopted. Instead, *Nuijten* appears to have applied an electrical engineer POSA's point of view; more specifically, the point of view of a circuit or communication system designer.

Setting aside the difficulties for the moment, the fundamental question is whether Nuijten's EM signals should be patentable. Based on legal precedents, the answer is yes. Nuijten's encoded signals should satisfy the criteria of the already-existing categories of patent-eligible subject matter, either "[articles of] manufacture" or "composition of matter." [18] Based on the historical intent of the U.S. Patent System, the answer is also yes. By a quirk of history, electromagnetism was beginning to be understood during the time of the American Revolution and the drafting of the Constitution. [19] Electromagnetism "shocked" and fascinated people, including Benjamin Franklin, and many inventions ensued worldwide.[20] When man-made, useful electromagnetic signals were first generated by an electromagnetic motor, they were patented during that time;[21] thus, it is arguable Congress would have favored patenting Nuijten's modern, man-made encoded EM signals. Moreover, the intent of the drafters was to "promote the Progress of Science and Useful Arts."[22] Therefore, since Nuijten's signals advance the progress of a Useful (technical) Art, they should be patent-eligible.[23]

The U.S. Patent System was created for the benefit of society.[24] From a societal point of view, it is of great concern when an inventor is unable to secure, through the patent system, a temporary, exclusive market right sufficient to reward his effort and investment. An entrepreneurial inventor would likely keep his ideas a secret and not explain to society how he implemented his invention.[25] Society would be better off allowing a patent, allowing the inventor to obtain some limited exclusive rights in exchange for his ideas rather than compel him to sell a black box forever hiding his

[18] 35 U.S.C. § 101 (2006).

[19] *See, e.g.*, 3 ENCYCLOPEDIA BRITANNICA, INC., THE NEW ENCYCLOPEDIA BRITANNICA 920 (15th ed. 1998).

[20] BENJAMIN FRANKLIN, THE FOUNDING FATHERS: BENJAMIN FRANKLIN, A BIOGRAPHY IN HIS OWN WORDS 85–130 (Thomas Fleming ed., Harper & Row, Publishers 1974).

[21] Thomas Davenport obtained the very first patent on the generation of useful, man-made electromagnetic signals in 1835, although he did not fully appreciate the implications of his invention. The title of his patent was "Improvements in Propelling Machinery by Magnetism and Electromagnetism." U.S. Patent No. 132 (filed Feb. 25, 1897), *available at* http://www.google.com/patents (search "Improvements in Propelling Machinery by Magnetism and Electromagnetism"; then follow the first hyperlink).

[22] U.S. Const. art. I, § 8, cls. 8, 18.

[23] *In re* Bergy, 596 F.2d 952, 958–60 (C.C.P.A. 1979) (stating that the present day equivalent of the term "useful arts" employed by the Founding Fathers is "technological arts"). The uses of Nuijten's signals include detecting piracy and providing legal proof of the copyright owner of the music. *In re* Nuijten, 500 F.3d 1346, 1348–49 (Fed. Cir. 2007).

[24] Graham v. John Deere Co., 383 U.S. 1, 10 (1966) (quoting the letters of Thomas Jefferson).

[25] Bonito Boats, Inc. v. Thunder Craft Boats, Inc., 489 U.S. 141, 151–52 (1989) ("The federal patent system thus embodies a carefully crafted bargain for encouraging the creation and disclosure of new, useful, and nonobvious advances in technology and design in return for the exclusive right to practice the invention for a period of years."). For a discussion of the lack of copyright protection for Nuijten's signals, see *infra* Part II.

know-how.[26] Unfortunately, Nuijten was not rewarded with a patent.

As a result, the *Nuijten* decision presently stands as good law, and therefore a future inventor, an existing patent holder, or a patent litigator needs solutions to overcome the decision in order to have the incentive to continue innovating in such non-traditional inventions and to win patent suits on existing patents (e.g., existing patents on various allegedly non-tangible inventions). One solution may be new legislation, but this is generally a very slow process.[27] Or perhaps new patent case law may eventually emerge for advanced technologies. Because there is division among the CAFC, one can still hope for a change.[28] Until then, inventors should consider alternative solutions. A first solution is drafting patent claims in a way consistent with software claim drafting. Encoded-EM signals were rejected in *Nuijten* because they are considered intangible. Similarly, software is considered intangible and not patent-eligible, but there are claim drafting workarounds that enable software to be patent-eligible. As a second solution, an inventor in front of the U.S. Patent & Trademark Office's ("USPTO") Board of Patent Appeals and Interferences ("BPAI") or a plaintiff at court could argue why encoded EM signals should be patentable using a physicist POSA's point of view, explaining why the signals are in fact tangible, non-transitory articles of manufacture. As a third solution, an inventor could argue the inherent presence of an object implied in the claim language (e.g., a transmitter circuit) in order for the claimed invention to pass the "tangibility" requirement of the courts. Alternatively, although the doctrine of equivalents arises in the context of an infringement action,[29] similar reasoning makes sense in the context of the patentability of EM signals. The rejected encoded EM signals in *Nuijten* are, in fact, equivalent to things that are commonly deemed as tangible devices. If particular equivalent tangible devices are patentable, it stands to reason that encoded EM signals should be as well. That is, a court should interpret the law so that the principles underlying the doctrine of equivalents or inherent function apply to make encoded EM signals patent eligible.

This Article is organized as follows. Part II provides an overview of the *In re Nuijten* decision and dissent, along with a discussion of internal inconsistencies in the opinion. Part III considers case law supporting the argument that the Nuijten invention satisfies the "tangibility," "non-transitory," and "matter [articles]" criteria. Part IV examines the science of EM signals and proposes that Nuijten's signals be categorized as either "manufacture[s]" or "composition[s] of matter." Part V proposes alternative solutions to overcome the problems introduced by the *Nuijten* court. Appendix I provides diagrams to aid the understanding of the Nuijten invention.

[26] *Bonito Boats*, 489 U.S. at 151–52.

[27] The *Nuijten* decision was denied certiorari, which leaves only new legislation as the "fastest" viable alternative. U.S. Patent & Trademark Office Solicitor Chen mentioned a *fifth* patentable subject matter category as a legislative possibility.

[28] *Nuijten* is not an en banc decision, but rather two judges and an assertive dissent. *In re* Nuijten, 500 F.3d 1346, 1348, 1358 (Fed. Cir. 2007); *see infra* Part II. Three judges dissented in a subsequent case. *In re* Bilski, 545 F.3d 943 (Fed. Cir. 2008).

[29] Graver Tank & Mfg. v. Linde Air Prods. Co., 339 U.S. 605, 609 (1950); 35 U.S.C. § 112 (2006).

II. *IN RE NUIJTEN*: REJECTION OF SIGNALS AS PATENT-ELIGIBLE SUBJECT MATTER

The modern statute governing patentable subject matter, 35 U.S.C. § 101, states that: "Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title."[30] The *Nuijten* court held that the patent claims reciting "signals" as subject matter do not satisfy § 101 and do not qualify under any of the four categories, not even as "article[s] of manufacture."[31] However, the signals are indeed manufactured; they are uniquely encoded, and not naturally occurring.

A. *In re Nuijten*: the Invention and Decision

The Nuijten invention was originally filed in 1997 as a patent application to the European Patent Organization ("EPO") and to the World Intellectual Property Organization ("WIPO").[32] The application was then fanned out to individual countries, including the United States. The purpose of watermarking is to provide legal proof of the copyright owner of a particular electromagnetic signal, and to allow tracing of piracy.[33] The purpose is very similar to watermarking paper money to discourage counterfeiters. Nuijten and his co-inventors in the Netherlands developed an electronic circuit to provide "tagged" output signals—watermarked EM signals containing extra digital bits that are added to the original input audio or video signals (see Appendix I, fig. 2).[34] Nuijten's special signals (see Appendix I, fig. 4) make it less likely a listener or a viewer will notice the effect of the added watermarks. Compared to past signal inventions (Appendix I, fig. 3), Nuijten's supplemented music/video signal (Appendix I, fig. 4) would theoretically sound/look "nice," as if they had never been altered or at least sound or look nearly identical to the original signal.[35] The concept may be easier to understand by

[30] 35 U.S.C. § 101 (2006).

[31] *Nuijten*, 500 F.3d at 1357 ("A transitory, propagating signal like Nuijten's is not a 'process, machine, manufacture, or composition of matter.' Those four categories define the explicit scope and reach of subject matter patentable under 35 U.S.C. § 101; thus, such a signal cannot be patentable subject matter.").

[32] Embedding Supplemental Data in an Encoded Signal, WIPO Patent Application No. WO 99/33266 (filed Dec. 22, 1997) [hereinafter WO 99/33266]; EPO Application EP 97204056.2 (filed Dec. 22, 1997). The U.S. equivalent of the WIPO application is U.S. Patent Application Serial No. 09/211,928, which is not available to the public. The U.S. application can be inferred from the inventor's appeal to the USPTO's own Board of Patent Appeals and Interferences ("BPAI"). *Ex parte* Nuijten, 84 U.S.P.Q.2d 1335 (B.P.A.I. 2006). *See also* U.S. Patent No. 6,157,330 (filed Jan. 26, 1998) (listing additional inventors along with Nuijten).

[33] WO 99/33266, *supra* note 32.

[34] *Id.* fig.2 (depicting an arbitrary, original audio or video signal); *id.* fig.3 (depicting the result of adding a code to the original signal of fig. 2, using a method that existed before Nuijten's invention); *cf. id.* fig.4 (depicting the result of adding a code to the original signal of fig. 2, using Nuijten's method).

[35] *Id.* figs.2–4. Notice how Fig. 4 looks much more like Fig. 2, than Fig. 3 does. This means Fig. 4, Nuijten's method of encoding signals produces a final audio or video signal that is much closer to the original. Thus, a listener or viewer would be able to hear or see a more accurate version. The prior

visually comparing figs. 2, 3, and 4. Fig. 4 (Nuijten's signal) is very similar to fig. 2, whereas fig. 3 (that of a competitor's) is much more dissimilar to fig. 2.

Most of the Nuijten patent claims, all related to the same invention, were actually allowed by the U.S. Patent Office ("USPTO") including Claim 15, which is almost identical to the disputed-rejected Claim 14.[36] Claim 14, on appeal, and the patented Claim 15 recite:

> Claim 14. A signal with embedded supplemental data, the signal being encoded in accordance with a given encoding process and selected samples of the signal representing the supplemental data, and at least one of the samples preceding the selected samples is different from the sample corresponding to the given encoding process.
>
> Claim 15. A storage medium having stored thereon a signal with embedded supplemental data, the signal being encoded in accordance with a given encoding process and selected samples of the signal representing the supplemental data, and at least one of the samples preceding the selected samples is different from the sample corresponding to the given encoding process.[37]

Claim 15, now patented, contains the extra phrase "a storage medium having stored thereon," whereas Claim 14, rejected, does not.[38] Claim 14, but not Claim 15, remained on appeal and was presented to the CAFC.[39] Claims 22, 23, and 24 are similar to Claim 14 and were also rejected by the USPTO and remained on appeal;[40] they depend

---

invention, shown in Fig. 3, is not only less accurate, but also tends to produce sudden glitches in the sound or video scene.

[36] *Ex parte* Nuijten, 84 U.S.P.Q.2d 1335 (B.P.A.I. 2006). The inventors were already issued two U.S. patents on substantially the same invention before the instant patent application was rejected and Nuijten tried to appeal the decision. U.S. Patent No. 6,507,299 (filed Oct. 26, 1999) (issued Jan. 14, 2003); '330 Patent (issued Dec. 5, 2000). So, the USPTO appears to have "accepted" the invention prior to the instant application. As an aside for those readers who do not prosecute patents, there are several levels of review available to an inventor applicant who disagrees with the USPTO's decisions about the wording of a patent claim. The USPTO's primary patent examiners make a first decision, which may be reviewed by a supervisory examiner, whose decision may be appealed to the USPTO's internal BPAI of administrative judges, and then appealed subsequently to the CAFC.

[37] *Ex parte* Nuijten, 84 U.S.P.Q.2d 1335; *In re* Nuijten, 500 F.3d at 1351 ("Finally, Nuijten's *allowed* Claim 15 is directed to '[a] storage medium having stored thereon a signal with embedded supplemental data,' where the stored signal has essentially the encoding properties described above… The Examiner rejected a number of claims in Nuijten's application for obviousness-type double patenting, and rejected Claims 14, 15, and 22-24 as directed to nonstatutory subject matter under § 101. On appeal, the Board reversed the double-patenting rejections. As to Claim 15, it found that '[t]he storage me-dium in claim 15 nominally puts the claim into the statutory category of a 'manufacture'' and thus *reversed the Examiner's § 101 rejection of that claim*. However, it affirmed the Examiner's § 101 rejections of Claims 14 and 22-24 on two grounds.") (emphases added).

[38] *In re* Nuijten, 500 F.3d at 1351; WO 99/33266, *supra* note 32, at 11.

[39] Interview with Raymond T. Chen, Deputy General Counsel for Intellectual Property Law and Solicitor, Patent and Trademark Office (Dec. 29, 2008) (stating that one of the roles of the PTO is to bring issues like statutory matter before the federal courts for the courts to weigh in on the issues).

[40] *In re* Nuijten, 500 F.3d at 1351.

(perhaps a better term would be "are predicated") on Claim 14. Furthermore, these claims have additional limitations (requirements)—Claim 22 requires that the signal be an audio signal, Claim 23 requires that the signal be a video signal, and Claim 24 requires that the embedded data is a watermark.[41] This paper considers only the independent Claims 14 and 15.

The *Nuijten* court first provided a comment stating that, if "signals" were interpreted as being merely "information," then they are not patent-eligible subject matter.[42] The parties and the court then agreed the "signals" referred to some form of "electromagnetic" signals.[43] The *Nuijten* court then held that electromagnetic signals are not patent-eligible.[44]

In the claim construction section of the opinion, the court interpreted "signals" in Claim 14 as some kind of information—which puts "signals" only nominally above the level of the "abstract" and the "non-physical."[45] The majority adopted a view that the claimed invention would have been more "tangible" (though still not necessarily patentable) if Claim 14 included words directed to "some *carrier* upon which the information is embedded".[46] The majority considered the word "signals" alone to be insufficient and stated that the claim should have contained additional wording to give the signal "some physical form" or specify "the signal's physical *carrier*."[47] The court proposed the *carrier* could include any of the following: "electrical signals," "modulated electromagnetic waves," or "pulses in fiber optic cable."[48]

Although it did not rule on Claim 15, the court seemed to accept Claim 15 rather than Claim 14 because Claim 15 recited something "physical" and "tangible." The BPAI allowed Claim 15 because it deemed that the "storage device" described in Claim 15 satisfied the "tangibility" factor.[49] While the word "signal" in Claim 15 was construed as non-physical "information," the "signal" contacts, is embodied in, or is contained in the storage medium, and thus it has "tangibility."[50]

---

[41] *Id.*

[42] *Id.* at 1353 ("The only limitations in Claim 14 address the signal's informational content.").

[43] *Id.*

[44] *Id.* The court states that the inquiry is "whether a transitory, propagating signal is within any of the four statutory categories." *Id.* "Nuijten and the PTO agree that the claims include physical but transitory forms of signal transmission such as radio broadcasts, electrical signals through a wire, and light pulses through a fiber-optic cable, so long as those transmissions convey information encoded in the manner disclosed and claimed by Nuijten. We hold that such transitory embodiments are not directed to statutory subject matter." *Id.*

[45] *Id.*

[46] *Id.* (emphasis added). In other words, a "carrier" means something to carry the information. For example, suppose mail consists of information, and a mailman "carries," transmits, and delivers the mail.

[47] *Id.* (emphasis added). "In summary, some physical form for the signal is required, but any form will do, so long as a recipient can understand the message—the nature of the signal's physical carrier is totally irrelevant to the claims at issue." *Id.*

[48] *Id.* (emphasis added).

[49] *Id.*

[50] *Id.*

Finally, despite the *Nuijten* opinion's initial advice about adding adjectives such as "electrical" or "modulated electromagnetic waves" to "signals," the opinion's final holding was that even if the signals were electromagnetic in nature, such signals are only "transitory," "intangible," and "not perceptible" unless some equipment were used to detect the signals.[51] The court did not settle on any one definition for EM signals. Rather the majority considered EM signals to be energy, electrical signals, changes in electric potential/variance, something encoded in an electromagnetic carrier, waves, particles, photons that travels at or near the speed of light, or something transmitted through a vacuum.[52] Regardless, the majority held encoded electromagnetic signals do *not* meet the criteria of any patent-eligible subject category, such as "articles of manufacture" or "composition of matter."[53]

B. *In re Nuijten*: Inconsistencies, Electrical Signals, and the POSA

There are numerous inconsistencies in the case, which create confusion as to what future inventors should claim as their invention. The inconsistencies may also set an unfortunate precedent. Some of the inconsistencies could have been resolved or even avoided by using an *appropriate* person of ordinary skill ("POSA") standard in interpreting the claim language and patent application.[54]

A first inconsistency stems from the fact that a few years before the present case and patent application were submitted, the USPTO had actually granted a patent claim directed towards a signal. On December 5, 2000, the USPTO had granted Nuijten (Bruekers is listed as the first inventor, Nuijten third) a patent that claims the "encoded signal" itself as the subject matter.[55] Claim 20 of Patent 6,157,330 claims "[a]n encoded *signal* with embedded supplemental data, in which selected bits of the encoded signal have been inverted to represent the supplemental data with the number of bit periods between successive inverted bits representing the embedded data."[56] Like Claim 14, this Claim 20 makes no reference to any "storage device" or any other hardware and yet Claim 20 was allowed. Patent Claim 20 was granted six years before the BPAI's current rejection of Nuijten Claim 14 and seven years before the CAFC's current rejection.[57] Before the instant case even commenced, the USPTO and BPAI were aware of the earlier Patent 6,157,330, and the earlier patent was discussed before the BPAI court in relation

[51] *Id.* at 1356.
[52] *Id.* at 1355–58.
[53] *Id.* at 1357.
[54] Phillips v. AWH Corp., 415 F.3d 1303, 1313 (Fed. Cir. 2005) ("We have made clear, moreover, that the ordinary and customary meaning of a claim term is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention, *i.e.*, as of the effective filing date of the patent application.").
[55] WO 99/33266, *supra* note 32, col.8 ll.8–12
[56] *Id.* (emphasis added).
[57] Compare the dates of U.S. '330 Patent (issued Dec. 5, 2000), *Ex parte* Nuijten, 84 U.S.P.Q.2d 1335 (B.PA.I. 2006), and *In re* Nuijten, 500 F.3d 1346 (Fed. Cir. 2007).

to other issues—but not in relation to "signals."[58] It is not clear why *Nuijten* and *Ex parte Nuijten* did not consider Claim 20 from the 6,157,330 Patent.[59] Either both Claims 14 (present case) and 20 (earlier patent) should have been equally rejected or equally allowed.

A second inconsistency was pointed out by the dissent: the fact that Claim 14 was rejected whereas Claim 15 was allowed as reciting patent-eligible subject matter makes "little sense."[60] Claim 15 contains some extra nondescript words, "a storage medium," whereas Claim 14 does not.[61] The dissent noted the invention is the *uniquely-watermarked* signal and not whether it was ever on a storage device.[62] Therefore, the dissent did not consider the invention innovative merely because the signal happens to be stored in "a storage medium."[63] The dissent considered it irrelevant to the actual invention that the signal may be stored. Moreover, Claim 14 describes the invention more accurately than Claim 15. Patented Claim 15 is actually claiming the wrong thing because the subject of the sentence is the "storage medium." In fact, the proper subject of the sentence should be the uniquely-coded signal itself, as drafted in Claim 14.

The significance of the second inconsistency relates to issues of obviousness, a subject not covered in this paper, and also to uncertainties in claim drafting. Because the extra words in Claim 15 seem irrelevant or obvious, it is unclear as to what the threshold is for a claim to pass the subject matter eligibility test. In a footnote, the majority speculated on how to fix Claim 14, hinting that Claim 15 is satisfactory—perhaps suggesting *Nuijten* endorsed Claim 15 in some fashion.[64]

Even though Claim 15 was allowed, the interpretation of "a storage medium" is unclear.[65] The phrase could mean something like a digital video recorder (TiVo/DVR) that stores electric signals by recording them, which is typically done for audio and video signals. The phrase should be construed as any storage medium consistent with the written text and figures in the patent application.[66] "Storage medium" does appear in the

---

[58] *See Ex parte Nuijten*, 84 U.S.P.Q.2d 1335 (noting that the '330 Patent is listed as a reference in the BPAI appeal decision).

[59] There is an obviousness double patenting rejection discussion regarding the two applications overall, but there is no reference to Claim 20 itself, even though Claim 20 is directly on point in the litigation, whereas the double patenting discussion is not on point and merely analyzes whether there is "obviousness." *Id.*

[60] *In re* Nuijten, 500 F.3d 1346, 1366 (Linn, J., concurring in part and dissenting in part).

[61] *Id.* at 1365–66. The BPAI's reason for permitting Claim 15 is that it relates to patentable subject matter under a category of "manufacture" because the claim refers to something the BPAI deems "physical," the storage medium. *Id*. at 1351–52 (summarizing the procedural history at the BPAI).

[62] *Nuijten*, 500 F.3d at 1366 (Linn, J., concurring in part and dissenting in part).

[63] *Id.* Maintaining signals on a storage medium is commonplace, e.g., music on a recorder.

[64] *Id.* at 1357 n.6.

[65] *Id.* at 1351 (noting that the original patent examiner rejected both Claims 14 and 15).

[66] Phillips v. AWH Corp., 415 F.3d 1303, 1313 (Fed. Cir. 2005) (construing the meaning of "baffles" in a patent claim from the viewpoint of a POSA as opposed to its plain meaning, the Court considers the foremost step to be "[i]mportantly, the person of ordinary skill in the art is deemed to read the claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the specification").

application, but it refers to a device that stores the input, raw signal, not the inventive, output, encoded signal. Thus, under such a construction for "storage medium," Claim 15 is not even accurately drafted since it states the output, encoded signal is stored, rather than the input signal.

Given the problems with the interpretation for "storage medium," perhaps it is better to seek an alternative meaning. A storage medium may be considered an inherent part of the equipment to conduct the encoding. Although not recited explicitly in Claim 14, some sort of device is already implied in the claim because the language states the encoded signal is "processed" ("encoding process")—a phrase that appears twice in Claim 14; so, some equipment has to exist to do the processing.

It may be easier to infer a "storage medium" in Claim 14 by studying the electronic circuit diagrams and the rest of the patent specification. The word "circuit" appears twelve times, and the figures include what is known as a DSP circuit (digital signal processor) or a computer.[67] The "encoding" may be implemented by the DSP circuit, but DSPs contain sub-component circuits (latches and flip-flops) that are, in fact, small "storage devices" because they have memory: they are able to "memorize" and store an electrical signal.[68] If there is a "storage medium" already implied in Clam 14, then Claim 14 is equivalent to Claim 15 that recites "storage medium" explicitly. Therefore, either both Claims 14 and 15 should have been equally rejected or equally allowed, notwithstanding the issue of claim differentiation. This is exactly the position the USPTO patent examiner had adopted before the case went to appeal to the BPAI and then to the CAFC.[69]

Another inconsistency relates to the word "signal" in Claim 14, which should have been interpreted as "electrical signal" based on the application. For example, there are twelve textual instances of "circuit."[70] Since a "circuit" refers to electronic circuits, which are objects that transport electric signals, it should have been evident that "signal" refers to electric or EM signals. The significance of interpreting "signal" as "electric signal" relates to tangibility, an issue that is discussed in Part III of this paper. *Nuijten* initially took it to mean "information," which is not tangible but merely numbers and letters or other symbols. Subsequently, *Nuijten* took "signal" to mean "electrical signal" or "electromagnetic signal"—which this paper contends is "tangible"[71]—stating

> The claims on appeal cover transitory *electrical and electromagnetic signals* propagating through some medium, such as wires, air or a vacuum. Those types of signals are not encompassed by any of the four enumerated

[67] WO 99/33266, *supra* note 32, figs.1, 6, & 7; U.S. '330 Patent, *supra* note 32, figs.1, 2, 6, 10, 11, & 12.

[68] PAUL HOROWITZ & WINFIELD HILL, ART OF ELECTRONICS 512 (2d ed. 1989) (describing sequential logic and memory).

[69] *Nuijten*, 500 F.3d at 1351–52.

[70] WO 99/33266, *supra* note 32.

[71] Even based on an ordinary dictionary's *electronics* meaning, a "signal" does not necessarily mean "information." Some dictionaries take "signal" to mean the carrier of information, such as "electromagnetic waves." Dictionary.com, *supra* note 5 (entry for "signal," fifth definition).

> statutory categories: "process, machine, manufacture, or composition of matter."[72]

During the appeal to the BPAI, Nuijten's attorneys argued primarily about energy and electromagnetic signals for broadcast music and movies rather than current in a circuit.[73] Thus, the *Nuijten* court focused primarily on electromagnetic signals through air, making references to photons, the speed of light, and a vacuum.[74] Therefore, this paper takes the "signal" in Claim 14 to refer mostly to electromagnetic signals perceived on Earth and transmitted through the air.

Courts resolve and construe the language of a patent by considering the viewpoint of a POSA (person of ordinary skill in the art). *Phillips* instructs, "Importantly, the person of ordinary skill in the art is deemed to read the claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the specification."[75] *Phillips* further instructs that claim terminology is construed with an understanding of their meaning in the field, and through knowledge of any special meaning and usage in the field.[76] Moreover,

> Other claims of the patent in question, both the asserted and unasserted, can also be valuable sources of enlightenment as to the meaning of a claim term. Because claim terms are normally used consistently throughout the patent, the usage of a term in one claim can often illuminate the meaning of the same term in other claims.[77]

For example, applying *Phillips,* and looking at the patent disclosure and the other claims, an electrical engineer POSA may think that the disclosure refers to electrical signals in a circuit rather than to electromagnetic signals through air. The reason is that the figures show a circuit, and the written description refers to "circuit" twelve times.[78] Thus, "signals" in Claim 14 could have been understood to be "electrical signals" by considering an electrical engineer POSA.

The choice of a POSA is not mentioned in *Nuijten*.[79] Who is the right POSA for *Nuijten*? The Nuijten invention involves the design of a circuit and algorithm to generate encoded signals. Claim 14 claims the uniquely encoded electromagnetic signal itself.

---

[72] *Nuijten*, 500 F.3d at 1352 (emphasis added).

[73] *Ex parte* Nuijten, 84 U.S.P.Q.2d 1335 (B.P.A.I. 2006).

[74] *Nuijten*, 500 F.3d at 1356–57.

[75] Phillips v. AWH Corp., 415 F.3d 1303, 1313 (Fed. Cir. 2005).

[76] *Id*.

[77] *Id.* at 1314.

[78] None of the words "electrical," "electromagnetism," or "current" appear in the patent application, but the word "circuit" does. In addition, the figures show a circuit containing a DSP (digital signal processor) or a computer containing the program. WO 99/33266, *supra* note 32, figs.1, 6, & 7; '330 Patent, *supra* note 32, figs.1, 2, 6, 10, 11, & 12. There are other references to circuitry. Aside from "circuits," the text refers to "MPEG encoders," "analog," "digital," "sigma delta modulators." The language in the other claims includes "feedback loop," and "sigma-delta modulation," which are readily understood to refer to electrical circuits. WO 99/33266, *supra* note 32, at 3–5; '330 Patent cols.2–4.

[79] *Nuijten*, 500 F.3d 1346.

While a POSA for construing the circuit, algorithm, and "storage medium" is generally an electrical design engineer, the POSA for the electromagnetic signal itself is, instead, a physicist.[80] The POSA who understands or discovers the reality of an electromagnetic signal itself is a physicist who has studied quantum mechanics in his senior year at college, and has a masters degree along with work experience or a has a doctoral degree.[81] In contrast, most electrical engineering practitioners do not need to learn quantum mechanics for their work, and seldom design algorithms and circuits like those in Nuijten's patent application. This paper contends that by adopting a physicist POSA's viewpoint, a uniquely encoded "electromagnetic signal" readily constitutes patent-eligible subject matter.

C. Problems Faced by Inventors Claiming Encoded Electromagnetic Signals

Inventors face numerous problems in trying to patent an invention like "electromagnetic signals" due to *Nuijten* not applying a physicist POSA's viewpoint, thus resulting in a lack of understanding about EM signals. When such misunderstandings are maintained in a legal opinion, it causes problems for future inventors applying for patents.

Moreover, *In re Nuijten* created a "hole" in patent-eligible subjects, and, other than patents, there are no alternative means of intellectual property ("IP") protection for many inventions. Some types of inventions may be protected by different or even multiple sets of IP rights.[82] So, it is worth considering whether Nuijten's encoded signals may be eligible either for patent protection as a new idea or for copyright protection as an original expression.[83] Nuijten's invention is directed towards transmitted audio or video signals that contain a special watermark on them.[84] Normally, the underlying, non-watermarked audio or video signal such as music or movies may register for a copyright.[85] Similarly, information data, by which the *In re Nuijten* court characterized

[80] The educational background of a physicist, from Columbia University or California Institute of Technology for example, includes a year of electromagnetism taught to physics majors in their junior year, quantum mechanics in their senior year, and advanced electromagnetism (quantum electrodynamics) in the first year of graduate study. For examples of books that, even in 2000, were very widely used by physics students to study EM signals and advanced electromagnetism, see generally J.D. JACKSON, CLASSICAL ELECTRODYNAMICS (2d ed. 1975); J.D. BJORKIN & S. DRELL, RELATIVISTIC QUANTUM MECHANICS (1964).

[81] UNITED STATES DEPARTMENT OF LABOR, OCCUPATIONAL OUTLOOK HANDBOOK 2008–09 EDITION (2008) (describing in the "Physicists and Astronomers" section that the education and training needed to get employment as a typical physicist is at least at the master's or doctorate degree level), *available at* http://www.bls.gov/oco/ocos052.htm#training.

[82] Laura Heymann, *The Trademark/Copyright Divide*, 60 SMU L. Rev. 55, 74 (2007) ("Neither the Copyright Statute nor any other says that because a thing is patentable it may not be copyrighted." (quoting Mazer v. Stein, 347 U.S. 201, 207 (1954))).

[83] *Id.*

[84] *Nuijten*, 500 F.3d at 1348.

[85] Copyright protects a broad variety of creative works, ranging from books, paintings and music to computer programs, motion pictures and architectural works, including the buildings themselves. *See generally* 17 U.S.C. §§ 101–122 (2006). The Internet has heightened the need for copyright protection of creative works. *See* Digital Millennium Copyright Act, Pub. L. No. 105-304, 112 Stat. 2860 (1998)

Nuijten's "signals," may also be copyright protected if they constitute original compilations or derivative works.[86] However, Nuijten had an invention that he could not copyright. One use of the watermark is to detect the true ownership of copyrighted material. Copyrighting the watermarked music or video divulges the secret mark and defeats the purpose of watermarking. Even if an invention such as Nuitjen's is not used for the tracing of piracy, it may still not be appropriate to obtain a copyright. For example, if an invention is implemented impromptu for, say, radio broadcasts, where the exact location of the watermark code is not pre-determined, it is not feasible to file an anticipatory copyright registration; thus, infringement remedies, if any, are limited under copyright laws.[87] In contrast, recorded music or movies are fixed with pre-determined notes, chords, scenes, and acts, and thus lend themselves to copyright.[88] Therefore, if Nuijten cannot get a copyright or a patent right due to *In re Nuijten*, there is a gap in intellectual property law denying Nuijten exclusive rights to his uniquely marked electromagnetic signals. *Nuijten* thus decreases the scope of protectible subject matter.

Another problem arises from a recent decision, *In re Bilski*,[89] which many attorneys believe "affirms" and expands the *Nuijten* decision because *Bilski* seemingly contains rationale similar to that underlying *Nuijten*.[90] The *Bilski* court provided a new, and *only*, test to determine whether *method* claims in patents constitute patent-eligible statutory matter.[91] This is an *en banc* decision, carrying more force than *In re Nuijten* and creating a bigger "hole" in patentable subjects that may reaffirm or even enlarge the gap created by *Nuijten*. Since the *Bilski* court held that its test is the only test, the concern is whether it is necessary to also look to *Bilski* regarding electromagnetic signals. The invention in *Bilski* relates to a business algorithm for hedging risks of buying and selling futures and options, but the Federal Circuit took the opportunity to also comment on software and information ("abstract") types of inventions.[92] *Bilski* holds that where the claimed invention is drafted in a process (method) claim format, then subject matter patent-eligibility under 35 U.S.C. § 101 is determined by a machine-or-transformation

---

(codified at scattered sections of 17 U.S.C. (2006)). *See also* MARTIN J. ADELMAN ET AL., CASES AND MATERIALS ON PATENT LAW 41 (2d ed. 2003) (providing examples of copyrightable material and noting that registering material with the Copyright Office provides notice and allows the owner certain advantages when enforcing their copyrights, including the advantage of having presumed standing to bring suit and easily obtaining damages).

[86] 17 U.S.C. § 103 (2006). "[There are] two well-established propositions. The first is that facts are not copyrightable; the other, that compilations of facts generally are." Feist Publ'ns, Inc. v. Rural Tel. Serv. Co., 499 U.S. 340, 344 (1991). Applying *Feist* leads to a conclusion that if Nuijten's encoded signals were purely information, then the signals may not be copyrightable altogether.

[87] ADELMAN ET AL., *supra* note 85, at 41.

[88] *Id.*

[89] *In re* Bilski, 545 F.3d 943, 965 (Fed. Cir. 2008).

[90] Interview with Raymond T. Chen, Deputy General Counsel for Intellectual Property Law and Solicitor, Patent and Trademark Office (Dec. 29, 2008); Kevin Meek, Baker Botts LLP, Class presentation at Southern Methodist University (Fall 2008).

[91] *Bilski*, 545 F.3d at 965 (holding that business methods are not statutory matter, the Court provided dicta that software patents are not statutory matter either, unless the claims recite sufficient machinery or transformation).

[92] *Id.* at 958–60.

test.[93] Method claims describe the steps of performing the invention rather than the end product of the method. In contrast, Claim 14 describes the end product, the encoded signal itself.

The machine-or-transformation test is an either-or test, but the "machine" portion is akin to a "tangibility" test. If the patent claim language includes sufficient hardware (machines), it is more likely to have patent-eligible statutory matter. Therefore, there are attorneys who draw an analogy between *Bilski* and *Nuijten*: Claim 15 in *Nuijten* recites to hardware, the storage medium, and thus, Claim 15 is patentable. Whereas, Claim 14 does not recite hardware, but instead intangible electromagnetic signals; it therefore is not patentable. Another way that *Bilski* may somehow be applicable to *Nuijten* is that *Bilski* contains a comment about electronic signals as being the raw materials of many information-age processes.[94]

Nuijten may be distinguished from *Bilski* so that it should not be necessary to apply *Bilski* tests to Nuijten's Claim 14 because the claim is directed to a product, whereas *Bilski* focused on method claims.[95] But, it may be problematic that even though *Bilski* purportedly applied its tests to only method claims, the court actually overruled certain tests for other types of claims for product, device, and system claims.[96] Thus, *Bilski* may have created tests for non-method claims as well. However, there is also a statement in *Bilski* that effectively distances *Bilski* from *Nuijten*. *Bilski* states "we *decline to discuss In re Nuijten* . . . ."[97] In addition, the *Bilski* court did not overrule the criteria held in *Nuijten*, the way *Bilski* overruled tests developed in *State Street* and other yet older tests such as the *Freeman-Walter-Abele* test.[98] Therefore, *Nuijten* remains good law, and its test remains valid independent of *Bilski*.[99] For now, it should not be

[93] *Id.* at 961. There are different types of claims, including process claims that describe a method of making something and manufacture claims that describe something man-made.

[94] *Id.* at 962 (questioning which processes constitute a "transformation" under its new test, the court noted "[t]he raw materials of many information-age processes, however, are electronic signals and electronically-manipulated data").

[95] *Id.* at 951 ("[T]he issue before us involves what the term 'process' [methods] in § 101 means . . . ."); *id.* at 977 (Newman, J., dissenting) ("The court today holds that any process that does not transform physical matter or require performance by machine is not within the definition of 'process' in any of the patent statutes since 1790.").

[96] *Id.* at 958–59 ("[O]ur predecessor court and this court have reviewed numerous cases presenting a wide variety of process [method] claims, some in technology areas unimaginable when those seminal Supreme cases were heard. Looking to these precedents, we find a wealth of detailed guidance and helpful examples on how to determine the patent-eligibility of process claims."). But, the opinion then goes on to consider non-method claims such as in *In re Freeman*, 573 F.2d 1237 (C.C.P.A. 1978) (involving claims directed to a system rather than to a method), and in *In re Abele*, 684 F.2d 902 (C.C.P.A. 1982) (involving claims directed to an apparatus). *Id.*

[97] *Bilski*, 545 F.3d at 951 (emphasis added).

[98] *Id.* at 958–60 (referring to *In re* Freeman, 573 F.2d 1237 (C.C.P.A. 1978), *In re* Walter, 618 F.2d 758 (C.C.P.A. 1980), *In re* Abele, 684 F.2d 902 (C.C.P.A. 1982), and State St. Bank & Trust Co. v. Signature Fin. Group, Inc., 149 F.3d 1368, 1373 (Fed. Cir. 1998)).

[99] *Nuijten* is again mentioned by the dissent in *Bilski*, questioning the inconsistencies in the various contemporaneous rulings over patentable subject matter, arguing that *Nuijten* may be inconsistent with *Bilski* and with *AT&T v. Excel*, 172 F.3d 1352 (Fed. Cir. 1999). *Bilski*, 545 F.3d at 995 (Newman, J.,

necessary to apply any tests proposed in *Bilski* to EM signals.

III. CASE LAW: THINGS THAT ARE DETECTABLE, TANGIBLE AND NOT TRANSITORY

Although *Nuijten* ultimately rejected the patent eligibility of encoded electromagnetic signals, the court analyzed whether the signals would have most likely qualified as an "article of manufacture."[100] The court addressed the definitions of "articles" and "manufacture" based on the properties of the articles, especially the property of tangibility.[101] The court also considered the property of transience, saying "[a] *transient* electric or electromagnetic transmission does not fit within the definition [of patentable subject matter]."[102]

The various forms of electromagnetic signals initially contemplated by the parties and court were radio broadcasts, electrical signals through a wire, and light pulses through a fiber-optic cable.[103] The court considered such examples of EM signals as being transitory, not tangible, and not detectable (perceptible) except by equipment, and thus, do not constitute physical matter (articles).[104] However, based on everyday experience, people may realize two of the examples of EM signals are already well on their way to passing the threshold of tangibility and perceptibility. People can feel electrical signals traveling through wires especially when the current and voltages are very large, such as near the big power lines or when a shock occurs. People can also see light pulses at the ends of a fiber-optic cable.[105] The third example, radio broadcasts through air, may be less familiar to people because such signals are not so readily visible to the human eye. Nevertheless, EM signals that travel through the air do have the requisite properties to legally satisfy being an "article of manufacture," especially in view of case law related to "tangibility" and "transitory." This section of the paper examines such law.

However, not all case law on "tangibility," "transience," and "articles" should be considered, even if they relate to EM signals. First of all, the patent claim on signals in *Nuijten* was drafted as a "thing" claim rather than a method claim.[106] So, only case law

---

dissenting). Also, the dissent stated the new decision together with silence about certain previous decisions creates much uncertainty in the area of patentable subject matter. *Id.*

[100] *In re* Nuijten, 500 F.3d 1346, 1356 (Fed. Cir. 2007) ("The question of whether the claimed signals are 'manufacture' is more difficult.").

[101] *Id.*

[102] *Id.* (emphasis added).

[103] *Id.* at 1353.

[104] *Id.* at 1353, 1356–57.

[105] Optic fiber cable is coated with a substance so that light does not "leak" out through the side of the cable, but if one looks at the ends of the cable, or a cross-section of the cable, one can readily see the light.

[106] *Ex parte* Nuijten, 84 U.S.P.Q.2d 1335 (reproducing the text of Claim 14, the claim in dispute); *see supra* Part II.A; *see also* MPEP, *supra* note 1, § 2106(IV)(A)–(B). This section of the MPEP explains the four categories of claims under 35 U.S.C. 101. The USPTO calls three of the categories "things," and equates the category "apparatus" with "machine." The MPEP further describes the nature of apparatus versus method claims, and states "that an *apparatus* claim with process steps is not classified as a 'hybrid'

related to "thing" claims is considered. For example, the Federal Circuit has case law on signals (seismic waves) already,[107] but the claims are method claims and thus not considered in this paper.

Second, although *stare decisis* required *Nuijten* be consistent with legal precedent, the precedent should still have an accurate scientific basis. For example, *Nuijten*[108] referred to the Supreme Court patent cases related to EM signals in the Morse code telegraph (*O'Reilly v. Morse*)[109] and in the Bell telephone (*The Telephone Cases*).[110] These cases should be set aside for the purposes of deciding the characteristics of EM signals because the scientific understanding of electromagnetic signals has changed much since the 1800s when *O'Reilly* and the *Telephone Cases* occurred. For example, the 1910 edition of ENCYCLOPEADIA BRITANNICA explains the history of "light": "light was a stream of corpuscles . . . . [This theory] gave place during the opening decades of the 19th century to the undulatory or wave theory . . . and it is now held that light is identical with electromagnetic disturbances . . . . Beyond this point we cannot go at present."[111] The 1910 edition of the encyclopedia did not include that Einstein and others came up with the *particle* explanation of light in 1905. The particle concept revolutionized the understanding of matter and energy, the stuff of which the universe is made. In contrast to the progression of science, the *Nuijten* court emphasized the wave theory rather than the modern particle theory.[112] Old case law related to a wave concept should be set aside.

Subpart A of this section examines case law that addresses the property of "transience," Subpart B addresses "tangibility," and Subpart C addresses "physical matter (articles)."

A. Nuijten: Not Unpatentably Transitory

The *Nuijten* court concluded, "A *transitory*, propagating signal like Nuijten's is not a process, machine, manufacture, or composition of matter . . . . [T]hus, such a signal cannot be patentable subject matter."[113] Since the opinion did not provide a definition for "transitory," one possibility is to obtain the definition from a dictionary: "transitory" means "not lasting, enduring, permanent, or eternal; lasting only a short time brief; short-

---

claim; instead, it is simply *an apparatus* claim including functional limitations." MPEP, *supra* note 1, § 2106(IV)(B) (emphases added).

[107] *See, e.g.*, *In re* Taner, 681 F.2d 787 (C.C.P.A. 1982).

[108] *See, e.g.*, *In re* Nuijten, 500 F.3d 1346, 1357, 1364 (Fed. Cir. 2007).

[109] O'Reilly v. Morse, 56 U.S. 62, 124 (1853) (containing one comment about tangibility of the Morse code). "His patent is not for the invention of a new alphabet; but for a combination of powers composed of *tangible* and *intangible* elements, described in his specification, by means of which marks or signs may be impressed upon paper at a distance, which can then be read and understood." *Id.* (emphases added).

[110] The Telephone Cases, 126 U.S. 1 (1888) (commenting about electromagnetism, but not about tangibility).

[111] 9 ENCYCLOPEDIA BRITANNICA 226 (11th ed. 1910) (emphasis added).

[112] *Nuijten*, 500 F.3d at 1356 (describing EM signals, the court stated "[i]n essence, energy embodying the claimed signal is fleeting and is devoid of any semblance of permanence during transmission").

[113] *Id.* at 1357 (emphasis added).

lived; temporary."[114] The *Nuijten* dissent argued that because other transitory things have been patent-eligible, it is not clear why the majority considered time duration to be of any significance to patentability in the instant case.[115] Furthermore, the Constitution, the Patent Acts, legislative notes, and the writings of the first patent examiner, Thomas Jefferson, do not condition patentability on how long an object lasts. In fact, the CCPA has stated that, "[i]t appears to us that the PTO would read into § 101 a requirement that compositions of matter must be stable [long-lived] which is a relative term to say the least. We see no good reason to do so."[116]

The Federal Circuit and its predecessor, the CCPA, decided a few cases related to things such as chemical inventions where the issue of "transience" had been raised. In *Breslow*, the chemical compound in the invention could not be isolated (detected) because it was transient, occurring through one of many phases in a chemical chain reaction, but it was conceded to theoretically exist at some point.[117] The court held the extremely short-lived substance was directed to a statutory class of invention so long as the element existed at some point in time.[118] The court expressly recognized that the existence of the compound was not in question based on chemical-reaction theory, and therefore upheld the claims that were directed to a transitory, intermediate thing.[119] In contrast, in *Morton International*, a chemical was denied patent eligibility because there was no evidence the compounds *ever existed*.[120] The CAFC affirmed that when "*no amount of testing* by equipment or methods available can identify, isolate or separate any compound claimed," then the Court would deny patentability.[121] Therefore, like in *Breslow* and unlike in *Morton International*, Nuijten's signals should have passed the "transitory" criterion because the *Nuijten* court stated that the signals were "detectable by equipment," and the "signals [did] exist."[122] That is, contrary to *Morton International*,

[114] Dictionary.com, *supra* note 5 (entry for "transitory").

[115] *Nuijten*, 500 F.3d at 1359 (Linn, J., concurring in part and dissenting in part).

[116] *In re* Breslow, 616 F.2d 516, 521 (C.C.P.A. 1980).

[117] *Id.* at 518.

[118] *Id.* at 522; *Nuijten*, 500 F.3d at 1359 (Linn, J., concurring in part and dissenting in part) ("[W]e held that chemical intermediates are patentable compositions of matter under § 101 even if they are 'transitory, unstable, and non-isolatable.' ").

[119] *Breslow*, 616 F.2d at 517–18, 522.

[120] Morton Int'l v. Cardinal Chem. Co., 5 F.3d 1464, 1468, 1470 (Fed. Cir. 1993) (holding chemical patent claims invalid, in part, because there was "no evidence that such compounds even exist").

[121] *Id.* at 1468, 1470 ("The court found that the claimed compounds cannot be identified by *testing* and that one skilled in the art could *no[t]* determine whether a given compound was within the scope of the claims. The record supports this conclusion. Since the evidence shows that the claims at issue here are not sufficiently precise to permit a potential competitor to determine whether or not he is infringing, we also agree with the district court's determination that the claims are *invalid* for failure to satisfy the 'definiteness.'") (emphases added). Thus, the *Morton* claims were rejected based on 35 U.S.C. § 112, non-enablement and indefiniteness, rather than on § 101 non-statutory subject matter. In contrast, *In re Breslow* was upheld as patentable subject matter. However, *Morton* is included in this paper to provide definitions for the concept of "transitory" and "tangibility."

[122] *Nuijten*, 500 F.3d at 1356 ("[S]uch a transmission is man-made and *physical*—it *exists in the real world* and has tangible causes and effects . . . .") (emphases added). However, the court goes on to note that "to be perceived, [it] must be measured at a certain point in space and time." *Id.* In other words,

the signals could be identified by testing and that one skilled in the art could determine their existence – to a scientist, this is the essence of an object being intransient enough to be tangible.

Aside from case law, patents have been issued already by the U.S. Patent Office for things-type claims related to electromagnetic signals that are transitory in a manner comparable to Nuijten's EM signals. A quick search on the USPTO Web site returns 3538 patents containing a patent claim reciting the phrase "radio signal."[123] There are also 4066 patents containing a patent claim reciting the phrase "television signal."[124] Radio and television signals are but two examples of electromagnetic signals that are transitory; there are in fact tens of thousands of patents related to EM signals in various media including air. There are at least two U.S. issued patents that claim the electromagnetic signal itself.[125] One is the Bruekers-Nuijten Patent 6,157,330, referred to in Part II.B of this paper. There is also a patented invention ("Koo") for television that reduces ghost images, or secondary images, and contains the claim: "An *electronic reference signal* in a system for minimizing the effects of ghosts occurring during the transmission and reception of a television signal over a communications path, wherein said reference signal is embodied in a processor readable memory . . . ."[126] These granted patents do not contain remarks disparaging the purported transiency of EM signals. These patents do not consider the longevity of EM signals at all. Therefore, it is not clear why *Nuijten* considered "transience" as having any bearing on patent-eligibility.

The negative treatment of the issue of "transience" is but one of several reasons why the *Nuijten* opinion is quite problematic. *Nuijten* sets broad legal precedent against fast or short-lived modern inventions because the decision now introduces a new criterion whether something constitutes statutory subject matter: transience.

Finally, the requirement of "intransience" as a condition of subject matter patent-eligibility in *Nuijten* does not comport with the physics of electromagnetic signals.[127] This would have been more readily apparent had a POSA physicist's point of view been adopted in interpreting the patent. First, longevity is relative as the Federal Circuit stated in *Breslow*;[128] so, using transience as a metric is difficult to quantify, leading to uncertainty in litigation. There are also many examples of EM signals that are not

---

Nuijten is saying the EM signals are physical and real, as opposed to something non-physical and abstract such as an idea.

[123] U.S. Patent and Trademark Office, USPTO Patent Full-Text and Image Database, http://patft.uspto.gov/netahtml/PTO/search-bool.html (search "Term 1: radio signal" in "Field 1: Claim(s)" in the 1790 to present database) (last visited Feb. 17, 2010).

[124] U.S. Patent and Trademark Office, USPTO Patent Full-Text and Image Database, http://patft.uspto.gov/netahtml/PTO/search-bool.html (search "Term 1: television signal" in "Field 1: Claim(s)" in the 1790 to present database) (last visited Feb. 17, 2010).

[125] *Ex parte* Nuijten, 84 U.S.P.Q.2d 1335 (B.P.A.I. 2006); Sam S. Han, *Analyzing the Patentability of "Intangible" Yet "Physical" Subject Matter*, 3 COLUM. SCI. & TECH. L. REV. 2, 56 (2002).

[126] System for Echo Cancellation Comprising an Improved Ghost Cancellation Reference Signal, U.S. Patent No. 5,568,202 col.5 ll.4–8 (filed Sept. 22, 1992) (emphasis added) (claim 1).

[127] *See infra* Part IV.

[128] *In re* Breslow, 616 F.2d 516, 521 (C.C.P.A. 1980).

transitory even in the slightest. For example, starlight is an example of electromagnetic signals that may exist for many human life-spans before reaching Earth. Man-made radio signals may travel to a satellite or back to Earth. Various planetary missions have sent images of the Moon, Mars, Pluto, and beyond back to Earth via man-made EM signals. These EM signals all existed for a relatively long time.

B. Nuijten: Definitely Tangible

The *Nuijten* decision contains inconsistent statements on the tangibility of electromagnetic signals. It states that "electrical signals, modulated electromagnetic waves, and pulses in fiber optic cable" are conventional examples of "*tangible* means of information carriage."[129] However, the opinion also states, "A transient electric or electromagnetic transmission . . . . is man-made and physical—it exists in the real world and has *tangible* causes and effects . . . [but] *to be perceived*, must be measured at a certain point in space and time by *equipment* capable of detecting and interpreting the signal."[130] Thus, on the one hand, the court said EM signals are tangible means of transmission (tangible themselves), but on the other hand, the court stated the signals are not really independently tangible, but have only tangible effects.

For purposes of statutory subject matter, the decision implies "tangibility" requires human perception and detection, rather than non-human (equipment) perception and detection. The opinion considers EM signals "intangible" because equipment is necessary in order to detect the signals.[131] This view immediately sets *Nuijten* contrary to litigated patents, such as chemical patents. In *Breslow*, the patented chemical was not detected by human senses or even non-human instruments.[132] If the intermediate compound were to ever be detected, very sophisticated equipment would have been necessary since the compound was extremely short-lived.

Sources other than case law also define "tangibility" based on perception by humans. The plain meaning of "tangible" is "capable of being touched; discernible by the touch; material or substantial."[133] Finally, BLACK'S LAW DICTIONARY'S first two definitions for "tangible" are "[h]aving or possessing physical form; CORPOREAL" and "[c]apable of being touched and seen; perceptible to the touch; capable of being possessed or realized."[134] The U.S. Patent Office examiners' definition is that "the opposite meaning of tangible is abstract."[135]

The Supreme Court has also indicated "tangibility" relates to human perception in

---

[129] *In re* Nuijten, 500 F.3d 1346, 1353 (Fed. Cir. 2007) (emphasis added).

[130] *Id.* at 1356 (emphases added).

[131] *Id.* (rejecting the tangibility of electromagnetic transmission because an EM signal "must be measured at a certain point in space and time by equipment capable of detecting and interpreting the signal").

[132] *Breslow*, 616 F.2d at 518, 522.

[133] Dictionary.com, *supra* note 5 (entry for "tangible").

[134] BLACK'S LAW DICTIONARY 1592–93 (9th ed. 2009) (defining "tangible").

[135] MPEP, *supra* note 1, § 2106 (IV)(C)(2)(2)(b) (defining "Tangible Result").

patent cases. For example, in *Wilson v. Simpson*, the Court commented that process (method) claims are *non-visible, and thus non-tangible*:

> It necessarily results from this ruling, that the reservation [grant of rights] applies only to such inventions as are embodied in *tangible*, material form. Processes [method inventions] which are only directory, and simply teach how a product or result is to be obtained, do not come within the [patent grant], because these have no *visible* material existence[]—such, for instance, as the process of tanning leather by submitting hides to the chemical action of a solution . . . .[136]

There are more recent cases regarding "tangibility." In *Brulotte v. Thys Co*., a dissenting Supreme Court Justice commented, "We have before us a mixed case involving the sale of a *tangible* machine which incorporates an *intangible*, patented *idea*."[137] In *Microsoft Corp. v. AT&T Corp*., the Court assumed that software is "intangible information," but asserted that a "speech-processing computer is a tangible thing."[138] Therefore, the Supreme Court's definition of "tangible" seems consistent with the dictionary meanings and with the *Nuijten* comments. Tangibility requires human perception by senses such as sight or touch (e.g., pressure), whereas ideas, information, and processes (methods) are considered intangible.

Applying these various definitions of "tangibility" to EM signals leads to the conclusion they are indeed tangible. This would have been evident had a POSA physicist's point of view been adopted.[139] Simply put, if there are EM signals in *sufficient quantities*, particularly in certain energy ranges, then human beings may readily perceive the signals either by sight or by touch. For example, humans see bright sunlight and a gradation of shadows (umbra and penumbra) that represent different quantities of EM signals. As another example, when humans get X-rays, they do not normally

[136] Wilson v. Simpson, 50 U.S. 109, 113 (1850) (emphases added) (considering a surfacing machine needing its knives changed and deciding the invention was really directed towards a machine, rather than a process).

[137] Brulotte v. Thys Co., 379 U.S. 29, 34 (1964) (Harlan, J., dissenting) (emphases added).

[138] Microsoft Corp. v. AT&T Corp., 550 U.S. 437, 447, 452 n.13 (2007) ("We need not address whether software in the abstract, or any other intangible, can *ever* be a component under § 271(f). If an intangible method or process, for instance, qualifies as a 'patented invention' under § 271(f) (a question as to which we express no opinion), the combinable components of that invention might be intangible as well. The invention before us, however, AT&T's speech-processing computer, is a tangible thing.").

[139] *Cf.* HOROWITZ & HILL, *supra* note 68, at 1, 15. *Engineer* Horowitz took "signals" to be "voltages that change in time in a particular way"; he also stated "you can't touch, see, smell, or hear electricity." However, based on a physics perspective, an "electric signal" includes both changing voltages and currents, due to charged particles in motion through wires or circuits; neither voltages nor currents exist without the other. *See, e.g.*, EDWARD M. PURCELL, ELECTRICITY AND MAGNETISM: BERKELEY PHYSICS COURSE—VOLUME 2 123–61 (2d ed. 1985). As for electricity, most people have experienced shock or a vibration sensation, or have seen a spark when they plugged a cord into an outlet. Thus, electricity is visible and tangible when there are enough charged particles in motion. In contrast to engineer Horowitz's view, there are other engineers who sometimes take "electric signal" to refer to either the voltage or current. *See, e.g.*, John Hewes, *AC, DC and Electrical Signals*, THE ELECTRONICS CLUB, http://www.kpsec.freeuk.com/acdc.htm#props (last visited Mar. 20, 2009) ("An electrical signal is a voltage or current which conveys information, usually it means a voltage. The term can be used for any voltage or current in a circuit.").

perceive the X-rays because the quantity (dosage) of the EM signals is very small. However, in large quantities, X-rays are visible as a blue-gray glow.[140] Laser light beams are also visible (e.g., at laser concerts). As for the other human senses, sunlight signals are also perceptible because they feel warm on skin. But if there is a solar eclipse, very few EM signals reach Earth, and humans perceive so little that they feel cold. X-rays are dangerous to the touch in sufficient quantities. Less well known, perhaps, is that light (any EM signal) exerts pressure, albeit a weak pressure. This was demonstrated experimentally in 1900 by Pyotr Lebedev.[141] The pressure is so weak that human neurons cannot readily detect the pressure unless there are many, many EM signals acting in concert. [142] There are many examples of EM signals that are perceptible to humans, so long as they appear in sufficient quantity.

IV. NUIJTEN SIGNALS: ARTICLE OF MANUFACTURE OR COMPOSITION OF MATTER

The *Nuijten* opinion invoked imprecise "scientific" explanations to rationalize why encoded EM signals do not constitute patent-eligible subject matter. For example, while it is true that EM signals can be perceived by equipment, the opinion incorrectly states that this is the only way to detect EM signals.[143] Humans themselves perceive EM signals in common, everyday situations, as noted in Part III. Below, Subpart A describes the hazards of using imprecise science, and how a precise zero-mass concept could have provided a universal test of patent-eligibility for certain types of inventions. Subpart B explains EM signals from the perspective of a POSA physicist and clarifies some of the "science" presented in *Nuijten*. Subparts C and D examine how encoded EM signals are consistent with the patent-eligible subject categories of either "articles of manufacture" or, possibly, "composition of matter" under 35 U.S.C. § 101.

A. Electromagnetic Signals: A Modern, Accurate Scientific View [144]

The *Nuijten* opinion used a "scientific" argument that is imprecise; the BPAI assumed that EM signals are not "matter" and not "tangible" because they are "energy."[145] However, the two courts neither defined "energy" nor explained that energy

[140] Normally, people get X-rays at a dental office or in a hospital, and the dosage is low enough that the X-rays are not seen or felt. But once the dosage is high enough, X-rays are both seen and felt. *See, e.g.*, Paul W. Frame, *Wilhelm Röntgen and the Invisible Light*, *available at* http://www.orau.org/ptp/articlesstories/invisiblelight.htm (last visited Nov. 1, 2009).

[141] Hong X. Tang, *Photonics Breakthrough for Silicon Chips*, I.E.E.E. SPECTRUM, Oct. 2009, http://www.spectrum.ieee.org/semiconductors/devices/photonics-breakthrough-for-silicon-chips/0; *see also* Yale Nanodevices Laboratory, http://www.eng.yale.edu/tanglab (last visited Oct. 12, 2009) (Nanotechnology research).

[142] *Id*.

[143] *In re* Nuijten, 500 F.3d 1346, 1356 (Fed. Cir. 2007).

[144] *See generally* FRANCIS HALZEN & ALAN MARTIN, QUARKS AND LEPTONS: AN INTRODUCTORY COURSE IN MODERN PARTICLE PHYSICS (1984); DAVID PARK, INTRODUCTION TO THE QUANTUM THEORY (1974); DONALD PERKINS, INTRODUCTION TO HIGH ENERGY PHYSICS (1982); Frank Wilcek, *Quantum Field Theory*, 71 REVS. MODERN PHYSICS S85 (1999), *available at* http://fr.arxiv.org/abs/hep-th/9803075.

[145] *Nuijten*, 500 F.3d at 1356; *Ex parte* Nuijten, 84 U.S.P.Q.2d 1335, 1347 (B.P.A.I. 2006).

comes in many different forms—including matter. The *Nuijten* and BPAI decisions' imprecise use of the word "energy" could have harmful consequences because "energy" encompasses many things. *Nuijten* could be interpreted as a general denial of patentability to things that are considered "energy." As the word "energy" is very broad in common usage, and very diverse even in scientific usage, such a denial would cover many possible inventions. For instance, in common usage, "there is an energy crisis" probably refers to an oil shortage, but could also refer to electricity or some other resource. In scientific terms, electromagnetism (of which electricity is an example) is considered a form of energy. In the classic scientific view, "oil" is generally not a form of energy, but contains potential energy, or is a form of matter. In modern scientific view, however, oil may also be a form of energy because matter is a form of energy.

The *Nuijten* court did not invoke the fact that EM signals do not have mass—i.e., real, physical EM signals have zero mass. This physics principle would have been a logical and more scientifically accurate way for the court to have rationalized that EM signals do not constitute matter, because by definition *matter* has *some mass*.[146] Therefore, the court could have argued, with zero mass, EM signals do not qualify under the categories of "composition of *matter*" or "machine" (which logically have some mass). Very few classes of real, physical objects in the universe other than EM signals have zero *rest* mass. Thus, had the *Nuijten* decision held that zero-rest-mass ($m_0 = 0$) objects such as EM signals are not patent-eligible, it would have made for a narrow, precise ruling and avoided creating interpretation difficulties for future inventions related to matter and energy.

In fact, the decision's use of the word "energy" creates a dilemma because matter is a form of energy: energy encompasses "matter" through Einstein's equation $E = mc^2$, an equation that is well-known to federal patent courts.[147] The equation states energy, "E," is equal to mass, "m," multiplied by a constant, "c" squared; thus, energy encompasses anything with some mass, i.e., matter. POSA physicists—for example, physicists at the U.S. Argonne National Lab—have phrased this in the following ways: "matter is a form of energy"; "'energy' and 'mass' are equivalent"; and "mass *is* energy," since "c" is merely a constant scale factor.[148] The scale factor "c" in $E = mc^2$ is akin to an exchange rate factor for currency, such as in the dollar = peso x rate. The dollar and peso are not identical, but both the dollar and peso are in fact money. Like the dollar and peso, matter and energy are equivalent. Therefore, in holding against EM signals because they are "energy," the *Nuijten* decision could be misinterpreted by future courts and

[146] *See, e.g.*, NASA IMAGINE THE UNIVERSE! DICTIONARY, http://imagine.gsfc.nasa.gov/docs/dict_jp.html#M [hereinafter NASA ONLINE DICTIONARY] (defining "matter") (last visited Mar. 3, 2009).

[147] The Supreme Court characterized this equation as "celebrated" in the famous *Chakrabarty* decision. Diamond v. Chakrabarty, 447 U.S. 303, 309 (1980).

[148] Richard Barrans, Vince Calder & Kenneth Mellendorf, *Energy and Form of Matter*, http://www.newton.dep.anl.gov/askasci/phy05/phy05080.htm (last visited Mar. 27, 2009) (answering a student's posted question about energy and form of matter). For qualifications of a POSA physicist, see *supra* note 80 and accompanying text.

litigators.[149] In short, the use of the word "energy" in the *Nuijten* and BPAI decisions is imprecise and unfortunate for future inventors.

Returning now to the fact that physical EM signals have zero mass:[150] what is "mass"? First, "mass" refers to the "rest mass" of an object. Rest mass is the inherent, intrinsic mass of a thing, regardless where it is located (on Earth, on the moon, and so on). Second, mass is "[a] measure of the total amount of material in a body, defined . . . by its gravitational influence on other bodies."[151] Readers are familiar with "mass" from everyday experience: people have a small amount of mass, the Earth has a medium amount of mass, but a very big thing like the sun has huge amount of mass. So, people do not have much gravitational pull on other objects, the Earth has a medium amount of pull on other objects, and the sun has an even bigger amount of pull on other objects like the planets. In this universe, there are few physical objects that may stand alone and still have zero mass. For example, there are things called "gluons" that have zero mass, but they cannot be transmitted and do not appear to exist standalone, but instead remain confined in sub-atomic material. Abstract ideas and data do stand alone, but they are not considered physical. In contrast, real EM signals are physical, may be standalone, like sunlight, and travel around freely, and yet have zero mass.

By arguing the zero-mass concept for matter, the *Nuijten* decision could have created a universal, uniform test of subject-matter eligibility and also justified why software programs, information and other things with zero mass are, in fact, not patentable unless sufficient hardware is also recited in their claim. Previously upheld claims, like Claim 15 in *Nuijten*, contain language referring to some equipment or device that has some non-zero amount of mass. For example, Claim 15 recites a "storage medium"; software program or data claims may recite a monitor screen, computer, or floppy disk;[152] X-rays recite a medical viewing device;[153] and so on. That said, this paper does not advocate using such a recitation of "devices" in patent claims to enable patent-eligibility. This approach is a legal fiction—an artifice to justify why some claims are patentable and others are not. As the dissent in *Nuijten* discussed, this approach seems irrational because the actual invention is the software or encoded signal itself, and not the

[149] *In re* Nuijten, 500 F.3d 1346, 1356 (Fed. Cir. 2007) ("In essence, *energy* embodying the claimed signal is fleeting and is devoid of any semblance of permanence during transmission." (emphasis added)).

[150] Physical EM signals are distinct from states where light (photons) are field quanta. Such a field quanta state is normally termed "virtual" and not exactly physical. Field quanta are not considered in this paper.

[151] NASA ONLINE DICTIONARY, *supra* note 146 (defining "mass"); *see also* RICHARD WEIDNER, ROBERT SELLS, ELEMENTARY MODERN PHYSICS ch. 12 (3d ed. 1980). However, the Weidner & Sells book lists neutrinos and photons both as having zero mass. Recent experiments show that the neutrinos have a non-zero mass. Photons have zero mass.

[152] *In re* Beauregard, 53 F.3d 1583, 1584 (Fed. Cir. 1995) (vacating the Board of Patent Appeals' initial decision to reject Beauregard's claim, as the Commissioner of Patents and Trademarks had subsequently admitted "computer programs embodied in a tangible medium" for patent (internal quotation marks omitted)).

[153] *In re* Abele, 684 F.2d 902, 903 (Fed. Cir. 1982).

computer or storage medium that contains the invention.[154]

There is a further advantage to invoking zero-mass as a test. The *Nuijten* court could have argued that information, data, holes ("absence of material" or "no physical existence"),[155] etc., have not been considered articles of manufacture because they have zero mass, and that encoded EM signals should not qualify as articles of manufacture, either, unless there is sufficient language in a claim directed to some piece of hardware.

A factor contributing to the scientific issues in *Nuijten* is that, while neither electromagnetic signals nor physics are inherently mysterious, they are not well studied by most people.[156] Understanding EM signals requires at least a reasonable knowledge of modern physics at the quantum mechanics/quantum field level.[157] Unfortunately, only classical and pseudo-modern perspectives of EM signals are generally taught at the introductory college-level courses in physics—even to physics majors—partly because the math skills needed to understand the more advanced material must be developed first.[158] The *Nuijten* opinion alludes to the classical and pseudo-modern wave-particle duality; this understanding is only a less advanced physics major's viewpoint, not a doctorate POSA physicist's viewpoint. Rather, it takes knowledge of quantum mechanics/quantum fields to appreciate EM signals for what they really are. Normally, quantum mechanics is taught in the senior year of a bachelor degree program in physics.[159] There were 5,373 physics bachelor degrees and 1,380 doctoral degrees awarded in 2006.[160] In contrast, there were about 2.44 million total bachelor degrees awarded that same year, and countless more young persons in the U.S. population do not graduate from college at all.[161] In addition, scholastic curricula for other majors do not normally

[154] *Nuijten*, 500 F.3d at 1358–69 (Fed. Cir. 2007) (Linn, J., concurring in part and dissenting in part); *see also supra* Part II.B.

[155] *See* Synthes (USA) v. Smith & Nephew, Inc., 547 F. Supp. 2d 436, 439, 442 (E.D. Pa. 2008) (construing the phrase "lower surface" to exclude screw holes in a patent for "'bone plating systems' for repairing bone fractures" because "it is far from clear how a hole - which is defined by the absence of the material surrounding it - can have a "surface" if it has no physical existence").

[156] *See, e.g.*, Patrick J. Mulvey & Starr Nicholson, *Enrollments and Degrees Report, 2006*, 2008 AIP REP. 1 (Sept. 2008), http://www.aip.org/statistics/trends/reports/ed.pdf (reporting on the number of undergraduate college students who graduate with a physics degree by the American Institute of Physics). Although there is a statistical increase due to the number of foreign students, the overall number remains low compared to increase in the total population of the U.S.

[157] PARK, *supra* note 144, at 26–49.

[158] *See, e.g.*, WEIDNER & SELLS, *supra* note 151, chs. 4–5. Although this book is older, a survey of course descriptions at Columbia University and Caltech in 2009 still indicates that only classical and pseudo-modern physics is taught to second year physics students. *See* Caltech Catalog, http://pr.caltech.edu:16080/catalog/ (last visited Nov. 10, 2009); Columbia College Course Descriptions, http://www.college.columbia.edu/bulletin/depts/physics.php?tab=courses (last visted Nov. 10, 2009).

[159] *See, e.g.*, Columbia College Bulletin, http://www.college.columbia.edu/bulletin/depts/physics.php?tab=ugrad (listing the courses required of a physics major at Columbia University) (last visited Feb. 12, 2009).

[160] Mulvey & Nicholson, *supra* note 156, at 1 (including both "physics" and "applied physics" majors).

[161] KURT J. BAUMAN & JESSICA W. DAVIS, U.S. DEP'T OF COMMERCE, U.S. CENSUS BUREAU, SCHOOL ENROLLMENT IN 2006 5 (2008), http://www.census.gov/prod/2008pubs/p20-559.pdf.

teach modern physics and quantum mechanics.[162] For example, electric engineering programs often do not teach modern physics and the quantum mechanics basis of electromagnetic signals.[163] In sum, many people do *not* have sufficient understanding of electromagnetic signals. And the *Nuijten* opinion seems to reflect this problem.

A further problem hampering *Nuijten*, is that the invention entailed EM signals in the context of a relatively recent technology of encoding the signals using digital signal processing circuits and techniques (DSP processors) in wireless data communications.[164] This topic is generally the purview of a different POSA, the electrical engineer, rather than a physicist. Thus, it is understandable that the *Nuijten* court adopted an electrical engineer's viewpoint. Under an engineer POSA's viewpoint, a signal is usually taken to be "information" or perhaps transmission of information.[165] Information is often just the content, the abstract idea or data, to an electrical engineer, much like the content of a movie to a movie aficionado. But the engineer viewpoint should be set aside for a physicist's viewpoint because inventor Nuijten desired to patent the signal itself. Such a patent claim necessitates analyzing what signals are, rather than what they do, such as convey information.

B. A Physicist's Perspective of Electromagnetic Signals: Tangible Particles

So, what are electromagnetic signals to a physicist? First, the words "electromagnetic signals" and "electromagnetism" are used interchangeably in this paper. The phrase "electromagnetic signals" is often used when the "electromagnetism" is not stationary, but is instead transmitted. Physics textbooks normally have chapters entitled "electromagnetism." A useful function of electromagnetism is that EM signals do indeed convey information. For example, sunlight is an example of electromagnetism, and the particular type of sunlight conveys information about the sun: that it exists, that it comprises certain elements like hydrogen, that it is a particular type of star and not a

---

[162] *See, e.g.*, Columbia University's School of Engineering, http://www.ee.columbia.edu (last visited Feb. 12, 2009); MIT Electric Engineering, http://engineering.mit.edu/education/undergraduate/eecs.php (last visited Feb. 12, 2009).

[163] *See, e.g.*, Columbia University's School of Engineering, http://www.ee.columbia.edu (last visited Feb. 12, 2009); MIT Electric Engineering, http://engineering.mit.edu/education/undergraduate/eecs.php (last visited Feb. 12, 2009).

[164] The big advances in modern DSP's and wireless communications are relatively recent, stemming from the surge in cell phone, pager, etc. usage. Nuijten's patent application has a filing date of December 22, 1997, which is only twelve years ago. WO 99/33266, *supra* note 32, at 1.

[165] Scott Bloebaum, *From Telegraphs to Content Protection: The Evolution of Signals as Patentable Subject Matter Under 35 U.S.C. § 101*, 9 N.C. J.L. & TECH. 243, 253–54 (2008) (arguing the courts have generally held an expansive view of patentable subject matter, but that *Nuijten* is a step backwards). Nevertheless, Bloebaum's definition of signal seems similar to that of the *Nuijten* court, namely, "a signal is a means to accomplish the fundamental human need to communicate or convey *information* to others beyond the range of sight or hearing." *Id.* (emphasis added). Due to his engineering background, Bloebaum concentrated on what a signal does. While this paper agrees that electromagnetic signals do indeed carry information, it is better to concentrate on what constitutes an electromagnetic signal, *what it is* physically, because Claim 14 in the Nuijten patent application attempts to *patent the signal itself*, and not what it does, such as convey information.

planet. If the electromagnetic sunlight arrives on Earth in a spurting pattern, the informational content is that solar flares are occurring on the surface of the sun in a particular way. Thus, even naturally occurring electromagnetism conveys informational content. Unlike sunlight, Nuijten's electromagnetic signals are man-made, produced in a unique way, but they also convey information, the video and mark.

Electromagnetic signals consist of particles that are tangible to human senses when there is a sufficient quantity of the particles. For instance, this is the difference between a sunny day when people see sunlight as opposed to a cloudy day when people do not; there is a much larger quantity of particles reaching the eye on sunny days because the particles are not blocked by clouds. EM signals may be created when charged particles accelerate. Therefore, when electrons, ions, quarks, and non-neutral molecules in a human being's body or in a circuit accelerate, EM signals are generated.

Electromagnetic signals consist of particles, but these particles are in particular "states"—as described by quantum mechanics. Like other things in the universe, EM signals are particles whose precise state of position, energy, and other characteristics are generally not known at a precise time point. There are an infinite number of states called "quantum states." Humans can perform a calculation and reasonably predict the quantum state for the particles. The basis for the calculation is called a wave function (equation), resulting in a probability predicting the "state" of a particle being in a particular state, say, having a particular amount of energy. The word "wave function" is not to be confused with the "wave-particle" duality mentioned in *Nuijten*.[166] A "wave function" is a calculation tool that uses a mathematical equation to predict that the EM particle has some energy, velocity, momentum, etc., at a given location and point in time.[167]

One analogy for a particle in a (quantum) state is a bear in a hibernation state as opposed to an awakened state. The bear behaves very differently in the two states. Humans may reasonably predict what state and behavior a bear is in depending on the time of day, time of year, and location. The bear's behavior is thus "calculated" as a function of the time of year and location.

The fact that EM signals are not classical waves is not discussed in the *Nuijten* opinion. Rather the opinion takes the opposite view. Having a classical wave viewpoint, the opinion remarks an EM signal is only a "change in electric potential that, to be perceived, must be measured at a certain point in space and time by equipment capable of detecting and interpreting the signal. In essence, energy embodying the claimed signal is fleeting and is devoid of any semblance of permanence during transmission."[168] However, in 1900, Pyotr Levedev proved by experiment that EM signals exert pressure.[169] Then in 1905, a great physicist of modern times, Albert Einstein, revolutionized the view of EM signals by proposing the particle concept in order to

[166] *In re* Nuijten, 500 F.3d 1346, 1357 n.8 (Fed. Cir. 2007).

[167] It is in this sense that EM particles "occupy space"—which is one definition given to "matter." Dictionary.com, *supra* note 5 (entry for "matter"). *See supra* Part IV.A.

[168] *Nuijten*, 500 F.3d at 1356.

[169] Tang, *supra* note 141.

explain such experiments and natural phenomena.[170] As stated by another great physicist of modern times, Richard Feynman, EM signals consist of particles:

> I want to emphasize that light comes in this form—particles. It is very important to know that light behaves like particles, especially for those of you who have gone to school, where you were probably told something about light behaving like waves. I'm telling you the way it *does* behave—like particles.[171]

Understanding that EM signals are particles makes it intuitively understandable why EM signals are able to exert pressure. Interestingly enough, the greatest physicist of an earlier time, Isaac Newton, also considered EM signals (light) to be comprised of particles (corpuscles). It was only during a brief period of the 1800's that EM signals were considered as being classical waves. And yet this is the concept *Nuijten* adopted.

The EM particle (now, also known as a photon) has many other properties aside from energy, position, and velocity. For example, it has a property called "spin," and is classified as a "boson" based on its spin. It also has a property of zero electric charge. Due to its spin and charge properties, many photons may aggregate and travel together, like sunlight, without repelling one another and falling apart. This "traveling together" gives the EM signal an appearance of a classical wave, with no beginning and no end as perceived by human sight.

Each particle of the EM signal always travels at the speed of light, whether in outer space, in air, or in a material like fiber cable. Contrary to the *Nuijten* statement about traveling only near the speed of light,[172] EM signals always travel at the speed of light in air or material, unless they encounter some other particle such as atoms. Then a signal reacts with the material, "dies," and a different EM signal particle is created. For example, air has many particles—oxygen, nitrogen, unstable charged particles, muons, etc. When air is aggregated together, it forms a cloud or a fog. When EM signals encounter the cloud or fog, they may interact with the cloud and "die." This annihilation and creation causes a delay and makes it appear as if EM particles travel slower in material than at the speed of light.

Similarly, a bear has many properties aside from the state of hibernation or activity. It may be male, female, brown, black, white, ferocious, gentle, and so on. When a bear encounters things such as a house, it may go inside and interact with things in there, and then the bear may not come out.[173]

If an EM signal does not encounter something else, it can travel forever. Contrary

[170] For example, the photoelectric effect and black-body radiation.

[171] RICHARD FEYNMAN, QED: THE STRANGE THEORY OF LIGHT AND MATTER 15 (1985).

[172] *Nuijten*, 500 F.3d at 1357 n.8.

[173] The bear analogy breaks down here. When the bear comes out of the house, it is the same bear. No new bear is created, unlike new EM signals (particles) that are created if the original particles encounter something and interact.

to the *Nuijten* opinion about EM signals being merely "fleeting,"[174] EM signals in fact can last longer than the life of a human being, and travel at the speed of light from distant galaxies to our galaxy. Outer space approximates a vacuum because the objects are spread far apart. Thus, an EM signal may travel great distances without encountering something in outer space. Human exploration of Mars and Pluto produced man-made, long-lived EM signals of planetary images, which were sent back to Earth. Similarly, a bear that encounters no enemies may live a very long time.

By making a quick reference to wave-particle duality,[175] the *Nuijten* opinion creates an inaccurate and misleading impression because it did not put the theory in context. The wave-particle duality is only a calculation tool, for purposes of simplifying the math of predicting the state of the photons.[176] It is wrong to think that EM signals are sometimes waves, and at other times particles. No, they are particles in a particular state. Those states and aggregate property of the particles may make the ensemble appear analogous to classical waves or undulations (e.g., water waves). Similarly, bears standing on their hind legs and waving their paws may make them appear similar to monkeys. But no, they are not sometimes a bear, and other times a monkey. They are bears.

Finally, the issue of tangibility has already been addressed in Part III.B. If there are sufficient quantities of EM signals, they aggregate in particular energy states, are quite visible, and are hot to the touch. Moreover, EM signals exert pressure on objects as predicted by James Clerk Maxwell and proven experimentally by Pyotr Lebedev in 1900; although the pressure is very weak by human standards, EM signals can exert enough force to flip switches on a silicon chip, which can be a vital technology in the near future.[177] For a more familiar example, electric signals in wire have a component with electrons and current, and are especially perceptible as a shock or visible as a spark of light when electrons fly off of the wire. Similarly, bears, too, are tangible. If there are many bears, they are quite visible compared to a lone bear disguised by foliage. They are hot to the touch, exert a large amount of pressure, and have a body temperature comparable to that of humans. And bears may "shock" humans when they do not get food and fly into a rage.

The reason why the modern particle physics and quantum mechanics explanations replaced the wave-particle duality for EM signals (photons) is that the new explanations most comprehensively and consistently described the phenomena of EM signals. EM signals may seem exotic to some people, but, likewise so may hibernation. For example, unlike bears, sharks may even hibernate without taking in oxygen. All these seemingly

[174] *Nuijten*, 500 F.3d at 1356.

[175] *Id.* at 1357 n.8.

[176] It is very difficult to calculate the state of each individual particle and then "sum" together their effects to predict how the particles will behave as an aggregate—such as how the aggregate creates shadows and goes through narrow openings (slits). It is much easier to have a mathematical tool for the aggregate that can simplify the mathematical computation. Using an analogy to waves permits simplifying the computation.

[177] Tang, *supra* note 141, at 47; *see also* Yale Nanodevices Laboratory, *supra* note 141.

strange phenomena are merely a statement that the universe is very diverse. And diverse too are man-made inventions deserving of patents.

C. Man-Made, Encoded Electromagnetic Signals: Article of Manufacture

Building on the above discussion of modern physics and relevant case law, this section now describes why Nuijten's EM signals are consistent with the statutory subject matter category "articles of manufacture." In *Nuijten*, the court stated, "[t]he essence of the dispute between the parties is whether a transitory signal is covered by *any* statutory category."[178] Due to such compartmentalization, however, inventions in fields of modern technology may be penalized regarding patentability if there is only a partial understanding of what the technology really comprises, as is often the case for intricate, leading-edge technology.

Compartmentalization into one of the four categories should not be the only way to determine patent-eligible subject matter because this may lead to situations that do not comport with the intent of the patent system.[179] Some inventions do not get patented due to what may be legal semantics and technicalities. Before 1952, there was an umbrella category, the catch-all category "art," to accommodate any invention of a man-made "thing" which did not fit precisely into a specific category.[180] After 1952, the modern-category "manufacture" is generally considered to be a catch-all category for "products" or "things,"[181] which should also accommodate Nuijten's invention. Nevertheless, modern case law requires identification of specific categories under which an invention qualifies.

Under the "manufacture" category, the only products excluded from this catch-all category are products that are naturally-occurring or are "printed matter."[182] The category even includes information and software, so long as the patent claims recite

---

[178] *Nuijten*, 500 F.3d at 1354 (emphasis added).

[179] *See* Han, *supra* note 125, at 63–64 (suggesting a broader reading of § 101).

[180] *See, e.g.*, Patent Act of 1870, ch. 230, § 24, 16 Stat. 198, 201 (rev. 1952) (current version at 35 U.S.C. § 101 (2006)) ("That any person who has invented or discovered any new and *useful art*, machine, manufacture, or composition of matter . . . [may] obtain a patent therefor." (emphasis added)); Patent Act of 1836, ch. 357, § 6, 5 Stat. 117, 119 (rev. 1870) (noting that "any new and *useful art*, machine, manufacture, or composition of matter" is patent-eligible (emphasis added)); Patent Act of 1793, ch. 11, § 1, 1 Stat. 318, 319 (repealed 1836) (listing the patent-eligible categories as "any new and *useful art*, machine, manufacture or composition of matter" (emphasis added)); Patent Act of 1790, ch. 7, § 1, 1 Stat. 109, 110 (repealed 1793) (noting that an invention or discovery is eligible for patent protection if it is "any *useful art*, manufacture, engine, machine, or device" (emphasis added)); *Corning v. Burden*, 56 U.S. 252, 267–68 (1853) ("A process, *eo nomine*, is not made the subject of a patent in our act of Congress. It is included under the general term 'useful art.' . . . In this use of the term it represents the function of a machine, or the effect produced by it on the material subjected to the action of the machine. But it is well settled that a man cannot have a patent for the function or abstract effect of a machine, but only for the machine which produces it. It is by not distinguishing between the primary and secondary sense of the term 'process,' that the learned judge below appears to have fallen into an error.").

[181] DONALD S. CHISUM, CHISUM ON PATENTS § 1.02 (2008).

[182] *Id.*

sufficient devices or structures.[183] Under this catch-all category, Nuijten's encoded EM signals should constitute an "article of manufacture" since they are man-made, and not merely information, software, or printed matter. The issues are whether Nuijten's EM signals are a) "manufactured," b) "articles," and c) sufficiently similar to the other products that courts have already ruled as being "articles of manufacture."

The easiest issue to address is "manufacture." The Supreme Court adopted a broad, "anything under the sun that is made by man," definition for "manufacture" in *Diamond v. Chakrabarty* where genetically-altered, oil-eating, living microorganisms were held as patentable subject matter.[184] The Court held the microorganisms are either "manufacture[s]" or "composition[s] of matter."[185] The Supreme Court's definition of "manufacture" came from an 1895 dictionary, Century Dictionary, used in the case *American Fruit v. Brogdex Co.*[186] The *Nuijten* court did not dispute that the signals are "manufactured" because "manufactured" means "man-made." The encoded EM signals were not naturally occurring, but were instead manufactured by electronic circuits that were designed and built by Nuijten and his engineering colleagues.[187]

A more difficult issue to address is "articles." The *Nuijten* court defined "article" as "a particular substance or commodity: as, an *article* of merchandise; an *article* of clothing; salt is a necessary *article*."[188]

Not only did the *Nuijten* court reject the EM signals as "articles" of manufacture, the court also rejected the signals as constituting tangible "articles."[189] The court stated, "[w]e recognize the wave-particle duality as applied to electromagnetic energy. However, the fact that photons traveling at or near the speed of light behave in some ways like particles does not make them tangible *articles*."[190] Quoting from *Chakrabarty*, the court defined the verb form of "manufacture" as "the production of *articles* for use from raw or prepared materials by giving to these materials new forms, qualities, properties, or combinations, whether by hand-labor or by machinery."[191] The *Nuijten* court emphasized the word "articles" because its contention was that EM signals are not

---

[183] *In re* Beauregard, 53 F.3d 1583, 1584 (Fed. Cir. 1995) (noting the PTO's statement that "computer programs embodied in a tangible medium, such as floppy diskettes, are patentable subject matter under 35 U.S.C. § 101").

[184] Diamond v. Chakrabarty, 447 U.S. 303, 308–10 (1980) ("In choosing such expansive terms as 'manufacture' and 'composition of matter,' modified by the comprehensive 'any,' Congress contemplated that the patent laws should be given wide scope. The relevant legislative history also supports a broad construction.").

[185] *Id.* at 309.

[186] Am. Fruit Growers, Inc. v. Brogdex Co., 283 U.S. 1, 11 (1931) (using the same Century Dictionary to define "manufacture," as "the production of articles for use from raw or prepared materials by giving to these materials new forms, qualities, properties, or combinations, whether by hand-labor or by machinery," or, alternatively, "anything made for use from raw or prepared materials").

[187] WO 99/33266, *supra* note 32.

[188] *In re* Nuijten, 500 F.3d 1346, 1356 (Fed. Cir. 2007) (quoting 1 CENTURY DICTIONARY 326 (William Dwight Whitney ed., 1895)).

[189] *Id.*

[190] *Id.* at 1357 n.8 (emphasis added).

[191] *Id.* at 1356 (quoting Diamond v. Chakrabarty, 447 U.S. 303, 308 (1980)).

"articles."[192] However, the phrases "manufacture" and "articles of manufacture" are used together or interchangeably by the Supreme Court and the CAFC among its various opinions, strongly implying that the focus of the statutory category is on "manufacture," i.e. man-made, and not whether something is a so-called "article."[193]

Nuijten narrowed the Supreme Court's expansive definition of the phrase "article of manufacture" because *Nuijten* took the definition out of context, leaving out the much more expansive description that preceded and followed the definition in *Chakrabarty*. Importantly, the Supreme Court did not provide a definition for the word "article" at all in *Chakrabarty*.

In addition, *Chakrabarty* effectively expanded the concept of "articles" by deciding that a living organism is an "article of manufacture." After providing the definition for "manufacture," the Supreme Court explicitly stated the intent of the patent laws. "In choosing such expansive terms as 'manufacture' and 'composition of matter,' modified by the comprehensive 'any,' Congress plainly contemplated that the patent laws would be given wide scope."[194] The *Chakrabarty* Court ultimately focused on "man-made" rather than "article," stating, "Congress thus recognized that the relevant distinction was not between living and inanimate things, but between products of nature, whether living or not, and human-made inventions."[195] The Supreme Court significantly deemphasized the word "article."

In contrast to *Chakrabarty*, *Nuijten* focused on "article" rather than "manufacture" and provided a narrow definition for "article" ("a particular substance or commodity").[196] However, such a definition may not be consistent with the intent of *Chakrabarty* because a *living* microorganism is not really a substance [197] or

[192] *Id.* ("These definitions address 'articles' of 'manufacture' as being tangible articles or commodities. A transient electric or electro-magnetic transmission does not fit within that definition.").

[193] *See, e.g.*, Am. Fruit Growers, Inc. v. Brogdex Co., 283 U.S. 1, 11–13 (1931) (rejecting oranges impregnated with borax as patent-eligible subject matter because the orange was not manufactured). In *Am. Fruit Growers*, the Court was faced with the question of whether or not "an orange, the rind of which has become impregnated with borax, through immersion in a solution, and thereby rendered resistant to blue mold decay, [is] a *'manufacture,' or manufactured article*, within the meaning of § 31, Title 35, U.S. Code." *Id.* at 11 (emphasis added). *See also* NTP, Inc. v. Research in Motion, Ltd., 418 F.3d 1282, 1322 (Fed. Cir. 2005) (using both "manufacture" and "article of manufacture" in the opinion even when referring to software code—something which is normally not considered an "article"). The Court in *NTP* referred to *Eolas Technologies Inc. v. Microsoft Corp*., 399 F.3d 1325, 1338–41 (Fed. Cir. 2005), which "addressed section 271(f) in the context of a suit for infringement of a claim to an article of manufacture." *NTP*, 418 F.3d at 1322.

[194] Diamond v. Chakrabarty, 447 U.S. 303, 308 (1980).

[195] *Id.* at 313.

[196] *Nuijten*, 500 F.3d at 1356 (quoting 1 CENTURY DICTIONARY 326 (William Dwight Whitney ed., 1895)).

[197] Dictionary.com, *supra* note 5 (defining substance as "1. that of which a thing consists; physical matter or material: form and *substance*. 2. a species of matter of definite chemical composition: a chalky *substance*").

commodity,[198] in the manner of merchandise, clothing, or salt. Thus, a living microorganism may not be an "article" and yet it was held to satisfy the statutory category of an "article of manufacture."

Aside from case law, inserting the word "article" is contrary to the statutes. Even the earliest American patent laws refer only to "any new and useful … manufacture."[199] The word "article" is not used in the Patent Acts or in the modern statute, 35 U.S.C. § 101.[200]

By focusing on "article," the *Nuijten* court created a precedent that will require future courts and litigators to first consider whether a claimed invention is an "article" before addressing whether it is an "article of manufacture." Even if it is now necessary to analyze whether something is an "article," this paper submits that Nuijten's EM signals are consistent with the concept of an "article" as defined by modern dictionaries. In contrast, the *Nuijten* court used an 1895 dictionary[201] to define "article." Given the scientific properties of EM signals, it may be difficult to characterize the signals as a "substance" or "commodity" under the 1895 definition. However, if modern dictionaries were used to provide a definition of "article," EM signals should satisfy the definition. There is no compelling reason to use an 1895 dictionary for "article." If it is even necessary to consider the word "article", then for the purposes of characterizing Nuijten's invention, a modern dictionary seems more appropriate rather than a 1895 dictionary for the definition of "article" given that the patent is recent and the opinion is recent.

BLACK'S LAW DICTIONARY defines "article" as "a particular item or thing."[202] The very first example in the first definition the dictionary gives is "*proprietary article*. A product manufactured under an exclusive right to sell it."[203] This example is pointedly applicable to *Nuijten*; the inventor had a product manufactured, and he desired a patent on Claim 14 in order to obtain exclusive rights protecting the sale of his manufactured product, the encoded EM signal. Importantly, the very first "Patents" definition for "article" in BLACK'S is "A workpiece, product, or thing that is operated on, modified, or changed by a machine or process."[204] This definition is indeed applicable to Nuijten's modified EM signals. The RANDOM HOUSE DICTIONARY defines "article" as "an individual object, member, or portion of a class; an item or particular: an article of food; articles of clothing."[205]

The relevant definitions in MERRIAM-WEBSTER'S ONLINE DICTIONARY are "a

[198] *Id*. (defining commodity as "1. an article of trade or commerce, esp. a product as distinguished from a service").

[199] *See supra* note 180 and accompanying text.

[200] 35 U.S.C. § 101 (2006).

[201] The *Nuijten* court used the same dictionary the Supreme Court relied on (in Am. Fruit Growers, Inc. v. Brogdex Co., 283 U.S. 1 (1931)) for its definition of "manufacture." *Nuijten*, 500 F.3d at 1356 (citing CENTURY DICTIONARY 326 (William Dwight Whitney ed., 1895)).

[202] BLACK'S LAW DICTIONARY, *supra* note 134, at 127.

[203] *Id*.

[204] *Id*.

[205] Dictionary.com, *supra* note 5 (entry for "article," second definition).

member of a class of things; especially: an item of goods <articles of value>" and "a thing or person of a particular and distinctive kind or class <the genuine article>."[206] EM signals are particles, which should satisfy the plain meaning: particles are "items," "objects," or "things." Moreover, the *Nuijten* court characterized the EM signals as "physical and real," a view that is consistent with science.[207] Thus, EM signals are physical and real particles, which arguably should satisfy the definition of an "item," "object," or "thing." In summary, EM signals are "articles"—articles of manufacture.

In addition to satisfying the definition of an "article," the nature of EM signals is consistent with case law that provides examples of what constitutes "articles." In *Breslow*, even transitory and unstable chemical compounds were held to be "articles of manufactures" or "compositions of matter," satisfying 35 U.S.C. § 101 as patent-eligible subject matter.[208] The transitory intermediates were presumed to exist, but since they are so reactive and short lived, the inventor had not been able to isolate the compound.[209] Therefore, something transitory and undetected was still held to be an "article."

Contrary examples include information, ideas, or granted legal rights—which are not considered "articles" or matter according to various courts. In *Microsoft Corp. v. AT&T Corp.*, patent infringement necessitated a showing of physical objects rather than merely information or software in the abstract.[210] A granted right to a monopoly or to a patent is not a physical *article* like the patented music graphaphone itself.[211]

The CAFC also has opinions referencing a "physical article," which provides further guidance and direction on the definition of "article." For example, in *Bayer AG v. Housey Pharmaceuticals*, the court commented that information in the form of research data is not a physical article: "in order for a product to have 'made by a process patented in the United States' it must have been a *physical article* that was 'manufactured,'" holding "that the production of *information* is not covered."[212] In *NTP*, the court held the "transmission of information, like the production of information, does not entail the manufacturing of a physical product."[213] Thus, *NTP* is consistent with *Bayer* and *Microsoft* regarding information not being a physical article. In short, the decisions by

[206] MERRIAM-WEBSTER ONLINE DICTIONARY (2009), http://www.merriam-webster.com/dictionary/article.

[207] *In re* Nuijten, 500 F.3d 1346, 1355 (Fed. Cir. 2007) ("A transitory signal made of electrical or electromagnetic variances is not made of 'parts' or 'devices' in any mechanical sense. While such a signal is physical and real, it does not possess concrete structure . . . .").

[208] *In re* Breslow, 616 F.2d 516, 518, 522 (C.C.P.A. 1980).

[209] *Id.*

[210] Microsoft Corp. v. AT&T Corp., 550 U.S. 437, 447–48 (2007) (holding that objects in the abstract cannot constitute a "component" for purposes of 35 U.S.C. § 271(f)).

[211] Boston Store of Chi. v. Am. Graphophone Co., 246 U.S. 8 (1918) (syllabus) ("Whether or not a patentee, in dealing with his monopoly right to sell, owns or retains title to the *physical article*, is not conclusive as to his intent in disposing of his monopoly right to sell. He may conditionally dispose of the right to sell, even though he had or has no title to the *article* itself." (emphases added) (citing Bement v. Harrow Co., 186 U.S. 70, 88, 91–93 (1902))).

[212] Bayer AG v. Housey Pharms., Inc., 340 F.3d 1367, 1377 (Fed. Cir. 2003) (emphases added).

[213] NTP, Inc. v. Research in Motion, Ltd., 418 F.3d 1282, 1323 (Fed. Cir. 2005).

the various courts held that information, data, ideas, and lack of matter (like a hole) do *not* constitute physical articles.

However, unlike information, data, or abstract software, Nuijten's EM signals are real, physical articles.

The last issue to address is whether EM signals are similar to other products that courts have already ruled as being "articles of manufacture." The *Nuijten* court stated that the "definitions [used by courts] address 'articles' of 'manufacture' as being tangible articles or commodities."[214] Given that "tangibility" is the criterion, the answer is "yes." EM signals have the requisite properties of tangibility and intransience, as described in Parts III and IV.A. In various cases, these properties were required to construe a claimed invention as an "article of manufacture."[215] Humans may readily perceive electromagnetic signals without the need of equipment, contrary to the statements in *Nuijten*. As previously explained, EM signals readily exist for long periods of time, and may be seen (as light in a fiber optical cable),[216] or felt (as electrical signals in a wire) by human beings, unlike the objects in *Breslow* and other cases. Therefore, for legal consistency, Nuijten's EM signals should also qualify as "articles of manufacture."

In summary, given the patent statutes' and the Supreme Court's focus on "man-made," on the catch-all nature of the category of "manufacture," and on physics, encoded EM signals should constitute "articles of manufacture."

D. Man-Made, Encoded Electromagnetic Signals: Composition of Matter

It is more difficult to establish encoded electromagnetic signals as a "composition of matter" under 35 U.S.C. § 101. The issues are whether Nuijten's EM signals are a) "matter" and b) "compositions" of matter.

Regarding the first issue, "matter," it could be difficult to justify EM signals as being "matter" based on science because one definition of "matter" is an object having some mass.[217] Physical EM signals have no mass, i.e., zero mass—implying EM signals are not "matter." In addition, Nuijten himself did not dispute the BPAI's assertion that EM signals were not "matter" in the case before the Federal Circuit.[218] Nuijten did not

[214] *In re* Nuijten, 500 F.3d 1346, 1356 (Fed. Cir. 2007).

[215] *See supra* Part III.

[216] Optic fiber cable is generally coated with a substance so that light does not "leak" out through the side of the cable. If one looks at the ends of the cable, or a cross-section of the cable, one can readily see the transmitted light.

[217] A general dictionary supports this definition. MERRIAM-WEBSTER ONLINE DICTIONARY defines "matter" as "a: the substance of which a physical object is composed; b: material substance that occupies space, has mass, and is composed predominantly of atoms consisting of protons, neutrons, and electrons, that constitutes the observable universe, and that is *interconvertible with energy*." MERRIAM-WEBSTER ONLINE DICTIONARY (2009), http://www.merriam-webster.com/dictionary/matter (emphasis added). The general dictionary differs somewhat from modern physics understanding, but the definition is reasonably accurate.

[218] *Nuijten*, 500 F.3d at 1357.

say EM signals are not matter; rather, Nuijten characterized EM signals as energy.[219] The *Nuijten* court had also accepted the fact that EM signals are a form of energy.[220] If EM signal particles are "energy," then the particles should also constitute a form of "matter" because modern physics equates "matter" and "energy," as described in Part IV.A.

It is arguable that the category "composition of *matter*" accommodates encoded EM signals based on historical reasons. When the category was created in 1793, the word "matter" was comprehensive because it included all physical and real things. There was no scientific understanding then that "matter" is a form of "energy," such that "energy" is even more comprehensive than "matter." For example, in the 1700s, humans thought things like light to be a corpuscle with a body and occupied space,[221] which probably made light corpuscles consistent with "matter." People, then, never even imagined that light might somehow be a subset of "energy." Nowadays, light is more often termed "energy," or "matter with zero mass," or "particles that travel at the speed of light" through the Planck-Einstein equation $E=h\nu$ and $E=mc^2$.[222] As a result, "energy" is more comprehensive than "matter." By equating the two equations for E, light is thus also matter.

As for the second issue, "composition," *Nuijten* adopted the definition from *Chakrabarty*: "'composition of matter' has been construed consistent with its common usage to *include* 'all *compositions* of two or more substances and . . . *all composite articles*, whether they be the results of chemical union, or of mechanical mixture, or whether they be gases, fluids, powders or solids.'"[223] The *Chakrabarty* court held the respondent had *composed* a microorganism that eats oil.[224]

Applying the definition, *Nuijten* held the EM signals are not a "'chemical union,' nor a gas, fluid, powder, or solid," and thus are not "compositions of matter."[225] However, *Nuijten* seemed to have narrowed the definition that the Supreme Court intended. The definition in *Chakrabarty* provided example compositions, but by using the word "*include*," the list of examples is *not* an exclusive, closed list. Rather the list may *include* other compositions. Moreover, "composing" a microorganism does not really satisfy the definition either because genetic engineering is not a "chemical union" or a "mechanical mixture." Genetic engineering entails directly altering the gene sequence and the definition of "composition" may be satisfied only if it was construed broadly. For example, if "composition" meant "created by humans," then the oil-eating

[219] *Ex parte* Nuijten, 84 U.S.P.Q.2d 1335 (B.P.A.I. 2006).

[220] *Nuijten*, 500 F.3d at 1356.

[221] 16 ENCYCLOPAEDIA BRITANNICA 617 (Hugh Chisholm ed., 11th ed. 1911).

[222] The Planck-Einstein equation is the product of the Planck constant "h" and the frequency characteristics associated with a light particle. *See, e.g.*, Robert T. Weidner & Robert L. Sells, ELEMENTARY MODERN PHYSICS 93–101 (3d ed. 1980).

[223] Diamond v. Chakrabarty 447 U.S. 303, 308 (1980) (emphasis added) (citing Shell Development Co. v. Watson, 149 F.Supp. 279, 280 (D.D.C. 1957) (citing A. DELLER, WALKER ON PATENTS § 14 (1st ed. 1937))).

[224] *Id.* at 308–10 (emphasis added).

[225] *Nuijten*, 500 F.3d at 1357.

microorganism would satisfy the definition. Therefore, the Supreme Court in *Chakrabarty* intended a broad definition for "composition of matter." In fact, the Supreme Court stated in relevant part: "in choosing such *expansive* terms as 'manufacture' and '*composition of matter*,' modified by the comprehensive 'any,' Congress plainly contemplated that the patent laws *would be given wide scope*, and the relevant legislative history also supports a broad construction . . . ."[226] Under a broad definition, encoded EM signals should also qualify as a "composition of matter."

In addition, analyzing the very citation the Supreme Court used to define "compositions of matter," WALKER stated: "this class [category] is a very broad one and embraces chemical compounds, mechanical or physical mixtures, alloys and a *great variety of things*."[227] The *Nuitjen* court had characterized the EM signals as being "physical and real," and physics describes the signals as particles. Therefore, EM signal particles are arguably a class member of a "great variety of things."

The category of "composition of matter" continues to expand. Chemical inventions and potions or recipes fell under composition of matter, but then the courts expanded the category to also include molecules and biotechnology (living microorganism) inventions.[228] If anything, the category may now be characterized as moving towards accommodating any *composition* of things.

Nuijten's encoded electromagnetic signals definitely constitute a "composition" by human ingenuity. One way to conceptualize the "composition" is to consider the original input, such as the unadulterated song, as a first electromagnetic signal, then the encoding signal as a second electromagnetic signal, and finally the two EM signals are combined and superimposed on top of each other to yield the watermarked signal. Another way to conceptualize the composition is that the original input electric signal passed through some electronic circuits that added or subtracted electric current and charge in the original input signal, to produce an output, the watermarked signal. This latter view was how Nuijten actually implemented his invention to *compose* the watermarked signal.[229] Thus, Nuijten's encoded EM signals constitute an electrical composition.

Nuijten's encoded EM signals are no less a composition than the undetected *Breslow* substances that were held to qualify as "composition[s] of matter."[230] Nor are encoded EM signals any less a composition than new molecules, which are compositions

---

[226] *Chakrabarty*, 447 U.S. at 308–10 (emphasis added).

[227] A. DELLER, WALKER ON PATENTS 126–27 (2d ed. 1964) (emphasis added); *see also* CHISUM, *supra* note 181, §1.02[2] (quoting A. DELLER, WALKER ON PATENTS 126–27 (2d ed. 1964)).

[228] ADELMAN ET AL., *supra* note 85, at 100–18; *see also* Patent Act of 1793, ch. 11, §§ 1, 3, 1 Stat. 318, 319, 322 (repealed 1836) (adding the sub-category, "composition of matter," which is quite distinct from "devices" because Congress required a patent applicant to actually present his invention to the patent office "sufficient in quantity for the purpose of experiment[ation]").

[229] *See, e.g.*, WO 99/33266, *supra* note 32.

[230] *See supra* Parts III.A, III.B, & IV.C.

or rearrangement of naturally occurring atoms.[231] Nor are the encoded EM signals any less of a composition than new isotopes that qualified as "composition of matter" in two cases of *In re Seaborg*.[232] In the first case, two isotopes of curium, curium 240 and 242, were held patentable, but the isotopes were merely the addition of a few more neutrons to the already existing pile of neutrons in the naturally occurring substance curium, an atomic element.[233] The isotopes were naturally occurring in the universe, just in very rare situations and extremely small quantities such that the "inventor" went ahead and made some himself. Nuijten's composition was considerably more sophisticated and complex than the isotopes. Moreover, the curium isotopes were essentially undetectable because it took an unimaginably long time to produce enough of them to have a tangible amount.[234] In contrast, encoded EM signals are considerably more unnatural, definitely more of a detectable *composition* than the isotopes of curium that were held as patent-eligible.

In summary, Nuijten's encoded EM signals should qualify as either "articles of manufacture" or as "compositions of matter."

V. PROTECTING VALUABLE INVENTIONS: PROPOSED SOLUTIONS

The *Nuijten* decision presently stands as good law, rejecting electromagnetic signals such as radio signals, electric signals, or light, as patent-eligible subjects even if they are encoded and man-made. Therefore, new patent applicants, existing patentees, and patent litigators need solutions to overcome the decision. One solution is new legislation, but this is generally a slow process. Another solution is to improve science and technology education to aid in the understanding of modern inventions such as encoded electromagnetic signals. This too is a slow process. A quick and realistic solution is using claim-drafting techniques as described in Subpart A. Subparts B and C describe solutions for existing patentees involved in litigation and licensing that requires claim construction. Patentees should urge adopting the viewpoint of the *appropriate* POSA (person of ordinary skill in the art) for each individual patent claim. The use of a physicist POSA rather than an engineer POSA could have avoided some of the inaccurate beliefs held in *Nuijten*; EM signals are not merely information, nor intangible, nor unpatentably transitory. Relying on the viewpoint of the correct POSA, it makes sense to borrow from the doctrine of equivalents or inherent function in construing the claims. That is, a court should interpret the law so that the principles underlying the doctrine of equivalents or inherent function apply to make encoded EM signals patent eligible.

---

[231] Schering Corp. v. Gilbert, 153 F.2d 428, 432 (2d Cir. 1946) (holding newly composed molecules to be patentable subject matter).

[232] *See In re* Seaborg, 328 F.2d 993 (C.C.P.A. 1964).

[233] *Id*. at 994. The scale of size is this: humans are made of cells, which are made of chemicals, which are made of molecules, which are made of atoms, which are made of protons, *neutrons* and electrons. Protons and *neutrons* are made of yet smaller objects, quarks and gluons. Gluons, like photons (EM signals) have zero mass, but gluons do not exist as standalone objects in human beings' massive body.

[234] The appellant asserted, uncontested, that "the reactor could have produced no more than one one-thousand-billionth of a gram of curium 242, and this one one-thousand-billionth of a gram would have been distributed throughout forty tons of intensely radioactive uranium reactor fuel. This amount, of an unknown, unconcentrated isotope, if present, would have been undetectable." *Id.*

There are yet more solutions proposed by other authors, such as techniques for the U.S. patent examiners to first focus on whether the claimed invention is "man-made."[235] There are also suggestions to continue to fight for claims drafted in the manner of Nuijten's Claim 14 because it may permit more patent licensing possibilities.[236] In addition, the *Nuijten* court itself wondered whether a design patent for Nuijten's Claim 14 might be a solution.[237]

As for the new legislation approach, courts including the Supreme Court have hinted that the area of modern technology may require Congressional resources and broad powers of investigation and new legislation may be a solution: "If these [computer] programs are to be patentable . . . the technological problems tendered in the many [amicus] briefs before us indicate to us that considered action by the Congress is needed."[238] In addition, the Solicitor who argued for the USPTO in *Nuijten* pointed out that adding a fifth category to the existing statutory subject matter categories could readily incorporate inventions such as signals.[239] However, Congress is unlikely to provide new legislation because the 2009 Patent Reform Act Proposal is much like the rejected 2007 Patent Reform Act Proposal, and it does not include any entries about patent-eligible subject matter.[240] Therefore, a legislative solution is highly unlikely.

---

[235] Han, *supra* note 125, at 64–71. Statutory subject matter is normally a threshold question for patent-eligibility. There are additional criteria of novelty and obviousness over prior inventions. It is unusual that Claims 14 and 15 were not rejected based on some other criteria because they were drafted in very broad and vague language, and were likely anticipated by prior similar inventions. A patent may not be granted on an application if it is not novel according to 35 U.S.C. § 102. For example, if a new invention is described in a claim as a "new chair," then it is very broad and vague because many chairs have been invented before, and a patent would not be issued. But if the claim describes a "chair with a side-arm handle that dispenses ice-cream when a button on the other side-arm is pressed," then it is narrow and specific, and there is probably no prior art. Although Nuijten's actual invention as described in the disclosure is fairly specific and probably novel, the wording of Claim 14 did not provide the details of the encoding and is instead very broad and vague. Many DSP algorithms have feedback, process input signals and add (encode) extra signals onto the input signal in the same manner as stated in Claim 14. Therefore, Claim 14 could have been rejected for reasons other than lacking statutory subject matter, and there would have been no need for the *Nuijten* case. For a discussion of DSP's, see for example, JOHN PROAKIS & DIMITRIS MANOLAKIS, DIGITAL SIGNAL PROCESSING: PRINCIPLES, ALGORITHMS, AND APPLICATIONS 500-738 (3d ed. 1996); RICHARD HIGGINS, DIGITAL SIGNAL PROCESSING IN VLSI 307-624 (1990). Both books pre-date Nuijten's patent application by over a year and provide insight to the state of the art at the time of Nuijten's invention.

[236] Bloebaum, *supra* note 165, at 284–90.

[237] *In re* Nuijten, 500 F.3d 1346, 1357 (Fed. Cir. 2007).

[238] Gottschalk v. Benson, 409 U.S. 63, 73 (1972) (reversing the CCPA's decision, the Supreme Court held the following invention did not constitute patentable subject matter: a method for programming any type of general purpose digital computer to convert binary-coded-decimal numerals into pure binary numerals, such method not being limited to any particular art or technology, to any particular machinery, or to any particular end use); *see also id.* at 73 n.6. Under a laymen's concept and definition of "information" and "signals," this algorithmic invention falls under the category of "information" and digital "signals."

[239] Telephone Interview with Raymond T. Chen, Deputy General Counsel for Intellectual Property Law and Solicitor, Patent and Trademark Office, the Deputy General Counsel for IP Law and Solicitor for the U.S. Patent Office (Dec. 29, 2008).

[240] Patent Reform Act of 2009, H.R. 1260, 111th Cong. (2009); Patent Reform Act of 2009, S. 515, 111th Cong. (2009); Posting of Dennis Crouch to Patently-O, http://www.patentlyo.com/patent/2009/03/patent-reform-act-of-2009.html (Mar. 3, 2009 14:58); *see also*

A. Patent Claim Drafting: The Way Courts Prefer

Strategic claim drafting is a proactive solution that courts often prefer to having to "expand" the interpretation of patent statutes or prior common law.[241] Both the *Nuijten* and *Bilski* opinions pointed out that some types of patent claims related to Nuijten's invention were in fact allowed by the USPTO and the PTO's own BPAI.[242] In *Nuijten*, the *method* claims directed to the encoding procedure were permitted.[243] Regardless, the goal should still be to draft a valid, enforceable *product* claim directed to the signal itself, because for patent licensing purposes, claims to the signal itself are much more protective and lucrative than the method claims. Product claim 14 was rejected. Although Claim 15, which was allowed, was a *product* claim, the subject of the sentence is the "storage medium" and not the "signal" itself—as noted by the *Nuijten* court: "[a] *storage medium having stored thereon a signal* with embedded supplemental data, the signal being encoded …."[244] Thus, Claim 15 is narrower than Claim 14, less protective, and less lucrative. Moreover, the CAFC did not seem to endorse Claim 15 in *Bilski*, and there may be enforceability issues in the future.[245]

Existing patents may provide some clues as how to best to accomplish the claim drafting directed to the signal itself. The USPTO did permit claims directed specifically to a signal itself in the Bruekers-Nuijten Patent 6,157,330 (*see* Part II.B of this paper) and in the Koo patent, Claim 1: "[a]n *electronic reference signal* in a system for minimizing the effects of ghosts occurring during the transmission and reception of a television signal over a communications path, wherein said reference signal is embodied in a processor readable memory . . . ."[246] The format of claim drafting adopted by Koo is preferable over Nuijten's Claim 15 because as noted *supra*, the emphasis of Claim 15 is grammatically unpreferrable, drafted as if the actual invention were the "storage

---

Andrew Noyes, *Senate Patent Reform Redux*, NationalJournal.com, (Jan. 30, 2009), http://techdailydose.nationaljournal.com/2009/01/senate-patent-reform-redux.php.

[241] In 2007, the Federal Circuit was popularizing a claim re-drafting solution for various ills in the patent system. For example, to solve a joint infringement patent litigation problem, the Federal Circuit adopted claim re-drafting. BMC Res., Inc. v. Paymentech, L.P., 498 F.3d 1373, 1381 (Fed. Cir. 2007) (rejecting patent claims under a so-called theory of "joint infringement" because they recite more than one party conducting the steps of the invention). Rather than expand the interpretation of the patent statutes, and permit the concept of "joint infringement," the CAFC wanted patentees to re-draft the claim language in a way as to use a single person's point of view. *Id. See also* Mark A. Lemley et al., *Divided Infringement Claims*, 33 AIPLA Q.J. 255, 271–75 (2005) (proposing unitary claim drafting as a solution).

[242] *Nuijten*, 500 F.3d at 1357; *In re* Bilski, 545 F.3d 943, 951 (Fed. Cir. 2008) ("We note that the PTO did not dispute that the process [method] claims in *Nuijten* were drawn to patent-eligible subject matter under § 101 and allowed those claims.").

[243] *Nuijten*, 500 F.3d at 1350. When a claim describes a method of producing the special signals, then the claim describes the properties of the signals, indirectly.

[244] *Id*. at 1357.

[245] *In re Bilski* mentioned only the method claims for generating Nuijten's EM signals, and not Claim 15. *Bilski*, 545 F.3d at 951. *In re Nuijten* remarked that Claim 15 was not before the court on appeal (for evaluation). *Nuijten*, 500 F.3d at 1357.

[246] U.S. Patent No. 5,568,202 (filed Sept. 22, 1992) (emphasis added).

medium" rather than the encoded signal.[247] While the USPTO permitted product claims such as Claim 15 and Koo Claim 1, it is not clear whether either styles of drafting would yield enforceable claims under the scrutiny of patent litigation or license battles in the courts.

Therefore, it is important to know what claim formats the courts have already accepted for product ("thing") inventions that may be related to encoded EM signals. Because the *Nuijten* court considered "signals" to be comparable to "information," clues to re-drafting Nuijten's Claim 14 should lie in "information" and "software" patent claims that the courts have upheld. As mentioned in the *Nuijten* dissent, for software patents, a *Beauregard*-style[248] of claim drafting is often adopted by patent practitioners even though the exact phraseology of the claim and its exact legal value are uncertain.[249] *In re Beauregard* was merely a court order by the CAFC dismissing a suit because the parties, the USPTO, and Beauregard (IBM), reached an agreement before trial to allow certain patent claims.[250] Thus, the court never ruled on the claim format. Beauregard's computer software product claims were considered to be merely information, or printed matter by the USPTO, but the PTO Commissioner then stated "that computer programs embodied in a tangible medium, such as floppy diskettes, are patentable subject matter under 35 U.S.C. § 101." [251]

Ever since *Beauregard*, the USPTO has generally allowed information or software claims if they include hardware (structural) or electronics incantations such as "a computer usable medium having computer readable program code embodied therein."[252] Even after *Bilski*, which provided dicta about computer software patent claims,[253] the USPTO's own court, the BPAI, has ruled and granted patents with the *Beauregard* style claims.[254]

The *Beauregard* case suggests federal courts may also accept the Koo or *Nuijten* Claim 15 style of drafting for electromagnetic signals, but with a caveat. The location of where to place a magical *Beauregard*-like phrase in a patent claim seems to be an

[247] What constituted the actual invention was of concern to Judge Linn. *Nuijten*, 500 F.3d at 1366 (Linn, J., concurring in part and dissenting in part) (stating that it makes little sense when "deemed abstractions [are patentable] just because those deemed abstractions are stored in a tangible medium, while rejecting the same inventions standing alone").

[248] *In re* Beauregard, 53 F.3d 1583, 1583 (Fed. Cir. 1995).

[249] *Nuijten*, 500 F.3d at 1365–66 (Linn, J., concurring in part and dissenting in part).

[250] *Beauregard*, 53 F.3d at 1583.

[251] *Id.*

[252] Posting of Dennis Crouch to Patently-O, http://www.patentlyo.com/patent/2008/11/post-bilski-bpa.html (Nov. 13, 2008) (upholding *Beauregard* claims, the B.P.A.I., Board of Patent Appeals and Interferences, is the first court to rule on computer software claims after *In re Bilski*).

[253] Per *Bilski*, for software in a method claim, the Federal Circuit desires recitation of a particular computer or how the software may be transformed to, say, a Web page on a screen. *In re* Bilski, 545 F.3d 943, 966 (Fed. Cir. 2008) ("The applicable test to determine whether a claim is drawn to a patent-eligible process under § 101 is the machine-or-transformation test set forth by the Supreme Court and clarified herein.").

[254] *Ex parte* Bo Li, 88 U.S.P.Q.2d (BNA) 1695 (B.P.A.I. 2008). *But see* MPEP, *supra* note 1, § 2106.01.

issue.[255] Beauregard placed his phrase in the body of the claim,[256] although others have placed it in the preamble of the claim.[257] On the other hand, the patent examiner's handbook, the MPEP, notes there exists much controversy with the preamble: sometimes the preamble is not limiting (*Bell Communications Research*); sometimes it is construed "in balance" with the body of the claim (*Pitney Bowes*); and it must always be decided on a case by case basis (*Catalina Mktg. Int'l*).[258] Given all the uncertainty and controversy over the preamble, the conservative thing to do is to draft some claims in each format in a patent application to include both the *Beauregard* and the Koo styles. At the very least, the *Beauregard* style (structural elements in the body of the claim) should be included. Although patent application fees increase by including more claims, the fees are small compared to the attorney prosecution costs.

While the *Beauregard* approach seems to be readily practiced, there is still an issue regarding exactly how much structure or hardware needs to be recited in a claim involving information, software, or *electromagnetic signals*. Providing some answers, *In re Lowry* involved a subject-matter controversy regarding data information and software on a computer; Claim 1 contained a *Beauregard*-like phrase in *both* the preamble and the body of the claim.[259] *Lowry* was a complete decision one year before *Beauregard*, whereas *Beauregard* was only a brief court order dismissing the case without an opinion or dicta.[260] The *Lowry* court held that the claims were directed towards patent-eligible subject matter because "[m]ore than mere abstraction, the *data structures are specific electrical or magnetic structural elements in a memory*. . . . In short, Lowry's data structures are physical entities that provided increased efficiency in computer operation. They are not analogous to printed matter. The Board is not at liberty to ignore such limitations."[261] Aside from giving guidance as to claim format, and the amount of hardware needed to be recited, the *Lowry* decision also provided guidance specific to *electromagnetic signals*. From a POSA physicist's perspective, the meaning of Lowry's claim is this: since the claim encompassed "data . . . electrical or magnetic structural elements in memory"[262] on a computer, it implies electrons stored on a capacitor

[255] MPEP, *supra* note 1, § 2111.02.

[256] U.S. Patent No. 5,710,578 (filed May 9, 1990).

[257] Email from David Taylor, Patent Attorney, Baker Botts, to author (Mar. 10, 2009) (on file with author) ("I only speak from experience working with the examiners on this type of issue. They very often will just ask you to amend the preamble to satisfy any issue they have with section 101. This is pre-Bilski though. I haven't had a 101 issue since Bilski.").

[258] MPEP, *supra* note 1, § 2111.02 (citing Catalina Mktg. Int'l v. Coolsavings.com, Inc., 289 F.3d 801, 808 (Fed. Cir. 2002); Bell Commc'ns Research, Inc. v. Vitalink Commc'ns Corp., 55 F.3d 615, 620 (Fed. Cir. 1995); Pitney Bowes, Inc. v. Hewlett-Packard Co., 182 F.3d 1298, 1305 (Fed. Cir. 1999); and Jansen v. Rexall Sundown, Inc., 342 F.3d 1329, 1333 (Fed. Cir. 2003)).

[259] For the text of Claim 1, see *In re Lowry*, 32 F.3d 1579, 1582 (Fed. Cir. 1994) ("A memory for storing data for access by an application program being executed on a data processing system, comprising: a data structure stored in said memory, said data structure including information resident in a database used by said application program and including a plurality of attribute data objects stored in said memory, each of said attribute data objects containing different information from said database . . . .").

[260] *Id.* at 1579.

[261] *Id.* at 1583–84 (emphasis added).

[262] *Id.*

(memory), and also electrons in motion (magnetism), which inherently and necessarily generate *electromagnetic signals*. A useful additional point to note is that from a POSA electrical engineer's perspective, the existence of the memory and the structure are also inherent to Nuijten's circuit, even though they were not explicitly stated in Claim 14. The implication is that Claim 14 inherently included hardware and structure.

An inventor desiring to claim the electromagnetic signals should argue Lowry's claim necessitated the inherent presence of electromagnetic signals. Thus, it is reasonable to also apply Lowry's technique in claim drafting to claim Nuijten's EM signals. Lowry's product ("thing") claim contained the *Beauregard* element in the body of the claim, and the body of the claim referred back to the preamble of the claim, and there were two instances of the word "structure" and three instances of the word "memory." Therefore, if the *Lowry*-like extra words are strategically added to Claim 14 for the encoded electromagnetic signal, the broad license and litigation value of the claim should generally remain intact because "obvious" and "inherent" clauses do not really limit an invention.[263] That is, the extra words are normally harmless to the claim and they would not limit the scope of the patent coverage. For example, if one claims a new invention "an orange with a green colored peel," then adding the word "spherical" yields the final claim "a spherical orange with a green colored peel." The final scope of the claim is not limited (narrowed) compared to the original one because oranges are spherical anyway.

Such a claim-drafting, proactive solution is obviously available to future patent applicants. However, it may also be available to existing patentees. Reissue patents present a way to correct a defective patent, and reissues are often used to prepare a patent for licensing or for enforcement litigation.[264] Under 37 C.F.R. 1.175(a), a reissue may be filed where an "applicant believes the original patent to be wholly or partly inoperative or invalid by reason of a defective specification . . . stating at least one error being relied upon as the basis for a reissue, and . . . arose without any deceptive intention on the part of the applicant."[265] The additional claims may be drafted in the manner of Koo, *Beauregard*, or *Lowry*. To justify such additional claims, patentees may cite to the new case law, *Nuijten* and *Bilski*, which created a need to "clarify" or "cure" the claim language. Alternatively, a patentee may argue "inherent function" of the technology (see Part II.B) as a way of obtaining new claims without introducing new information into an

[263] As usual, there may be a caveat regarding electromagnetism in that the MPEP states: "When nonfunctional descriptive material [information] is recorded on some computer-readable medium, in a computer or on an electromagnetic carrier signal, it *is not statutory* since no requisite functionality is present to satisfy the practical application requirement. Merely claiming nonfunctional descriptive material, i.e., abstract ideas, stored on a computer-readable medium, in a computer, or on an electromagnetic carrier signal, does not make it statutory." MPEP, *supra* note 1, § 2106.01 (emphasis added). This may not be of concern to the patent-drafting suggestions proposed in this paper because the MPEP instruction is consistent with *Nuijten*: electromagnetic signals carry information but are not patent-eligible. However, despite this admonition in the MPEP, the USPTO examiners do still grant patents to information claims drafted in the *Lowry* or *Beauregard* format.

[264] ADELMAN ET AL., *supra* note 85, at 674–87 (stating that a reissue "presents the most versatile possibility for correction and is often used to prepare a patent for enforcement litigation").

[265] Rules of Practice in Patent Cases, 37 C.F.R. 1.175(a) (2009).

existing patent.[266] Reissues do not permit broadening of claims after the second year a patent is issued. The above drafting technique, however, should not constitute a broadening but instead theoretically narrows the original claims because additional limiting words are added. But, there are risks associated with reissue requests. For example, the patentee loses intervening rights and may not sue during the reissue. Also, the USPTO starts prosecution *ab initio*, and the proceedings are open to the public, including competitors.[267] In addition, a reissue will be part of the prosecution record, and statements made by the inventor may be used to estop him during litigation.[268] Therefore, a reissue with new claims poses legal risks, but there is little risk for inventors filing completely new patent applications.

In summary, drafting claims to include some of the suggested techniques presented *supra* should be a good solution to the *Nuijten* patent-eligibility subject matter problem. *In re Lowry* provides useful guidance in claim drafting because the opinion related electromagnetism to structure that is inherent in inventions like that of Nuijten.

B. Principles of the Doctrine of Equivalents Salvage Encoded Signal Claims

A patent claim may be construed literally or by a textual equivalent to it under the doctrine of equivalents. Such claim construction is conducted during patent infringement litigation, including during or in combination with appeals from a decision of the BPAI.[269] Although the doctrine of equivalents arises in the context of an infringement action nowadays, the concept of equivalents is fundamental logic. As embodied in patent law's doctrine of equivalents, it also has a long history and was partly created by courts rather than by statute. The history is summarized in *Graver*.[270] Equivalents emerged under the Patent Act of 1793, where another patent could not be granted to a second, alleged invention "merely for a change of form" – i.e. because the second invention is equivalent to the first one.[271] As a consequence, the Supreme Court deemed it logically followed that an accused device that was equivalent to the invention arguably infringed the patent.[272] By the same logic, a second consequence should be that if encoded EM signals are tangible, equivalent to tangible objects that are patentable, then encoded EM signals should constitute patent-eligible subject matter as well. Sections III and IV of this

[266] Inherent function is a permitted argument. MPEP, *supra* note 1, § 2163.07(a). Introducing new information is not allowed in a reissue. *Id.* § 1400.

[267] ADELMAN ET AL., *supra* note 85, at 684.

[268] Phillips v. AWH Corp., 415 F.3d 1303, 1311 (Fed. Cir. 2005) (citing TurboCare Div. of Demag Delaval Turbomachinery Corp. v. Gen. Elec. Co., 264 F.3d 1111, 1121 (Fed. Cir. 2001)) (considering the prosecution history to be an accepted mechanism for construing the claims, the Court cited a case which looked at the prosecution history for guidance on "compressed springs"); Merck & Co. v. Teva Pharms. USA, Inc., 347 F.3d 1367, 1371 (Fed. Cir. 2003) (noting that the prosecution history is often considered when determining the definition of claim terms or ordinary usage).

[269] *See, e.g.*, *In re* Self, 671 F.2d 1344, 1346 (C.C.P.A. 1982); *In re* Hacklander, 328 F.2d 937, 939 (C.C.P.A. 1964).

[270] Graver Tank & Mfg. Co. v. Linde Air Prods. Co., 339 U.S. 605, 608 (1950).

[271] *See, e.g.*, Winans v. Adam, 56 U.S. 330, 341 (1854).

[272] *Id*.

paper rely on this equivalency and present arguments why encoded EM signals are merely a change in form of tangible devices. And as such, encoded EM signals should be patentable matter. Even if it is not their current practice, it makes sense in this context that the courts should interpret the law so as to allow the inventor applicant to prevail, especially since it was the courts themselves that created and championed equivalency from the outset. In addition, by applying equivalency in this manner, courts could harmonize how the concept may be applied in both the patent procurement phase, from where it emerged, with the patent litigation phase.[273]

The doctrine recognizes that limitations of language sometimes make it difficult to precisely describe the deserved scope of an invention in words.[274] One of the most frequent uses of the doctrine by the CAFC is to correct "errors" made by applicants.[275] Courts deem it unfair to an inventor if his invention satisfies the statutory criteria, but there are linguistic defects in his patent due to poor claim drafting[276] which "would be to convert the protection of the patent grant into a hollow and useless thing."[277] A recent journal paper shows that, unlike the courts, some patent litigants do not favor the use of the doctrine of equivalents,[278] but the doctrine is necessarily applied if the patent claims are drafted in a "means" format where the exact structure is not sufficiently stated in a claim.[279]

Equivalency has recently been successfully applied during litigation at the CAFC to construe a claim where the format of the language is directed towards an object.[280] Thus, if patents or claims like Claim 14 are rejected or invalidated for not literally stating patent-eligible subject matter, courts should consider using the principles underlying the

[273] This is already true to some extent due to the means-plus-function claim format. *See* 35 U.S.C. § 112 (2006); MPEP, *supra* note 1, § 2183 ("Making a Prima Facie Case of Equivalence").

[274] ADELMAN ET AL., *supra* note 85, at 776–81.

[275] *Id.* at 781 (citing Martin Adelman & Gary Francione, *The Doctrine of Equivalents in Patent Law: Questions that* Pennwalt *Did Not Answer*, 137 U. PA. L. REV. 673 (1989)).

[276] Moreover, inventors rarely have the expertise to properly draft their own patents without input from their attorneys.

[277] Graver Tank & Mfg. Co. v. Linde Air Prods. Co., 339 U.S. 605, 607 (1950) (providing a rationale for the doctrine of equivalents).

[278] *See* John R. Allison & Mark A. Lemley, *The (Unnoticed) Demise of the Doctrine of Equivalents*, 59 STAN. L. REV. 955, 956–57 (2007).

[279] *See, e.g.*, *In re* Alappat, 33 F.3d 1526 (Fed. Cir. 1994); AdvanceMe, Inc. v. Rapidpay, LLC, Nos. 6:05cv424, 6:06cv082, 2006 U.S. Dist. LEXIS 92444, at *6–7 (E.D. Tex. Dec. 21, 2006) ("Where a claim limitation is expressed in 'means plus function' language and does not recite definite structure in support of its function, the limitation is subject to 35 U.S.C. § 112." (internal citation omitted)). Such a claim limitation is to be construed based on the structure "described in the specification and equivalents thereof." *AdvanceMe*, 2006 U.S. Dist. LEXIS 92444, at *7 (internal citation omitted).

[280] Crown Packaging Tech., Inc. v. Rexam Bev. Can Co., 559 F.3d 1308 (Fed. Cir. 2009) (holding that the plaintiffs overcame the opposition's motion for summary judgment of non-infringement by relying on the doctrine of equivalents). "Crown addressed these new arguments in its opposition brief by simply stating that 'the declaration of Crown's expert, Mr. Higham, confirms that there is a genuine issue of material fact as to infringement by equivalents that precludes summary judgment.'" *Id.* at 1315. *See also* Voda v. Cordis Corp., 536 F.3d 1311, 1326–27 (Fed. Cir. 2008) (determining that the doctrine of equivalents was the correct way to construe the claims at issue).

doctrine of equivalents to interpret Claim 14 by its equivalents as understood by the appropriate POSA.

Equivalency is determined in the context of the patent, the prior art, and the particular circumstances of the case: "[e]quivalence, in the patent law, is not the prisoner of a formula and is not an absolute to be considered in a vacuum"; an important factor in the determination is whether persons reasonably skilled in the art would have known of the interchangeability of an ingredient not contained in the patent with one that was.[281] As noted above, the POSA for the electromagnetic signal is a physicist, whereas the POSA for the circuit and other hardware is an electrical engineer.

The concept of "equivalents" is a very old one and was even used in cases involving electromagnetic signals, the *Telephone Cases* of Alexander Graham Bell.[282] It is useful to consider the *Telephone Cases*, not necessarily for their scientific accuracy, but to see how precedent applies the method of linguistic equivalence. In the *Telephone Cases*, the Supreme Court stated that the two following phrases are equivalents, (a) Bell's patent claim (rephrased) and (b) a proposed claim phrase (rephrased):

> (a) I will do this by "method of and apparatus for causing *electrical undulations* similar in form to the vibrations of the air accompanying" such sounds;
>
> (b) We will do this by speaking to a membrane connected with a wire and battery, and thus cause the air vibrations accompanying any sound to be taken up by an *electrical current, and by means of that current to be reproduced*, so as to give to the hearer the same sensation as the original vibrations would have done . . . .[283]

Here, the Court deemed equivalent Bell's claim, which contains reference to *electrical undulations* (phrase a), to a much longer phrase that contains a reference to *electrical current*, and *by means of that current to be reproduced* (phrase b). The "electrical undulations" referred to "electrical waves"—which were considered intangible in the 1800s. The court took the "electrical waves" to be equivalent to "electrical current," which was considered tangible (current was believed to be tangible ever since Benjamin Franklin's experiment with electric shocks from flying kites in the 1700s). Therefore, linguistically, the Supreme Court found something intangible and something tangible to be equivalent. Applying the linguistic methods of the *Telephone Cases* to *Nuijten*, it should be permissible for the courts to classify the supposedly intangible *Nuijten* electromagnetic signals as equivalent to something tangible. For example, Claim

---

[281] *Graver*, 339 U.S. at 609, superceded by statute, 35 U.S.C. § 112 (1952), as recognized in Haney v. Timesavers, Inc., 29 U.S.P.Q.2d (BNA) 1605 (1993). The Supreme Court endorsed *Graver* in *Warner-Jenkinson Co., Inc. v. Hilton Davis Chem. Co.*, 520 U.S. 17, 24–25 (1997)).

[282] The Telephone Cases, 126 U.S. 1, 8 S. Ct. 778, 780, 787–89 (1888) (assessing whether Alexander Graham Bell's patents were invalid and if the prior publications and patents by other telephone "inventors" had phrases and claims equivalent to those of Bell); *see also* Dolly Wu, *Joint Infringement and Internet Software Patents: An Uncertain Future?*, 91 J. PAT. & TRADEMARK OFF. SOC'Y 439, 467 (2009).

[283] *The Telephone Cases*, 126 U.S. 1 (emphasis added); *see also* Wu, *supra* note 282, at 467.

14 may be analogized to some form of a claim that recites some structural hardware device because Claim 14 recites "signal . . . being encoded" (see Part II.B of this paper). Perhaps, a court would permit comparing "signal . . . being encoded" to "a signal . . . in circuits" because the specification references a "circuit" (twelve times) performing the encoding. "A signal in circuits" thus recites hardware. As this example illustrates, the possibility of arguing an equivalent depends heavily on the level of detail and choice of words provided in the patent application.[284]

The technique of applying the doctrine is not free of potential problems, such as prosecution history estoppel at the USPTO—what Nuijten stated or revised when he attempted to obtain a patent.[285] There should be no prosecution estoppel since Nuijten never changed Claim 14 from that in the original application.[286] The technique also requires a delicate balance against importing limitations from the specification and yet also judiciously using the specification to interpret the claims.[287] "The distinction is manageable 'if the . . . focus remains on understanding how a person of ordinary skill in the art would understand the claim terms.'"[288]

The modern day technique of applying the doctrine is based on an elemental analysis of each word in a patent claim. Under the elemental analysis, an insubstantial difference test determines that "[a]n element in the accused device is equivalent to a claim limitation if the only differences between the two are insubstantial."[289] This test has been effectively used in patent litigation cases, including in the grant of patents, such as *In re Hacklander*, and in the reissue of patents combined with infringement, *In re Self*.[290] The insubstantial difference test may be applied also to *Nuijten*.

The court already agreed that the parties, USPTO, and Nuijten, adopted the following interpretation for "signals": a physical but transitory form of signal transmission such as radio broadcasts, electrical signals through a wire, and light pulses through a fiber-optic cable. As is known to a physicist POSA, the three examples are insubstantially different because they are all examples of electromagnetic signals, merely

[284] *See, e.g.*, Phillips v. AWH Corp., 415 F.3d 1303, 1312 (Fed. Cir. 2005) (citing 35 U.S.C. § 112) ("The importance of the specification in claim construction derives from its statutory role. The close kinship between the written description and the claims is enforced by the statutory requirement that the specification describe the claimed invention in 'full, clear, concise, and exact terms.'"); Merck & Co. v. Teva Pharms. USA, Inc., 347 F.3d 1367, 1371 (Fed. Cir. 2003).

[285] Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co., 535 U.S. 722, 732–33 (2002) (determining what was equivalent to a particular element (phrase) of a patent claim in light of prosecution estoppel, the Supreme Court stood behind using the doctrine of equivalents to construe claims).

[286] *In re* Nuijten, 500 F.3d 1346 (Fed. Cir. 2007); WO 99/33266, *supra* note 32. It is presently not possible to see the prosecution history file for Nuijten's U.S. application.

[287] Baldwin Graphic Sys, Inc. v. Siebert, Inc., 512 F.3d 1338, 1345 (Fed. Cir. 2008).

[288] *Id.*

[289] Voda v. Cordis Corp., 536 F.3d 1311, 1326 (Fed. Cir. 2008) (quoting Honeywell Int'l, Inc. v. Hamilton Sundstrand Corp., 370 F.3d 1131, 1139 (Fed. Cir. 2004)).

[290] *In re* Hacklander, 328 F.2d 937, 939 (C.C.P.A. 1964); *In re* Self, 671 F.2d 1344, 1346 (C.C.P.A. 1982). The appellant challenged the Board's position by contending that the interchangeable use of the two terms in the specification and claims of the original patent demonstrated that Self considered them to be equivalent. The claims were rejected on other grounds, under 35 U.S.C. §§ 102, 251. *Id.*

traveling in different medium, air, wire or fiber. The underlying substance has not changed, merely the medium through which the substance traveled has changed. Applying the principles of the doctrine of equivalents to this definition makes the aerial radio broadcasts tangible, just like light in optical fiber, where people can readily perceive and see the light at the ends of the optical fiber. In addition, man-made radio signals exert pressure. Other man-made objects that exert pressure are patent-eligible; thus, as far as tangibility is concerned, man-made radio signals should also be patent-eligible. Therefore, under various ways of applying the principles of the doctrine of equivalents, it is possible to linguistically demonstrate the equivalence of Nuijten Claim 14 to some phrase that is deemed to be patent-eligible subject matter.

C. Inherent Function Salvages Encoded Signal Claims

The inherent function of an invention is a principle that may be considered in construing a patent claim.[291] Something may be implied in the claim even if it is not explicitly stated. For example, it may be intrinsic in the way a bottle is fabricated that hollow ribs would have been formed even if the words "hollow ribs" are not explicit.[292] Or a particular chemical reaction must inherently have gone through a certain phase and created an intermediate substance.[293] Courts and the USPTO have upheld a concept of inherency in inventions in order to read intrinsic function into the claims, and to allow amendments to the patent claim, even where the specification does not state the intrinsic property.[294] "By disclosing in a patent application a device that inherently performs a function or has a property . . . a patent application necessarily discloses that function . . . even though it says nothing explicit concerning it. The application may later be amended to recite the function . . . without introducing prohibited new matter."[295]

[291] *E.g.*, Phillips v. AWH Corp., 415 F.3d 1303, 1325 (Fed. Cir. 2005) (construing the word "baffles" in the claim, the Court stated "[t]hat limitation would be unnecessary if persons of skill in the art understood that the baffles inherently served such a function"). The Court's phrase indicates that the claim language does not necessarily need to expressly recite functions that are inherent.

[292] Continental Can Co. v. Monsanto Co., 948 F.2d 1264, 1268 (Fed. Cir. 1991) (finding a patent in the prior art does not need to explicitly state an inherent element in order for it to anticipate the asserted claim). The "hollow ribs" of a bottle are inherently there based on the way the bottle was made. *Id.* "To serve as an anticipation when the reference is silent about the asserted inherent characteristic, such gap in the reference may be filled with recourse to extrinsic evidence. Such evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill." *Id.*

[293] SmithKline Beecham Corp. v. Apotex Corp., 403 F.3d 1331, 1343–44 (Fed. Cir. 2005) (holding that a prior art patent to an anhydrous form of a compound "inherently" anticipated the claimed hemihydrate form of the compound because practicing the process in the prior art to manufacture the anhydrous compound "inherently results in at least trace amounts of" the claimed hemihydrate even if the prior art did not discuss or recognize the hemihydrate).

[294] *See, e.g.*, *In re* Robertson, 169 F.3d 743, 745 (Fed. Cir. 1999) (reiterating rules from prior cases to evaluate the claimed diaper fasteners). "To establish inherency, the extrinsic evidence 'must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill.' 'Inherency, however, may not be established by probabilities or possibilities.'" *Id.* (quoting *Continental Can*, 948 F.2d at 1268, 1269).

[295] MPEP, *supra* note 1, § 2163.07(a) (citing *In re* Reynolds, 443 F.2d 384, 389 (C.C.P.A. 1971); *In re* Smythe, 480 F.2d 1376, 1384 (C.C.P.A. 1973)).

Applying inherent function to *Nuijten* is to argue the inherent presence of a particular device such as a transmitter or receiver of the signal in order for the uniquely encoded signal to even exist—a fact that is known to a POSA electric engineer who builds cellular phone systems, for example. Alternatively, to a POSA physicist, matter and energy cannot be destroyed or created, only transformed; thus, the specially encoded electromagnetic signal had to have come from somewhere, such as a radio broadcast station. Moreover, the claims are construed in light of the disclosure and the drawings.[296] Thus, it should be considered that the word "circuit" appears twelve times in Nuijten's patent application. A POSA engineer arguably understands the circuit implications of the words "embedded" and "encoding process" in Claim 14. An example argument is provided in Part II.B of this paper. Moreover, the POSA knows that "electromagnetic" or "electric" is inherent to Claim 14 even though the claim only recites "signal" because of all of the references to "circuits" in the application. Through inherency, Claim 14 may be construed in a way that satisfies the requirement of statutory subject matter.

In summary, interpreting the Nuijten signal patent claims through the eyes of a POSA via inherency, or via the doctrine of equivalents, should allow the inventor applicant to argue Claim 14 is directed towards statutory subject matter under 35 U.S.C § 101.

VI. CONCLUSION

Man-made encoded electromagnetic signals should constitute patent-eligible subject matter. Whether it is under the category of "article of manufacture," "composition of matter" or some future category is of no consequence, so long as they are patent-eligible. Patentability of such signals is consistent with legal precendents because EM signals are tangible, are not transitory, and based on plain definition are also articles.

The *Nuijten* decision failed to apply a physicist POSA's viewpoint to interpret the patent claim language and to understand the exact nature of an EM signal. As a result, *Nuijten* created a "hole" in subject matter eligibility, most likely eliminating more than just EM signals because the concepts of "tangibility," "transience," and "energy" were not well defined. Future claims to inventions that possibly fall within the scope of such concepts may be denied a patent as well.

To overcome *Nuijten*, inventors with patent claims to "energy," "transitory," or "intangible" inventions have a few solutions. They may draft their claim language by placing certain words, such as "signals in a circuit," in the preamble and the body of the claims. Another option, absent prosecution history estoppel, is to borrow the principles equivalency from the doctrine of equivalents or inherent function.

Rather than resorting to these litigation and drafting strategies, ultimately, encoded EM signals should simply be granted subject-matter eligibility status. As the

[296] *Phillips*, 415 F.3d at 1312–34.

Supreme Court best put it in *Chakrabarty*: "Mr. Justice Douglas reminded that the inventions most benefiting mankind are those that 'push back the frontiers of chemistry, physics, and the like.' Congress employed broad general language in drafting § 101 precisely because such inventions are often unforeseeable."[297] Although *Chakrabarty* is about an oil-eating bug invention and has nothing to do with EM signals, the opinion then went on to list several revolutionary patented inventions, including the telegraph, telephone, electric lamp, airplane, transistor, neutronic reactor, and laser.[298] With the exception of the airplane, every single one of those inventions related to man-made EM signals. Some of the patentees of those inventions encountered litigation, where each court grappled with the concept of an EM signal. *Nuijten* seems to add more confusion to the subject. Finally, electromagnetism holds a special place in history. Its development coincided with the development of the U.S. patent system, which continually expanded to include ever more man-made inventions.

Man-made, uniquely encoded EM signals are inventive and should be patentable. Every such future invention should not have to contend with patent-eligibility issues merely because the invention may be poorly understood or the underlying the technology a bit mysterious. It seems overdue that an opinion clarify the comprehension of EM signals by adopting the viewpoint of the appropriate POSA, that is, a physicist with a proper understanding of EM signals. With that proper understanding in mind, courts will be able to give EM signals their rightful place in the universe of patent law.

[297] Diamond v. Chakrabarty, 447 U.S. 303, 316 (1980) (quoting Great A. & P. Tea Co. v. Supermarket Corp., 340 U.S. 147, 154 (1950) (Douglas, J., concurring)).

[298] *Id.*

Appendix I. Nuijten Invention: Pictures Worth a Thousand Words

Figures from Nuijten's International patent application WO9933266A2 that is available publicly corresponding to the U.S. patent application. See text and footnotes in Part II.A.

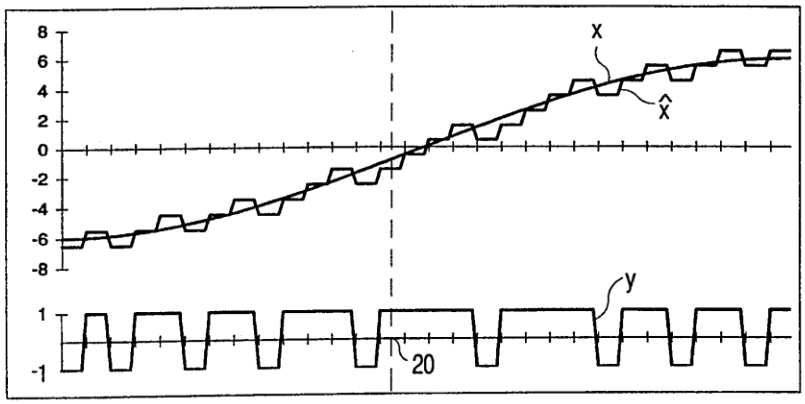

FIG. 2

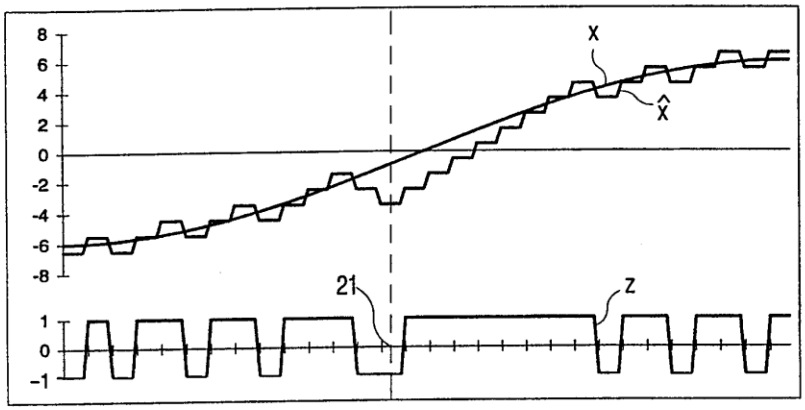

FIG. 3

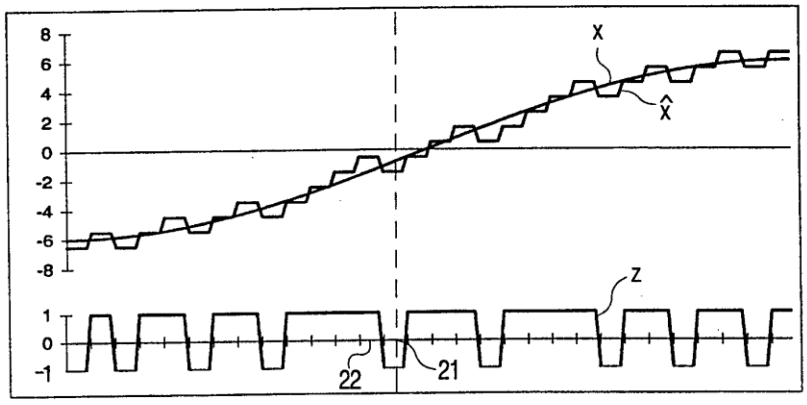

FIG. 4