1. I, John Moring, hereby declare:

2. I have personal knowledge of the facts set forth herein, and if called as a witness in a legal proceeding in the United States, or elsewhere, could and would testify competently thereto. All statements made herein on my personal knowledge are true, and those statements made on information and belief are believed to be true.

3. I have been asked to address and offer opinions on the technology claimed in U.S. Patent No. 9,282,396 ("the '396 patent").

4. I am being compensated at my customary hourly rate for the time spent on developing, forming, and expressing the facts and opinions in this declaration. I have no personal interest in the ultimate outcome of any related proceedings.

I. Expert background

5. I earned my Bachelor of Science degree in Electrical Engineering in 1981 from the University of Cincinnati, with specialization in computers and communications. I earned my Master of Science degree in Electrical Engineering in 1983 from the University of Southern California (as a Hughes Fellow), with specialization in communications and signal processing. I have worked in the field continuously since 1981.

6. In the early 1980s, I developed and simulated algorithms for advanced portable military wireless networks at Hughes Aircraft. In the late 1980s, I developed and fielded Internet hardware and applications for military use while at TRW. In the early 1990s, I developed standards and products for dynamic management of satellite communication systems at Titan Linkabit. In the mid-1990s, I contributed to the first cellular Internet products, and related projects at Pacific Communication Sciences, Inc.

7. Since 1997 I have consulted in the field full time. Projects are too numerous to list, but include working with wireless location technologies from the late 1990s, including designing and overseeing some of the first field trials of handset location technologies (including GPS) for cellular carriers, and contributing to the standards that described operation of that equipment. I have worked a number of projects involving Bluetooth

technology, notably consulting to the Bluetooth Special Interest Group continuously from 2000 through 2007. In this role I supported the qualification and testing efforts and reviewed the specifications released in this period.

8. My current projects include authoring standards for, and otherwise supporting development of, wireless communications for future intelligent highway deployments.

9. I have taught communications courses for the University of Wisconsin-Madison and the University of California-San Diego. I have presented at major technical conferences and contributed to texts in the field. I have thirteen US patents granted in my name, with others pending in the US and internationally. Please see Attachment 1 for a complete CV.

II. Materials considered

10. In the course of developing this declaration, I examined the following materials.

- Appl. No.: 10/027,391 ("2001 application") as originally filed, published as Pub. No. US 2003/0118196 A1 ("the '196 publication")
- Appl. No.: 10/648,012 ("2003 application") as originally filed
- Appl. No.: 13/775,754 as originally filed, issued as U.S. Patent No. 9,282,396 ("the '396 patent")
- Order No. 12 Construing Terms of the Asserted Patents, Inv. No. 337-TA-943, July 24, 2015 ("ITC claim constructions")

III. Level of Ordinary Skill in the Art

11. The order containing the ITC claim constructions includes a ruling that a person of ordinary skill in the art would have a Bachelor of Science degree in electrical engineering or a related field, and around two years of experience in the design or implementation of wireless communications systems, or the equivalent, or six years of experience in the design or implementation of wireless communications systems, or the equivalent. My education and experience levels exceed these criteria, and did so throughout the time of the applications.

Through my career, I have associated with hundreds – perhaps thousands - of engineers meeting these criteria, including co-workers and colleagues, students and clients, and am very familiar with the level of knowledge of those meeting this standard.

IV. Term constructions

12. In my analysis I used the ITC claim constructions for certain terms as stated in Order No. 12:

Term	Construction
"reduced intersymbol interference coding" (cl. 1, 2, 6, 9, 14, 16)	"coding that reduces intersymbol interference"
"configured for independent code division multiple access (CDMA) communication operation" (cl. 1, 2, 6, 9, 14, 16)	"configured for code division multiple access (CDMA) communication operation performed independent of any central control"
"unique user code" / "unique user code bit sequence" (cl. 1, 2, 6, 9, 14, 16)	"fixed code (bit sequence) specifically associated with one user of a device(s)"
"direct conversion module" (cl. 1, 2, 6, 9, 14, 16)	"a module for converting radio frequency to baseband or very near baseband in a single frequency conversion without an intermediate frequency"

V. Technical background

13. In support of the discussions in subsequent sections, here I provide some background on relevant terms and technologies.

V.A. "Direct conversion"

14. A radio system's general purpose is to deliver information from a transmitter to a receiver over the air, using electromagnetic radio-frequency (RF) energy. The transmitter takes the original information (e.g., a digital packet representing text or audio) and overlays it on a radio "carrier" wave at a much higher frequency, a process known as modulation. The resulting modulated radio signal is then sent over the air through the

transmitter antenna. The original information signal, before modulation, is known as a "baseband" signal, since the frequency "band" it occupies is near zero (in units of Hertz, or cycles per second).

15. A radio receiver's general purpose is to convert electromagnetic radio frequency energy, sensed by the receive antenna, into a signal from which the original information can be extracted. In doing so, it must separate the original baseband signal from the RF carrier. There are multiple solutions to achieving this objective. One class of solutions involves multiple stages of conversion ("heterodyne"), where the signal is first transformed to an intermediate frequency (IF), and then to baseband. Another class of solutions is direct conversion ("homodyne"), where no intermediate frequency is used. (Note that in either case, the RF carrier is removed, as the desired information is in the baseband signal.) A design tradeoff between these two approaches is that the direct conversion approach requires less circuitry, but higher precision and therefore more costly components, compared to the multi-stage conversion approach.

16. See Figure 1 through Figure 3 below for illustrations of conversions at the transmitter and the two classes of receiver described. (I produced each of the figures in this declaration to help illustrate the technical topics under discussion.)

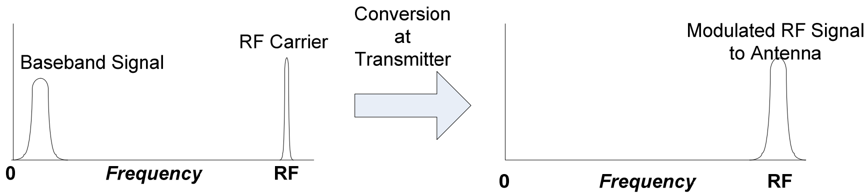

Figure 1: Conversion at the transmitter

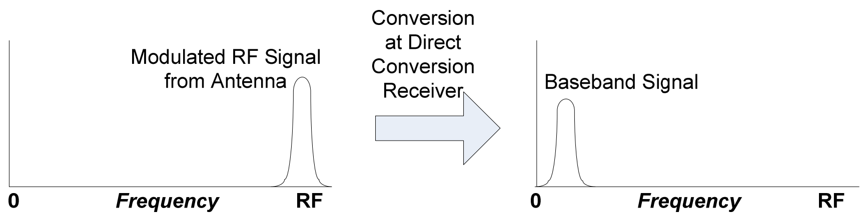

Figure 2: Direct conversion at the receiver

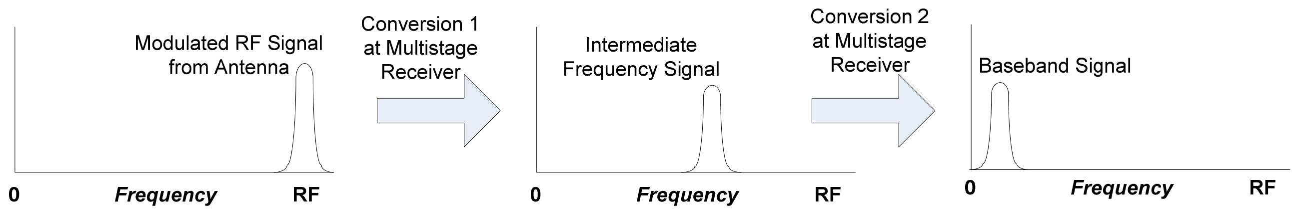

Figure 3: Multi-stage conversion at the receiver

V.B. "Reduced intersymbol interference coding" and "lowering signal detection error through reduced intersymbol interference coding"

V.B.1. Discussion of "intersymbol interference"

17. Intersymbol interference (ISI) refers to a phenomenon where a radio signal interferes with itself, causing problems for the receiver. ("Symbol" refers to one modulation unit in the information-carrying signal, used to represent one or more bits.) One symbol, shifted in time as described below, can interfere with neighboring symbols. A situation where this can occur is when multiple versions of the transmitted signal arrive at the receiver antenna at different times via different paths.

18. Consider the illustrated example in Figure 4 below. Because of blockage, there is no direct path from transmitter T to receiver R. However, the transmitted signal may take two reflected paths, resulting in two versions of the signal, S1 and S2, arriving at the receiver. Because of the path length differences, S2 will arrive slightly later in time than S1. When S1 and S2 arrive at a single receive antenna, the receiver can not easily distinguish between them, as it detects only the sum of the two signals.

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