economic prong of the domestic industry requirement. Finally, One-E-Way has not established that it (and/or a licensee) satisfies the technical prong of the domestic industry requirement.

Fourth Defense: No Unfair Act

9. The Sony Respondents have not committed an unfair act in violation of Section 337.

Fifth Defense: Other Defenses

10. The Sony Respondents are continuing to obtain and review information related to the Patents-in-Suit. As such, the Sony Respondents reserve the right to amend this Response to include other defenses learned of during the course of this Investigation, including but not limited to immunity from a remedial order of Sony consumer electronics for use of the United States, or to be used for the United States with the authorization or consent of the government; indemnity; prosecution laches; estoppel; and/or unenforceability due to breaches of 37 C.F.R. § 1.56 by the named inventor on the Patents-in-Suit and others substantively involved in the prosecution of applications leading to the Patents-in-Suit. The Sony Respondents further reserve the right to rely upon any defenses raised by any other party to this Investigation.

CONCLUSION

WHEREFORE, by reason of the foregoing, the Sony Respondents respectfully request that the Commission:

A. Find that no violation of Section 337 exists by reason of any manufacture, importation, offer for sale, or sale by the Sony Respondents of any Certain Wireless Headsets as described in the Complaint and Notice of Investigation, and terminate the Investigation;

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B. Determine that the Sony Respondents have not imported, sold for importation, or sold within the United States after importation any Certain Wireless Headsets covered by a valid and enforceable asserted claim of the Patents-in-Suit;

C. Find that One-E-Way's demands for relief are barred under Section 337 (d)(1), (f)(1) and (g)(1) because of the relief's effect upon the public health and welfare, competitive conditions in the United States economy, the production of like or directly competitive articles in the United States, and United States consumers;

D. Deny One-E-Way's request for an exclusion order, cease and desist order, bond, and all other relief requested as to the Sony Respondents and/or their accused products;

E. Impose such sanctions upon One-E-Way as deemed appropriate and just, including attorneys' fees; and

F. Award the Sony Respondents such other relief as the Commission deems appropriate based on the facts determined by the authority of the Commission.

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Dated: February 2, 2015

Respectfully submitted,

/s/ Paul T. Qualey
Paul T. Qualey

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Counsel for Respondents Sony Corporation, Sony Corporation of America, and Sony Electronics Inc.

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VERIFICATION

I, M. Ryan Pohlman, in accordance with 19 C.F.R. §§ 210.4 and 210.13 declare as follows. I am Intellectual Property Counsel for Sony Corporation of America. I have been authorized to make this verification on behalf of Respondents Sony Corporation, Sony Corporation of America, and Sony Electronics Inc. (collectively, "the Sony Respondents") in this Investigation. I have reviewed the contents of the *Response of Sony Corporation, Sony Corporation of America, and Sony Electronics Inc. to the Complaint of One-E-Way Under Section 337 of the Tariff Act of 1930, as Amended, and Notice of Investigation* and state that the responses of the Sony Respondents are true to the best of my knowledge, information, and belief after a reasonable inquiry under the circumstances. Although the facts of said responses may not be known to me personally, I know them to be based in whole or in part on information received from others or derived from corporate records.

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct. This Verification is executed at Kenyon & Kenyon, One Broadway, New York, NY 10004-1007.

Date: January 30, 2015 By:

M. Ryan Pohlman
Intellectual Property Counsel
Sony Corporation of America

CONFIDENTIAL EXHIBIT A

REDACTED IN ENTIRETY

EXHIBIT B

U.S. 5,491,839

U.S. 5,668880

U.S. 5,721783

U.S. 5,771441

U.S. 5,781542

U.S. 5,790595

U.S. 5,946343

U.S. 6,115478

U.S. 6,236862

U.S. 6,342844

U.S. 6,418558

U.S. 6,678892

U.S. 6,781977

U.S. 6,982132

U.S. 7,505823

U.S. 2003/0045235

U.S. 2004/0223622

GB 2252013 A

WO/2000076272 A1

WO2001033836 A1

Microsoft Computer Dictionary definition for Code Division Multiplex Access, copyright 2002.

American National Standard for Methods of Measurement of Compatibility Between Wireless Communication Devices and Hearing Aids-ANSI C63. 19-2001.

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A Conferencing Spread Spectrum Radio, KM Lye, TT Tjhung, KC Chua, TC Pek, WH Yung, WP Goh, YP Chia, WK Loh, FL Ma, KM Low, 1994.

Specification of the Bluetooth System, Version 1.0 B, pp. 17-27, 4144, 81-86, 143-147, Nov. 20, 1999.

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CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing **Sony's Response to the Complaint of One-E-Way** were served upon the following parties as indicated on this 2nd day of February, 2015.

Lisa R. Barton, Secretary
U.S. International Trade Commission
500 E Street, S.W., Room 112
Washington, D.C. 20436

☐ Via Hand Delivery
☐ Via Overnight Federal Express Delivery
☐ Via First Class Mail
☐ Via Facsimile
☒ Via Electronic Filing

Honorable Thomas B. Pender
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/s/ Emily J. Murphy
Project Assistant

UNITED STATES INTERNATIONAL TRADE COMMISSION
WASHINGTON, D.C.

Before the Honorable Thomas B. Pender
Administrative Law Judge

In the Matter of	**Inv. No. 337-TA-943**
CERTAIN WIRELESS HEADSETS	

GN NETCOM A/S'S RESPONSE TO THE COMPLAINT AND NOTICE OF INVESTIGATION

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Pursuant to 19 C.F.R. § 210.13, GN Netcom A/S ("GN"), by and through counsel, respectfully submits the following response ("Response") to One-E-Way, Inc.'s ("Complainant") Complaint Under Section 337 of the Tariff Act of 1930, as Amended ("Complaint") and to the Notice of Investigation ("Investigation") issued on January 8, 2015 by the United States International Trade Commission (the "Commission").

GN admits only those facts expressly admitted below and denies all others averred in the Complaint or stated in the Investigation. The Response reflects only the current status of GN's knowledge and belief regarding the subject matter of the allegations. The Response is subject to additional or different information that may be discovered during the course of this Investigation. GN reserves the right to take additional and/or modified positions, or raise additional defenses, after this Response is submitted.

GN provides information pursuant to 19 C.F.R. § 210.13(b) in confidential Exhibit A filed concurrently with this Response.

GN'S RESPONSE TO THE COMPLAINT

I. RESPONSE TO ALLEGATIONS REGARDING INTRODUCTION

1. GN admits that Complainant has requested the Commission to commence an investigation under Section 337 of the Tariff Act of 1930, as Amended, 19 U.S.C. § 1337. GN denies that it has engaged in the unlawful importation into the United States, the sale for importation into the United States, or the sale within the United States after importation of any articles covered by any valid and enforceable claim of U.S. Patent Nos. 7,865,258 ("the '258 Patent") and 8,131,391 ("the '391 Patent") (collectively, the "Patents-in-Suit"). To the extent Paragraph 1 of the Complaint includes any other factual allegations, GN denies them.

2. GN admits that the documents attached to the Complaint as Exhibits 1 and 2 are purported to be certified copies of the Patents-in-Suit. GN is without knowledge or information

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sufficient to form a belief as to the truth of the allegations about One-E-Way's ownership of the Patents-in-Suit in Paragraph 2 of the Complaint and therefore, they are denied. GN admits that the documents attached to the Complaint as Exhibits 3 and 4 are purported to be copies of the assignments of the Patents-in-Suit. GN denies that it has unlawfully imported, sold for importation, and/or sold after importation articles that infringe, directly or indirectly, any claim of the Patents-in-Suit, including claims 3, 4, 8, 10, or 11 of the '258 Patent or claims 1-6, or 10 of the '391 Patent. To the extent Paragraph 2 of the Complaint includes any other factual allegations, GN denies them.

3. GN admits that the Complaint names the following respondents: Sony Corporation, Sony Corporation of America, Sony Electronics, Inc., Sennheiser Electronic GmbH & Co. KG, Sennheiser Electronic Corporation, BlueAnt Wireless Pty, Ltd., BlueAnt Wireless, Inc., Creative Technology Ltd., Creative Labs, Inc., Beats Electronics, LLC, Beats Electronics International Ltd., Jawbone, Inc., and GN Netcom A/S. GN denies that it has engaged in unfair acts in violation of Section 337 through the unlawful importation, sale for importation, and/or sale after importation of certain wireless audio devices covered by one or more claims of the '258 and/or '391 Patents. With respect to the alleged activities of other respondents, GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 3 of the Complaint and therefore, they are denied. To the extent Paragraph 3 of the Complaint includes any other factual allegations, GN denies them.

4. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 4 of the Complaint and therefore, they are denied.

5. GN admits that Complainant seeks exclusion orders pursuant to Section 337(d) and/or cease and desist orders pursuant to Section 337(f). GN denies that its wireless audio

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devices are covered by one or more claims of the Patents-in-Suit. With respect to the alleged wireless audio devices of other respondents, GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 5 of the Complaint and therefore, they are denied. To the extent Paragraph 5 of the Complaint includes any other factual allegations, GN denies them.

II. RESPONSE TO ALLEGATIONS REGARDING COMPLAINANT

6. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 6 of the Complaint and therefore, they are denied.

III. RESPONSE TO ALLEGATIONS REGARDING RESPONDENTS

Response to Allegations Regarding Sony, Sony America and Sony Electronics

7. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 7 of the Complaint and therefore, they are denied.

8. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 8 of the Complaint and therefore, they are denied.

9. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 9 of the Complaint and therefore, they are denied.

10. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 10 of the Complaint and therefore, they are denied.

Response to Allegations Regarding Sennheiser and Sennheiser America

11. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 11 of the Complaint and therefore, they are denied.

12. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 12 of the Complaint and therefore, they are denied.

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13. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 13 of the Complaint and therefore, they are denied.

Response to Allegations Regarding BlueAnt and BlueAnt-US

14. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 14 of the Complaint and therefore, they are denied.

15. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 15 of the Complaint and therefore, they are denied.

Response to Allegations Regarding Creative and Creative Labs

16. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 16 of the Complaint and therefore, they are denied.

17. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 17 of the Complaint and therefore, they are denied.

18. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 18 of the Complaint and therefore, they are denied.

Response to Allegations Regarding Beats and Beats Ireland

19. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 19 of the Complaint and therefore, they are denied.

20. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 20 of the Complaint and therefore, they are denied.

21. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 21 of the Complaint and therefore, they are denied.

Response to Allegations Regarding Jawbone

22. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 22 of the Complaint and therefore, they are denied.

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Response to Allegations Regarding Jabra

23. GN admits that it is organized under the laws of Denmark with a principal place of business at Lautrupbjerg 7, 2750 Ballerup, Denmark. GN admits that it owns the federally-registered trademark JABRA® used on or in connection with GN's goods or services, and that Complainant refers to GN as "Jabra" throughout the Complaint. GN denies that manufactures, markets, sells for importation, imports, and/or sells after importation into the United States products that infringe, directly or indirectly, any claim of the Patents-in-Suit. To the extent Paragraph 23 of the Complaint includes any other factual allegations, GN denies them.

IV. RESPONSE TO ALLEGATIONS REGARDING THE TECHNOLOGIES AND PRODUCTS AT ISSUE

24. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 24 of the Complaint and therefore, they are denied.

V. RESPONSE TO ALLEGATIONS REGARDING THE PATENTS-IN-SUIT

25. GN admits that the '391 Patent states that it issued from U.S. Patent Application No. 12/940,747, and that the '258 Patent states that it issued from U.S. Patent Application No. 12/570,343. GN admits that U.S. Patent Application No. 12/940,747 states that it is a continuation of U.S. Patent Application No. 12/570,343. GN is without knowledge or information sufficient to form a belief as to the truth of the remaining allegations in Paragraph 25 of the Complaint and therefore, they are denied.

A. Response to Allegations Regarding the '258 Patent

Response to Allegations Regarding Identification of the Patent and Ownership by One-E-Way

26. GN admits that the '258 Patent states that its title and issue date are "Wireless Digital Audio System" and January 4, 2011, respectively. GN admits that the '258 Patent states that it has only one inventor, C. Earl Woolfork, and one assignee, Complainant. GN is without

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knowledge or information sufficient to form a belief as to the truth of the remaining allegations in Paragraph 26 of the Complaint and therefore, they are denied.

27. GN admits that the documents attached to the Complaint as Appendices A and B are purported to contain (1) a certified copy and three additional copies of the prosecution history of the '258 Patent, and (2) four copies of each reference document mentioned in the prosecution history. To the extent Paragraph 27 of the Complaint includes any other factual allegations, GN denies them.

Response to Allegations Regarding Non-Technical Description of the Patented Invention

28. The allegations in Paragraph 28 of the Complaint constitute legal conclusions to which no response is required. To the extent that Paragraph 28 of the Complaint contains any factual allegations, GN denies them.

29. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 29 of the Complaint and therefore, they are denied.

B. Response to Allegations Regarding The '391 Patent

Response to Allegations Regarding Identification of the Patent and Ownership by One-E-Way

30. GN admits that the '391 Patent states that its title and issue date are "Wireless Digital Audio System" and March 6, 2012, respectively. GN admits that the '391 Patent states that it has only one inventor, C. Earl Woolfork, and one assignee, Complainant. GN is without knowledge or information sufficient to form a belief as to the truth of the remaining allegations in Paragraph 26 of the Complaint and therefore, they are denied.

31. GN admits that the documents attached to the Complaint as Appendices C and D are purported to contain (1) a certified copy and three additional copies of the prosecution history of the '391 Patent, and (2) four copies of each reference document mentioned in the prosecution

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Samsung Electronics Co., Ltd. et al. v. One-E-Way, Inc.
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history. To the extent Paragraph 31 of the Complaint includes any other factual allegations, GN denies them.

Response to Allegations Regarding Non-Technical Description of the Patented Invention

32. The allegations in Paragraph 32 of the Complaint constitute legal conclusions to which no response is required. To the extent that Paragraph 32 of the Complaint contains any factual allegations, GN denies them.

33. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 33 of the Complaint and therefore, they are denied.

VI. RESPONSE TO ALLEGATIONS REGARDING UNFAIR ACTS OF THE RESPONDENTS

A. Response to Allegations Regarding Sony, Sony America and Sony Electronics

34. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 34 of the Complaint and therefore, they are denied.

35. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 35 of the Complaint and therefore, they are denied.

36. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 36 of the Complaint and therefore, they are denied.

37. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 37 of the Complaint and therefore, they are denied.

38. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 38 of the Complaint and therefore, they are denied.

39. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 39 of the Complaint and therefore, they are denied.

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Samsung Electronics Co., Ltd. et al. v. One-E-Way, Inc.
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40. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 40 of the Complaint and therefore, they are denied.

B. Response to Allegations Regarding Sennheiser and Sennheiser America

41. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 41 of the Complaint and therefore, they are denied.

42. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 42 of the Complaint and therefore, they are denied.

43. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 43 of the Complaint and therefore, they are denied. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 43 of the Complaint and therefore, they are denied.

44. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 44 of the Complaint and therefore, they are denied.

45. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 45 of the Complaint and therefore, they are denied.

46. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 46 of the Complaint and therefore, they are denied.

47. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 47 of the Complaint and therefore, they are denied.

C. Response to Allegations Regarding BlueAnt and BlueAnt-US

48. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 48 of the Complaint and therefore, they are denied.

49. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 49 of the Complaint and therefore, they are denied.

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Samsung Electronics Co., Ltd. et al. v. One-E-Way, Inc.
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50. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 50 of the Complaint and therefore, they are denied.

51. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 51 of the Complaint and therefore, they are denied.

52. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 52 of the Complaint and therefore, they are denied.

53. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 53 of the Complaint and therefore, they are denied.

54. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 54 of the Complaint and therefore, they are denied.

D. Response to Allegations Regarding Creative and Creative Labs

55. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 55 of the Complaint and therefore, they are denied.

56. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 56 of the Complaint and therefore, they are denied.

57. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 57 of the Complaint and therefore, they are denied.

58. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 58 of the Complaint and therefore, they are denied.

59. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 59 of the Complaint and therefore, they are denied.

60. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 60 of the Complaint and therefore, they are denied.

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Samsung Electronics Co., Ltd. et al. v. One-E-Way, Inc.
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61. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 61 of the Complaint and therefore, they are denied.

E. Response to Allegations Regarding Beats and Beats Ireland

62. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 62 of the Complaint and therefore, they are denied.

63. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 63 of the Complaint and therefore, they are denied.

64. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 64 of the Complaint and therefore, they are denied.

65. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 65 of the Complaint and therefore, they are denied.

66. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 66 of the Complaint and therefore, they are denied.

67. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 67 of the Complaint and therefore, they are denied.

68. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 68 of the Complaint and therefore, they are denied.

F. Response to Allegations Regarding Jawbone

69. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 69 of the Complaint and therefore, they are denied.

70. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 70 of the Complaint and therefore, they are denied.

71. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 71 of the Complaint and therefore, they are denied.

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72. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 72 of the Complaint and therefore, they are denied.

73. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 73 of the Complaint and therefore, they are denied.

74. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 74 of the Complaint and therefore, they are denied.

75. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 75 of the Complaint and therefore, they are denied.

G. Response to Allegations Regarding Jabra

76. GN denies the allegations of Paragraph 76 of the Complaint.

77. GN denies the allegations of Paragraph 77 of the Complaint.

78. GN denies the allegations of Paragraph 78 of the Complaint.

79. GN denies the allegations of Paragraph 79 of the Complaint.

80. GN denies the allegations of Paragraph 80 of the Complaint.

81. GN denies the allegations of Paragraph 81 of the Complaint.

82. GN denies the allegations of Paragraph 82 of the Complaint.

VII. RESPONSE TO ALLEGATIONS REGARDING SPECIFIC INSTANCES OF UNFAIR IMPORTATION AND SALE

83. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 83 of the Complaint and therefore, they are denied.

84. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 84 of the Complaint and therefore, they are denied.

85. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 85 of the Complaint and therefore, they are denied.

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86. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 86 of the Complaint and therefore, they are denied.

87. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 87 of the Complaint and therefore, they are denied.

88. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 88 of the Complaint and therefore, they are denied.

89. GN denies the allegations of Paragraph 89 of the Complaint.

VIII. RESPONSE TO ALLEGATIONS REGARDING CLASSIFICATION OF THE INFRINGING PRODUCTS UNDER THE HARMONIZED TARIFF SCHEDULE OF THE UNITED STATES

90. With respect to the classification of products allegedly imported by other respondents, GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 90 of the Complaint and therefore, they are denied. GN admits that Exhibit A contains a list of Harmonized Tariff Schedule classification numbers. To the extent Paragraph 90 of the Complaint includes any other factual allegations, GN denies them.

IX. RESPONSE TO ALLEGATIONS REGARDING RELATED LITIGATION

91. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 91 of the Complaint and therefore, they are denied.

X. RESPONSE TO ALLEGATIONS REGARDING DOMESTIC INDUSTRY

92. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 92 of the Complaint and therefore, they are denied.

A. Response to Allegations Regarding One-E-Way's Development of the Domestic Industry

93. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 93 of the Complaint and therefore, they are denied.

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B. **Response to Allegations Regarding One-E-Way Licensees' Development of the Domestic Industry**

94. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 94 of the Complaint and therefore, they are denied.

95. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 95 of the Complaint and therefore, they are denied.

96. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 96 of the Complaint and therefore, they are denied.

97. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 97 of the Complaint and therefore, they are denied.

98. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 98 of the Complaint and therefore, they are denied.

99. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 99 of the Complaint and therefore, they are denied.

100. GN is without knowledge or information sufficient to form a belief as to the truth of the allegations in Paragraph 100 of the Complaint and therefore, they are denied.

XI. RESPONSE TO ALLEGATIONS REGARDING RELIEF REQUESTED

101. GN denies that Complainant is entitled to any of the relief requested in Paragraph 101 of the Complaint.

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GN'S RESPONSE TO THE NOTICE OF INVESTIGATION

102. GN admits the Investigation has been instituted, and that GN is a named respondent therein. GN otherwise denies the existence of the predicates and requirements for liability under such Investigation and, therefore, denies the allegations in the Notice of Investigation to the extent such allegations exist. Specifically, GN denies that there has been any violation of 19 U.S.C. § 1337 by GN in the importation into the United States, sale for importation, or sale within the United States after importation of certain wireless headsets by reason of infringement of any valid and enforceable claims of the Patents-in-Suit. On information and belief, Complainant has not adequately alleged and cannot prove that a domestic industry exists and/or that such domestic industry is in the process of being established, as is required under § 1337(a)(2) and defined under § 1337(a)(3), in connection with Patents-in-Suit. GN further contends that the asserted claims of the Patents-in-Suit are invalid and/or unenforceable and cannot support any contention of alleged infringement. GN denies that Complainant is entitled to any relief and/or remedies as a result of the Investigation. GN contends that the public interest does not support granting any relief and/or remedies to Complainant.

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GN'S AFFIRMATIVE DEFENSES

FIRST AFFIRMATIVE DEFENSE
(Non-Infringement)

103. GN denies that it (i) infringes or has infringed, either literally or under the doctrine of equivalents, (ii) contributes or has contributed to infringement by others, and/or (iii) induces or has induced others to infringe any valid and enforceable claims of the Patents-in-Suit.

104. GN has not manufactured, imported, sold for importation, or sold within the United States after importation, any product that is covered by any valid and enforceable claim of the Patents-in-Suit.

SECOND AFFIRMATIVE DEFENSE
(Invalidity)

105. On information and belief, and without prejudice to further amendment upon information found during discovery, each asserted claim of the Patents-in-Suit is invalid for failure to meet the requirements set forth in Title 35 of the United States Code, including §§ 101, 102, 103, 112, 115, 116, or 256, or judicially created doctrines of invalidity including, but not limited to, obviousness-type double patenting.

106. For example, the asserted claims of the Patents-in-Suit are invalid under 35 U.S.C. §§ 102 and/or 103 as anticipated by, or obvious in light of, one or more prior art references, either alone or in combination. The prior art references include: (i) the prior art references cited by the examiner and/or disclosed during prosecution of the Patents-in-Suit and the related applications and patents, including the applications and patents to which the Patents-in-Suit claim priority; (ii) the prior-art references listed in Exhibit B to this Response; and (iii) all prior-art references identified by all the other respondents in this Investigation in each of their respective responses to the Complaint, which are incorporated herein by reference.

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107. As another example, the asserted claims of the Patents-in-Suit are invalid for failure to comply with the requirements of 35 U.S.C. § 112 due to lack of written description, failure to particularly point out and distinctly claim the subject matter which is regarded as the alleged invention, and/or failure to set forth a written description sufficient to enable any person skilled in the art to make and use the alleged invention. For instance, the claim term "virtually free from interference," which appears in all asserted claims of the Patents-in-Suit, fails to particularly point out and distinctly claim the subject matter which is regarded as the alleged invention because, among other deficiencies, the phrase does not reasonably apprise one of ordinary skill in the art of the scope of the alleged invention and provides no objective boundaries.

108. The examples listed above are exemplary only and do not limit GN's defenses in this Investigation. GN reserves the right to alter, amend, or supplement this affirmative defense as the Investigation proceeds. GN is in the process of identifying additional relevant prior art, including through discovery, which is in its early stages at the time of this Response. GN reserves the right to rely on additional prior art.

THIRD AFFIRMATIVE DEFENSE
(Prosecution History Estoppel)

109. On information and belief, by reason of the proceedings in the U.S. Patent and Trademark Office ("USPTO") during the prosecution of the applications resulting in the issuance of the Patents-in-Suit, namely, the cancellations, concessions, admissions, representations, and amendments made on behalf of the applicant(s) for the Patents-in-Suit and for related patents and patent applications, Complainant is estopped from extending the coverage of the asserted claims of the Patents-in-Suit, including under the doctrine of equivalents, to cover any allegedly infringing GN product.

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110. For example, during prosecution and in response to prior-art rejections from the USPTO, the applicant(s) represented that the unique code is used to spread and despread the signal spectrum at the transmitter and receiver, respectively. As such, Complainant is estopped from asserting that the unique code encompasses functions or elements that do not spread and/or despread signal spectrum, including without limitation access codes, device addressing, and packet format codes.

111. The examples listed above are exemplary only and do not limit GN's defenses in this Investigation. GN reserves the right to alter, amend, or supplement this affirmative defense as the Investigation proceeds.

FOURTH AFFIRMATIVE DEFENSE
(Lack of Importation)

112. Complainant is barred, in whole or in part, from asserting the Patents-in-Suit against GN products that have never been or are no longer imported into the United States.

113. Complainant is barred, in whole or in part, from obtaining exclusion orders pursuant to Section 337(d) and/or cease and desist orders pursuant to Section 337(f) for GN products that are imported into the United States by third parties.

FIFTH AFFIRMATIVE DEFENSE
(Lack of Unfair Act)

114. GN has not committed any unfair acts defined within 19 U.S.C. 1337(a)(1) and does not make, import into the United States, sell for importation, or sell within the United States any product that infringes any asserted claim of the Patents-in-Suit.

SIXTH AFFIRMATIVE DEFENSE
(Lack of Domestic Industry)

115. On information and belief, Complainant has not adequately alleged and cannot prove: (1) that a domestic industry exists; and/or (2) that such domestic industry is in the process

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of being established, as is required under § 1337(a)(2) and defined under § 1337(a)(3), in connection with Patents-in-Suit. Specifically, on information and belief, and prior to meaningful discovery, Complainant has failed to show it or its licensees practice a valid claim of the Patents-in-Suit or that it or its licensees have made a substantial investment in the exploitation of a valid claim of the Patents-in-Suit, including substantial investments in labor, capital, research, development, design, engineering, product support, or licensing in the United States.

116. Complainant cannot establish that it or its licensees have made "significant investment" in plant, equipment, labor, or capital relating to articles protected by at least one claim of each of the Patents-in-Suit. Complainant cannot establish a "substantial investment" in licensing, research and development, or other qualifying activities relating to the Patents-in-Suit, sufficient to satisfy the economic prong of the domestic industry requirement. Complainant also cannot establish satisfaction of the technical prong of the domestic industry requirement in this Investigation. On information and belief, as no protectable industry exists or is being established in the United States as defined under Section 337 with respect to the Patents-in-Suit, GN reserves the right to assert the lack of domestic industry as a defense.

SEVENTH AFFIRMATIVE DEFENSE
(Unenforceability)

117. On information and belief, Complainant has made claims that are barred in whole or in part by the doctrines of acquiescence, estoppel, waiver, unclean hands, patent exhaustion, patent misuse, and/or other equitable doctrines.

EIGHTH AFFIRMATIVE DEFENSE
(Lack of Ownership and Standing)

118. To the extent that Complainant does not have substantially all the rights or all the rights to the Patents-in-Suit, or to the extent the purported assignments of the Patents-in-Suit are defective for any reason, Complainant lacks standing to bring this action. In particular, on

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information and belief, third parties that are not parties to this Investigation have security and/or other ownership rights in the Patents-in-Suit. Complainant improperly seeks to assert the Patents-in-Suit without joinder of all such third parties who possess such rights.

NINTH AFFIRMATIVE DEFENSE
(Inventorship)

119. To the extent that the alleged inventors did not invent the purported inventions, or to the extent that the actual inventors are not named as inventors, the Patents-in-Suit are unenforceable.

TENTH AFFIRMATIVE DEFENSE
(Prosecution Laches)

120. On information and belief, and prior to meaningful discovery, Complainant's claims are barred in whole or in part pursuant to the doctrine of prosecution laches. Specifically, on information and belief, Complainant unreasonably delayed in filing and prosecution of the applications that later issued as the Patents-in-Suit. For example, the parent application to which the Patents-in-Suit claims the benefit of priority—U.S. Patent Application No. 10/027,391—was filed on December 21, 2001, more than seven years before the either of the applications for the Patents-in-Suit was filed. Additionally, a total of four different patent applications were filed over that seven-plus year period.

121. The examples listed above are exemplary only and do not limit GN's defenses in this Investigation. GN reserves the right to alter, amend, or supplement this affirmative defense as the Investigation proceeds.

ELEVENTH AFFIRMATIVE DEFENSE
(Relief Not in the Public Interest)

122. Complainant demands relief and/or remedies that are barred under 19 U.S.C. § 1337(d)-(f) because the relief and/or remedies Complainant seeks are contrary to the public

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interest, to competitive conditions in the U.S. economy, and to the interests of U.S. consumers. There are strong public policy reasons for denying the relief and/or remedies Complainant seeks.

TWELFTH AFFIRMATIVE DEFENSE
(Other Defenses)

123. GN further reserves the right to amend its Response to include other affirmative defenses that GN may learn of during the course of this Investigation by way of discovery of additional evidence or otherwise.

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PRAYER FOR RELIEF

WHEREFORE, GN requests that the Commission issue an order:

124. Denying all relief requested in the Complaint;

125. Finding that GN has not violated Section 337 of the Tariff Act of 1930, as Amended, 19 U.S.C. § 1337;

126. Finding that GN has not infringed, directly or indirectly, any of the asserted claims of the Patents-in-Suit;

127. Finding that the Patents-in-Suit are invalid for failure to meet the requirements set forth in Title 35 of the United States Code, including §§ 101, 102, 103, 112, 115, 116, or 256, or under judicially created doctrines of invalidity;

128. Finding that there is no domestic industry for the Patents-in-Suit;

129. Awarding GN its attorneys' fees and costs incurred in responding to the Complaint and defending this Investigation;

130. Dismissing the Complaint and terminating the Investigation; and

131. Awarding such other and/or further relief as the Commission deems just and proper.

Dated: February 2, 2015

Respectfully submitted,

HAYNES AND BOONE, LLP

/s/ William B. Nash

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Jason W. Whitney
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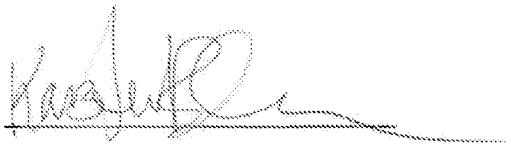
Attorneys for Respondent GN Netcom A/S

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VERIFICATION

I, Karsten Bernholm Sørensen, am Corporate Legal Counsel, Attorney at Law of GN Netcom A/S. I am authorized to make this verification on behalf of GN Netcom A/S. I have read GN Netcom A/S's Response to the Complaint and Notice of Investigation and know its contents. I am informed and believe that the matters stated herein are true, and on that ground only, and not based upon personal knowledge of the matters stated herein, I declare under penalty of perjury that same are true and correct.

Dated: February 2, 2015



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P.O. Box 99
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CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing GN Netcom A/S's Response to the Complaint and Notice of Investigation were served upon the following parties on this 2nd day of February, 2015 in the manner stated below.

/s/ William B. Nash
William B. Nash

Lisa R. Barton, Secretary U.S. International Trade Commission 500 E. Street, S.W., Room 112 Washington, DC 20436	[ ] Via Hand Delivery [X] Via Overnight Delivery (2 copies) [ ] Via E-Mail: [ ] Via First Class Mail [X] Via Electronic Filing - EDIS
The Honorable Thomas B. Pender U.S. International Trade Commission 500 E. Street, S.W., Room 317 Washington, DC 20436	[ ] Via Hand Delivery [X] Via Overnight Delivery (2 copies) [X] Via E-Mail to Attorney Advisor: Gregory.moldafsky@usitc.gov [ ] Via First Class Mail [ ] Via Electronic Filing - EDIS
Vu Bui, Esq. Office of Unfair Import Investigations U.S. International Trade Commission 500 E. Street, S.W., Room 401 Washington, DC 20436	[ ] Via Hand Delivery [ ] Via Overnight Delivery [X] Via E-Mail: vu.bui@usitc.gov [ ] Via First Class Mail [ ] Via Electronic Filing - EDIS
Complainant One-E-Way, Inc. Douglas G. Muehlhauser Knobbe, Martens, Olson & Bear, LLP 2040 Main Street, 14th Floor Irvine, CA 92614	[ ] Via Hand Delivery [ ] Via Overnight Delivery [X] Via E-Mail: 1EWayITC@knobbe.com [ ] Via First Class Mail [ ] Via Electronic Filing - EDIS

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Respondents Sony Corporation, Sony Corporation of America, and Sony Electronics, Inc. Paul T. Qualey Kenyon & Kenyon, LLP 1500 K Street, NW Washington, DC 20005-1257	[ ] Via Hand Delivery [ ] Via Overnight Delivery [X] Via E-Mail: Sony-ITC-943@kenyon.com [ ] Via First Class Mail [ ] Via Electronic Filing - EDIS
Respondent Sennheiser Electronic GmbH & Co. KG, and Sennheiser Electronic Corporation Sean P. DeBruine Kilpatrick Townsend & Stockton, LLP 1080 Marsh Road Menlo Park, CA 94025	[ ] Via Hand Delivery [ ] Via Overnight Delivery [X] Via E-Mail: SennheiserITC@kilpatricktownsend.com [ ] Via First Class Mail [ ] Via Electronic Filing - EDIS
Respondent BlueAnt Wireless Pty. Ltd. and BlueAnt Wireless, Inc. Duane H. Mathiowetz Novak Druce Connolly Bove & Quigg LLP 555 Mission Street, 34th Floor San Francisco, CA 94105	[ ] Via Hand Delivery [X] Via E-Mail: BlueAntITC@novakdruce.com [ ] Via Overnight Delivery [ ] Via First Class Mail [ ] Via Electronic Filing - EDIS
Respondent Creative Labs, Inc.and Creative Technology, Ltd. Jonathan Baker Farney Daniels, P.C. 411 Borel Ave., Suite 350 San Mateo, CA 94402	[ ] Via Hand Delivery [ ] Via Overnight Delivery [X] Via Email: Creative-ITC-943@farneydaniels.com [ ] Via First Class Mail [ ] Via Electronic Filing - EDIS
Respondent Beats Electronics, LLC, and Beats Electronics International Ltd. Celine Jimenez Crowson Hogan Lovells US, LLP 555 Thirteenth Street, NW Washington, DC 20004	[ ] Via Hand Delivery [ ] Via Overnight Delivery [X] Via Email: Beats-OEWCase@hoganlovells.com [ ] Via First Class Mail [ ] Via Electronic Filing - EDIS
Respondent AliphCom d/b/a Jawbone, Inc. Stephen R. Smith Cooley LLP 1299 Pennsylvania Avenue, NW, Suite 700 Washington, DC 20004	[ ] Via Hand Delivery [ ] Via Overnight Delivery [ ] Via First Class Mail [X] Via Email: Stephen.smith@cooley.com [ ] Via Electronic Filing - EDIS

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[redacted]

[redacted] Exhibit A

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[redacted]

UNITED STATES INTERNATIONAL TRADE COMMISSION
WASHINGTON, D.C.

Before the Honorable Thomas B. Pender
Administrative Law Judge

In the Matter of	
CERTAIN WIRELESS HEADSETS	**Inv. No. 337-TA-943**

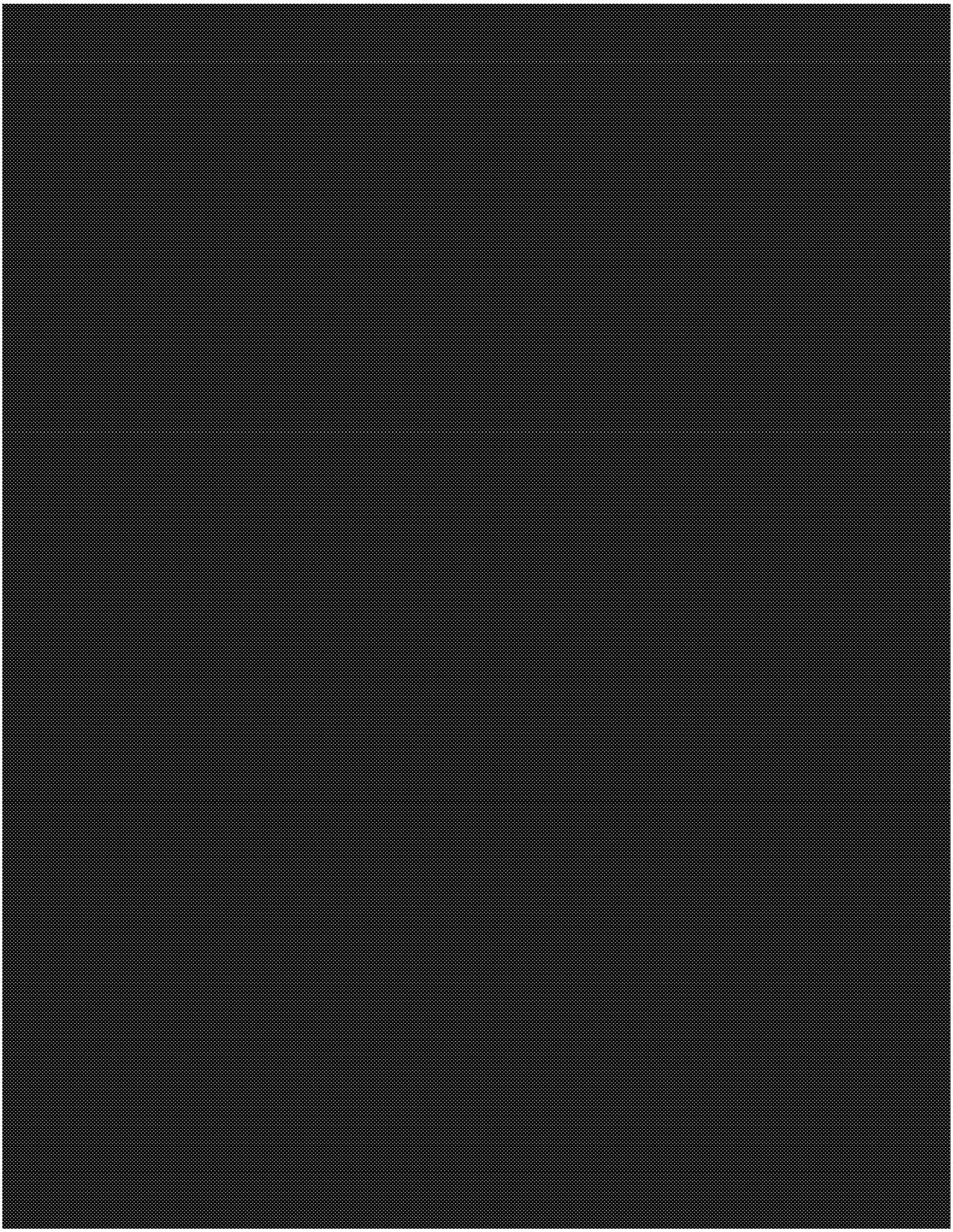
[redacted] **EXHIBIT A TO GN NETCOM A/S'S RESPONSE TO THE COMPLAINT AND NOTICE OF INVESTIGATION**

Pursuant to 19 C.F.R. § 210.13(b), GN Netcom A/S ("GN") provides the following additional information. By providing this information, GN intends only to supply data required by 19 C.F.R. § 210.13(b). GN specifically denies that any of the information or data supplied below relates to or supports any allegations of infringement against GN or any violation of Section 337.

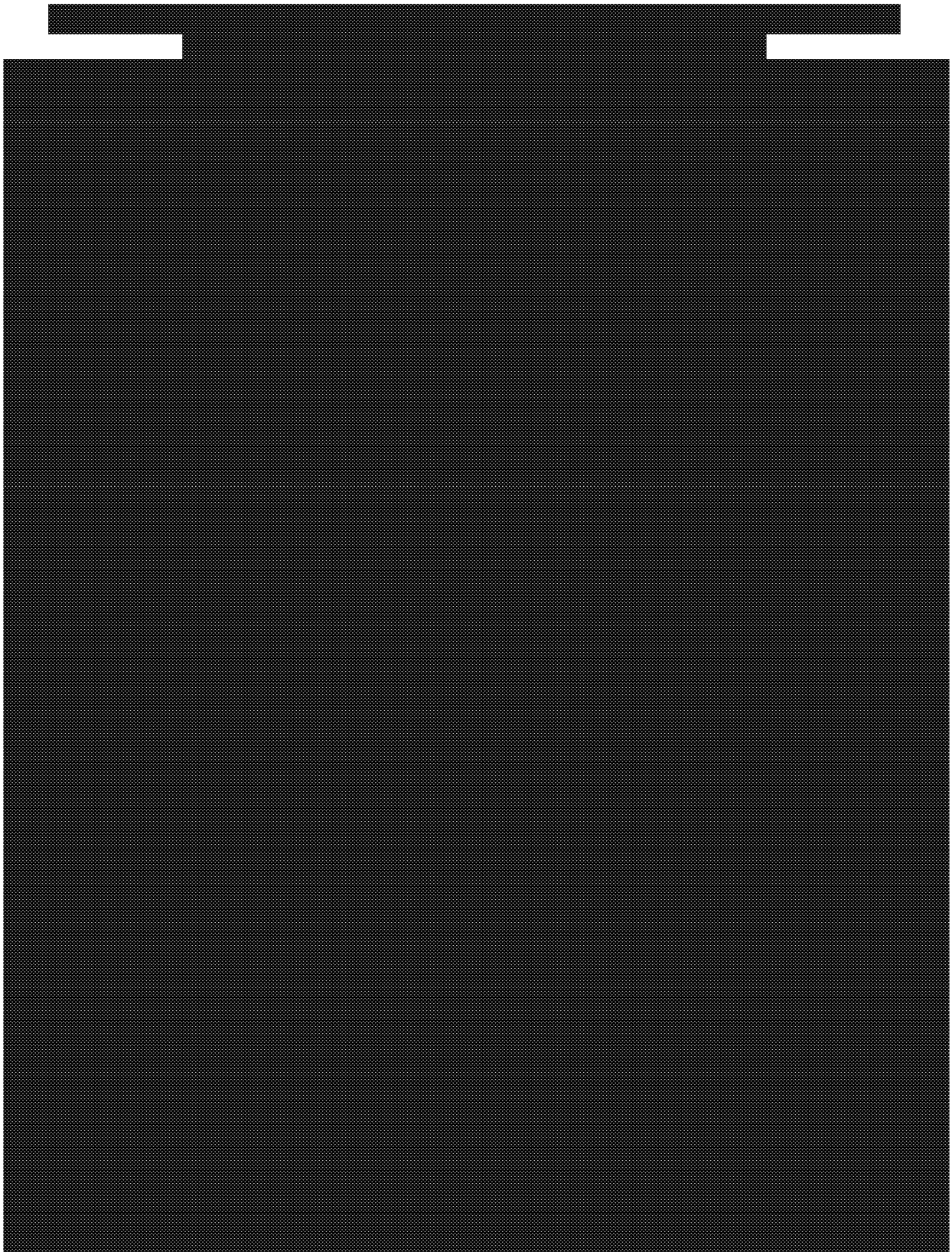
Paragraph 77 of the Complaint Under Section 337 of the Tariff Act of 1930, as Amended ("Complaint") lists allegedly infringing "names and model numbers" purportedly manufactured, marketed, sold for importation, imported, and/or sold alter importation by GN. Based on the list alleged in Paragraph 77 of the Complaint, [redacted]

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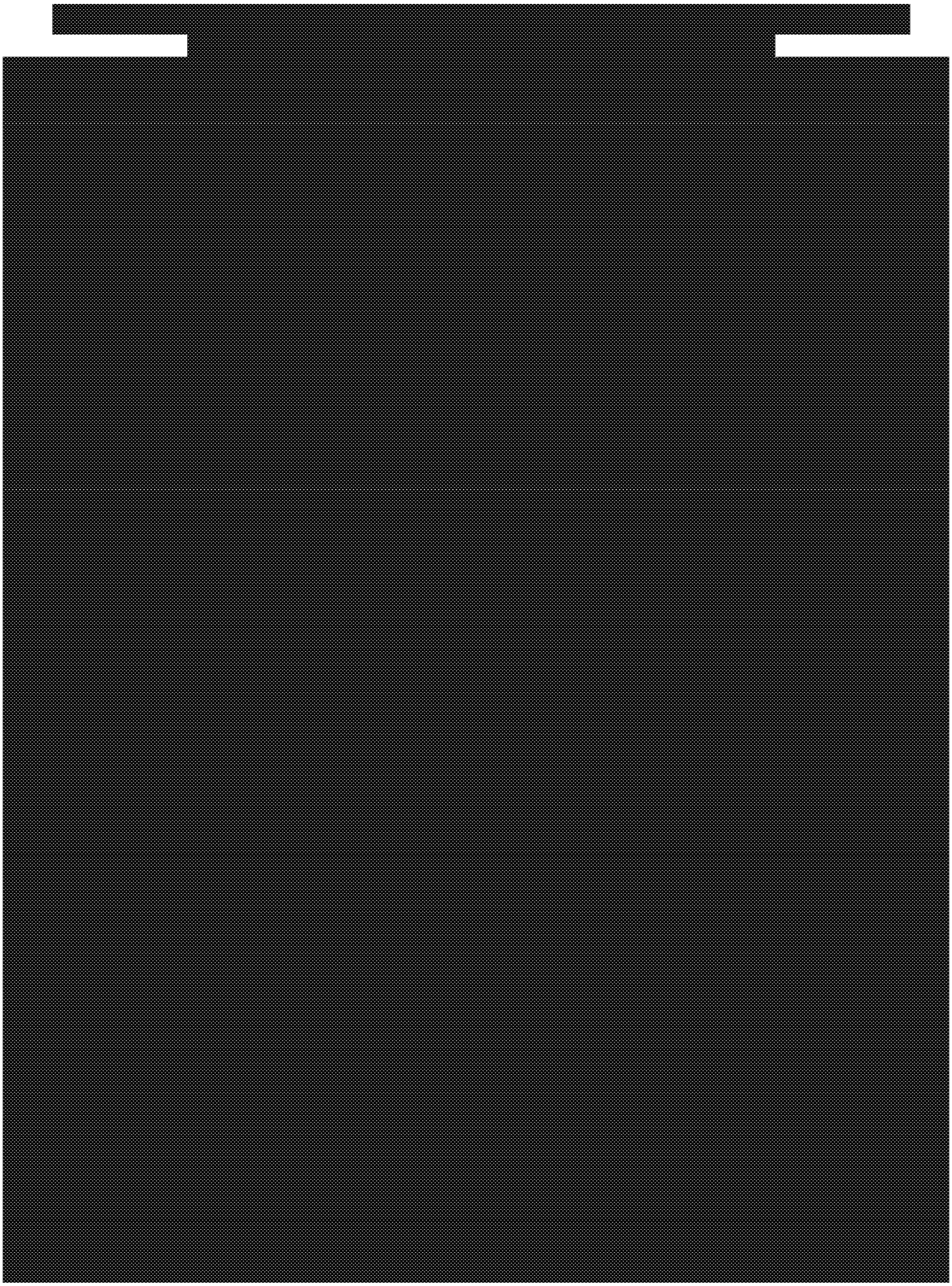
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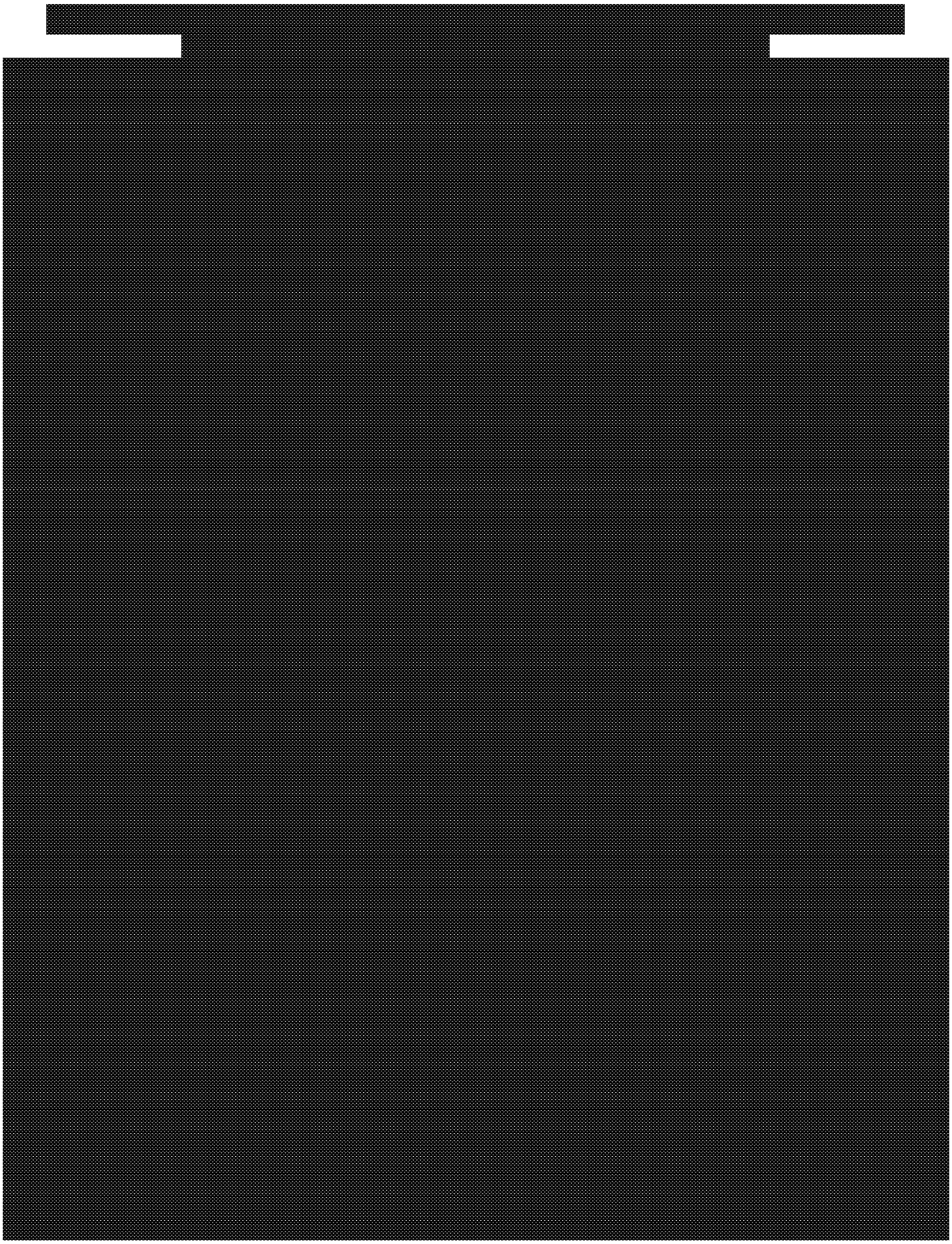
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Exhibit B

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- Jennifer Bray & Charles F. Sturman, Bluetooth: Connect Without Cables (2001)
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Standards and related documents

- Bluetooth v1.0A (1999)
- Bluetooth v1.0B (1999)
- Bluetooth v1.1 (2001)
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- IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs) Submission, LCW HRWPAN Throughput Calculations (27 Oct. 2000)
- IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs) Submission, IEEE802.15 TG3 PHY Sub-Group Conference Call Minutes (24 Dec. 2000)
- IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs) Submission, Supergold Encoding for High Rate WPAN Physical Layer (16 January 2001)
- IEEE P802.15 Wireless Personal Area Networks submission, Adaptive Frequency Hopping ad-hoc group update (May 10, 2001)
- IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs) Submission, Nokia PHY submission to Task Group 4 (2 July 2001)

Other Publications

- Hills, A., "Terrestrial Wireless Networks," Scientific American

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- Hughes, et al., "Spread-Spectrum Radio," Scientific American (April 1998)

Products and related documents

- GN Netcom A/S, GN 9010 / GN 9015 Bluetooth(TM) Headset (B00011)
- Digianswer A/S, Digianswer Bluetooth(TM) Headset (B00012)
- Ericsson Mobile Communications AB, Ericsson Bluetooth Headset (B00057)
- Japan Total Design Communication Co., Ltd., JTDC Headset & Dongle Evaluation Kit (B00128)
- GN Netcom, Bluetooth Wireless Headset (B00374)
- Ericsson Mobile Communications AB, Ericsson Bluetooth Headset (B00392)
- Emkay Innovative Products, Bluetooth Headset (B00420)
- RTX Telecom A/S, MARS 2.4GHz Frequency hopping and Dual slot diversity System
- Motorola's Bluetooth Solution to Interference Rejection and Coexistence with 802.11

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UNITED STATES INTERNATIONAL TRADE COMMISSION
WASHINGTON, D.C.

Before The Honorable Thomas B. Pender
Administrative Law Judge

In the Matter of CERTAIN WIRELESS HEADSETS	**Investigation No. 337-TA-943**

RESPONSE OF RESPONDENTS CREATIVE TECHNOLOGY LTD. AND CREATIVE LABS, INC. TO THE COMPLAINT OF ONE-E-WAY, INC. AND NOTICE OF INVESTIGATION

RESPONDENTS:

Creative Technology Ltd.
31 International Business Park
#03-01, Creative Resource
Singapore 609921
Telephone: +65 6895 4000

Creative Labs, Inc.
1901 McCarthy Boulevard
Milpitas, CA 95035
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Pursuant to Commission Rule 210.13, 19 C.F.R § 210.13, Respondents Creative Technology Ltd. ("CTL") and Creative Labs, Inc. ("CLI") (CTL and CLI, collectively, "Creative") hereby respond to the Complaint filed by One-E-Way, Inc. ("One-E-Way" or Complainant") on December 8, 2014, and to the Notice of Investigation issued by the United States International Trade Commission ("Commission") on January 8, 2015. As to the Notice of Investigation, Creative admits that such an investigation exists and that CTL and CLI are named as two of the respondents therein. Creative otherwise denies the existence of the predicates and requirements for liability under such investigation, and therefore, denies the allegations in the Notice of Investigation to the extent such allegations exist.

As an initial matter, Creative denies that it has engaged in unfair competition or violated Section 337 of the Tariff Act of 1930, as amended, by importing, selling for importation, or selling within the United States after importation any device that infringes any valid or enforceable intellectual property right at issue in this investigation. Creative further denies that any patent claims at issue in this investigation are valid or enforceable. Creative further reserves the right to amend or supplement its response based on additional facts or developments that become available or that arise after the filing of this Response. Creative responds to the Complaint by admitting only those facts expressly admitted below and denying all others averred in the Complaint.

For ease of reference, Creative has adopted the headings set forth in the Complaint. To the extent that such headings themselves contain factual or legal characterizations, however, Creative denies such characterizations.

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I. INTRODUCTION

1. Creative admits that One-E-Way has filed the Complaint under Section 337 of the Tariff Act of 1930, as amended, 19 U.S.C. § 1337. Creative denies engaging in unlawful importation into the United States, the unlawful sale for importation and/or the unlawful sale within the United States after importation, of articles covered by valid and enforceable United States patents owned by One-E-Way. Creative denies that the Creative articles cited in the Complaint as being accused are covered by U.S. Patent Nos. 7,865,258 ("the '258 Patent") and 8,131,391 ("the '391 Patent") (collectively, the "Patents-in-Suit"). Creative lacks sufficient knowledge or information to form a belief regarding the remaining allegations in Paragraph 1 and, therefore, denies those allegations.

2. Creative admits that certified copies of the '258 and '391 Patents accompanied the Complaint. Creative denies that the importation, sale for importation, and/or sale after importation of the named Creative products are unlawful or infringe the Asserted Claims. Creative lacks sufficient knowledge or information regarding One-E-Way's alleged ownership of the Patents-in-Suit, and therefore, denies these allegations. Creative lacks sufficient knowledge or information to form a belief regarding the remaining allegations in Paragraph 2 and, therefore, denies those allegations.

3. Creative admits CLI and CTL and the remaining Respondents were identified as Respondents in the Complaint, but denies that Creative has engaged in unfair acts in violation of Section 337 through the unlawful importation, sale for importation, and/or sale after importation of wireless audio devices covered by one or more claims of the '258 and '391 Patents. Creative lacks sufficient knowledge or information to form a belief regarding the remaining allegations in Paragraph 3 and, therefore, denies those allegations.

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4. To the extent Paragraph 4 contains conclusions of law, no response is necessary. To the extent that a response is necessary, Creative denies the allegations and characterizations of Paragraph 4.

5. Creative admits that One-E-Way seeks limited exclusion orders excluding from entry into the United States the Respondents' wireless audio devices allegedly covered by one or more claims of the '258 and/or '391 Patents, but denies that One-E-Way is entitled to any of the requested relief. Creative further admits that One-E-Way seeks cease and desist orders directed to Respondents to halt the importation, marketing, advertising, demonstration, warehousing of inventory for distribution, sale and use of such imported products in the United States, but denies that One-E-Way is entitled to any of the requested relief. Creative also denies that any of its products infringe any valid and enforceable claim of the Patents-in-Suit. Creative denies the remaining allegations and characterizations of Paragraph 5.

II. COMPLAINANT

6. Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 6 and, therefore, denies those allegations.

III. RESPONDENTS

Sony, Sony America and Sony Electronics

7. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 7 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 7 and, therefore, denies those allegations.

8. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 8 is required,

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Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 8 and, therefore, denies those allegations.

9. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 9 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 9 and, therefore, denies those allegations.

10. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 10 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 10 and, therefore, denies those allegations.

Sennheiser and Sennheiser America

11. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 11 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 11 and, therefore, denies those allegations.

12. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 12 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 12 and, therefore, denies those allegations.

13. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 13 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 13 and, therefore, denies those allegations.

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BlueAnt and BlueAnt-US

14. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 14 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 14 and, therefore, denies those allegations.

15. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 15 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 15 and, therefore, denies those allegations.

Creative and Creative Labs

16. Creative admits that CTL is a corporation organized under the laws of Singapore with its principal place of business at 31 International Business Park, #03-01, Creative Resource, Singapore 609921. Creative denies that CTL manufactures, markets, sells for importation, imports, and/or sells after importation into the United Sates products that directly and/or indirectly infringe the '258 and/or '391 Patents. Creative denies the remaining allegations and characterizations of Paragraph 16.

17. Creative admits that CLI is a corporation organized under the laws of the State of California with its principal place of business at 1901 McCarthy Blvd., Milpitas, California 95035. Creative denies that CLI manufactures, markets, sells for importation, imports, and/or sells after importation into the United States products that directly and/or indirectly infringe the '258 and/or '391 Patents. Creative denies the remaining allegations and characterizations of Paragraph 17.

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18. Creative admits that CTL is the parent entity of CLI and has primary responsibility for the manufacturing of Creative-branded products. Creative admits that CLI has primary responsibility for the marketing and sales of Creative-branded products within the United States. Creative lacks sufficient knowledge or information to form a belief regarding the remaining allegations in Paragraph 18 and, therefore, denies those allegations.

Beats and Beats Ireland

19. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 19 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 19 and, therefore, denies those allegations.

20. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 20 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 20 and, therefore, denies those allegations.

21. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 21 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 21 and, therefore, denies those allegations.

Jawbone

22. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 22 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 22 and, therefore, denies those allegations.

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Jabra

23. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 23 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 23 and, therefore, denies those allegations.

IV. THE TECHNOLOGIES AND PRODUCTS AT ISSUE

24. Creative denies that the accused Creative products practice the '258 and '391 Patents. Creative lacks sufficient knowledge or information to form a belief regarding the remaining allegations in Paragraph 24 and, therefore, denies those allegations.

V. THE PATENTS-IN-SUIT

25. Creative admits that the '391 Patent indicates that it issued from U.S. Patent Application No. 12/940,747, which is a continuation of U.S. Patent Application No. 12/570,343, which issued as the '258 Patent. Creative further admits that the '391 Patent and the '258 Patent purport to claim priority, via a continuation-in-part, to U.S. Patent Application No. 10/027,391, filed on December 21, 2001. Creative lacks sufficient knowledge or information to form a belief regarding the remaining allegations contained in Paragraph 25 and, therefore, denies those allegations.

A. The '258 Patent

Identification of the Patent and Ownership by One-E-Way

26. Creative admits that the face of the '258 Patent indicates it is entitled "Wireless Digital Audio System," was issued on January 4, 2011, and lists C. Earl Woolfork as the sole named inventor. Creative further admits that Exhibit 1 purports to be a certified copy of the '258 Patent. Creative further admits that Exhibit 3 purports to contain materials from the U.S. Patent

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and Trademark Office showing information regarding assignments of the '258 Patent. Creative lacks sufficient knowledge or information to form a belief regarding the remaining allegations contained in Paragraph 26 and, therefore, denies those allegations.

27. To the extent that Paragraph 27 contains conclusions of law, no response is necessary. To the extent that a response is necessary, Creative admits that Appendix A purports to contain a certified copy of the file wrapper for the '258 Patent. Although the Complainant's filing via EDIS does not identify any documents as comprising Appendix B, Creative admits that Complainant appears to have filed via EDIS at least some of the references cited in the prosecution history. Creative lacks sufficient knowledge or information to form a belief regarding the remaining allegations contained in Paragraph 27 and, therefore, denies those allegations.

Non-Technical Description of the Patented Invention

28. To the extent that Paragraph 28 makes any allegations about the scope or construction of the claims of the '258 Patent, such allegations mischaracterize the claims of the '258 Patent, and therefore Creative denies those allegations and characterizations. Creative denies that the description of the '258 Patent in Paragraph 28 is complete or accurate. Creative lacks sufficient knowledge or information to form a belief regarding the remaining allegations contained in Paragraph 28 and, therefore, denies those allegations.

29. To the extent that Paragraph 29 contains conclusions of law, no response is necessary. To the extent that a response is necessary, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 29 and, therefore, denies those allegations.

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B. The '391 Patent

Identification of the Patent and Ownership by One-E-Way

30. Creative admits that the face of the '391 Patent indicates it is entitled "Wireless Digital Audio Music System," was issued on March 6, 2012, is a continuation of the earlier patent application that issued as the '258 Patent, and lists C. Earl Woolfork as the sole named inventor. Creative further admits that Exhibit 2 purports to be a certified copy of the '391 Patent. Creative further admits that Exhibit 4 purports to contain materials from the U.S. Patent and Trademark Office showing information regarding assignments of the '391 Patent. Creative lacks sufficient knowledge or information to form a belief regarding the remaining allegations contained in Paragraph 30 and, therefore, denies those allegations.

31. To the extent that Paragraph 31 contains conclusions of law, no response is necessary. To the extent that a response is necessary, Creative admits that Appendix C purports to contain a certified copy of the file wrapper for the '391 Patent. Although the Complainant's filing via EDIS does not identify any documents as comprising Appendix D, Creative admits that Complainant appears to have filed via EDIS at least some of the references cited in the prosecution history. Creative lacks sufficient knowledge or information to form a belief regarding the remaining allegations contained in Paragraph 31 and, therefore, denies those allegations.

Non-Technical Description of the Patented Invention

32. To the extent that Paragraph 32 makes any allegations about the scope or construction of the claims of the '391 Patent, such allegations mischaracterize the claims of the '391 Patent, and therefore Creative denies those allegations and characterizations. Creative denies that the description of the '391 Patent in Paragraph 32 is complete or accurate. Creative

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lacks sufficient knowledge or information to form a belief regarding the remaining allegations contained in Paragraph 32 and, therefore, denies those allegations.

33. To the extent that Paragraph 33 contains conclusions of law, no response is necessary. To the extent that a response is necessary, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 33 and, therefore, denies those allegations.

VI. UNFAIR ACTS OF THE RESPONDENTS

A. Sony, Sony America, and Sony Electronics

34. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 34 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 34 and, therefore, denies those allegations.

35. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 35 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 35 and, therefore, denies those allegations.

36. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 36 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 36 and, therefore, denies those allegations.

37. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 37 is required,

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Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 37 and, therefore, denies those allegations.

38. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 38 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 38 and, therefore, denies those allegations.

39. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 39 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 39 and, therefore, denies those allegations.

40. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 40 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 40 and, therefore, denies those allegations.

B. Sennheiser and Sennheiser America

41. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 41 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 41 and, therefore, denies those allegations.

42. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 42 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 42 and, therefore, denies those allegations.

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43. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 43 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 43 and, therefore, denies those allegations.

44. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 44 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 44 and, therefore, denies those allegations.

45. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 45 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 45 and, therefore, denies those allegations.

46. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 46 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 46 and, therefore, denies those allegations.

47. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 47 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 47 and, therefore, denies those allegations.

C. **BlueAnt and BlueAnt-US**

48. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 48 is required,

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Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 48 and, therefore, denies those allegations.

49. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 49 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 49 and, therefore, denies those allegations.

50. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 50 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 50 and, therefore, denies those allegations.

51. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 51 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 51 and, therefore, denies those allegations.

52. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 52 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 52 and, therefore, denies those allegations.

53. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 53 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 53 and, therefore, denies those allegations.

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54. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 54 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 54 and, therefore, denies those allegations.

D. Creative and Creative Labs

55. Creative denies that it manufactures, markets, sells for importation, imports, and/or sells after importation into the United States any products that directly infringe the '391 Patent and/or indirectly infringe the '258 and '391 Patents. Creative denies the remaining allegations and characterizations of Paragraph 55.

56. Creative admits that One-E-Way has accused headsets sold under the following names: Sound Blaster EVO Zx, Sound Blaster EVO Wireless, Aurvana Platinum, Aurvana Gold, WP-450, Hitz WP380, WP-350, WP-300, and WP-250 (hereinafter referred to as the "Accused Creative Products"), but Creative denies that any of these accused Creative products infringe any valid and enforceable claim of the '258 or '391 Patents. Creative further admits that Exhibit 14 appears to contain images of examples of these products and images of physical Exhibit 46. Creative denies the remaining allegations and characterizations of Paragraph 56.

57. Creative admits that the Accused Creative Products are manufactured, assembled, and/or packaged outside of the United States and then imported into the United States. Creative further admits that these products are sold after importation into the United States by CLI. Creative denies the remaining allegations and characterizations of Paragraph 57.

58. Creative denies that its actions constitute direct infringement of the '391 Patent. Creative admits that Exhibit 15 consists of claim charts that purport to show infringement of the

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'391 Patent. Creative lacks sufficient knowledge or information to form a belief regarding the remaining allegations contained in paragraph 58 and, therefore, denies those allegations.

59. Creative denies that its actions constitute contributory and induced infringement of the '258 and '391 Patents. Creative admits that Exhibit 16 consists of claim charts that purport to show indirect infringement of the '258 and '391 Patents. Creative lacks sufficient knowledge or information to form a belief regarding the remaining allegations contained in paragraph 59 and, therefore, denies those allegations.

60. To the extent Paragraph 60 contains conclusions of law, no response is necessary. To the extent that a response is necessary, Creative admits that CLI received a letter dated August 8, 2014 from counsel for Complainant alleging that Creative was infringing the Patents-in-Suit. Creative denies the remaining allegations and characterizations of Paragraph 60.

61. To the extent Paragraph 61 contains conclusions of law, no response is necessary. To the extent that a response is necessary, Creative admits that CLI received a letter dated August 8, 2014 from counsel for Complainant alleging that Creative was infringing the Patents-in-Suit. Creative denies the remaining allegations and characterizations of Paragraph 61.

E. Beats and Beats Ireland

62. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 62 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 62 and, therefore, denies those allegations.

63. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 63 is required,

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Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 63 and, therefore, denies those allegations.

64. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 64 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 64 and, therefore, denies those allegations.

65. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 65 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 65 and, therefore, denies those allegations.

66. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 66 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 66 and, therefore, denies those allegations.

67. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 67 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 67 and, therefore, denies those allegations.

68. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 68 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 68 and, therefore, denies those allegations.

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F. Jawbone

69. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 69 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 69 and, therefore, denies those allegations.

70. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 70 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 70 and, therefore, denies those allegations.

71. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 71 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 71 and, therefore, denies those allegations.

72. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 72 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 72 and, therefore, denies those allegations.

73. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 73 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 73 and, therefore, denies those allegations.

74. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 74 is required,

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Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 74 and, therefore, denies those allegations.

75. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 75 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 75 and, therefore, denies those allegations.

G. Jabra

76. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 76 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 76 and, therefore, denies those allegations.

77. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 77 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 77 and, therefore, denies those allegations.

78. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 78 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 78 and, therefore, denies those allegations.

79. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 79 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 79 and, therefore, denies those allegations.

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80. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 80 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 80 and, therefore, denies those allegations.

81. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 81 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 81 and, therefore, denies those allegations.

82. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 82 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 82 and, therefore, denies those allegations.

VII. SPECIFIC INSTANCES OF UNFAIR IMPORTATION AND SALE

83. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 83 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 83 and, therefore, denies those allegations.

84. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 84 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 84 and, therefore, denies those allegations.

85. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 85 is required,

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Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 85 and, therefore, denies those allegations.

86. Creative admits that Exhibit 29 purports to be a receipt for a "Creative WP-350 Wireless Bluetooth Headphones with Invisible Mic." Creative lacks sufficient knowledge or information to form a belief regarding the remaining allegations contained in Paragraph 86 and, therefore, denies those allegations.

87. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 87 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 87 and, therefore, denies those allegations.

88. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 88 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 88 and, therefore, denies those allegations.

89. Creative understands that this Paragraph is not directed to Creative, and no response from Creative is needed. To the extent that a response to Paragraph 89 is required, Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 89 and, therefore, denies those allegations.

VIII. CLASSIFICATION OF THE INFRINGING PRODUCTS UNDER THE HARMONIZED TARIFF SCHEDULE OF THE UNITED STATES

90. Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 90 and, therefore, denies those allegations.

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IX. RELATED LITIGATION

91. Creative admits that the Patents-in-Suit have been the subject of prior litigation in the United States district courts. Creative lacks sufficient knowledge or information to form a belief regarding the remaining allegations contained in Paragraph 91 and, therefore, denies those allegations.

X. DOMESTIC INDUSTRY

92. To the extent that Paragraph 92 contains conclusions of law, no response is necessary. To the extent that a response is necessary, Creative denies that a domestic industry as required by 19 U.S.C. § 1337(a)(2) and (a)(3) exists with respect to the Patents-in-Suit. Creative lacks sufficient knowledge or information to form a belief regarding the remaining allegations contained in Paragraph 92 and, therefore, denies those allegations.

A. One-E-Way's Development of the Domestic Industry

93. Creative admits that Exhibits 34 and 35 consist of claim charts purporting to show how certain One-E-Way products allegedly practice the Patents-in-Suit. Creative lacks sufficient knowledge or information to form a belief regarding the remaining allegations contained in Paragraph 93 and, therefore, denies those allegations.

B. One-E-Way Licensees' Development of the Domestic Industry

94. Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 94 and, therefore, denies those allegations.

95. Creative admits that Exhibits 38 and 39 consist of claim charts purporting to show how certain Plantronics products allegedly practice the Patents-in-Suit. Creative lacks sufficient knowledge or information to form a belief regarding the remaining allegations contained in Paragraph 95 and, therefore, denies those allegations.

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96. Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 96 and, therefore, denies those allegations.

97. Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 97 and, therefore, denies those allegations.

98. Creative admits that Exhibits 41 and 42 consist of claim charts purporting to show how certain Jaybird products allegedly practice the Patents-in-Suit. Creative lacks sufficient knowledge or information to form a belief regarding the remaining allegations contained in Paragraph 98 and, therefore, denies those allegations.

99. Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 99 and, therefore, denies those allegations.

100. Creative lacks sufficient knowledge or information to form a belief regarding the allegations contained in Paragraph 100 and, therefore, denies those allegations.

XI. RELIEF REQUESTED

101. To the extent that Paragraph 101 contains conclusions of law, no response is necessary. To the extent that a response is necessary, Creative denies the statements in this Paragraph to the extent that those statements purport to allege the existence of any factual or legal predicates for the relief requested as to Creative. Creative further denies that One-E-Way is entitled to relief pursuant to 19 U.S.C. § 1337(d), (f), or (j) as to Creative, and further denies that it has violated Section 337. Creative also denies that One-E-Way is entitled to any relief whatsoever with respect to Creative, including without limitation the relief requested in this paragraph. Creative denies the remaining allegations contained in Paragraph 101.

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RESPONSE TO THE NOTICE OF INVESTIGATION

Without admitting any of the specific allegations set forth in One-E-Way's Complaint as referenced in the Notice of Investigation, Creative provides the following response to the Notice of Investigation.

Creative admits that a Complaint was filed on behalf of One-E-Way with the Commission on December 8, 2014, pursuant to Section 337 of the Tariff Act of 1930, as amended. Creative admits that the Complaint alleges certain violations of Section 337 in the importation, the sale for importation, and the sale after importation of certain wireless headsets, but denies that it has violated Section 337. Creative admits that the Complaint further alleges that an industry in the United States exists as required by Section 337 but denies that an industry in the United States exists or is in the process of being created as required by Section 337. Creative admits that One-E-Way requested that the Commission instituted an investigation and, after the investigation, issue a general or limited exclusion order and cease and desist orders, but denies that the Commission should issue any such relief to One-E-Way. Creative admits that the Commission instituted an investigation as set forth in the Notice of Investigation.

Specifically, Creative denies that it has engaged in any acts of unfair competition or violated Section 337 by importing, selling for importation, or selling within the United States after importation any articles that infringe any valid and enforceable claim of the Patents-in-Suit, or otherwise. Creative denies all of One-E-Way's allegations and characterizations of infringement and domestic industry. Creative denies that any asserted claim of the Patents-in-Suit is valid and enforceable. Creative denies that One-E-Way is entitled to any relief whatsoever. Except as expressly admitted, Creative denies the allegations and characterizations in the Notice of Investigation.

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STATEMENT UNDER COMMISSION RULE 210.13(b)

Pursuant to Commission Rule 210.13(b), 19 C.F.R. § 210.13(b), Creative provides the following additional information. By providing the following information, Creative intends only to supply data required by 19 C.F.R. § 210.13(b). Creative specifically denies that any of the information or data supplied below relate to or support any allegations of infringement against Creative or any violation of Section 337.

Creative understands that One-E-Way in its Complaint accuses certain Creative products of infringing certain claims of the Patents-in-Suit.

Creative provides statistical data on the quantity and value of these accused products in Confidential Exhibit 1.

The Harmonized Tariff Schedule Number for the accused Creative products is believed to include at least 8517.62.0050 or one or more sub-classifications under that number.

Creative has the capacity to produce, or to have made by others, sufficient quantities of the accused wireless headset products to satisfy the foreseeable demand.

Creative states that the significance of the United States market for its accused wireless headset products is illustrated by the information provided in Confidential Exhibit 1.

Creative provides the name and address of the suppliers of the accused Creative products in Confidential Exhibit 1.

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CREATIVE'S AFFIRMATIVE AND OTHER DEFENSES

1. Creative asserts the following affirmative and other defenses. Creative's inclusion of these defenses is not a concession that Creative bears the burden of proof with respect to any of these defenses. Creative notes that this Investigation is in its early stages and that discovery has just recently commenced. Creative has not yet had the opportunity to identify and assert certain possible defenses, for example due to lack of discovery, and thus necessarily does not yet know the full extent of its defenses to One-E-Way's allegations. Accordingly, Creative reserves the right to supplement and amend its defenses to assert additional defenses as this Investigation proceeds.

First Defense
(Non-Infringement)

2. Creative has not directly or indirectly infringed, contributed to, or induced infringement of any valid and enforceable claim of the Patents-in-Suit, either literally or under the doctrine of equivalents, and has not otherwise committed any acts in violation of 35 U.S.C. § 271 and/or 19 U.S.C. § 1337. By way of example and without limitation, and subject to further investigation, the accused Creative products lack at least the following limitations, which are present in each asserted claim of the Patents-in-Suit: "virtually free from interference" and "a digital demodulator [module] configured for independent [code division multiple access / CDMA] communication operation." Additionally, by way of example and without limitation, the accused Creative products were not especially made for use in infringement of the Patents-in-Suit, and are staple articles suitable for substantial non-infringing use, and Creative lacks any intent to cause infringement of the Patents-in-Suit by others. Furthermore, by way of example and without limitation, Complainant's theories of indirect infringement against the accused Creative products are not properly the subject of a Section 337 investigation because the alleged

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acts of direct infringement which appear to be the basis for Complainant's theories of indirect infringement occur, if at all, in the United States after importation. Creative's investigation relating to Complainant's allegations of infringement are ongoing, and Creative expects to identify additional grounds demonstrating that the accused Creative products do not infringe the Patents-in-Suit as the Investigation proceeds.

Second Defense
(Invalidity)

3. Each of the claims of the Patents-in-Suit alleged to be infringed by Creative is invalid for failing to comply with one or more of the conditions for patentability set forth in Part II of the Title 35 United States Code, including but not limited to 35 U.S.C. §§ 101, 102, 103, 112, and/or 256, or any judicially created doctrine of invalidity, including but not limited to obviousness-type double patenting.

4. The Complaint appears to allege that the asserted claims cover wireless headsets complying with the Bluetooth standard. As such, the asserted claims are invalid over the prior art. The use of wireless communications between a transmitter and a wireless headset for transmitting audio material from an audio source to a listener was well-known in the prior art. For example, WO 00/19632 (Dress) which was published on April 6, 2000 discloses a base unit with a wireless connection to a headphone receiver. This reference further discloses the use of digital modulation and coding over the wireless communication channel, as well as the use of spread spectrum methods such as code-division multiple access. Additionally, the Bluetooth standard itself constitutes prior art since the Bluetooth 1.0 Specification was released in July 1999, which is more than one year before the August 26, 2003 priority date of the Patents-in-Suit. On information and belief, wireless headsets using Bluetooth technology were sold in 2000 and therefore also qualify as prior art. Accordingly, the Dress reference, the Bluetooth standard,

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and the prior art Bluetooth wireless headsets either anticipate or render the asserted claims obvious under the Complainant's theory of infringement.

5. The asserted claims of the Patents-in-Suit are also invalid due to indefiniteness under 35 U.S.C. § 112. By way of example, the limitations "virtually free of interference" and "reduced intersymbol interference coding" are indefinite for failure to inform those skilled in the art about the scope of the invention with reasonable certainty.

6. The asserted claims of the Patents-in-Suit are also invalid due to lack of written description and lack of enablement under 35 U.S.C. § 112. By way of example, the specification fails to describe or enable the limitations "virtually free of interference" and "reduced intersymbol interference coding."

7. Creative's investigation of the invalidity of the Patents-in-Suit is ongoing and Creative expects to locate and identify additional prior art and additional grounds demonstrating the invalidity of the asserted claims as the Investigation proceeds.

Third Defense
(Lack Of Domestic Industry)

9. Complainant cannot satisfy the domestic industry requirement of either Section 337(a)(2) or Section 337(a)(3) in connection with any of the Patents-in-Suit.

10. Complainant cannot establish that any of its products practice at least one claim of each of the Patents-in-Suit. The Complainant further cannot establish that it has made a significant investment in plant and equipment, significant employment of labor and capital, or substantial investment in exploitation, including engineering, research and development, or licensing, with respect to any articles that are covered by one or more claims of the Patents-in-Suit.

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11. Complainant cannot establish that it may properly rely on the activities of its licensees to satisfy the domestic industry requirements because those licenses were revenue-driven rather than production-driven licenses. Additionally, Complainant cannot establish that any of One-E-Way Licensees' products practice at least one claim of each of the Patents-in-Suit. Complainant further cannot establish that any of One-E-Way Licensees have made a significant investment in plant and equipment, significant employment of labor and capital, or substantial investment in exploitation, including engineering, research and development, or licensing, with respect to any articles that are covered by one or more claims of the Patents-in-Suit.

Fourth Defense
(Prosecution History Estoppel/Disclaimer)

12. By reason of representations, omissions, and/or concession made during prosecution of the Patents-in-Suit, and/or related U.S. or foreign patents and patent applications, the Complainant is estopped from claiming that Creative infringes the Patents-in-Suit.

Fifth Defense
(Relief Not In Public Interest)

13. The Complainant's demands for relief are barred under 19 U.S.C. § 1337(d)(1) and (f)(1) because of the detrimental effect such relief would have upon the public health and welfare, competitive conditions in the United States economy, the product of like or directly competitive articles in the United States, and United States consumers.

Sixth Defense
(No Unfair Acts)

14. Creative has not committed any unfair acts as defined within 19 U.S.C. § 1337.

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Seventh Defense
(Other Defenses)

15. Creative expressly adopts any defenses raised by any other respondent to this Investigation and reserves the right to assert additional defenses based on further discovery and investigation.

CREATIVE'S PRAYER FOR RELIEF

WHEREFORE, by reason of the foregoing, Creative respectfully requests that the Commission issue an order:

A. Denying all relief requested in the Complaint, including but not limited to the request for a limited exclusion order and a cease and desist order;

B. Finding that Creative has not violated Section 337 of the Tariff Act of 1930, as amended;

C. Finding that Creative has not imported, sold for importation, or sold within the United States after importation any product covered by a valid and enforceable claim of the Patents-in-Suit;

D. Finding that Creative has not infringed, whether directly and/or indirectly, any asserted claim of the Patents-in-Suit;

E. Finding that the Patents-in-Suit are invalid and unenforceable;

F. Finding that no domestic industry exists in connection with any of the Patents-in-Suit;

G. Awarding Creative its attorneys' fees and costs incurred in responding to One-E-Way's Complaint and defending this Investigation;

H. Dismissing the Complaint and terminating the present Investigation; and

I. Granting such other relief as the Commission deems just and proper.

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Dated: February 2, 2015

Respectfully submitted,

By: */s/ Jonathan D. Baker*

Jonathan D. Baker
FARNEY DANIELS PC
411 Borel Avenue, Suite 350
San Mateo, California 94402
Telephone: (424) 268-5210
Facsimile: (424) 268-5219

Counsel for Respondents Creative Labs, Inc. and Creative Technology Ltd.

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VERIFICATION OF RESPONSE TO THE COMPLAINT AND NOTICE OF INVESTIGATION

I, S. Sivananthan, am Vice President of Legal Services of Creative Technology, Ltd. I submit this verification on behalf of Creative Technology, Ltd. in accordance with 19 C.F.R. §§ 210.4(c) and 210.13(b), and declare as follows:

1. I am duly authorized to execute this verification.

2. I have read the Response to the Complaint and Notice of Investigation and am familiar with its contents.

3. To the best of my knowledge, information, and belief formed after reasonable inquiry, the foregoing Response and statements made therein:

   a. are not made for any improper purposes;

   b. are well grounded in fact and are warranted by existing law or a good faith argument for the extension, modification, or reversal of existing law;

   c. have evidentiary support or are likely to have evidentiary support after a reasonable opportunity for further investigation or discovery; and

   d. to the extent they deny factual contentions, are warranted on the evidence or are reasonably based on a lack of information or belief.

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct to the best of my knowledge, information, and belief.

Dated: February 2nd, 2015

By: _____
S. Sivananthan
Vice President of Legal Services
Creative Technology, Ltd.

VERIFICATION OF RESPONSE TO THE COMPLAINT AND NOTICE OF INVESTIGATION

I, Russell N. Swerdon, am Director of Intellectual Property of Creative Labs, Inc. I submit this verification on behalf of Creative Labs, Inc. in accordance with 19 C.F.R. §§ 210.4(c) and 210.13(b), and declare as follows:

1. I am duly authorized to execute this verification.

2. I have read the Response to the Complaint and Notice of Investigation and am familiar with its contents.

3. To the best of my knowledge, information, and belief formed after reasonable inquiry, the foregoing Response and statements made therein:

   a. are not made for any improper purposes;

   b. are well grounded in fact and are warranted by existing law or a good faith argument for the extension, modification, or reversal of existing law;

   c. have evidentiary support or are likely to have evidentiary support after a reasonable opportunity for further investigation or discovery; and

   d. to the extent they deny factual contentions, are warranted on the evidence or are reasonably based on a lack of information or belief.

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct to the best of my knowledge, information, and belief.

Dated: February 2, 2015

By _____
Russell N. Swerdon
Director of Intellectual Property
Creative Labs, Inc.

CERTIFICATE OF SERVICE

I hereby certify that true and correct copies of the foregoing document have been served on February 2, 2015 on the following:

Lisa R. Barton, Secretary **U.S. International Trade Commission** 500 E. Street, S.W. Washington, D.C. 20436	Via Electronic Filing (EDIS)
Honorable Thomas B. Pender **U.S. International Trade Commission** 500 E. Street, S.W., Room 317 Washington, D.C. 20436 Gregory.Moldafsky@usitc.gov	Via Hand Delivery (2 copies); and Via Electronic Mail (word format)
Vu Bui, Esq. **Office of Unfair Import Investigations** **U.S. International Trade Commission** 500 E. Street, S.W., Room 317 Washington, D.C. 20436 Vu.Bui@usitc.gov	Via Electronic Mail
COUSNEL FOR COMPLAINANT ONE-E-WAY, INC. Douglas G. Muehlhauser Paul A. Stewart Payson LeMeilleur Alan G. Laquer Yimeng Dou KNOBBE, MARTENS, OLSON & BEAR LLP 2040 Main Street, 14th Floor Irvine, CA 92614 1EWayITC@knobbe.com	Via Electronic Mail
RESPONDENTS:	
Counsel for AliphCom d/b/a Jawbone Stephen R. Smith COOLEY LLP 1299 Pennsylvania Avenue, NW, Suite 700 Washington, DC 20004 stephen.smith@cooley.com	Via Electronic Mail

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Counsel for Sennheiser Electronic GmbH & Co. KG and Sennheiser Electronic Corporation Sean P. DeBruine KILPATRICK TOWNSEND 1080 Marsh Road Menlo Park, CA 94025 SennheiserITC@kilpatricktownsend.com	Via Electronic Mail
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Counsel for Beats Electronics, LLC and Beats Electronics International Celine Jimenez Crowson HOGAN LOVELLS US LLP 555 Thirteenth Street, N.W. Washington, D.C. 20004 Beats-OEWCase@hoganlovells.com	Via Electronic Mail
Counsel for Sony Corporation, Sony Corporation of America, and Sony Electronics, Inc. Paul T. Qualey KENYON & KENYON LLP 1500 K Street, N.W. Washington, D.C. 20005-1257 Sony-ITC-943@kenyon.com	Via Electronic Mail

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Counsel for GN Netcom A/S d/b/a Jabra William B. Nash HAYNES AND BOONE, LLP 112 East Pecan Street San Antonio, TX 78205 GN-ITC@haynesboone.com	Via Electronic Mail

/s/ Peter R. Eichman
Peter R. Eichman, Paralegal

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

Before The Honorable Thomas B. Pender
Administrative Law Judge

In the Matter of **CERTAIN WIRELESS HEADSETS**	**Investigation No. 337-TA-943**

RESPONSE OF SENNHEISER ELECTRONIC CORPORATION AND SENNHEISER ELECTRONIC GmbH & CO. KG TO THE COMPLAINT OF ONE-E-WAY, INC. UNDER SECTION 337 OF THE TARIFF ACTION OF 1930, AS AMENDED AND NOTICE OF INVESTIGATION

Pursuant to 19 C.F.R. § 210.13, Sennheiser Electronic Corporation and Sennheiser electronic GmbH & Co. KG (collectively, "Sennheiser") hereby respond to the Complaint filed pursuant to Section 337 of the Tariff Act of 1930, as amended, 19 U.S.C. § 1337 ("Section 337") by One-E-Way, Inc. ("Complainant") on December 8, 2014, and to the Notice of Investigation issued by the United States International Trade Commission ("the Commission") on January 8, 2015, (80 Fed Reg. 1663).

As an initial matter, Sennheiser denies that it has engaged in unfair competition or violated Section 337 by importing, selling for importation, or selling within the United States after importation any devices, products, or articles that infringe any valid and enforceable intellectual property rights aas alleged in this Investigation.

Because discovery and Sennheiser's investigation have just begun, Sennheiser has not had sufficient time and opportunity to collect and review all of the information that may be relevant to the issues raised in this Response. Accordingly, Sennheiser reserves the right to

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amend or supplement this Response, including raising additional defenses, based on any additional facts, analysis or developments that become available or that arise after the filing of this Response. Sennheiser also incorporates herein by this reference the Responses to the Complaint filed by the other Respondents in this Investigation.

Further, Sennheiser denies each and every allegation averred in the Complaint that is not expressly admitted below. Any factual allegation admitted below is admitted only as to the specific admitted facts, and not as to any purported conclusions, characterizations, implications or speculations that might follow from the admitted facts.

Although Sennheiser includes the headings from the Complaint in this Response for clarity, to the extent such headings themselves contain factual and legal characterizations, Sennheiser denies such characterizations.

RESPONSE TO THE COMPLAINT

I. INTRODUCTION

1. Sennheiser admits that Complainant requested that the Commission commence an investigation pursuant to Section 337 of the Tariff Act of 1930, as amended, 19 U.S.C. § 1337, to remedy the purportedly unlawful importation into the United States, sale for importation into the United States, and sale within the United States after importation of articles purportedly covered by U.S. Patents No. 7,865,258 ("the '258 patent") and No. 8,131,391 ("the '391 patent") (collectively, the "Patents-in-Suit" or "Asserted Patents"), but Sennheiser denies that it has engaged in any such unlawful activities as alleged, and on information and belief denies that Complainant is the owner of the Patents-in-Suit, and denies that the Patents-in-Suit are valid or enforceable.

2. Sennheiser admits that Exhibits 1 and 2 are attached to the Complaint and contain what Complainant purports to be a certified copies of the '258 and '391 patents. Sennheiser

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admits that Exhibit 3 and 4 are attached to the Complaint and contain what purport to be copies of the assignments of the '258 and '391 patents respectively, but on information and belief, denies that Complainant is the owner of the entire right, title, or interest of the '258 and '391 patents. Sennheiser admits that Complainant asserts the following claims (the "Asserted Claims") of the '258 and '391 patents against certain named Respondents, including Sennheiser: claims 3, 4, 8, 10, and 11 of the '258 patent; and claims 1, 2, 3, 4, 5, 6, and 10 of the '391 patent. Sennheiser specifically denies that any Sennheiser product infringes, directly or indirectly, any Asserted Claim of any Patent-in-Suit, and Sennheiser denies any and all remaining allegations contained in paragraph 2 of the Complaint. Moreover, the allegations of indirect infringement in paragraph 2 are irrelevant and should be stricken, as indirect infringement as alleged does not constitute a violation of § 337.

3. Sennheiser admits that it is identified as a respondent in paragraph 3 of the Complaint, but denies that it has engaged in any unlawful activity alleged in paragraph 3. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the remaining allegations of paragraph 3, and therefore denies the same.

4. Sennheiser denies that an industry as defined by Section 337(a)(3) exists in the United States, or is in the process of being created in the United States, relating to certain wireless audio devices protected by the '258 and '391 patents.

5. Sennheiser admits that Complainant seeks relief in this action, including a limited exclusion order, and cease and desist orders, but Sennheiser denies that any such relief is proper. Sennheiser denies any and all remaining allegations contained in paragraph 5 of the Complaint.

II. COMPLAINANT

6. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 6, and therefore denies the same.

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III. RESPONDENTS

Sony, Sony America and Sony Electronics

7. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 7, and therefore denies the same.

8. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 8, and therefore denies the same.

9. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 9, and therefore denies the same.

10. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 10, and therefore denies the same.

Sennheiser and Sennheiser America

11. Sennheiser electronic GmbH & Co. KG admits that it is organized under the laws of the Federal Republic of Germany and has its principal place of business at Am Labor 1, 30900 Wedemark, Germany. Sennheiser electronic GmbH & Co. KG denies the remaining allegations in paragraph 11.

12. Sennheiser Electronic Corporation ("Sennheiser America") admits that it is a corporation organized under the laws of Delaware with its principal place of business at 1 Enterprise Drive, Old Lyme CT 06371. Sennheiser Electronic Corporation denies the remaining allegations of paragraph 12.

13. Sennheiser is without information as to the meaning of "parent entity" in paragraph 13 and on that basis denies the allegations in the first sentence of that paragraph. Sennheiser admit that Sennheiser America is engaged in the marketing and sales of the accused Sennheiser headsets in the United States. Sennheiser denies the remaining allegations of paragraph 13.

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BlueAnt and BlueAnt-US

14. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 14, and therefore denies the same.

15. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 15, and therefore denies the same.

Creative and Creative Labs

16. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 16, and therefore denies the same.

17. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 17, and therefore denies the same.

18. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 18, and therefore denies the same.

Beats and Beats Ireland

19. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 19, and therefore denies the same.

20. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 20, and therefore denies the same.

21. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 21, and therefore denies the same.

Jawbone

22. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 22, and therefore denies the same.

Jabra

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23. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 23, and therefore denies the same.

IV. THE TECHNOLOGIES AND PRODUCTS AT ISSUE

24. On information and belief Sennheiser denies that any products practice any valid claim of the Asserted Patents. Sennheiser understands that the remaining general allegations in this paragraph do not require a response, and therefore denies the same.

V. THE PATENTS-IN-SUIT

25. Sennheiser admits that the '391 patent purports to have issued from U.S. Patent Application No. 12/940,747, which purports to be a continuation application of U.S. Patent Application No. 12/570,343. Sennheiser also admits that the '258 patent purports to have issued from U.S. Patent Application No. 12/570,343. Sennheiser admits that the '391 patent purports to claim priority to U.S. Patent Application No. 10/027,391 ("the '391 application"), and that the '391 patent states that this application was filed on December 21, 2001. On information and belief, Sennheiser denies that the '391 patent has priority to December 21, 2001. Sennheiser admits that a certificate of correction appended to the '258 patent purports to claim priority to the '391 application, and that the certificate of correction states that the '391 application was filed on December 21, 2001. On information and belief, Sennheiser denies that the '258 patent has priority to December 21, 2001. Sennheiser is without knowledge as to the status of any corresponding foreign patents or applications, and on that basis denies those allegations.

B. The '258 Patent

Identification of the Patent and Ownership by One-E-Way

26. Sennheiser admits that that Exhibit 1 to the Complaint appears to be a copy of the asserted '258 patent and that Earl C. Woolfork is the only inventor named on that patent. On information and belief Sennheiser denies that One-E-Way is the assignee of the '258 patent.

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Sennheiser is without knowledge as to the status of any corresponding foreign patents or applications, and on that basis denies those allegations.

27. Sennheiser admits that Appendices A and B of the Complaint appear to include the file history and cited references for the '258 patent. Except as expressly admitted, Sennheiser denies the allegations of paragraph 27.

Non-Technical Description of the Patented Invention

28. Sennheiser denies the allegations of paragraph 28.

29. To the extent that paragraph 29 is directed to Sennheiser, Sennheiser denies the allegations in paragraph 29. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the remaining allegations of paragraph 29, and therefore denies the same.

C. The '391 Patent

Identification of the Patent and Ownership by One-E-Way

30. Sennheiser admits that Exhibit 2 to the Complaint appears to be a copy of the asserted '391 patent and that Earl C. Woolfork is the only inventor named on that patent. On information and belief, Sennheiser denies that One-E-Way is the assignee of the '391 patent. Sennheiser is without knowledge as to the status of any corresponding foreign patents or applications, and on that basis deny those allegations.

31. Sennheiser admits that Appendices C and D of the Complaint appear to include the file history and cited references for the '391 patent. Except as expressly admitted, Sennheiser denies the allegations of paragraph 31.

Non-Technical Description of the Patented Invention

32. Sennheiser denies the allegations of paragraph 32.

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33. To the extent that paragraph 33 is directed to Sennheiser, Sennheiser denies the allegations in paragraph 33. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the remaining allegations of paragraph 33, and therefore denies the same.

VI. UNFAIR ACTS OF THE RESPONDENTS

Sony, Sony America and Sony Electronics

34. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 34, and therefore denies the same.

35. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 35, and therefore denies the same.

36. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 36, and therefore denies the same.

37. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 37, and therefore denies the same.

38. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 38, and therefore denies the same.

39. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 39, and therefore denies the same.

40. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 40, and therefore denies the same.

Sennheiser and Sennheiser America

41. Sennheiser denies the allegations of paragraph 41.

42. Sennheiser admits that Complaint has alleged that the headsets with the following names and/or model numbers infringe the Asserted Claims: MM 550-X (XPLT22), MM 550-X (XZUC6806), MM 450-X (XZlC6902), MM 400-X (XZUC6802), Presence Basic (XLC2l04),

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VMX 200-II (XMDSC2004), and EZX 80 (XM2D2305). Sennheiser denies that the model numbers listed in parentheticals in the Complaint (XPLT22, XZUC6806, XZ1C6902, XZUC6802, XLC2l04, XMDSC2004, XM2D2305) are Sennheiser model numbers. Sennheiser admits that Exhibit 8 includes photographs of certain of these products. Except as expressly admitted, Sennheiser denies the allegations of paragraph 42.

43. Admitted.

44. Sennheiser admits that exhibit 9 purports to be a claim chart comparing the accused products to claims of the '391 patent. Except as expressly admitted, Sennheiser denies the allegations of paragraph 44.

45. Sennheiser admits that exhibit 10 purports to be a claim chart comparing the accused products to claims of the '258 and '391 patents. Except as expressly admitted, Sennheiser denies the allegations of paragraph 45. Moreover, the allegations of indirect infringement in exhibit 10 are irrelevant, as indirect infringement as alleged does not constitute a violation of § 337.

46. Sennheiser denies the allegations of paragraph 46. Moreover, the allegations of paragraph 46 are irrelevant, as indirect infringement as alleged does not constitute a violation of § 337.

47. Sennheiser denies the allegations of paragraph 47. Moreover, the allegations of paragraph 46 are irrelevant, as indirect infringement as alleged does not constitute a violation of § 337.

BlueAnt and BlueAnt-US

48. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 48, and therefore denies the same.

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49. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 49, and therefore denies the same.

50. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 50, and therefore denies the same.

51. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 51, and therefore denies the same.

52. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 52, and therefore denies the same.

53. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 53, and therefore denies the same.

54. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 54, and therefore denies the same.

Creative and Creative Labs

55. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 55, and therefore denies the same.

56. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 56, and therefore denies the same.

57. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 57, and therefore denies the same.

58. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 58, and therefore denies the same.

59. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 59, and therefore denies the same.

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Beats and Beats Ireland

60. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 60, and therefore denies the same.

61. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 61, and therefore denies the same.

62. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 62, and therefore denies the same.

63. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 63, and therefore denies the same.

64. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 64, and therefore denies the same.

65. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 65, and therefore denies the same.

66. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 66, and therefore denies the same.

67. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 67, and therefore denies the same.

68. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 68, and therefore denies the same.

Jawbone

69. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 69, and therefore denies the same.

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70. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 70, and therefore denies the same.

71. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 71, and therefore denies the same.

72. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 72, and therefore denies the same.

73. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 73, and therefore denies the same.

74. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 74, and therefore denies the same.

75. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 75, and therefore denies the same.

Jabra

76. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 76, and therefore denies the same.

77. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 77, and therefore denies the same.

78. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 78, and therefore denies the same.

79. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 79, and therefore denies the same.

80. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 80, and therefore denies the same.

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81. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 81, and therefore denies the same.

82. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 82, and therefore denies the same.

VII. SPECIFIC INSTANCES OF UNFAIR IMPORTATION AND SALE

83. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 83, and therefore denies the same.

84. Sennheiser admits that Exhibit 27 appears to be a receipt for the purchase of one MM 400-X headset. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the remaining allegations of paragraph 84, and therefore denies the same.

85. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 85, and therefore denies the same.

86. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 86, and therefore denies the same.

87. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 87, and therefore denies the same.

88. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 88, and therefore denies the same.

89. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 89, and therefore denies the same.

VIII. CLASSIFICATION OF THE INFRINGING PRODUCTS UNDER THE HARMONIZED TARIFF SCHEDULE OF THE

90. To the extent this paragraph is directed toward Sennheiser Accused Products, Sennheiser admits that the Sennheiser Accused Products are classifiable under Harmonized

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Tariff Schedule No. 8518.30.95 or 8517.62.00. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the remaining allegations of paragraph 90, and therefore denies the same.

IX. RELATED LITIGATION

91. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 91, and therefore denies the same.

X. DOMESTIC INDUSTRY

92. On information and belief, Sennheiser denies that a domestic industry exists or is the process of being established in the United States in products covered by the Asserted Patents, as required under 19 U.S.C. § 1337.

B. One-E-Way's Development of the Domestic Industry

93. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 93, and therefore denies the same. Further, even if taken as true, the facts alleged in paragraph 93 are not sufficient to carry Complainant's burden of proof to establish the existence of the required domestic industry as a matter of law.

C. One-E-Way's Licensees' Development of the Domestic Industry

94. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 94, and therefore denies the same.

95. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 95, and therefore denies the same.

96. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 96, and therefore denies the same.

97. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 97, and therefore denies the same.

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98. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 98, and therefore denies the same.

99. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 99, and therefore denies the same.

100. Sennheiser is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 100, and therefore denies the same.

XI. RELIEF REQUESTED

101. Sennheiser denies that any relief is appropriate as to Sennheiser, including as set forth in subparagraphs (a) through (e). In particular, on information and belief Sennheiser contends that Complainant does not has standing to pursue this investigation, that Sennheiser has not undertaken any unfair acts and that the asserted patent claims are invalid and unenforceable, and thus the requirements for any relief under 19 U.S.C. § 1337 are not met.

RESPONSE TO THE NOTICE OF INVESTIGATION

Pursuant to Commission Rule 210.13, Sennheiser responds to the Notice of Investigation issued by the United States International Trade Commission ("the Commission") on January 8, 2015, and published in the Federal Register on January 13, 2015 (80 Fed Reg. 1663) as follows:

Sennheiser admits that the Commission issued an original Notice of Investigation, based on the Complaint filed by Complainant on December 8, 2014, which published in the Federal Register on January 13, 2015 (80 Fed. Reg. 1663). Sennheiser admits that the Complaint generally sets forth the allegations summarized in the Notice of Investigation, but denies those allegations with respect to Sennheiser. Sennheiser admits that, as set forth in the Notice of Investigation, Complainant requested that an investigation be instituted and that, after the investigation, a limited exclusion order, or cease and desist orders be issued, but denies that Complainant is entitled to any such relief.

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Sennheiser denies that there has been any violation of Section 337 by Sennheiser. In addition, Sennheiser contends that one or more of the Asserted Claims of the Asserted Patents are invalid and cannot support any remedy for alleged infringement. Sennheiser further contends that it has performed no unfair act, that Complainant has no domestic industry, the requested relief is not in the public interest, and that Complainant has waived its right to enforce, and is equitably estopped from enforcing, one or more of the Asserted Patents.

STATEMENT UNDER COMMISSION RULE 210.13(b)

By providing the following information, Sennheiser intends only to supply data required by 19 C.F.R. § 210.13(b). Sennheiser denies that any of the information or data supplied relates to or supports any violation of Section 337 or any allegation of infringement against Sennheiser.

Sennheiser imports the Sennheiser Accused Products into the United States under Harmonized Tariff Schedule No. 8518.30.20. Confidential Exhibit A to this Response provides statistical data on the quantity and value of imports of the Sennheiser Accused Products, a statement concerning Sennheiser's capacity to produce the Sennheiser Accused Products, and the relative significance of the United States market to Sennheiser's operations.

Sennheiser has relied on and currently relies on third parties to produce the Sennheiser Products. The names and addresses of Sennheiser's suppliers of the Sennheiser Products are also set forth in Confidential Exhibit A.

DEFENSES

Sennheiser alleges and asserts the following defenses in response to the allegations in the Complaint, and undertakes the burden of proof only as to those defenses that are deemed by law to be affirmative defenses. Sennheiser has not had sufficient opportunity to collect and review information in connection with this Investigation that is relevant to potentially available defenses

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against the allegations in the Complaint. Sennheiser reserves the right to supplement and/or amend its defenses as the Investigation progresses. Sennheiser also reserves the right to rely upon any defense(s) raised by any other party to this Investigation.

First Defense: Non-Infringement

1. Sennheiser has not directly infringed nor contributed to or induced infringement of any valid and enforceable claim of the '258 and '391 patents, including asserted claims 3, 4, 8, 10, and 11 of the '258 Patent; and asserted claims 1, 2, 3, 4, 5, 6, and 10 of the '391 Patent. Moreover, indirect infringement as alleged, the only grounds asserted in the Complaint as to all claims of the '258 patent and claims 3 and 4 of the '391 patent, does not constitute an unfair act in violation of §337.

Second Defense: Prosecution History Estoppel

2. Upon information and belief, Complainant is precluded by the doctrine of prosecution history estoppel and/or by prior art from asserting any construction of some or all of the claims of the Asserted Patents, or from asserting infringement under the doctrine of equivalents, that could cover any products used, imported, sold, or offered for sale by Sennheiser due to certain arguments, cancellations, representations, admissions and statements made to the USPTO during the prosecution of the applications that resulted in the asserted patents and applications related thereto.

Third Defense: Invalidity

3. Upon information and belief, one or more of the Asserted Patents are invalid for failure to comply with one or more of the requirements of patentability set forth in the Patent Act, including, but not limited to 35 U.S.C. §§ 102, 103, 112, 115 and/or 116.

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4. Upon information and belief, one or more of the Asserted Claims are invalid under 35 U.S.C. § 112 for failure to satisfy the written description and/or enablement requirements, and for failing to particularly point out and distinctly claim the alleged invention.

5. Upon information and belief, one or more of the Asserted Claims of the Asserted Patents are invalid under 35 U.S.C. §§ 102 and/or 103 as anticipated by, or obvious in light of, the prior art, including but not limited to the prior art references cited by the examiner during prosecution of asserted patents and related applications; prior art references disclosed during prosecution of those applications and other prior art references not disclosed to the patent office. By way of example and without limitation, on information and belief Sennheiser states that respondent GN Netcom began commercial sales of a wireless digital audio transmitter and headphone system in or around September 2000. That system operated on the Bluetooth standard, and included all of the elements of the Asserted Claims, or would render those claims obvious in light of well-known prior art wireless networking concepts. *See, e.g.* Haartsen, *The Bluetooth Radio System*, IEEE Personal Communications, Feb. 2000, pgs. 28 *et seq.*, Bluetooth Specifications v. 1.0b *et seq.*, Rappaport, *Wireless Communications: Principles and Practice*, 1996. Sennheiser incorporates by reference all prior art references identified by all the other Respondents in this Investigation in each of their respective Responses to the Complaint. Sennheiser is in the process of identifying further relevant prior art, including through discovery, which is in its early stages at the time of this Response. Sennheiser will set forth further invalidity allegations upon obtaining relevant prior art and consistent with the forthcoming procedural schedule in this Investigation. Sennheiser reserves the right to amend its response after further discovery in this investigation, including offering invalidity charts under Rule 210.13(b)(3), after further discovery in this investigation.

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Fourth Defense: Lack of Domestic Industry

6. Upon information and belief, Complainant has not and cannot adequately established the existence of a domestic industry for the Asserted Patents as required by Section 337(a)(2) and defined by Section 337(a)(3). Specifically, Complainant has not established that it (and/or a licensee) has made a "significant investment" in plant, equipment, labor, or capital relating to articles protected by at least one claim of each of the asserted patents, sufficient to satisfy the economic prong of the domestic industry requirement. Further, Complainant has not established that it (and/or a licensee) has made a "substantial investment" in licensing, research and development, or other qualifying activities relating to each of the asserted patents and/or to articles protected by at least once claim of each of the asserted patents, sufficient to satisfy the economic prong of the domestic industry requirement. Upon information and belief, Complainant has not, and cannot, adequately establish under section 337 (a)(2), that there is a domestic industry which is in the process of being established, or that they have taken, and are presently taking, the necessary tangible steps to establish such an industry in the United States, or that there is a significant likelihood that the domestic industry requirement will be satisfied in the future. Finally, Complainant has not established that it (and/or a licensee) has satisfied the technical prong of the domestic industry requirement.

Fifth Defense: No Unfair Act

7. Sennheiser has not committed an unfair act in violation of Section 337.

Sixth Defense: Equitable Defenses

8. Upon information and belief, Complainant's claims for relief are barred, in whole or in part, by defenses of license (either express or implied), waiver, estoppel, patent exhaustion, and/or laches.

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Seventh Defense: Lack of Ownership and Standing

9. To the extent that Complainant does not have substantially all rights to the asserted '258 or '391 Patents or the purported assignments are defective for any reason, Complainant lacks standing to bring this action.

Eighth Defense: Unenforceability of All Asserted Patents Based on Patent Misuse

10. Complainant knows and has known that the asserted patents are invalid and/or unenforceable based on the prior art disclosed by the patent office and defendants in the prior litigation.

11. By knowingly raising claims of infringement of invalid and/or unenforceable patents, Complainant has attempted to impermissibly broaden the temporal and physical scope of their patents with an anticompetitive effect.

12. Complainant's asserted patents are unenforceable based on patent misuse.

Ninth Defense: Other Defenses

13. Sennheiser further reserves the right to amend its Response to include other affirmative defenses that it may learn of during the course of this Investigation.

CONCLUSION

WHEREFORE, by reason of the foregoing, Sennheiser respectfully requests that the Commission:

A. find that no violation of Section 337 of the Tariff Act of 1930, as amended, exists by reason of any manufacture, importation, offer for sale, or sale by Sennheiser of any Certain Wireless Headsets as described in the Complaint and Notice of Investigation, and terminate the Investigation;

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B. find that Sennheiser has not imported, sold for importation, or sold within the United States after importation any Certain Wireless Headsets covered by a valid and enforceable asserted claim of the '258 or '391 patents;

C. find that Complainant's demands for relief are barred under 19 U.S.C. § 1337(d)(1), (f)(1), and (g)(1) because of the relief's effect upon the public health and welfare, competitive conditions in the United States economy, the production of like or directly competitive articles in the United States, and United States consumers;

D. deny Complainant's request for a limited exclusion order, cease and desist order, and all other relief requested as to Sennheiser and/or its respective accused products;

E. impose sanctions upon Complainant as deemed appropriate and just, including attorneys' fees; and

F. award Sennheiser such other and further relief as the Commission deems appropriate based on the facts determined by the authority of the Commission.

DATED: February 2, 2015

Respectfully submitted,

/s/ Sean DeBruine

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CERTIFICATE OF SERVICE

I, Sharon D. Eurich, certify that on February 2, 2015, I caused the foregoing **RESPONSE OF RESPONDENTS SENNHEISER ELECTRONIC CORPORATION and SENNHEISER eLECTRONIC GmbH & CO. KG TO THE COMPLAINT OF ONE-E-WAY, INC. UNDER SECTION 337 OF THE TARRIF ACTION OF 1930, AS AMENDED AND NOTICE OF INVESTIGATION** to be served upon the following parties in the manner indicated below:

The Honorable Lisa R. Barton Secretary to the Commission **U.S. International Trade Commission** 500 E Street SW, Room 112 Washington, D.C. 20436	Via Electronic Filing (EDIS)
The Honorable Thomas B. Pender Administrative Law Judge **U.S. International Trade Commission** 500 E Street SW, Room 317 Washington, D.C. 20436 Gregory.Moldafsky@usitc.gov Rebecca.Barbisch@usitc.gov	Via Electronic Filing (EDIS); Hand Delivery (2 copies); and Electronic Mail (Word format)
Vu Bui, Esq. **Office Of Unfair Import Investigations (OUII)** **U.S. International Trade Commission** 500 E Street SW, Room 401 Washington, D.C. 20436 Vu.Bui@usitc.gov	Via Electronic Mail
COUNSEL FOR COMPLAINANT ONE-E-WAY, INC. Douglas G. Muehlhauser Paul A. Stewart Payson LeMeilleur Alan G. Laquer Yimeng Dou KNOBBE, MARTENS, OLSON & BEAR LLP 2040 Main Street, 14th Floor Irvine, CA 92614 1EWayITC@knobbe.com	Via Electronic Mail

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/s/ Sharon D. Eurich
Sharon D. Eurich

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CONFIDENTIAL EXHIBIT A
FILED SEPARATELY

UNITED STATES INTERNATIONAL TRADE COMMISION
WASHINGTON, D.C.

Before the Honorable Thomas B. Pender
Administrative Law Judge

In the Matter of CERTAIN WIRELESS HEADSETS	Investigation No. 337-TA-943

BLUEANT'S RESPONSE TO THE COMPLAINT AND NOTICE OF INVESTIGATION

Respondents BlueAnt Wireless, Inc. and BlueAnt Wireless Pty. Ltd. (collectively, "BlueAnt") hereby respond to the Complaint filed by One-E-Way, Inc. ("Complainant" or "One-E-Way") on December 8, 2014, in the above-captioned Investigation and to the Notice of Investigation issued by the United States International Trade Commission ("the Commission") as published in the Federal Register on January 13, 2015. (80 Fed. Reg. 1,663).

BlueAnt denies that it has engaged in acts of unfair competition in violation of Section 337 by importing, selling for importation, and/or selling after importation into the United States any product that infringes literally and/or under the doctrine of equivalents, directly, indirectly, by contribution and/or by inducement, any claim of U.S. Patent No. 7,865,258 ("the '258 patent") and United States Patent No. 8,131,391 (the '391 patent) (collectively "patents-in-suit"). BlueAnt denies that the claims of the '258 and '391 patents are valid and enforceable.

Except as specifically admitted herein, BlueAnt denies all of the allegations of the Complaint. BlueAnt has not had sufficient time and opportunity to collect and review all of the information that may be relevant and necessary to respond to the matters raised in One-E-Way's Complaint. To the extent that any allegations of the Complaint refer to or rely upon information not previously supplied to BlueAnt, BlueAnt is without information sufficient to admit or deny such allegations, and therefore denies the same. Moreover, BlueAnt also reserves the right to take further positions and raise additional defenses as may become apparent as a result of additional information discovered subsequent to filing this Response.

The numbered Paragraphs herein correspond to and respond to the numbered Paragraphs set forth in the Complaint.

I. INTRODUCTION[1]

1. BlueAnt admits that One-E-Way requested that the United States International Trade Commission commence an investigation pursuant to Section 337 of the Tariff Act of 1930, as amended, 19 U.S.C. §1337, and that One-E-Way seeks a remedy for what it contends is the unlawful importation or articles covered by the patents-in-suit. BlueAnt denies that it has engaged in acts of unfair competition in violation of Section 337 by importing, selling for importation, and/or selling within the United States after importation any articles covered by the patents-in-suit. BlueAnt denies that the patents-in-suit are infringed, valid or enforceable. BlueAnt lacks sufficient knowledge or information on which to admit or deny the remaining allegations of Paragraph 1 and, on that basis, denies them. Except as expressly admitted, BlueAnt denies each and every allegation of Paragraph 1 of the Complaint.

2. BlueAnt admits that documents purporting to be certified copies of the patents-in-suit are attached to the Complaint as Exhibits 1 and 2, but lacks knowledge or information sufficient to form a belief regarding E-One-Way's allegation that Exhibits 1 and 2 are true and correct copies of the patents-in-suit. BlueAnt admits that documents purporting to be certified copies of assignments of the patents-in-suit are attached to the complaint as Exhibits 3 and 4, but lacks knowledge or information sufficient to form a belief regarding E-One-Way's allegation that Exhibits 3 and 4 are true and correct copies of assignments of the patents-in-suit. BlueAnt denies that it unlawfully imports, sells for importation, and/or sells after importation articles that infringe any claim of the patents-in-suit, directly or indirectly. BlueAnt denies that it infringes (directly or indirectly) claims 3, 4, 8, 10 and 11 of the '258 patent. BlueAnt denies that it infringes (directly or indirectly) claims 3 and 4 of the '391 patent. To the extent such allegations are contained in Paragraph 2, BlueAnt denies the patents-in-suit are valid or enforceable. Except

[1] For purposes of clarity and ease of reference, BlueAnt responds to the Complaint using the same format and titles used by One-E-Way. Nonetheless, the use of this format and these titles should not be construed as an admission on BlueAnt's part to any of the facts and/or allegations contained within the Complaint.

as expressly admitted, BlueAnt denies each and every allegation of Paragraph 2 of the Complaint.

3. BlueAnt admits that One-E-Way named Sony Corporation, Sony Corporation of America, Sony Electronics, Inc., Sennheiser Electronic GmbH & Co. KG, Sennheiser Electronic Corporation, BlueAnt Wireless Pty, Ltd, BlueAnt Wireless, Inc., Creative Technology Ltd., Creative Labs, Inc., Beats Electronics, LLC, Beats Electronics International Ltd., Jawbone, Inc., and GN Netcom A/S which does business as Jabra (collectively, "Respondents") as Respondents in this Investigation. BlueAnt denies that it has engaged in unfair acts in violation of Section 337 thorough the unlawful importation, sale for importation, and /or sale after importation of certain wireless audio devices covered by one or more claims of the patents-in-suit. To the extent such allegations are contained in Paragraph 3, BlueAnt denies the patents-in-suit are valid or enforceable. BlueAnt lacks sufficient knowledge of information on which to admit or deny the remaining allegations of Paragraph 3 and, on that basis, denies them. Except as expressly admitted, BlueAnt denies each and every allegation of Paragraph 3 of the Complaint.

4. On information and belief, BlueAnt denies the allegations of Paragraph 4.

5. BlueAnt admits that One-E-Way seeks a limited exclusion order and a cease and desist order, but denies that One-E-Way is entitled to any such relief. BlueAnt denies the remaining allegations of Paragraph 5.

II. COMPLAINANT

6. BlueAnt lacks sufficient knowledge or information on which to admit or deny the allegations of Paragraph 6 and, on that basis, denies them.

III. RESPONDENTS

Sony, Sony America and Sony Electronics

7. The allegations of Paragraph 7 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

8. The allegations of Paragraph 8 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

9. The allegations of Paragraph 9 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

10. The allegations of Paragraph 10 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

Sennheiser and Sennheiser America

11. The allegations of Paragraph 11 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

12. The allegations of Paragraph 12 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

13. The allegations of Paragraph 13 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

BlueAnt and BlueAnt-US

14. BlueAnt Wireless Pty. Ltd. admits that it is organized under the laws of Australia. Except as expressly admitted, BlueAnt denies each and every allegation of Paragraph 14 of the Complaint.

15. BlueAnt Wireless, Inc. admits it is a subsidiary of BlueAnt Wireless Pty., Ltd, that it is a California Corporation and that it had, at one time, a place of business at 125 Wacker Drive, Suite 300, in Chicago, Illinois 60606. BlueAnt Wireless, Inc. denies that it currently has a place of business at that location. Except as expressly admitted, BlueAnt denies each and every allegation of Paragraph 15 of the Complaint.

Creative and Creative Labs

16. The allegations of Paragraph 16 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

17. The allegations of Paragraph 17 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

18. The allegations of Paragraph 18 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

Beats and Beats Ireland

19. The allegations of Paragraph 19 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

20. The allegations of Paragraph 20 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

21. The allegations of Paragraph 21 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

Jawbone

22. The allegations of Paragraph 22 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

Jabra

23. The allegations of Paragraph 23 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

IV. ONE-E-WAY'S ALLEGATIONS OF TECHNOLOGIES AND PRODUCTS AT ISSUE

24. To the extent the allegations of Paragraph 24 are not directed at BlueAnt, no answer is required, but to the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny any such allegations and, on that basis, denies them.

BlueAnt denies that any of its products infringe or have infringed any valid and enforceable Asserted Claim of the Asserted Patents. Except as expressly admitted, BlueAnt denies each and every allegation of Paragraph 24 of the Complaint.

V. THE PATENTS-IN-SUIT

25. The allegations of Paragraph 25 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt admits that the prosecution history on its face supports One-E-Way's contention that the '391 Patents issues from U.S. Patent Application No. 12/940,747, which appears to be a continuation application of U.S. Patent Application No. 12/570,343, which issued as the '258 Patent. The public record on its face shows that both patents claim priority to U.S. Patent Application No. 10/027,391, filed December 21, 2001 but BlueAnt lacks sufficient knowledge or information on which to admit or deny One-E-Way's right to the alleged priority date and, on that basis, denies that allegation. BlueAnt lacks sufficient knowledge or information on which to admit or deny the remaining allegations of Paragraph 25 and, on that basis, denies them. Except as expressly admitted, BlueAnt denies each allegation of Paragraph 25 of the Complaint.

A. The '258 Patent

Identification of the Patent and Alleged Ownership by One-E-Way

26. BlueAnt admits that the '258 patent is entitled "Wireless Digital Audio System." BlueAnt admits that the '258 patent states on its face that it issued on January 4, 2011. BlueAnt admits the '258 patent states on its face that the inventor is C. Earl Woolfork, but BlueAnt lacks sufficient knowledge or information on which to admit or deny that C. Earl Woolfork is the true and sole inventor and, on that basis, denies that allegation. BlueAnt lacks sufficient knowledge or information on which to admit or deny the remaining allegations of Paragraph 26 and, on that basis, denies them.

27. BlueAnt admits that what purport to be certified copies of the of the prosecution history of the '258 patent and copies of reference documents mentioned in the prosecution history are included as Appendices A and B to the Complaint. BlueAnt lacks sufficient knowledge or information on which to admit or deny the remaining allegations of Paragraph 27 and, on that basis, denies them.

One-E-Way's Non-Technical Description of the Patented Invention

28. BlueAnt disagrees with One-E-Way's characterization of the technology, and therefore denies the allegations of Paragraph 28. To the extent Paragraph 28 makes allegations regarding the alleged invention and the scope of the claims, BlueAnt denies such allegations. BlueAnt's responses are not intended to interpret the meaning or scope of the claims in the '258 patent. BlueAnt denies the remaining allegations of Paragraph 28.

29. The allegations of Paragraph 29 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt disagrees with One-E-Way's characterization of the technology, and therefore denies the allegations of Paragraph 29. To the extent Paragraph 29 makes allegations regarding the alleged invention and the scope of the claims, BlueAnt denies such allegations. BlueAnt's responses are not intended to interpret the meaning or scope of the claims in the '258 patent. BlueAnt denies the remaining allegations of Paragraph 29.

B. The '391 Patent

Identification of the Patent and Alleged Ownership by One-E-Way

30. BlueAnt denies that the '391 patent is entitled "Wireless Digital Audio System." BlueAnt admits that the '391 patent states on its face that it issued on March 6, 2012 and appears to be a continuation of the earlier patent application that issued as the '258 patent. BlueAnt admits the '391 patent states on its face that the inventor is C. Earl Woolfork, but BlueAnt lacks sufficient knowledge or information on which to admit or deny that C. Earl Woolfork is the true and sole inventor and, on that basis, denies that allegation. BlueAnt lacks sufficient knowledge or information on which to admit or deny the remaining allegations of Paragraph 30 and, on that basis, denies them.

31. BlueAnt admits that what purport to be certified copies of the of the prosecution history of the '391 patent and copies of reference documents mentioned in the prosecution history are included as Appendices C and D to the Complaint. BlueAnt lacks sufficient knowledge or information on which to admit or deny the remaining allegations of Paragraph 31 and, on that basis, denies them.

One-E-Way's Non-Technical Description of the Patented Invention

32. BlueAnt disagrees with One-E-Way's characterization of the technology, and therefore denies the allegations of Paragraph 32. To the extent Paragraph 32 makes allegations regarding the alleged invention and the scope of the claims, BlueAnt denies such allegations. BlueAnt's responses are not intended to interpret the meaning or scope of the claims in the '391 patent. BlueAnt denies the remaining allegations of Paragraph 32.

33. The allegations of Paragraph 33 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt disagrees with One-E-Way's characterization of the technology, and therefore denies the allegations of Paragraph 33. To the extent Paragraph 33 makes allegations regarding the alleged invention and the scope of the claims, BlueAnt denies such allegations. BlueAnt's responses are not intended to interpret the meaning or scope of the claims in the '391 patent. BlueAnt denies the remaining allegations of Paragraph 33.

VI. ONE-E-WAY'S ALLEGATIONS OF UNFAIR ACTS BY RESPONDENTS

A. One-E-Way's Allegations For Sony, Sony America, and Sony Electronics

34. The allegations of Paragraph 34 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

35. The allegations of Paragraph 35 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

36. The allegations of Paragraph 36 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

37. The allegations of Paragraph 37 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

38. The allegations of Paragraph 38 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

39. The allegations of Paragraph 39 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

40. The allegations of Paragraph 40 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

B. One-E-Way's Allegations For Sennheiser and Sennheiser America

41. The allegations of Paragraph 41 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

42. The allegations of Paragraph 42 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

43. The allegations of Paragraph 43 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

44. The allegations of Paragraph 44 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

45. The allegations of Paragraph 45 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

46. The allegations of Paragraph 46 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

47. The allegations of Paragraph 47 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

C. One-E-Way's Allegations For BlueAnt and BlueAnt-US

48. BlueAnt denies that it manufactures, markets, sells for importation, imports, and /or sells after importation into the United States products that infringe, either directly or indirectly, any valid and enforceable Asserted Claim of the patents-in-suit. BlueAnt denies the remaining allegations of Paragraph 48.

49. BlueAnt admits that One-E-Way has identified BlueAnt products sold under the names Ribbon, PUMP, Q2, Q3, T1, Connect and Endure as Accused Products, but denies that any BlueAnt product infringes any valid and enforceable asserted claim of the patents-in-suit. BlueAnt admits that Exhibit 11 includes images of the Pump, Q3, Ribbon and T1 products. Paragraph 49 contains legal argument for which no answer is required. BlueAnt denies any remaining allegations of Paragraph 49.

50. BlueAnt admits that its products are manufactured, assembled and/or packaged outside the United States. BlueAnt admits that One-E-Way has identified BlueAnt products as Accused Products, but denies that BlueAnt imports, sells for importation, or sells after importation any products that infringe any valid and enforceable Asserted Claim of the patents-in-suit. BlueAnt lacks sufficient knowledge or information on which to admit or deny the remaining allegations of Paragraph 50 and, on that basis, denies them.

51. BlueAnt denies that it infringes, directly or indirectly, any valid and enforceable claim of the '391 patent. BlueAnt admits that Exhibit 12 to the Complaint contains a chart purporting to compare claims '391 patent to BlueAnt accused products, but denies that such chart is accurate and denies the allegations in the chart. BlueAnt denies any remaining allegations of Paragraph 51.

52. BlueAnt denies that it infringes, directly or indirectly, any valid and enforceable any claim of the '258 and '391 patents. BlueAnt admits that Exhibit 13 to the Complaint contains a chart purporting to compare claims of the patents-in-suit to the BlueAnt accused

products, but denies that such chart is accurate and denies the allegations in the chart. BlueAnt denies any remaining allegations of Paragraph 52.

53. Paragraph 53 contains legal argument and conclusions; therefore, no answer is required. To the extent an answer is required, BlueAnt denies all allegations of Paragraph 53.

54. Paragraph 54 contains legal argument and conclusions; therefore, no answer is required. To the extent an answer is required, BlueAnt denies all allegations of Paragraph 54.

D. One-E-Way's Allegations For Creative and Creative Labs

55. The allegations of Paragraph 55 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

56. The allegations of Paragraph 56 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

57. The allegations of Paragraph 57 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

58. The allegations of Paragraph 58 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

59. The allegations of Paragraph 59 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

60. The allegations of Paragraph 60 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

61. The allegations of Paragraph 61 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

E. One-E-Way's Allegations For Beats and Beats Ireland

62. The allegations of Paragraph 62 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

63. The allegations of Paragraph 63 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

64. The allegations of Paragraph 64 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

65. The allegations of Paragraph 65 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

66. The allegations of Paragraph 66 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

67. The allegations of Paragraph 67 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

68. The allegations of Paragraph 68 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

F. One-E-Way's Allegations For Jawbone

69. The allegations of Paragraph 69 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

70. The allegations of Paragraph 70 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

71. The allegations of Paragraph 71 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

72. The allegations of Paragraph 72 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

73. The allegations of Paragraph 73 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

74. The allegations of Paragraph 74 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

75. The allegations of Paragraph 75 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

G. One-E-Way's Allegations For Jabra

76. The allegations of Paragraph 76 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

77. The allegations of Paragraph 77 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

78. The allegations of Paragraph 78 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

79. The allegations of Paragraph 79 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

80. The allegations of Paragraph 80 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

81. The allegations of Paragraph 81 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

82. The allegations of Paragraph 82 are not directed to BlueAnt and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny such allegations and, on that basis, denies them.

VII. ONE-E-WAY'S ALLEGED SPECIFIC INSTANCES OF UNFAIR IMPORTATION AND SALE

83. The allegations of Paragraph 83 are not directed at BlueAnt, and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny the allegations of Paragraph 83 and, on that basis, denies them.

84. The allegations of Paragraph 84 are not directed at BlueAnt, and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny the allegations of Paragraph 84 and, on that basis, denies them.

85. BlueAnt admits that Exhibit 28 purports to contain a copy of a receipt for the purchase of a BlueAnt Pump headset. BlueAnt denies that the Pump infringes the Asserted Claims of the Asserted Patents. BlueAnt lacks sufficient knowledge or information on which to admit or deny the remaining allegations of Paragraph 85 and, on that basis, denies them.

86. The allegations of Paragraph 86 are not directed at BlueAnt, and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny the allegations of Paragraph 86 and, on that basis, denies them.

87. The allegations of Paragraph 87 are not directed at BlueAnt, and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or

information on which to admit or deny the allegations of Paragraph 87 and, on that basis, denies them.

88. The allegations of Paragraph 88 are not directed at BlueAnt, and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny the allegations of Paragraph 88 and, on that basis, denies them.

89. The allegations of Paragraph 89 are not directed at BlueAnt, and therefore no answer is required. To the extent an answer is required, BlueAnt lacks sufficient knowledge or information on which to admit or deny the allegations of Paragraph 89 and, on that basis, denies them.

VIII. ONE-E-WAY'S CLASSIFICATION OF THE INFRINGING PRODUCTS UNDER THE HARMONIZED TARIFF SCHEDULE OF THE UNITED STATES

90. BlueAnt admits that the Accused Products may be classified under the following heading of the Harmonized Tariff Schedules ("HTS") of the United States: 8518.30.20. BlueAnt lacks sufficient knowledge or information to admit or deny the allegations of Paragraph 90 pertaining to any other entity than BlueAnt and, therefore, denies them. BlueAnt denies the remaining allegations in Paragraph 90.

IX. RELATED LITIGATION

91. BlueAnt lacks sufficient knowledge or information on which to admit or deny the allegations of Paragraph 91 and, on that basis, denies them.

X. DOMESTIC INDUSTRY

92. BlueAnt lacks sufficient knowledge or information on which to admit or deny the allegations of Paragraph 92 and, on that basis, denies them.

A. One-E-Way's Alleged Development of the Domestic Industry

93. BlueAnt lacks sufficient knowledge or information on which to admit or deny the allegations of Paragraph 93 and, on that basis, denies them.

B. One-E-Way's Allegations Regarding Licensees' Development of the Domestic Industry

94. BlueAnt lacks sufficient knowledge or information on which to admit or deny the allegations of Paragraph 94 and, on that basis, denies them.

95. BlueAnt admits that Exhibit 37 to the Complaint purports to be photographs of products offer by Plantronics. BlueAnt admits that Exhibits 38 and 39 to the Complaint contain a chart purporting to compare the Plantronics's products to the claims of the patents-in-suit, but denies that such chart is accurate and denies the allegations in the chart. BlueAnt lacks sufficient knowledge or information on which to admit or deny the allegations of Paragraph 95 and, on that basis, denies them.

96. BlueAnt lacks sufficient knowledge or information on which to admit or deny the allegations of Paragraph 96 and, on that basis, denies them.

97. BlueAnt lacks sufficient knowledge or information on which to admit or deny the allegations of Paragraph 97 and, on that basis, denies them.

98. BlueAnt admits that Exhibit 40 to the Complaint purports to be photographs of products offer by Jaybird. BlueAnt admits that Exhibits 41 and 42 to the Complaint contain a chart purporting to compare the Jaybird's products to the claims of the patents-in-suit, but lacks sufficient knowledge or information on which to determine whether such chart is accurate. BlueAnt lacks sufficient knowledge or information on which to admit or deny the remaining allegations of Paragraph 98 and, on that basis, denies them.

99. BlueAnt lacks sufficient knowledge or information on which to admit or deny the allegations of Paragraph 99 and, on that basis, denies them.

100. BlueAnt lacks sufficient knowledge or information on which to admit or deny the allegations of Paragraph 100 and, on that basis, denies them.

XI. ONE-E-WAY'S STATEMENT OF RELIEF REQUESTED

101. BlueAnt denies that One-E-Way is entitled to the relief requested, or to any other relief.

XII. BLUEANT'S RESPONSE TO NOTICE OF INVESTIGATION[2]

102. Without admitting any of the specific or general allegations set forth in One-E-Way's Complaint as referenced in the Notice of Investigation, BlueAnt provides the following response to the Notice of Investigation. BlueAnt acknowledges that the U.S. International Trade

[2] This heading, and the following headings and paragraphs, do not correspond to numbered headings and paragraphs set forth in the Complaint.

Commission has initiated an investigation as set forth in the Commission's Notice of investigation, as published in 80 Fed. Reg. 1,663 on January 15, 2015. BlueAnt denies that there have been any violations of Section 337 by BlueAnt in the importation into the United States, the sale for importation, or the sale after importation into the United States of products by reason of alleged infringement of the Asserted Claims of any patents owned by or assigned to One-E-Way. BlueAnt lacks sufficient knowledge or information to form a belief as to whether there exists a domestic industry as required by Section 337(a)(2) and defined by Section 337(a)(3), and, on that basis, denies those allegations. BlueAnt denies that One-E-Way is entitled to any relief in this proceeding.

XIII. BLUEANT'S STATEMENT PURSUANT TO COMMISSION RULE 210.13(b)

103. Pursuant to Commission Rule 210.13(b), BlueAnt provides the following additional information. By providing this information, BlueAnt intends only to supply statistical and other data required by Commission Rule 210.13(b), 19 C.F.R. § 210.13(b). BlueAnt specifically denies that any of the supplied data refers or relates to any unlawful act under Section 337 or otherwise, and BlueAnt specifically denies that the Accused Products infringe any valid and enforceable Asserted Claim of the Asserted Patents. Discovery has only begun, and is ongoing. Thus, BlueAnt reserves the right to amend and/or supplement the information provided below.

104. BlueAnt understands that One-E-Way accuses BlueAnt headsets sold under the names Ribbon, PUMP, Q2, Q3, T1, connect, and Endure of infringing certain claims of the patents-in-suit. Statistical data regarding the quantity and value of imports of these accused products, as well as a statement regarding the name and supplier of its accused imports, is provided in Confidential Exhibit A. This information is preliminary in nature and will be supplemented and amended as appropriate.

105. BlueAnt's Accused Products may fall within the following classification of the Harmonized Tariff Schedules of the United States: 8517.12 (telephones for cellular networks or for other wireless networks).

XIV. AFFIRMATIVE AND OTHER DEFENSES

106. BlueAnt asserts the following additional defenses. Discovery of One-E-Way has just begun, and BlueAnt has not yet had sufficient time or opportunity to collect and review information that may be relevant to the matters raised herein, and the affirmative defensives available to the same. BlueAnt reserves the right to modify, supplement, or expand these defenses and to take further positions as discovery proceeds.

107. BlueAnt hereby adopts and incorporates by reference, as if fully set forth herein, the affirmative defenses of any other Respondents currently or subsequently named in this Investigation.

FIRST AFFIRMATIVE DEFENSE
NON-INFRINGEMENT

108. BlueAnt does not and has not directly infringed, indirectly infringed, contributed to infringement, or induced infringement of any valid and enforceable Asserted Claim of the Asserted patents either literally or under the doctrine of equivalents, and has not otherwise committed any acts in violation of 35 U.S.C. § 271 or 19 U.S.C. § 1337.

SECOND AFFIRMATIVE DEFENSE
INVALIDITY AND/OR UNENFORCEABILITY

109. The asserted claims of the Patents-in-Suit are each invalid for failure to comply with one or more of the conditions and requirements of the patent laws, including, but not limited to 35 U.S.C. §§ 101, 102, 103, 112, 116, and/or 256. Discovery is ongoing and BlueAnt will set forth further invalidity allegations in accordance with the Procedural Schedule set forth in this Investigation.

THIRD AFFIRMATIVE DEFENSE
LACK OF DOMESTIC INDUSTRY

110. On information and belief, One-E-Way has not adequately alleged or established the existence of a domestic industry for any of the Asserted patents, as required by Section 337(a)(2) and defined by Section 337(a)(3).

FOURTH AFFIRMATIVE DEFENSE
THE REQUESTED REMEDY IS NOT IN THE PUBLIC INTEREST

111. One-E-Way's demands for relief are barred under 19 U.S.C. § 1337(d)(1) because of the detrimental effect such relief would have upon the public welfare, competitive conditions

in the United States economy, the production of like or directly competitive articles in the United States, the United States consumers.

FIFTH AFFIRMATIVE DEFENSE
PROSECUTION HISTORY ESTOPPEL

112. By reason of representation, omissions, and/or concessions made during prosecution of the patents-in-suit, and/or related U.S. or foreign patents and patent applications, One-E-Way is estopped from claiming that BlueAnt infringes the patents-in-suit.

SIXTH AFFIRMATIVE DEFENSE
ESTOPPEL, ACQUIESCENSCE, AND WAIVER

113. On information and belief, one or both of the patents-in-suit are unenforceable based on the doctrines of estoppel, acquiescence and waiver.

SEVENTH AFFIRMATIVE DEFENSE
UNCLEAN HANDS

114. On information and belief, One-E-Way's claims are barred in whole or in part by the doctrine of unclean hands.

EIGHTH AFFIRMATIVE DEFENSE
PATENT MISUSE

115. On information and belief, the patents-in-suit are unenforceable due to One-E-Way's misuse of the patents, including attempting to extend its patent rights beyond the permissible legal boundaries of the patents though license agreements and other activities.

NINTH AFFIRMATIVE DEFENSE
UNENFORCEABILITLY FOR PATENT EXHAUSTION AND/OR
FIRST SALE DOCTRINE

116. On information and belief, one or more of the patents-in-suit unenforceable in whole or in part based on the doctrines of patent exhaustion and/or the first sale doctrine.

TENTH AFFIRMATIVE DEFENSE
INCORRECT INVENTORSHIP

117. On information and belief, the Asserted Patents are invalid under at least 35 U.S.C. §§ 101, 102, 115, and 116 for failure to correctly name and/or join the inventors of the claimed subject-matter.

XV. CONCLUSION

BlueAnt requests that the Commission determine and direct that: (1) BlueAnt has not violated 19 U.S.C. § 1337; (2) BlueAnt has not infringed the patents-in-suit; (3) One-E-Way's request for a limited exclusion order and cease and desist order be denied; (4) the Asserted Patents be found invalid and/or unenforceable; (5) there is no protectable domestic industry in the asserted patents; (6) BlueAnt's request for an exclusion order and cease and desist order is against the public interest; and (7) such other and further relief as the Commission deems just and proper under the law.

Dated: February 3, 2015

Respectfully submitted,

/s/ Duane H. Mathiowetz

Duane H. Mathiowetz
Patricia L. Peden
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Counsel for BlueAnt Wireless, Pty Ltd. and BlueAnt Wireless Inc.

CERTIFICATE OF SERVICE

I hereby certify that on February 3, 2015, a copy the foregoing **BLUEANT'S RESPONSE TO THE COMPLAINT AND NOTICE OF INVESTIGATION,** was served as indicated to the parties listed below:

Lisa R. Barton, Secretary **U.S. International Trade Commission** 500 E. Street, S.W. Washington, D.C. 20436	Via Electronic Filing (EDIS)
Honorable Thomas B. Pender **U.S. International Trade Commission** 500 E. Street, S.W., Room 317 Washington, D.C. 20436 Gregory.Moldafsky@usitc.gov	Via Hand Delivery (2 copies); and Via Electronic Mail (word format)
Vu Bui, Esq. **Office of Unfair Import Investigations** **U.S. International Trade Commission** 500 E. Street, S.W., Room 317 Washington, D.C. 20436 vu.bui@usitc.gov	Via Electronic Mail
Counsel for Complainant One-E-Way, Inc. Douglas G. Muehlhauser Paul A. Stewart Payson LeMeilleur Alan G. Laquer Yimeng Dou KNOBBE, MARTENS, OLSON & BEAR LLP 2040 Main Street, 14th Floor Irvine, CA 92614 1EWayITC@knobbe.com	Via Electronic Mail

RESPONDENTS:	
Jawbone, Inc. 99 Rhode Island Street, Third Floor San Francisco, CA 94103	Via USPS First Class Mail
Counsel for Sennheiser Electronic GmbH & Co. KG and Sennheiser Electronic Corporation Sean P. DeBruine KILPATRICK TOWNSEND 1080 Marsh Road Menlo Park, CA 94025 SennheiserITC@kilpatricktownsend.com	Via Electronic Mail
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Counsel for Beats Electronics, LLC and Beats Electronics International Ltd. Celine Jimenez Crowson HOGAN LOVELLS US LLP 555 Thirteenth Street, N.W. Washington, D.C. 20004 Beats-OEWCase@hoganlovells.com	Via Electronic Mail
Counsel for Sony Corporation, Sony Corporation of America, and Sony Electronics, Inc. Paul T. Qualey KENYON & KENYON LLP 1500 K Street, N.W. Washington, D.C. 20005-1257 Sony-ITC-943@kenyon.com	Via Electronic Mail

Counsel for GN Netcom A/S d/b/a Jabra William B. Nash HAYNES AND BOONE, LLP 112 East Pecan Street San Antonio, TX 78205 GN-ITC@haynesboone.com	Via Electronic Mail

/s/ Dani Quever
Dani Quever, Legal Assistant

[redacted]

EXHIBIT A

[redacted]

[redacted]

INFORMATION REQUIRED BY 19 C.F.R. § 210.13(B)

1. Pursuant to Commission Rule 210.13(b), the BlueAnt Respondents provide the following information with the sole intention of supplying statistical and other data required by 19 C.F.R. § 210.13(b). The BlueAnt Respondents specifically deny that any of the supplied data refers or relates to any unlawful act under Section 337 or otherwise, and the BlueAnt Respondents specifically deny that their products infringe any of the claims of the Asserted Patents. Discovery has only recently begun and is ongoing. BlueAnt reserves the right to amend and/or supplement the information provided below.

2. For calendar year 2014, BlueAnt imported the following approximate number of unites of accused products having the following approximate value.

Product	Number of Units	Approximate Value
Ribbon		$
Pump		$
Q2		$
Q3		$
T1		$
Connect		$
Endure		$

3. BlueAnt does not manufacture products. Its suppliers are:

4. Pursuant to Rule 210.13(b), the BlueAnt Respondents state that for calendar year 2014, its best estimate at this time, is that the United States market represented approximately of BlueAnt's worldwide market for the accused products.

5. This information is preliminary in nature and will be supplemented and amended as appropriate.

Electronic Acknowledgement Receipt

EFS ID:	21787543
Application Number:	13356949
International Application Number:	
Confirmation Number:	2299
Title of Invention:	Wireless Digital Audio Music System
First Named Inventor/Applicant Name:	C. Earl Woolfork
Customer Number:	68533
Filer:	Megan Elizabeth Lyman
Filer Authorized By:	
Attorney Docket Number:	1028.6
Receipt Date:	17-MAR-2015
Filing Date:	24-JAN-2012
Time Stamp:	09:15:06
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Terminal Disclaimer Filed	TDastoApp949.pdf	205637 423c2ffc2851e33b8f175771351252feba04edce	no	2

Warnings:	
Information:	

2	Notice of concurrent proceedings / decisions	SatementforAnswers.pdf	69924 4e692d97eb91da8f198d749d80c2cc79347c6e24	no	2
Warnings:					
Information:					
3	Notice of concurrent proceedings / decisions	ArgumentsSmallest.pdf	4869485 108ec9dc0c34f59b36cb203362ed8ad61e18f892	no	213
Warnings:					
Information:					
			Total Files Size (in bytes):	5145046	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/25 (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

TERMINAL DISCLAIMER TO OBVIATE A PROVISIONAL DOUBLE PATENTING REJECTION OVER A PENDING "REFERENCE" APPLICATION	Docket Number (Optional) 1028.6

In re Application of:

Application No.:

Filed:

For:

The owner*, C. Earl Woolfork, of 100 percent interest in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of any patent granted on pending **reference** Application Number 13/356,949, filed on 01/24/2012, as such term is defined in 35 U.S.C. 154 and 173, and as the term of any patent granted on said **reference** application may be shortened by any terminal disclaimer filed prior to the grant of any patent on the pending **reference** application. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and any patent granted on the **reference** application are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the owner does not disclaim the terminal part of any patent granted on the instant application that would extend to the expiration date of the full statutory term as defined in 35 U.S.C. 154 and 173 of any patent granted on said **reference** application, "as the term of any patent granted on said **reference** application may be shortened by any terminal disclaimer filed prior to the grant of any patent on the pending **reference** application," in the event that: any such patent: granted on the pending **reference** application: expires for failure to pay a maintenance fee, is held unenforceable, is found invalid by a court of competent jurisdiction, is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321, has all claims canceled by a reexamination certificate, is reissued, or is in any manner terminated prior to the expiration of its full statutory term as shortened by any terminal disclaimer filed prior to its grant.

Check either box 1 or 2 below, if appropriate.

1. ☐ For submissions on behalf of a business/organization (e.g., corporation, partnership, university, government agency, etc.), the undersigned is empowered to act on behalf of the business/organization.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

2. ☑ The undersigned is an attorney or agent of record. Reg. No. 57,054

/Megan Lyman/ — Signature
3/28/2015 — Date

Megan Lyman — Typed or printed name

(919) 341-4023 — Telephone Number

☑ Terminal disclaimer fee under 37 CFR 1.20(d) is included.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).
Form PTO/SB/96 may be used for making this statement. See MPEP § 324.

This collection of information is required by 37 CFR 1.321. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt

EFS ID:	21907570
Application Number:	13356949
International Application Number:	
Confirmation Number:	2299
Title of Invention:	Wireless Digital Audio Music System
First Named Inventor/Applicant Name:	C. Earl Woolfork
Customer Number:	68533
Filer:	Megan Elizabeth Lyman
Filer Authorized By:	
Attorney Docket Number:	1028.6
Receipt Date:	28-MAR-2015
Filing Date:	24-JAN-2012
Time Stamp:	21:12:06
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Terminal Disclaimer Filed	TDastoApp949.pdf	205588 20299cd0b9feee942f68d49ab8f99bbc26f341f8	no	2

Warnings:	
Information:	

Total Files Size (in bytes):	205588

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Application Number	Application/Control No.	Applicant(s)/Patent under Reexamination	
	13/356,949	WOOLFORK, C. EARL	

Document Code - DISQ	Internal Document – DO NOT MAIL

TERMINAL DISCLAIMER	☐ APPROVED	☒ DISAPPROVED
Date Filed : 03/28/15	This patent is subject to a Terminal Disclaimer	

Approved/Disapproved by:

Td heading is incomplete.

The application number identified is incorrect, see FP 14.32.

NO FEE is required.

Angie Walker

Doc Code: DIST.E.FILE **Document Description: Electronic Terminal Disclaimer - Filed**	PTO/SB/26 U.S. Patent and Trademark Office Department of Commerce

Electronic Petition Request	**TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT**
Application Number	13356949
Filing Date	24-Jan-2012
First Named Inventor	C. Woolfork
Attorney Docket Number	1028.6
Title of Invention	Wireless Digital Audio Music System

☒ Filing of terminal disclaimer does not obviate requirement for response under 37 CFR 1.111 to outstanding Office Action

☒ This electronic Terminal Disclaimer is not being used for a Joint Research Agreement.

Owner	Percent Interest
C. Earl Woolfork	100%

The owner(s) with percent interest listed above in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of prior patent number(s)

8131391

7865258

7684885

7412294

as the term of said prior patent is presently shortened by any terminal disclaimer. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the prior patent are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the owner does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term of the prior patent, "as the term of said prior patent is presently shortened by any terminal disclaimer," in the event that said prior patent later:
- expires for failure to pay a maintenance fee;
- is held unenforceable;
- is found invalid by a court of competent jurisdiction;
- is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321;
- has all claims canceled by a reexamination certificate;
- is reissued; or
- is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer.

○ Terminal disclaimer fee under 37 CFR 1.20(d) is included with Electronic Terminal Disclaimer request.

◉ I certify, in accordance with 37 CFR 1.4(d)(4), that the terminal disclaimer fee under 37 CFR 1.20(d) required for this terminal disclaimer has already been paid in the above-identified application.

THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES

I certify, in accordance with 37 CFR 1.4(d)(4) that I am:

◉ An attorney or agent registered to practice before the Patent and Trademark Office who is of record in this application

Registration Number 57054

○ A sole inventor

○ A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors as evidenced by the power of attorney in the application

○ A joint inventor; all of whom are signing this request

Signature	/Megan Lyman/
Name	Megan Lyman

*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).
Form PTO/SB/96 may be used for making this certification. See MPEP § 324.

Doc Code: DISQ.E.FILE
Document Description: Electronic Terminal Disclaimer – Approved

Application No.: 13356949

Filing Date: 24-Jan-2012

Applicant/Patent under Reexamination: Woolfork et al.

Electronic Terminal Disclaimer filed on March 30, 2015

☒ APPROVED

This patent is subject to a terminal disclaimer

☐ DISAPPROVED

Approved/Disapproved by: Electronic Terminal Disclaimer automatically approved by EFS-Web

U.S. Patent and Trademark Office

Electronic Acknowledgement Receipt

EFS ID:	21913157
Application Number:	13356949
International Application Number:	
Confirmation Number:	2299
Title of Invention:	Wireless Digital Audio Music System
First Named Inventor/Applicant Name:	C. Earl Woolfork
Customer Number:	68533
Filer:	Megan Elizabeth Lyman
Filer Authorized By:	
Attorney Docket Number:	1028.6
Receipt Date:	30-MAR-2015
Filing Date:	24-JAN-2012
Time Stamp:	13:56:55
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Electronic Terminal Disclaimer-Filed	eTerminal-Disclaimer.pdf	32917 dbf3af8c287c321c0c5d295de14aaed283da0d6e	no	2

Warnings:	
Information:	

Total Files Size (in bytes):	32917

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

68533 7590 04/13/2015

MEGAN LYMAN
1816 SILVER MIST CT.
RALEIGH, NC 27613

EXAMINER
FLANDERS, ANDREW C

ART UNIT	PAPER NUMBER
2656	

DATE MAILED: 04/13/2015

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/356,949	01/24/2012	C. Earl Woolfork	1028.6	2299

TITLE OF INVENTION: Wireless Digital Audio Music System

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$480	$0	$0	$480	07/13/2015

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PTOL-85 (Rev. 02/11)

Samsung Exhibit 1002, Page 587 of 880
Samsung Electronics Co., Ltd. et al. v. One-E-Way, Inc.
IPR2025-01541

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

68533 7590 04/13/2015
MEGAN LYMAN
1816 SILVER MIST CT.
RALEIGH, NC 27613

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/356,949	01/24/2012	C. Earl Woolfork	1028.6	2299

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nonprovisional	SMALL	$480	$0	$0	$480	07/13/2015

EXAMINER	ART UNIT	CLASS-SUBCLASS
FLANDERS, ANDREW C	2656	700-094000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. The following fee(s) are submitted:
❑ Issue Fee
❑ Publication Fee (No small entity discount permitted)
❑ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
❑ A check is enclosed.
❑ Payment by credit card. Form PTO-2038 is attached.
❑ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
❑ Applicant certifying micro entity status. See 37 CFR 1.29
NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
❑ Applicant asserting small entity status. See 37 CFR 1.27
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
❑ Applicant changing to regular undiscounted fee status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

PTOL-85 Part B (10-13) Approved for use through 10/31/2013. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Samsung Exhibit 1002, Page 588 of 880
Samsung Electronics Co., Ltd. et al. v. One-E-Way, Inc.
IPR2025-01541

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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68533 7590 04/13/2015

MEGAN LYMAN
1816 SILVER MIST CT.
RALEIGH, NC 27613

EXAMINER	
FLANDERS, ANDREW C	
ART UNIT	PAPER NUMBER
2656	

DATE MAILED: 04/13/2015

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

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OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 13/356,949	Applicant(s) WOOLFORK, C. EARL	
	Examiner Andrew C. Flanders	Art Unit 2656	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *the amendment filed 20 February 2015*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on_____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *1-12*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov .
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some *c) ☐ None of the:
   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☐ Examiner's Amendment/Comment
6. ☒ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/Andrew C Flanders/
Primary Examiner, Art Unit 2656

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Samsung Electronics Co., Ltd. et al. v. One-E-Way, Inc.
IPR2025-01541

The present application is being examined under the pre-AIA first to invent provisions.

EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Megan E. Lyman on 31 March 2015.

The application has been amended as follows:

8. (Currently Amended) A wireless digital coded music audio spread spectrum transmitter operatively coupled to a music audio source and configured to transmit a unique user code and an original audio signal representation in the form of packets, wherein said digital coded music audio transmitter coupled to said music audio source, and configured to be directly communicable with a mobile digital audio spread spectrum receiver, is capable of being moved in any direction during operation, said wireless digital coded audio transmitter comprising:

encoding operative to encode said original audio signal representation to reduce intersymbol interference and aid in lowering signal detection error of said audio representation signal respective to said receiver and mobile said transmitter coupled to said music audio source;

a digital modulator module configured for independent code division multiple access communication operation, wherein [[a]] each user has their own separate audio transmitter configured to independently communicate with their receiver, said transmitter configured to wirelessly transmit said audio to be reproduced virtually free from interference from transmission and reception device ~~transmitted~~ signals operating in the wireless digital audio transmitter shared spectrum.

10. (Currently Amended) A wireless digital coded audio spread spectrum transmitter operatively coupled to a audio source and configured to transmit a unique user code and an original audio signal representation in the form of packets, wherein said digital coded audio transmitter coupled to said audio source, and configured to be directly communicable with a mobile digital audio spread spectrum receiver, is capable of being moved in any direction during operation, said wireless digital coded audio transmitter comprising:

an encoding module operative to encode said original audio signal representation to reduce intersymbol interference and aid in lowering signal detection error of said audio signal representation, said transmitter coupled to said audio source;

a digital modulator module configured for independent code division multiple access communication operation, wherein [[a]] each user has their own separate audio transmitter configured to independently communicate with their receiver, said transmitter configured to wirelessly transmit said audio to be reproduced virtually free

from interference from transmission and reception device ~~transmitted~~ signals operating in the wireless digital audio transmitter shared spectrum.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Andrew C. Flanders whose telephone number is (571)272-7516. The examiner can normally be reached on M-F 8:30 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Curtis Kuntz can be reached on (571) 272-7499. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Andrew C Flanders/
Primary Examiner, Art Unit 2656

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	13356949
	Filing Date	2012-24-01
	First Named Inventor	C. Earl Woolfork
	Art Unit	2656
	Examiner Name	Andrew Flanders
	Attorney Docket Number	

U.S.PATENTS						Remove
Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	6982132		2006-03-01	Goldner,Ronald	
	2	7505823		2009-17-03	Bartlett,David	
If you wish to add additional U.S. Patent citation information please click the Add button.						Add

U.S.PATENT APPLICATION PUBLICATIONS						Remove
Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					
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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							☐
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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /ACF/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13356949
	Filing Date	2012-24-01
	First Named Inventor	C. Earl Woolfork
	Art Unit	2656
	Examiner Name	Andrew Flanders
	Attorney Docket Number	

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1		☐

If you wish to add additional non-patent literature document citation information please click the Add button **Add**

EXAMINER SIGNATURE

Examiner Signature	/Andrew Flanders/	Date Considered	04/06/2015

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /ACF/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13356949
	Filing Date	2012-24-01
	First Named Inventor	C. Earl Woolfork
	Art Unit	2656
	Examiner Name	Andrew Flanders
	Attorney Docket Number	

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ None

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature		Date (YYYY-MM-DD)	
Name/Print		Registration Number	

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

EFS Web 2.1.17

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /ACF/

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1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /ACF/

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13356949	WOOLFORK, C. EARL
	Examiner	Art Unit
	ANDREW C FLANDERS	2656

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
700	94	12/16/14	acf

SEARCH NOTES		
Search Notes	Date	Examiner
see history attached	10/2/13	acf
reviewed and repeatedsearch history of entire family; 10/027,391 10/648,012 12/144,729 12/570,343 12/940,747	10/2/13	acf
eDan, EAST and PALM inventor search for double patenting	10/2/13	acf
google.com patents search	10/2/13	acf
updated	5/1/14	acf
updated	12/16/14	acf
updated	4/6/15	acf

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
700	94	4/6/15	acf

	/ANDREW C FLANDERS/ Primary Examiner.Art Unit 2656

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13356949	WOOLFORK, C. EARL
	Examiner	Art Unit
	ANDREW C FLANDERS	2656

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☒ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	10/02/2013	05/01/2014	12/16/2014	04/06/2015					
1	1	✓	✓	✓	=					
2	2	✓	✓	✓	=					
3	3	✓	✓	✓	=					
4	4	✓	✓	✓	=					
5	5	✓	✓	✓	=					
6	6	✓	✓	✓	=					
7	7	✓	✓	✓	=					
8	8	✓	✓	✓	=					
9	9		✓	✓	=					
10	10		✓	✓	=					
11	11			✓	=					
12	12				=					

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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	0	wo0019632	US-PGPUB; USPAT; USOCR	OR	OFF	2015/04/06 11:01
L2	0	wo0019632	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2015/04/06 11:01
L3	1	"wo 00/19632"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2015/04/06 11:01
L4	2	(("6061387") or ("6269130")).PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2015/04/06 11:03
L5	35	("20020016188" | "4816769" | "4864599" | "5428836" | "5687218" | "5794163" | "5799097" | "5845197" | "5911119" | "6021207" | "6026082" | "6032028" | "6118882" | "6119002" | "6122388" | "6141356" | "6185418" | "6307945" | "6339695").PN. OR ("6519448").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2015/04/06 11:27
L6	9	l5 and cdma	US-PGPUB; USPAT; USOCR	OR	OFF	2015/04/06 11:27
L7	4	"8131391"	US-PGPUB; USPAT; USOCR	OR	OFF	2015/04/06 11:28
L8	4	(("8131391") or ("7865258") or ("7684885") or ("7412294")).PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2015/04/06 11:28
S1	9	FHSS with unique with user	US-PGPUB; USPAT	OR	OFF	2007/03/20 09:30
S2	6	S1 and @ad<"20011221"	US-PGPUB; USPAT	OR	OFF	2006/05/02 17:45
S3	0	FHSS with unique adj hop	US-PGPUB; USPAT	OR	OFF	2006/05/02 17:46
S4	0	FHSS with each adj user	US-PGPUB; USPAT	OR	OFF	2006/05/02 17:46
S5	0	FHSS with individual adj user	US-PGPUB; USPAT	OR	OFF	2006/05/02 17:47
S6	0	(FHSS or "frequency hopping spread	US-PGPUB;	OR	OFF	2006/05/02

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		spectrum") with individual adj user	USPAT			17:47
S7	0	(FHSS or "frequency hopping spread spectrum") near user same unique	US-PGPUB; USPAT	OR	OFF	2006/05/02 17:47
S8	9	(FHSS or "frequency hopping spread spectrum") with user same unique	US-PGPUB; USPAT	OR	OFF	2006/05/02 17:48
S9	17	(FHSS or "frequency hopping spread spectrum") same unique same user	US-PGPUB; USPAT	OR	OFF	2006/05/02 17:48
S10	6	S9 and @ad<"20011221"	US-PGPUB; USPAT	OR	OFF	2006/05/02 17:48
S11	9	(FHSS or "frequency hopping spread spectrum") same multiple adj user!	US-PGPUB; USPAT	OR	OFF	2006/05/03 10:32
S12	91	(FHSS or "frequency hopping spread spectrum") same (pn or "hopping code")	US-PGPUB; USPAT	OR	OFF	2006/05/02 17:50
S13	13	(FHSS or "frequency hopping spread spectrum") with ("hopping code")	US-PGPUB; USPAT	OR	OFF	2006/05/02 17:50
S14	3	S13 and @ad<"20011221"	US-PGPUB; USPAT	OR	OFF	2006/05/02 17:51
S15	1	("5946343").PN.	US-PGPUB; USPAT	OR	OFF	2006/05/03 11:46
S16	1	("6342844").PN.	US-PGPUB; USPAT	OR	OFF	2006/05/03 11:46
S17	1	("5771441").PN.	US-PGPUB; USPAT	OR	OFF	2006/08/28 15:55
S18	10725	"rechargeable battery" and @ad<"20011220"	US-PGPUB; USPAT	OR	OFF	2006/08/28 15:55
S19	376	"rechargeable battery".ti. and @ad<"20011220"	US-PGPUB; USPAT	OR	OFF	2006/08/28 15:55
S20	17	("rechargeable battery" and portable).ti. and @ad<"20011220"	US-PGPUB; USPAT	OR	OFF	2006/08/28 15:57
S21	3623043	("rechargeable battery" and portable) with mah andd @ad<"20011220"	US-PGPUB; USPAT	OR	OFF	2006/08/28 15:57
S22	0	("rechargeable battery" and portable) with mah and @ad<"20011220"	US-PGPUB; USPAT	OR	OFF	2006/08/28 15:57
S23	3623041	("rechargeable battery" and portable) with ma-h andd @ad<"20011220"	US-PGPUB; USPAT	OR	OFF	2006/08/28 15:57
S24	3623041	("rechargeable battery" and portable) with "ma-h" andd @ad<"20011220"	US-PGPUB; USPAT	OR	OFF	2006/08/28 15:57
S25	0	("rechargeable battery" and portable) with "ma-h" and @ad<"20011220"	US-PGPUB; USPAT	OR	OFF	2006/08/28 15:57
S26	640693	("rechargeable battery" and portable) with milliamp hours and @ad<"20011220"	US-PGPUB; USPAT	OR	OFF	2006/08/28 15:57
S27	18	("rechargeable battery" and portable) and "milliamp hours" and @ad<"20011220"	US-PGPUB; USPAT	OR	OFF	2006/08/31 12:17
S28	29	"5491839"	US-PGPUB; USPAT	OR	OFF	2006/08/30 12:56
S29	1	("5491839").PN.	US-PGPUB; USPAT	OR	OFF	2006/08/30 12:56
S30	1	("5771441").PN.	US-PGPUB; USPAT	OR	OFF	2006/08/30 12:56
S31	1	("6,107,147").PN.	US-PGPUB; USPAT	OR	OFF	2006/08/31 12:17

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S32	0	(10/648012).APP.	US-PGPUB; USPAT	OR	OFF	2006/09/25 09:26
S33	1	("5946343").PN.	US-PGPUB; USPAT	OR	OFF	2006/09/25 09:50
S34	422	(455/564.1,412,413).CCLS.	US-PGPUB; USPAT	OR	OFF	2006/09/25 09:50
S35	5294	(375/219,295-297,346,348).CCLS.	US-PGPUB; USPAT	OR	OFF	2006/09/25 10:02
S36	1	("20040223622").PN.	US-PGPUB; USPAT	OR	OFF	2006/09/25 10:04
S37	1	("5946343").PN.	US-PGPUB; USPAT	OR	OFF	2006/09/25 10:05
S38	1	("7,050,419").PN.	US-PGPUB; USPAT	OR	OFF	2007/03/20 09:32
S39	1	("20010025358").PN.	US-PGPUB; USPAT	OR	OFF	2007/03/20 09:37
S40	2618	(375/341,140,147).CCLS.	US-PGPUB; USPAT	OR	OFF	2007/03/20 09:37
S41	1807	S40 and @ad<"20011220"	US-PGPUB; USPAT	OR	OFF	2007/03/20 09:38
S42	8	("2001/0025358").URPN.	USPAT	OR	OFF	2007/03/20 09:51
S43	0	("2002/0025009").URPN.	USPAT	OR	OFF	2007/03/20 09:59
S44	0	("2002/0025009").URPN.	USPAT	OR	OFF	2007/03/20 10:01
S45	12	("20020159543" | "5434623" | "5867532" | "5973642" | "6243423" | "6327314" | "6339612" | "6459728" | "6477210" | "6480554" | "6654429" | "6671338").PN. OR ("7099413").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2007/03/20 10:08
S46	74	"band pass" and demodulator and interleaver and "viterbi decoder"	US-PGPUB; USPAT; USOCR	OR	OFF	2007/03/20 10:08
S47	59	S46 and @ad<"20011220"	US-PGPUB; USPAT; USOCR	OR	OFF	2007/03/20 10:08
S48	17	("4278978" | "4635063" | "5175558" | "5493307").PN. OR ("6130643").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2007/03/20 10:15
S49	1	("5175558").PN.	US-PGPUB; USPAT	OR	OFF	2007/03/20 10:16
S50	13	("4651155" | "4931977").PN. OR ("5175558").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2007/03/20 10:34
S51	1	("5946343").PN.	US-PGPUB; USPAT	OR	OFF	2007/03/20 11:40
S52	7186	(375/295,146,130,340,316,148).CCLS.	US-PGPUB; USPAT	OR	OFF	2007/03/20 11:41
S53	4473	S52 and @ad<"20011220"	US-PGPUB; USPAT	OR	OFF	2007/03/20 11:41
S54	1	("20040223622").PN.	US-PGPUB; USPAT	OR	OFF	2007/03/21 12:11
S55	5	"reed solomon" with "intersymbol	US-PGPUB;	OR	OFF	2007/03/21

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		interference"	USPAT			12:13
S56	30	"reed solomon" same "intersymbol interference"	US-PGPUB; USPAT	OR	OFF	2007/03/21 12:13
S57	21	S56 and @ad<"20011220"	US-PGPUB; USPAT	OR	OFF	2007/03/21 12:27
S58	1	("20030045235").PN.	US-PGPUB; USPAT	OR	OFF	2007/03/21 12:37
S59	1	("5790595").PN.	US-PGPUB; USPAT	OR	OFF	2007/03/21 12:37
S60	2435	((375/262,265,341) or (714/794,795)).CCLS.	US-PGPUB; USPAT	OR	OFF	2007/03/24 09:15
S62	56	"375".clas. and "fuzzy logic"	US-PGPUB; USPAT	OR	OFF	2007/03/26 11:04
S64	1	("4970637").PN.	US-PGPUB; USPAT	OR	OFF	2007/03/28 13:46
S65	755	(audio sound music voice) same (a/d "analog to digital") same (lpf "low pass")	US-PGPUB; USPAT	OR	OFF	2007/03/28 13:46
S66	282	(audio sound music voice) with (a/d "analog to digital") with ((lpf "low pass") and "digital")	US-PGPUB; USPAT	OR	OFF	2007/03/28 13:47
S67	227	(audio sound music voice) with (a/d "analog to digital") with ((lpf "low pass") and "digital") and @ad<"20011221"	US-PGPUB; USPAT	OR	OFF	2007/03/28 15:33
S68	34712	"band pass filter" bpf with "direct conversion receiver"	US-PGPUB; USPAT	OR	OFF	2007/03/28 15:33
S69	35	("band pass filter" bpf) with "direct conversion receiver"	US-PGPUB; USPAT	OR	OFF	2007/03/28 15:33
S70	8	S69 and @ad<"20011221"	US-PGPUB; USPAT	OR	OFF	2007/03/28 15:55
S71	1	("20030045235").PN.	US-PGPUB; USPAT	OR	OFF	2007/03/28 16:16
S72	1	("20040223622").PN.	US-PGPUB; USPAT	OR	OFF	2007/03/28 16:20
S73	1	("5946343").PN.	US-PGPUB; USPAT	OR	OFF	2007/03/28 16:27
S74	364	"64-ary"	US-PGPUB; USPAT	OR	OFF	2007/03/28 16:27
S75	74	"64-ary" near modulat$4	US-PGPUB; USPAT	OR	OFF	2007/03/28 16:27
S76	46	S75 and @ad<"20011120"	US-PGPUB; USPAT	OR	OFF	2007/03/28 16:27
S77	2	(("4970637") or ("5790595")).PN.	US-PGPUB; USPAT	OR	OFF	2007/07/16 09:58
S78	3	(("4970637") or ("5790595") or ("20040223622")).PN.	US-PGPUB; USPAT	OR	OFF	2007/07/16 09:58
S79	3	("2004/0223622").URPN.	USPAT	OR	OFF	2007/07/16 11:25
S80	1	("5771441").PN.	US-PGPUB; USPAT	OR	OFF	2007/07/16 11:25
S81	60	("2236946" | "2828413" | "2840694" | "3080785" | "3085460" | "3087117" | "3296916" | "3579211" | "3743751" | "3781451" | "3825666" | "3863157" |	US-PGPUB; USPAT; USOCR	OR	OFF	2007/07/16 11:26

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		"3901118" | "3906160" | "4004228" | "4229826" | "4335930" | "4344184" | "4369521" | "4430757" | "4453269" | "4464792" | "4471493" | "4612688" | "4647135" | "4721926" | "4794622" | "4845751" | "4899388" | "4988957" | "5025704" | "5214568").PN. OR ("5771441").URPN.				
S82	2	S81 and cdma	US-PGPUB; USPAT; USOCR	OR	OFF	2007/07/16 11:26
S83	1	("6678892").PN.	US-PGPUB; USPAT	OR	OFF	2008/05/20 11:41
S84	1	("20020072816").PN.	US-PGPUB; USPAT	OR	OFF	2008/05/20 14:24
S85	22	"fuzzy logic" and modulat$5 and filter and (dpsk "phase shift key")	US-PGPUB; USPAT	OR	OFF	2008/06/06 09:20
S86	0	"455".clas. and "375".clas. and S85	US-PGPUB; USPAT	OR	OFF	2008/06/06 09:21
S87	1	"10100351"	US-PGPUB; USPAT	OR	OFF	2008/06/06 11:49
S88	1	("6,678,892").PN.	US-PGPUB; USPAT	OR	OFF	2008/06/06 12:38
S89	3	("20030021429" | "20030076346" | "6867820").PN.	US-PGPUB; USPAT	OR	OFF	2008/06/06 12:42
S90	13	("4589134" | "4626892" | "5042070" | "5541638" | "5581621" | "5631850" | "5775939" | "6100936" | "6195438").PN. OR ("6867820").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2008/06/06 12:43
S91	2	"10648012"	US-PGPUB; USPAT	OR	OFF	2009/02/14 10:23
S92	1	"12144729"	US-PGPUB; USPAT	OR	OFF	2009/02/14 10:31
S93	1	("5790595").PN.	US-PGPUB; USPAT	OR	OFF	2009/02/14 12:36
S94	1	("6678892").PN.	US-PGPUB; USPAT	OR	OFF	2009/02/14 12:37
S95	1	("6678892").PN.	US-PGPUB; USPAT	OR	OFF	2009/05/26 07:51
S96	1680	portable and music and CDMA and transmitter and receiver	US-PGPUB; USPAT	OR	OFF	2009/09/01 11:35
S97	527	portable and music and CDMA and transmitter and receiver and private	US-PGPUB; USPAT	OR	OFF	2009/09/01 11:35
S98	57	portable and music and CDMA and transmitter and receiver and private and "fuzzy logic"	US-PGPUB; USPAT	OR	OFF	2009/09/01 11:35
S99	0	S98 and @ad<"20011221"	US-PGPUB; USPAT	OR	OFF	2009/09/01 11:36
S100	41	S97 and @ad<"20011221"	US-PGPUB; USPAT	OR	OFF	2009/09/01 11:36
S101	1	("6678692").PN.	US-PGPUB; USPAT	OR	OFF	2009/09/01 11:39
S102	1	("6678892").PN.	US-PGPUB; USPAT	OR	OFF	2009/09/01 11:39
S103	25	("5555466" | "5771441" | "6058288" |	US-PGPUB;	OR	OFF	2009/09/01

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		"6243645" | "6266815" | "6300880" | "6317039").PN. OR ("6678892").URPN.	USPAT; USOCR			11:39
S104	63	("2236946" | "2828413" | "2840694" | "3080785" | "3085460" | "3087117" | "3296916" | "3579211" | "3743751" | "3781451" | "3825666" | "3863157" | "3901118" | "3906160" | "4004228" | "4229826" | "4335930" | "4344184" | "4369521" | "4430757" | "4453269" | "4464792" | "4471493" | "4612688" | "4647135" | "4721926" | "4794622" | "4845751" | "4899388" | "4988957" | "5025704" | "5214568").PN. OR ("5771441").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2009/09/01 11:42
S105	10	("20030045235" | "20040223622" | "5491839" | "5771441" | "5790595" | "5946343" | "6342844" | "6418558" | "6678892" | "6982132").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2009/09/01 11:42
S106	4453	"fuzzy logic" and @ad<"20011221"	US-PGPUB; USPAT; USOCR	OR	OFF	2009/09/01 11:48
S107	659	S106 and transmitter	US-PGPUB; USPAT; USOCR	OR	OFF	2009/09/01 11:48
S108	591	S106 and portable	US-PGPUB; USPAT; USOCR	OR	OFF	2009/09/01 11:48
S109	4	S106 and portable adj player	US-PGPUB; USPAT; USOCR	OR	OFF	2009/09/01 11:49
S110	0	"fuzzy logic" with reciever	US-PGPUB; USPAT; USOCR	OR	OFF	2009/09/01 11:50
S111	49	"fuzzy logic" with receiver	US-PGPUB; USPAT; USOCR	OR	OFF	2009/09/01 11:50
S112	27	S111 and @ad<"20011221"	US-PGPUB; USPAT	OR	OFF	2009/09/01 11:50
S113	192	"fuzzy logic" same receiver	US-PGPUB; USPAT; USOCR	OR	OFF	2009/09/01 11:51
S114	72	S113 and @ad<"20011221"	US-PGPUB; USPAT	OR	OFF	2009/09/01 11:52
S115	71	("4019141" | "4229829" | "5264795" | "5404577" | "5437057" | "5568516" | "5694467" | "5771438" | "5771441" | "5867223" | "5978689" | "6006115").PN. OR ("6424820").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2009/09/02 11:27
S116	34	S115 and @ad<"20011221"	US-PGPUB; USPAT	OR	OFF	2009/09/02 11:28
S117	31	bluetooth with (headphone headset earphone "head phone" "head set" "ear phone") with cdma	US-PGPUB; USPAT	OR	OFF	2009/09/02 11:32
S118	2	S117 and @ad<"20011221"	US-PGPUB; USPAT	OR	OFF	2009/09/02 11:32
S119	32	wireless with (headphone headset	US-PGPUB;	OR	OFF	2009/09/02

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		earphone "head phone" "head set" "ear phone") with cdma	USPAT			11:33
S120	3	S119 and @ad<"20011221"	US-PGPUB; USPAT	OR	OFF	2009/09/02 11:33
S121	57	(headphone headset earphone "head phone" "head set" "ear phone") with cdma	US-PGPUB; USPAT	OR	OFF	2009/09/02 11:34
S122	10	S121 and @ad<"20011221"	US-PGPUB; USPAT	OR	OFF	2009/09/02 11:34
S123	0	WO0056093	US-PGPUB; USPAT	OR	OFF	2009/09/02 11:36
S124	0	WO0056093	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/09/02 11:37
S125	0	WO/0056093	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/09/02 11:37
S126	2	(("5781542") or ("5799005")).PN.	US-PGPUB; USPAT	OR	OFF	2009/09/02 11:42
S127	1	("6199076").PN.	US-PGPUB; USPAT	OR	OFF	2009/09/02 13:51
S128	0	woolfork-earl.in.	US-PGPUB; USPAT	OR	OFF	2009/11/23 11:44
S129	3	woolfork-c-$.in.	US-PGPUB; USPAT	OR	OFF	2009/11/23 11:44
S139	1	("7412294").PN.	US-PGPUB; USPAT	OR	OFF	2010/01/11 12:21
S140	1	("7412294").PN.	US-PGPUB; USPAT	OR	OFF	2010/06/01 09:29
S141	3	"12144729"	US-PGPUB; USPAT	OR	OFF	2010/06/01 09:34
S142	843	cdma and "fuzzy logic"	US-PGPUB; USPAT	OR	OFF	2010/10/18 09:46
S143	66	S142 and @ad<"20011221"	US-PGPUB; USPAT	OR	OFF	2010/10/18 09:46
S144	14	cdma same "fuzzy logic"	US-PGPUB; USPAT	OR	OFF	2010/10/18 09:46
S145	5	S144 and @ad<"20011221"	US-PGPUB; USPAT	OR	OFF	2010/10/18 09:46
S146	11	code same wireless same "fuzzy logic"	US-PGPUB; USPAT	OR	OFF	2010/10/18 09:49
S147	2	S146 and @ad<"20011221"	US-PGPUB; USPAT	OR	OFF	2010/10/18 09:49
S148	2704	(700/94).CCLS.	US-PGPUB; USPAT	OR	OFF	2010/10/21 12:51
S149	3	(("7412294") or ("7865258") or ("7684885")).PN.	US-PGPUB; USPAT	OR	OFF	2011/05/02 14:06
S150	1	("6418558").PN.	US-PGPUB;	OR	OFF	2011/11/03

Samsung Exhibit 1002, Page 607 of 880
Samsung Electronics Co., Ltd. et al. v. One-E-Way, Inc.
IPR2025-01541

			USPAT; USOCR			09:41
S151	1	("6678892").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2011/11/03 09:42
S152	1	S150 and reed same intersymbol	US-PGPUB; USPAT; USOCR	OR	OFF	2011/11/03 10:03
S154	1	("8131391").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2013/10/02 10:23
S155	1	("8131391").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2013/10/02 10:27
S156	1765	wireless and (audio music) and "direct conversion"	US-PGPUB; USPAT; USOCR	OR	OFF	2013/10/02 10:30
S157	177	S156 and @ad<"20011221"	US-PGPUB; USPAT	OR	OFF	2013/10/02 10:30
S158	6	S157 and (headphone "head phone" earphone "ear phone")	US-PGPUB; USPAT	OR	OFF	2013/10/02 10:31
S159	18	(US-20010025358-$ or US-20040223622-$).did. or (US-6130643-$ or US-6982132-$ or US-7099413-$ or US-7047474-$ or US-6418558-$ or US-5175558-$ or US-6317039-$ or US-5771441-$ or US-5946343-$ or US-5491839-$ or US-6424820-$ or US-6898585-$ or US-6781977-$ or US-5781542-$ or US-6678892-$ or US-6456645-$).did.	US-PGPUB; USPAT	OR	OFF	2013/10/02 10:34
S160	6	S159 and packet	US-PGPUB; USPAT; USOCR	OR	OFF	2013/10/02 10:34
S161	6	S159 and cdma	US-PGPUB; USPAT; USOCR	OR	OFF	2013/10/02 10:44
S162	1	S159 and "direct conversion"	US-PGPUB; USPAT; USOCR	OR	OFF	2013/10/02 10:52
S163	4	(("8131391") or ("7865258") or ("7684885") or ("7412294")).PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2013/10/02 12:00
S164	18	(US-20010025358-$ or US-20040223622-$).did. or (US-6130643-$ or US-6982132-$ or US-7099413-$ or US-7047474-$ or US-6418558-$ or US-5175558-$ or US-6317039-$ or US-5771441-$ or US-5946343-$ or US-5491839-$ or US-6424820-$ or US-6898585-$ or US-6781977-$ or US-5781542-$ or US-6678892-$ or US-6456645-$).did.	US-PGPUB; USPAT	OR	OFF	2013/12/05 09:59
S165	1	S164 and intersymbol	US-PGPUB; USPAT; USOCR	OR	OFF	2013/12/05 09:59
S166	1	S164 and intersymbol and reed	US-PGPUB; USPAT;	OR	OFF	2013/12/05 09:59

Samsung Exhibit 1002, Page 608 of 880
Samsung Electronics Co., Ltd. et al. v. One-E-Way, Inc.
IPR2025-01541

			USOCR			
S167	18	(US-20010025358-$ or US-20040223622-$).did. or (US-6130643-$ or US-6982132-$ or US-7099413-$ or US-7047474-$ or US-6418558-$ or US-5175558-$ or US-6317039-$ or US-5771441-$ or US-5946343-$ or US-5491839-$ or US-6424820-$ or US-6898585-$ or US-6781977-$ or US-5781542-$ or US-6678892-$ or US-6456645-$).did.	US-PGPUB; USPAT	OR	OFF	2014/12/16 09:58
S168	18	(US-20010025358-$ or US-20040223622-$).did. or (US-6130643-$ or US-6982132-$ or US-7099413-$ or US-7047474-$ or US-6418558-$ or US-5175558-$ or US-6317039-$ or US-5771441-$ or US-5946343-$ or US-5491839-$ or US-6424820-$ or US-6898585-$ or US-6781977-$ or US-5781542-$ or US-6678892-$ or US-6456645-$).did.	US-PGPUB; USPAT	OR	OFF	2014/12/16 10:03

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S130	0	woolfork-earl.in.	USPAT; UPAD	OR	OFF	2009/11/23 11:44
S131	1	woolfork-c-$.in.	USPAT; UPAD	OR	OFF	2009/11/23 11:44
S132	195	(700/94).CCLS.	UPAD	OR	OFF	2009/11/23 11:59
S133	225	((700/94) or (455/3.06)).CCLS.	UPAD	OR	OFF	2010/01/11 11:18
S153	31	(700/94).CCLS.	UPAD	OR	OFF	2012/01/09 11:39

4/6/2015 11:41:49 AM
C:\Users\aflanders\Documents\EAST\Workspaces\12940747.wsp

Samsung Exhibit 1002, Page 609 of 880
Samsung Electronics Co., Ltd. et al. v. One-E-Way, Inc.
IPR2025-01541

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13356949	WOOLFORK, C. EARL
	Examiner	**Art Unit**
	ANDREW C FLANDERS	2656

CPC						
Symbol					**Type**	**Version**
H04R		1	/	1083	F	2013-01-01
H04R		5	/	033	A	2013-01-01
H04R		2420	/	07	A	2013-01-01
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CPC Combination Sets							
Symbol					**Type**	**Set**	**Ranking**	**Version**
			/					
			/					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	12	
/ANDREW C FLANDERS/ Primary Examiner.Art Unit 2656	04/06/2015	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

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	13356949	WOOLFORK, C. EARL
	Examiner	**Art Unit**
	ANDREW C FLANDERS	2656

US ORIGINAL CLASSIFICATION		INTERNATIONAL CLASSIFICATION										
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED					
700	94	G	0	6	F	17 / 00 (2006.01.01)						

CROSS REFERENCE(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	12	
/ANDREW C FLANDERS/ Primary Examiner.Art Unit 2656	04/06/2015	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

U.S. Patent and Trademark Office

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	13356949	WOOLFORK, C. EARL
	Examiner	**Art Unit**
	ANDREW C FLANDERS	2656

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☒ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1														
2	2														
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4	4														
5	5														
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11	11														
12	12														

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 12	
/ANDREW C FLANDERS/ Primary Examiner.Art Unit 2656 (Primary Examiner)	04/06/2015 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 1

Samsung Exhibit 1002, Page 612 of 880
Samsung Electronics Co., Ltd. et al. v. One-E-Way, Inc.
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PTO/SB/08a (01-10)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
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Application Number	13356949
Filing Date	2012-24-01
First Named Inventor	C. Earl Woolfork
Art Unit	2656
Examiner Name	Andrew Flanders
Attorney Docket Number	

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	5822440		1998-10-13	Oltman,Randy	
	2	6104913		2000-08-15	McAllister,Alexander	
	3	5778022		1998-07-07	Walley,John	
	4	5506861		1996-09-04	Bottomley,Gregory	

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EFS Web 2.1.17

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	Art Unit	2656
	Examiner Name	Andrew Flanders
	Attorney Docket Number	

	1	EP 0840465 A2			1998-05-06	Kivela,Seppo		☐

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	ANTHONY EPHREMIDES, WTEC Study on Wireless Technologies and Information Systems, July 2000	☐

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EXAMINER SIGNATURE

Examiner Signature	/Andrew Flanders/	Date Considered	04/06/2015

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	Examiner Name	Andrew Flanders
	Attorney Docket Number	

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

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☐ See attached certification statement.

☒ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ None

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Megan Lyman/	Date (YYYY-MM-DD)	2015-03-02
Name/Print	Megan Lyman	Registration Number	57054

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3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

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5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

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First Named Inventor	C. Earl Woolfork
Art Unit	2656
Examiner Name	Andrew Flanders
Attorney Docket Number	

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	7925238		2011-12-04	Suominen, Edwin	

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☐ See attached certification statement.

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Name/Print		Registration Number	

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EFS ID:	22142486
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International Application Number:	
Confirmation Number:	2299
Title of Invention:	Wireless Digital Audio Music System
First Named Inventor/Applicant Name:	C. Earl Woolfork
Customer Number:	68533
Filer:	Megan Elizabeth Lyman
Filer Authorized By:	
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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Notice of concurrent proceedings / decisions	SecondSubmissionSmallerest.pdf	12845223 9c99cda0b6f0080ef172a87192f2879b10d936e3	no	57

Warnings:	
Information:	

2	Information Disclosure Statement (IDS) Form (SB08)	Megan_IDS_for_USPTO_04-22-2015.pdf	611542 5d04a0a17ff84fc9eba2debf5b00a3b0c93a224b	no	4
Warnings:					
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			Total Files Size (in bytes):	13456765	

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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Transmission of Opposing Arguments in Litigation

To Whom It May Concern:

The above application is involved in an ITC investigation. The applicant has attached three documents to this submission: One-E-Way's Ground Rule 8.2 Proposed Preliminary Construction of Identified Claim Terms, Respondents' Joint Preliminary Claim Constructions, and Ericsson's Bluetooth Headset HBH-10 User's Guide. It is with candor and good faith that this information is provided. Please do not hesitate to contact me with any questions or concerns.

April 22 2015

Respectfully Submitted,



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UNITED STATES INTERNATIONAL TRADE COMMISSION
WASHINGTON, D.C.

Before the Honorable Thomas B. Pender
Administrative Law Judge

In the Matter of **CERTAIN WIRELESS HEADSETS**	**Inv. No. 337-TA-943**

ONE-E-WAY'S GROUND RULE 8.2 PROPOSED PRELIMINARY CONSTRUCTION OF IDENTIFIED CLAIM TERMS

Pursuant to the Joint proposed Procedural Schedule filed March 3, 2015 and Ground Rule 8.2 in Order No. 2 (January 15, 2015), Complainant, One-E-Way ("One-E-Way") provides the proposed preliminary construction of claim terms of U.S. Patent No. 7,865,258 ("the '258 Patent") and U.S. Patent No. 8,131,391 ("the '391 Patent") as identified in Appendix A attached hereto.

One-E-Way reserves its right to supplement or modify the following proposed constructions in light of Respondents', Beats Electronic, LLC, and Beats Electronics International (collectively, "Beats"), Sony Corporation, Sony Corporation of America, Sony Electronics Inc. (collectively, "Sony"), BlueAnt Wireless Pty, Ltd., BlueAnt Wireless, Inc. (collectively, "BlueAnt"), AliphCom d/b/a Jawbone ("Jawbone"), GN Netcom A/S ("GN"), and Creative Technology Ltd., Creative Labs, Inc. (collectively, "Creative") proposed terms for construction, further discovery in this matter, any rulings for the ITC, or other pre-hearing proceedings.

Dated: March 27, 2015

By:/s/ Douglas G. Muehlhauser
Douglas G. Muehlhauser

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APPENDIX A

"Fed. Standard 1037C" refers to the August 7, 1996 publication of the Federal Standard 1037C ("Telecommunications: Glossary of Telecommunications Terms"), produced as 1EWAY00056769–7267 and also available at http://www.its.bldrdoc.gov/fs-1037/fs-1037c.htm

Citations to the asserted patents' specification are identified according to location within the '391 patent's specification and also include by that reference the corresponding location within the '258 patent's specification.

"'196 Pub." refers to U.S. Patent Application Publication No. 2003/0118196, which the asserted patents incorporate by reference.

No.	Claim Term	One-E-Way's Proposed Construction	Supporting References
1.	reduced intersymbol interference coding / reduced inter-symbol interference coding	One-E-Way does not believe that this term needs construed. However, if the Court is inclined to construe the term, then One-E-Way proposes that it should be construed consistent with its ordinary meaning as: "coding that improves the ability to distinguish between individual signal elements by reducing distortion in the temporal spreading and consequent overlap of individual pulses"	Spec. 1:35–53; 4:1–9; '196 Pub. ¶ 13 1EWAY00056738–39; 2967–2983; 195–202; 641–55; 743–56; 796–821; 56515–29; 56396–99 Fed. Standard 1037C definition of "intersymbol interference" Expert opinion of Joseph C. McAlexander, P.E. that the claim term has this ordinary meaning.

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No.	Claim Term	One-E-Way's Proposed Construction	Supporting References
2.	original audio signal representation in packet format / original audio signal representation in the form of packets / digital audio . . . representation signal in the form of a packet	One-E-Way does not believe that this term needs construed. However, if the Court is inclined to construe the term, then One-E-Way proposes that it should be construed consistent with its ordinary meaning as: "one or more packets corresponding to the original audio signal"	Spec. 2:30–36; 3:40–4:16; FIGS. 1–3; '196 Pub. ¶¶ 12, 17, 18 1EWAY00003574; 2957–66; 2789–846; 195–202 Expert opinion of Joseph C. McAlexander, P.E. that the claim term has this ordinary meaning.
3.	CDMA / code division multiple access (CDMA) / code division multiple access	One-E-Way does not believe that this term needs construed. However, if the Court is inclined to construe the term, then One-E-Way proposes that it should be construed consistent with its ordinary meaning as: "a coding scheme, used as a modulation technique, in which multiple channels are independently coded for transmission over a single wideband channel"	Abstract; Spec. 1:35–53; 1:57–62; 3:17–22; '196 Pub. ¶ 16 1EWAY00003114–31; 2789–846; 195–202; 641–55; 743–56 2007-06-11 Response (1EWAY00002960) Fed. Standard 1037C definition of "code-division multiple access (CDMA)" Expert opinion of Joseph C. McAlexander, P.E. that the claim term has this ordinary meaning.

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No.	Claim Term	One-E-Way's Proposed Construction	Supporting References
4.	configured for independent CDMA communication operation / configured for independent code division multiple access (CDMA) operation / configured for independent code division multiple access communication operation	One-E-Way does not believe that this term needs construed; *See* preliminary proposed constructions for term no. 5 above and treat this term consistent with that other term. The term "configured for independent code division multiple access (CDMA) operation" should be treated according to its ordinary meaning. However, if the Court is inclined to construe this term, then One-E-Way proposes that it should be construed consistent with its ordinary meaning as: "configured for CDMA operation control by only the user's devices"	Abstract; Spec. 1:35–53; ; 1:57–62; 2:1–4; 2:54–59; 2:66–3:31; 3:32–36; FIGS. 2 and 3; '196 Pub. ¶¶ 14, 16 1EWAY000035724–5; 3425–32; 3389–95; 3257–61; 3114–31; 2957–66; 2885–99; 2789–846; 2723–30; 5659–63; 5515–16; 5507–09; 5507–09; 113–120; 56515–29; 56449–53; 56396–99 2007-09-20 Response (1EWAY00002887) Expert opinion of Joseph C. McAlexander, P.E. that the claim term has this ordinary meaning.
5.	unique user code / unique user code bit sequence	One-E-Way does not believe that this term needs construed. However, if the Court is inclined to construe the term, then One-E-Way proposes that it should be construed consistent with its ordinary meaning as: "code that distinguishes the transmissions of the user's devices from those of other users' devices"	Abstract; Spec. 1:35–53; 2:1–4; 2:54–59; 2:66–3:31; 3:32–36; FIGS. 2 and 3; '196 Pub. ¶¶ 14, 16 1EWAY000035724–5; 3425–32; 3389–95; 3257–61; 3114–31; 2957–66; 2885–99; 2789–846; 2723–30; 5659–63; 5507–09; 113–120; 56515–29; 56449–53; 56396–99 2007-09-20 Response (1EWAY00002887) Expert opinion of Joseph C. McAlexander, P.E. that the claim term has this ordinary meaning.

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No.	Claim Term	One-E-Way's Proposed Construction	Supporting References
6.	a digital demodulator	One-E-Way does not believe that this term needs construed. However, if the Court is inclined to construe the term, then One-E-Way proposes that it should be construed consistent with its ordinary meaning as: "a module configured to recover, from a modulated carrier, a signal having substantially the same characteristics as the original modulated signal"	Spec. 2:40–43; 2:50–53; 2:64–3:26; FIGS. 2 and 3; '196 Pub. ¶¶ 14, 17, 18 1EWAY00003120; 2796–98; 2836; 2725 Fed. Standard 1037C definitions of "demodulation" and "modulation" Expert opinion of Joseph C. McAlexander, P.E. that the claim term has this ordinary meaning.
7.	direct conversion module	One-E-Way does not believe that this term needs construed. However, if the Court is inclined to construe the term, then One-E-Way proposes that it should be construed consistent with its ordinary meaning as: "module that converts from radio frequency to or very near to baseband"	Spec. 2:30–3:36; 4:17–28; FIGS. 2 and 3; '196 Pub. ¶¶ 12, 15, 16 1EWAY00003403–4; 113–120; 195–202; 641–55; 743–56; 743–56 Expert opinion of Joseph C. McAlexander, P.E. that the claim term has this ordinary meaning.

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No.	Claim Term	One-E-Way's Proposed Construction	Supporting References
8.	virtually free from interference	One-E-Way does not believe that this term needs construed. However, if the Court is inclined to construe the term, then One-E-Way proposes that it should be construed consistent with its ordinary meaning as: "for practical purposes free from extraneous energy artifacts impeding the desired signal"	Abstract; Spec. 1:35–53; 4:17–28; FIG. 1.; '196 Pub. ¶ 16 1EWAY000035724–5; 3389–95; 3114–31; 2957–66; 2885–99; 2789–846;; 2772–73; 2723–30; 5659–63; 5507–09; 113–120; 195–202; 56515–29; 56449–53; 56396–99 Fed. Standard 1037C definition of "interference" Expert opinion of Joseph C. McAlexander, P.E. that the claim term has this ordinary meaning.

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CERTIFICATE OF SERVICE

The undersigned certifies that on March 27, 2015, I caused copies of **ONE-E-WAY'S GROUND RULE 8.2 PROPOSED PRELIMINARY CONSTRUCTION OF IDENTIFIED CLAIM TERMS** to be served as indicated below:

Staff Investigative Attorney – U.S. International Trade Commission	
Vu Bui, Lead Attorney **Office of Unfair Import Investigation** U.S. International Trade Commission 500 E Street, S.W., Room 401 Washington, DC 20436	Via E-mail – Vu.Bui@usitc.gov
Respondents	
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For Respondents *Creative Technology Ltd. and Creative Labs, Inc.* Jonathan Baker FARNEY DANIELS PC 411 Borel Avenue, Suite 350 San Mateo, CA 94402	Via E-mail – Creative-ITC-943@farneydaniels.com
For Respondents *Beats Electronics, LLC and* *Beats Electronics International* Celine J. Crowson HOGAN LOVELLS U.S. LLP 555 Thirteenth Street, N.W. Washington, D.C. 20004 Telephone: 202-637-5600	Via E-mail – Beats-OEWCase@hoganlovells.com
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/s/ Alan G. Laquer

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UNITED STATES INTERNATIONAL TRADE COMMISSION
WASHINGTON, D.C.

Before The Honorable Thomas B. Pender,
Administrative Law Judge

In the Matter of **CERTAIN WIRELESS HEADSETS**	Investigation No. 337-TA-943

RESPONDENTS' JOINT PRELIMINARY CLAIM CONSTRUCTIONS

Pursuant to the joint proposed Procedural Schedule filed March 3, 2015 and Ground Rule 8.2 in Order No. 2 (January 15, 2015), Respondents Beats Electronic, LLC, and Beats Electronics International (collectively, "**Beats**"); Sony Corporation, Sony Corporation of America, Sony Electronics Inc. (collectively, the "**Sony Respondents**"); BlueAnt Wireless Pty, Ltd., BlueAnt Wireless, Inc. (collectively, "**BlueAnt**"); AliphCom d/b/a Jawbone ("**Jawbone**"); GN Netcom A/S ("**GN**"); and Creative Technology Ltd., Creative Labs, Inc. (collectively, "**Creative**") (the foregoing, "**Respondents**") submit the following proposed constructions for terms identified by Respondents as requiring construction.

Discovery is in its early stages, and Respondents anticipate receiving additional documents and information from Complainant One-E-Way, Inc. and its witnesses and from third parties. Respondents therefore reserve the right to amend and supplement the proposed constructions below based on further investigation and discovery and in a manner consistent with the Commission's Rules, the ALJ's Ground Rules for this investigation, and Order No. 2. Respondents reserve the right to offer evidence and argument regarding the construction of any term that is identified by any other party in this investigation, including but not limited to any term identified by any other party for which the Respondents have not proposed a construction

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below (e.g., because they presently believe no construction is necessary). Nothing in the list below shall be construed to limit Respondents' right to argue that any claim of any of the patents-in-suit is invalid.

In the interest of narrowing the issues in this investigation, Respondents no longer believe it is necessary to construe, and thus have not proposed constructions for, the following terms that they previously identified as requiring construction: "configured for direct digital wireless communication" / "configured for direct digital wireless spread spectrum communication"; "de-interleaver"; "interleaver"; "a decoder operative to decode reduced intersymbol interference coding" / "a decoder operative to decode the applied reduced intersymbol interference coding"; and "an encoder operative to encode said original audio signal representation to reduce intersymbol interference" / "a encoder operative to encode said original audio signal representation to reduce intersymbol interference."

The disclosures in the table below use the following definitions: "'391 Application" means the U.S. Application No. 10/027,391 filed on Dec. 21, 2001; "'294 Patent" means U.S. Patent 7,412,294; "'885 Patent" means U.S. Patent 7,684,885; "'258 Patent" means U.S. Patent 7,865,258; "'391 Patent" means U.S. Patent 8,131,391; and "Asserted Patents" means the '258 Patent and the '391 Patent.

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Proposed Term / Phrase	Proposed Construction	Supporting Evidence
CDMA / code division multiple access (CDMA) / code division multiple access	"a method of direct-sequence spread spectrum encoding"	Specification[1] '258 Patent at 2:32-37, 2:62-3:1, 3:6-18, Figs. 2 & 3; '391 Patent at 3:10-22, Figs. 2 & 3; '391 Application[2] at ¶¶ [0014], [0016], Figs. 2 & 3. File History '391 Patent File History: Response dated Dec. 15, 2011 at 8. '258 Patent File History: Response dated Feb. 4, 2010 at 7; Response dated Aug. 4, 2010 at 4. '885 Patent File History: Response dated Mar. 4, 2009. '294 Patent File History: Response dated Mar. 17, 2006 at 3; Response dated Aug. 15, 2006 at 2, 22; Declaration dated Aug. 15. 2006 at 2; Final Rejection dated Oct. 2,

[1] Citations herein to the figures of a patent should be understood as also referring to the corresponding portions of the text of the specification discussing those figures, and citations to portions of the text of the specification should be understood as also referring to the figures discussed therein. Also, because the '391 Patent and the '258 Patent share a substantially identical specification, citations to either of those patents should also be understood as referring to the corresponding portions of the other patent.

[2] The '391 Patent incorporates the '391 Application by reference. '391 Patent at 1:3-15. The applicant obtained a certificate of correction that incorporated the '391 Application into the '258 Patent by reference. '258 Patent, Certificate of Correction dated Jan. 4, 2011. Therefore, the disclosures of the '391 Application may be considered part of the specification of both Asserted Patents. If, for any reason, either incorporation by reference is found ineffective, these disclosures will be deemed supporting evidence from the file history rather than supporting evidence from the specification.

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Proposed Term / Phrase	Proposed Construction	Supporting Evidence
		2006 at 3-7; Response dated Nov. 29, 2006 at 37-38; Response dated Nov. 29, 2006 at 2, 34, 36. Extrinsic Evidence Ke-Lin Du and M. N. S. Swamy, WIRELESS COMMUNICATION SYSTEMS at ch. 8 (2010). Robert C. Dixon, SPREAD SPECTRUM SYSTEMS WITH COMMERCIAL APPLICATIONS at 412 (3rd Ed. 1994). Bluetooth Measurement Fundamentals, Application Note, Agilent Technologies (2006). MCGRAW-HILL DICTIONARY OF SCIENTIFIC AND TECHNICAL TERMS at 397 (5th ed. 1993). Muthuthamby Sreetharan & Rajiv Kumar, CELLULAR DIGITAL PACKET DATA, at 25-26 (1996). Lawrence Harte et al., THE COMPREHENSIVE GUIDE TO WIRELESS TECHNOLOGIES, at 51-52 (2000). Lawrence Harte et al., CELLULAR AND PCS, at 71-72, 255-56 (1997). Andreas F. Molisch, WIRELESS COMMUNICATIONS at ch. 18 (2005). Theodore S. Rappaport, WIRELESS COMMUNICATIONS: PRINCIPLES & PRACTICE, at 404-07 (1996). Andrew J. Viterbi, CDMA PRINCIPLES OF SPREAD

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Proposed Term / Phrase	Proposed Construction	Supporting Evidence
		SPECTRUM COMMUNICATION chs. 1 & 2 (1995). Testimony of expert witnesses Dr. Robert Akl, James T. Geier and/or Regis J. "Bud" Bates (see below for listing of opinions).
configured for independent CDMA communication operation / configured for independent code division multiple access (CDMA) communication operation / configured for independent code division multiple access communication operation	"configured to access the medium individually without any central control, using the unique user code to spread or de-spread the signal spectrum"	Specification '258 Patent at 2:50-55, 3:9-13, 3:16-18, 3:40-43; '391 Patent at 2:54-59, 3:13-17, 3:20-22, 3:44-47; '391 Application ¶¶ [0014], [0016]. File History '391 Patent File History: Response dated Nov. 14, 2011 at 6-9. '258 Patent File History: Response dated Aug. 4, 2010 at 2-4; Response dated Feb. 4, 2010 at 5-7. '885 Patent File History: Response dated Mar. 4, 2009. '294 Patent File History: Response dated Apr. 27, 2008 at 23, 25-26; Appeal Brief at 10, 39-40; Response dated Nov. 29, 2006 at 34, 36; Final Rejection dated Oct. 2, 2006 at 7; Response dated Aug. 15, 2006 at 36-37; Response dated Feb. 16, 2006 at 14-15; Response dated Dec. 30, 2005 at 15; Response dated Jan. 29, 2007 at 22-23; Summary of Examiner Interview on May 20, 2008 at 3. '391 Application File History: Specification at ¶¶ [0014],

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Proposed Term / Phrase	Proposed Construction	Supporting Evidence
		[0016]. Extrinsic Evidence None.
unique user code / unique user code bit sequence	"a fixed code word specifically associated with one wireless digital audio system user"	Specification '258 Patent at 2:50-55, 3:9-13, 3:40-43; '391 Patent at 2:54-59, 3:13-17, 3:44-47. File History '258 Patent File History: Response dated Feb. 4, 2010, at 5-7. '294 Patent File History: Appeal Brief at 10-11, 39-40; Response dated Oct. 2, 2006 at 3-7; Response dated Feb. 16, 2006 at 14-15; Response dated Aug. 15, 2006 at 36-37; Response dated Apr. 29, 2008 at 25-26; Response dated Sep. 20, 2007 at 29. '391 Application File History: Specification at ¶¶ [0014], [0016]. Extrinsic Evidence None
a digital demodulator	"a component that converts received symbols into bits"	Specification '391 Patent at 2:30-3:31, Figs. 2, 3 & asserted claims;

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Proposed Term / Phrase	Proposed Construction	Supporting Evidence
		'258 Patent asserted claims. File History '391 Application File History: Drawings 2 & 3; Specification at ¶¶ 5, 13, 14, 7, 20 & claims 3, 4, 6; Response dated July 1, 2005 at 14; Office Action dated Nov. 26, 2002 at 4, 6. '294 Patent File History: Response to Office Action of October 2, 2006, at 33, 35; Supplemental After Final Response to Office Action of October 2, 2006, at 23; Summary of Examiner Interview on May 20, 2008, at 3; Request for Continued Examination, at 23, 25-26; Appeal Brief In Compliance With 37 CFR § 41.37, at 8, 10, 12-13; Response dated July 1, 2005 at 6, 14. '258 Patent File History: Information Disclosure Statement dated Aug. 4, 2010, PCT/US99/28686 at 6. Extrinsic Evidence None.
virtually free from interference	Indefinite.	Specification '258 Patent at 1:64-67; '391 Patent at 2:1-4; '391 Application ¶ [0016]. File History '294 Patent File History: Appeal Brief at 24.

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Proposed Term / Phrase	Proposed Construction	Supporting Evidence
		'885 Patent File History: Response dated Oct. 2, 2009 at 2. Extrinsic Evidence Testimony of expert witnesses Dr. Robert Akl, James T. Geier and/or Regis J. "Bud" Bates (see below for listing of opinions).
original audio signal representation in packet format / original audio signal representation in the form of packets / digital audio . . . representation signal in the form of a packet	"digital format that carries high quality audio data without compression"	Specification '258 Patent at 2:41-42, 3:36-39; '391 Patent at 2:45-46, 3:40-43. File History '391 Patent File History: Response dated Aug. 2, 2011 at 13 Extrinsic Evidence None.
reduced intersymbol interference coding / reduced inter-symbol interference coding	Indefinite.	Specification None. File History '391 Patent File History: Response dated Dec. 5, 2011 at 1-3. '258 Patent File History: Response dated Jun. 7, 2010 at

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Proposed Term / Phrase	Proposed Construction	Supporting Evidence
		7 and Exhibit IV thereto. Extrinsic Evidence Testimony of expert witnesses Dr. Robert Akl, James T. Geier and/or Regis J. "Bud" Bates (see below for listing of opinions).
direct conversion module	"a receiver which performs only a single frequency conversion, without an intermediate frequency, thereby converting the received signal to a baseband signal"	Specification '258 Patent at 2:60-3:27, Fig. 3; '391 Patent at 2:64-31, Fig. 3. File History '391 Patent File History: Office Action dated Nov. 4, 2011 at 11-15; Response dated Aug. 2, 2011 at 11-15. '258 Patent File History: Response dated August 3, 2010 at 4-7. Extrinsic Evidence Ke-Lin Du and M. N. S. Swamy, *Wireless Communication Systems: From RF Subsystems to 4G Enabling Technologies*, §§ 1.4.1, 1.4.2 (2010). Janine Sullivan, *Direct Conversion Receivers: A Buyer's Guide*, EE TIMES (Nov. 1, 2001) (available at http://www.eetimes.com/document.asp?doc_id=1277455). Asad A. Abidi, *Direct-Conversion Radio Transceivers*

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Proposed Term / Phrase	Proposed Construction	Supporting Evidence
		for Digital Communications, IEEE Journal of Solid-State Circuits, Vol. 30, No. 12 (Dec. 1995). Ashkan Mashhour, William Domino, Norman Beamish, *On the Direct Conversion Receiver – A Tutorial*, MICROWAVE JOURNAL (June 1, 2001)

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Some or all of the Respondents may additionally rely on expert testimony by Dr. Robert Akl, James T. Geier and/or Regis J. "Bud" Bates on claim construction and indefiniteness issues. A description of the substance of this testimony (including the opinions to be rendered in connection with claim construction) is as follows:

Level of ordinary skill in the art.

A person of ordinary skill in the art of the Asserted Patents 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. Alternatively, a person of ordinary skill in the art of the Asserted Patents would have six years of experience in the design or implementation of wireless communications systems, or the equivalent.

"CDMA" / "code division multiple access (CDMA)" / "code division multiple access"

Code Division Multiple Access generally refers to a technique for allowing multiple transmitters to utilize the same communications channel at the same time. CDMA is distinct from other multiple access techniques such as Time Division Multiple Access ("TDMA") and Frequency Division Multiple Access ("FDMA") in that CDMA attempts to minimize transmitter interference by use of a code. One way of accomplishing this code division or separation is direct sequence spread spectrum ("DSSS"), in which the system combines the data signal and a higher-rate spreading code.

When the '391 Application was filed, persons of ordinary skill in the art actually had two distinct understandings of CDMA. One was that CDMA was synonymous with DSSS. For example, this meaning was used by industry-leader Qualcomm, particularly in its promotion of the IS-95 standard. The other definition of CDMA included both DSSS and FHSS. For those

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using this second meaning of CDMA, they would often specify the particular spread spectrum technique used to create CDMA, for example, by clearly referring to "FH-CDMA" or "DS-CDMA." Based on my personal experience, I (along with many other skilled artisans at that time) would have identified the term "CDMA," without more context, as synonymous with DSSS.

The context of the '391 Application, including paragraphs [0014] and [0016] and figures 2 and 3, would have made this meaning of CDMA even clearer to a person of ordinary skill in the art. The context of the applicant's subsequent disclosures in the later applications, including col. 3, lines 6 – 18 and figures 2 and 3 of the '258 Patent and col. 3, lines 10 – 22 and figures 2 and 3 of the '391 Patent, are to the same effect and convey to one of ordinary skill in the art that the applicant considered his invention to be based on direct sequence spread spectrum modulation.

"virtually free from interference"

The asserted claims relate to a wireless digital audio system for listening to audio, and require that "said audio" has been wirelessly transmitted and reproduced free from interference. Based on the intrinsic record, the term "interference" relates to specific interference from other, nearby users of similar wireless audio systems. The claim phrase "virtually free from interference" when "read in light of the specification describing the patent, and the prosecution history, fails to inform, with reasonable certainty, those skilled in the art about the scope of the invention." The phrase is highly subjective on its face and may depend on the determination of each individual person. Moreover, the intrinsic evidence provides no objective boundaries for when audio becomes "virtually free" (as opposed to less-than-virtually-free) from interference. And even if one assumed a particular threshold at which audio becomes "virtually free" from

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interference, the intrinsic evidence provides no objective standard or criteria by which to measure whether this threshold has been met. Finally, "virtually free from interference" is not a term of art and has no particular meaning to a person of ordinary skill in the art.

"reduced intersymbol interference coding"

The term "reduced intersymbol interference coding" does not have a known meaning in the field. Nor does the specification of the Asserted Patents explain the meaning of that term. One of skill in the art would not recognize reduced intersymbol interference coding as referring to any particular category or classification of codings. Thus, the phrase "reduced intersymbol interference coding" when read in light of the specification, and the prosecution history, fails to inform those skilled in the art about the scope of the invention with reasonable certainty. Moreover, parsing and examining the individual words of the phrase fails to provide reasonable certainty as to its meaning. In particular, the phrase is ambiguous because it is unclear what the appropriate reference point is for determining whether a coding is a "*reduced* intersymbol interference coding," i.e., reduced compared to what? Rather, one of skill in the art could select any number of potential codings for data transmission, with a variety of potential effects on intersymbol interference under various circumstances. Additionally, the intrinsic evidence provides no guidance on how to determine what threshold of intersymbol interference reduction renders a coding a "*reduced* intersymbol interference coding," i.e., reduced by how much? The intrinsic evidence provides no objective standard or criteria by which to measure whether this threshold has been met. Nor would one of skill in the art recognize this term as referring to a particular threshold of intersymbol interference known in the field.

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CERTIFICATE OF SERVICE

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Introduction

The *Bluetooth*™ Headset HBH-10 is a cordless portable handsfree solution based on *Bluetooth* wireless technology.

Please read the "Guidelines for Safe and Efficient Use" and "Limited Warranty" chapters before using your Headset.

What is *Bluetooth* Wireless Technology?

The *Bluetooth* wireless technology makes it possible to connect any compatible portable and stationary communications device without using cables. The technology is based on a radio link that offers fast and reliable transmission of voice and data information. It does not require a line-of-sight connection in order to establish communication. The *Bluetooth* wireless technology uses a globally available frequency range intended to ensure communication compatibility worldwide. Please refer to the section "Product Care and Maintenance" on page 19 for any exceptions to availability.

How Can I Use My Headset?

You can connect your Headset to your mobile phone or PC – or any device with *Bluetooth* wireless technology that supports the Headset Profile – to keep your hands free for more important tasks when you are at the office or in the car. This User's Guide focuses on how to use the Headset with your mobile phone. When the Headset is connected to your mobile phone, you can use voice control to make calls (if your phone supports this function). The phone can be tucked away in your pocket or in a bag. You can handle incoming and outgoing calls, and adjust the volume using a single three-way button on the Headset.

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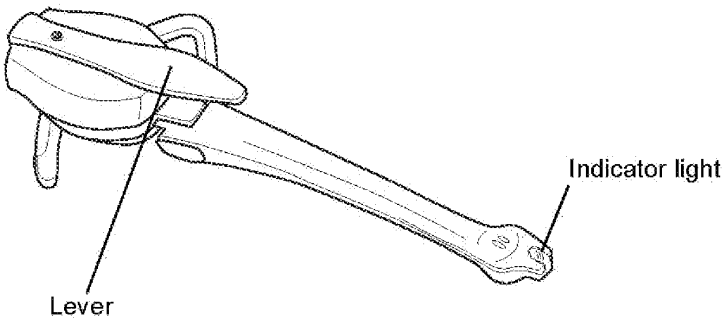
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Using Your Headset

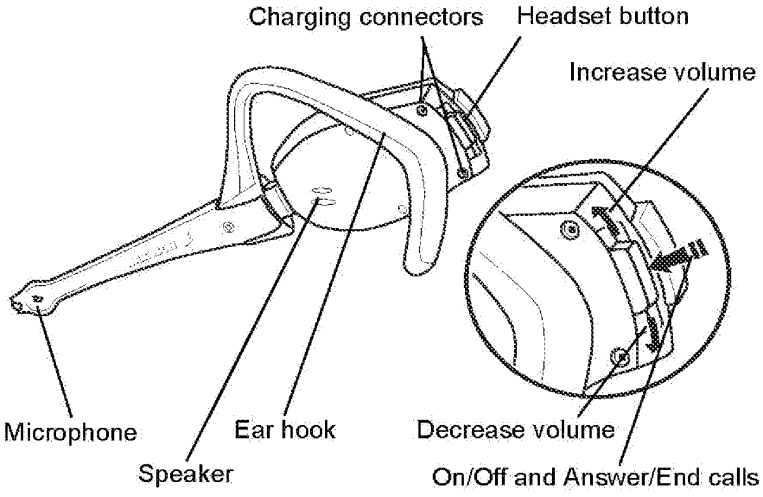
Overview

Any device that you want to use with the *Bluetooth* Headset has to be compatible with *Bluetooth* wireless technology and support the Headset Profile. To be able to use the Headset together with a mobile phone, you need to have a phone with built-in *Bluetooth* capability, or a phone with a *Bluetooth* adapter connected to it.

Front



Back

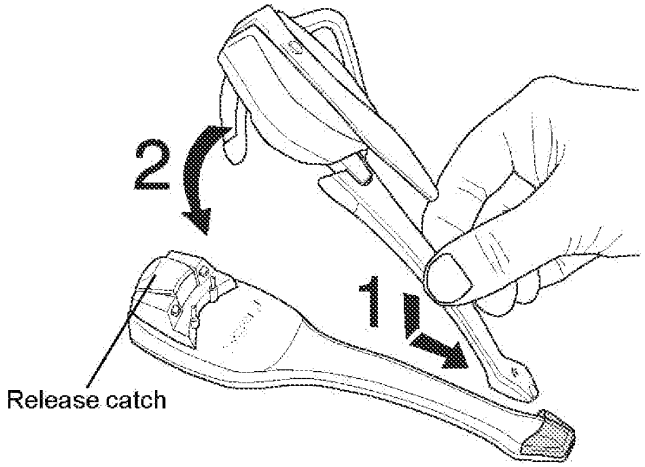


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The Headset comes with a cradle, which holds the Headset during charging.

The Cradle



Looking After the Headset

Always keep the Headset in a case or in the cradle when not wearing it on your ear. You can keep the Headset in the cradle even when not charging it.

Note: *Always handle the Headset with care!*

Getting Started

Before you start using the Headset with a phone or other device for the first time, you should do the following:

- Decide on which ear you want to wear the Headset (it is delivered for right-ear use).
- Charge the Headset in the cradle using an appropriate Ericsson charger.
- Pair the Headset with a device, for example, a mobile phone.

These three stages are described in turn below.

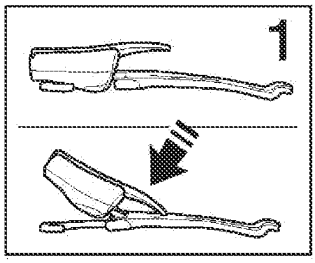
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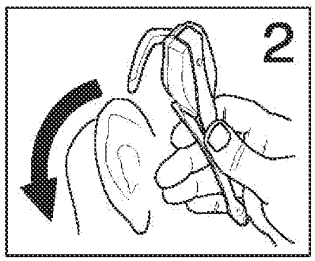
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Putting On the Headset

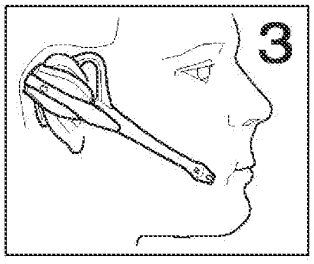
- Press down the lever as shown.



- Put on the Headset with the ear hook behind your ear.



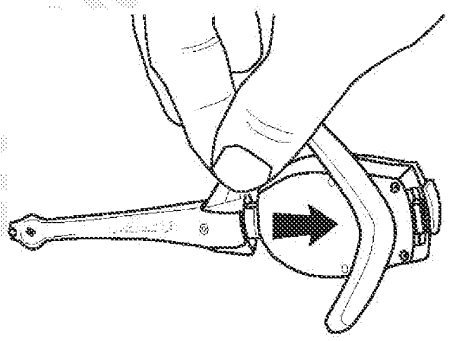
- Make sure the microphone is pointing towards your mouth.



Right or Left Ear

If you want to wear the Headset on your left ear, you have to change the orientation of the ear hook.

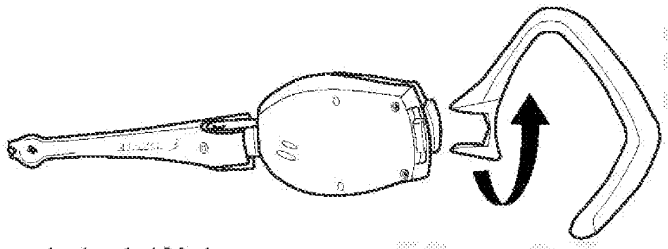
To adjust the ear hook for left-ear use:



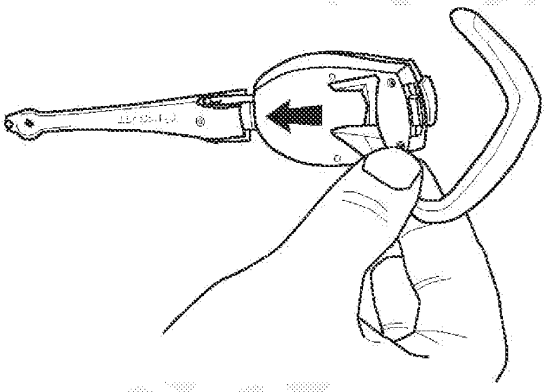
1. Gently pull the ear hook from the Headset as shown above. Always hold the hook as shown.

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2. Turn the hook 180 degrees.



3. Attach the ear hook by gently pressing it into place.

You also have to change the orientation of the volume button. You can do this either using the Headset, or, if using an Ericsson phone, via the menu system in the phone.

To change the orientation of the volume button

1. When the Headset is turned off, press and hold the Headset button for up to 10 seconds until the indicator light on the Headset flashes green and red.
2. Slide the volume button in the direction (upwards or downwards) that you want to use to increase the volume.
3. Press the Headset button until the Headset is switched off.

See "Right or Left Ear" on page 15 if you want to change the orientation of the volume button using the phone's menu system.

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Charging

The Headset comes with a built-in rechargeable battery. The battery is not fully charged when you buy the Headset. We recommend that you charge the Headset until the indicator light turns green before using it for the first time. Put the Headset into the cradle to charge it.

- To remind you that you will soon need to recharge the battery, the Headset indicator light flashes red when the Headset is on.
- It takes 1-1.5 hours to fully recharge the battery.
- During charging the indicator light shows a steady red light when the Headset is turned off, and flashes red when the Headset is on.
- When the battery is fully charged the indicator shows a steady green light if the Headset is off, or a flashing green light if the Headset is on.

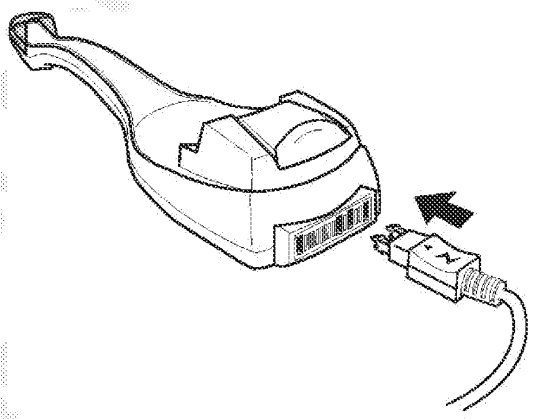
Which Chargers Can I Use

You can attach the following chargers to the cradle:

- Ericsson Travel Charger CTR-10
- Ericsson Cigarette Lighter Adapter CLA-10

Note: *You may already have one of these chargers if you have an Ericsson phone.*

How to Charge the Battery

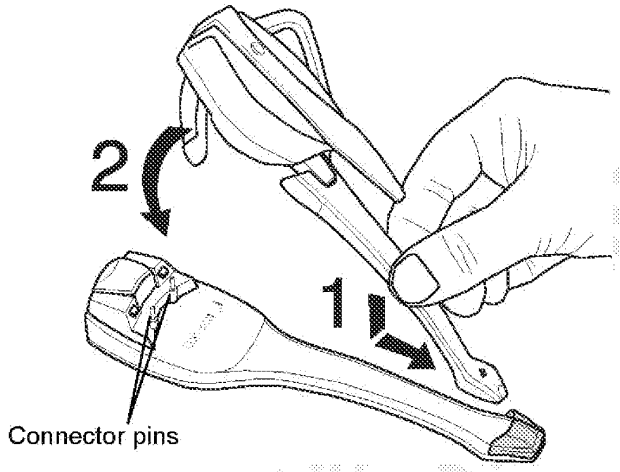


- Connect the charger to the cradle and to the mains. The flash symbol on the plug must face upwards.

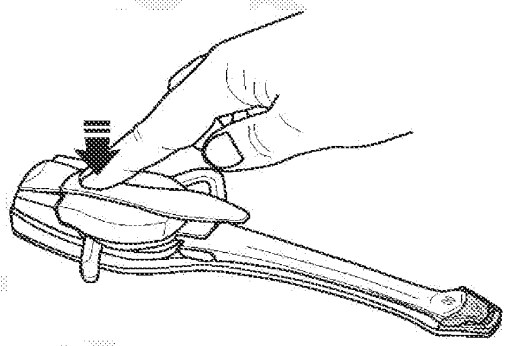
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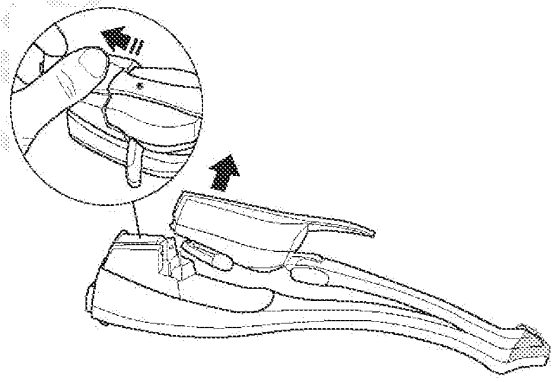
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- Insert the Headset into the charging cradle as shown in the picture. Make sure the connector pins are aligned with the connector holes in the Headset



- Gently press the Headset until it clicks into place.



- To remove the Headset from the cradle, slide the release catch backwards and lift the Headset up.

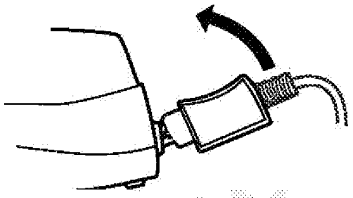
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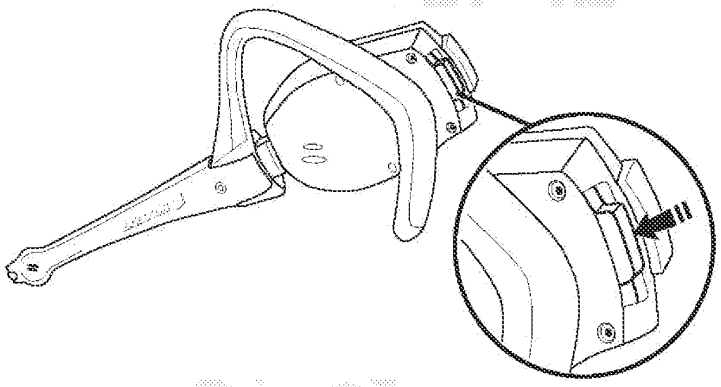
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Disconnecting the Charger

- Tilt the plug upwards to remove it.



Turning the Headset On or Off



To turn the Headset on

- Press and hold the Headset button until you hear a short low tone followed by a short high tone.
  The Headset indicator light flashes green. If the battery is low, the light flashes red.

To turn the Headset off

- Press and hold the Headset button until you hear a short high tone followed by a short low tone. The Headset indicator light is switched off.

Pairing the Headset

Before you start using the Headset for the first time, you must pair the Headset with the device you want to use it with, for example, a mobile phone. This section describes three ways of pairing the Headset:

- With an Ericsson phone with built-in *Bluetooth* capability
- With an Ericsson phone with a *Bluetooth* phone adapter attached
- With another *Bluetooth* device or non-Ericsson phone

Note: *The default Headset passkey is 0000.*

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Using an Ericsson Phone with Built-in *Bluetooth* Capability

You pair the Headset with your phone by adding it to a list of paired devices in the phone. They then recognize each other when they connect.

To pair the Headset with the phone

1. In the phone, scroll to **Extras**, **YES**, **Bluetooth**, **YES**, **Paired devices**, **YES**, **Add device?**, **YES**, **Phone initiates**, **YES**.
2. A list of device types that you can pair with your phone is shown. Scroll to **Headset** and press **YES**.
3. With the Headset turned off, press and hold the Headset button for up to 10 seconds until the indicator light on the Headset flashes green and red. Make sure the Headset and the phone are not too far apart.
4. Enter the Headset passkey and press **YES**. The phone starts searching for the Headset.
5. When the search is complete, the display shows a list of available devices. Scroll to **HBH** and then press **YES**.
6. You may now replace the given Headset name with a personal name tag and then press **YES**. When pairing has been completed, the Headset indicator light flashes green.

Using an Ericsson Phone with a *Bluetooth* Adapter Attached

You pair the Headset with your phone adapter by adding it to a list of paired devices in the phone. They then recognize each other when they connect.

To pair the Headset with the phone adapter

1. Attach the *Bluetooth* adapter to the phone and turn on the phone.
2. Scroll to **Extras**, **YES**, **Accessories**, **YES**, **DBA-10**, **YES**, **Paired devices**, **YES**, **Headset**, **YES**, **Add device?**. You are then asked to prepare the Headset for pairing.
3. With the Headset turned off, press and hold the Headset button for up to 10 seconds until the indicator light on the Headset flashes green and red. Make sure the Headset and the phone are not too far apart.
4. Press **YES** on the phone. The pairing procedure starts.
5. Scroll to **HBH** and press **YES**. Press **YES** again to confirm that you want to add the Headset to the list of paired devices.
6. Enter the Headset passkey and press **YES**.
   When you get confirmation that the Headset has been added to the list, and the Headset light flashes green, the pairing has been successful.

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Using Another Device or a Non-Ericsson Phone

The device or phone must have *Bluetooth* capability and support the Headset profile.

To pair the Headset with another device

1. Activate the *Bluetooth* function in the other device if necessary. To do this, please refer to the user documentation for the device.
2. With the Headset turned off, press and hold the Headset button for up to 10 seconds until the indicator light on the Headset flashes green and red. Make sure the Headset and the phone are not too far apart.
3. Initiate *Bluetooth* pairing in the other device to pair it with the Headset. To do this, please refer to the user documentation for the device.
4. When asked, enter the Headset passkey and press **YES**. If pairing is successful, the Headset indicator light flashes green.

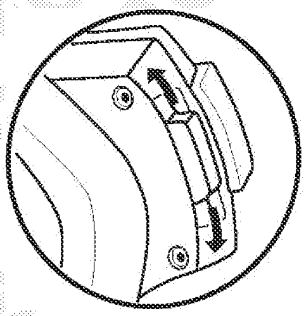
Resetting the Headset

You may want to reset the Headset to its default settings, if, for example, you forget your Headset passkey. This also clears all current pairings.

To reset the Headset

1. With the Headset turned off, press and hold the Headset button for up to 10 seconds until the indicator light on the Headset flashes green and red. Then release the button.
2. Press and hold the button again until the Headset beeps and is turned off. The Headset has now been reset.

Adjusting the Volume



Adjusting the Listening Volume

You can adjust the Headset listening volume during a call.

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To adjust the listening volume

- To increase the volume, slide the Headset button up.
- To decrease the volume, slide the Headset button down.

Note: *If you change the ear on which you wear the Headset, you must also change the orientation of the volume button. See "To change the orientation of the volume button" on page 6.*

Adjusting the Ring Volume

You can adjust the Headset ring volume when you are not engaged in a call.

To adjust the ring volume

- To increase the ring volume, slide the Headset button up.
- To decrease the ring volume, slide the Headset button down.

Note: *If you change the ear on which you wear the Headset, you must also change the orientation of the volume button. See "To change the orientation of the volume button" on page 6.*

Making and Receiving Calls

Once you have paired the Headset with your phone, you can make and receive calls using the Headset as long as it is turned on and within range of the phone (up to 10 m./30 ft. with no solid objects in the way).

If your phone supports voice dialling, you can use this feature with the Headset. Please refer to your phone's user documentation for more information on voice control.

The Headset light indicator flashes more quickly during an ongoing call.

In connection with making and receiving calls you press the Headset button to:

- make a call (by using voice control)
- answer a call
- end a call
- transfer the sound from the phone to the Headset

The following instructions cover the use of the Headset with an Ericsson phone with built-in *Bluetooth* capability, or a *Bluetooth* phone adapter from Ericsson and an Ericsson phone.

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Making Calls

To make a call using voice dialling

1. Make sure the phone and the Headset are on and within range of each other. Press the Headset button once.
2. After the beep, voice dial as you normally would.

Note: *If using the Bluetooth phone adapter: Say the voice label after the phone beep (not after the Headset beep). To know when the phone beeps in relation to the Headset beep, make a test call using voice dialling.*

3. End the call by pressing the Headset button or the **NO** key on the phone.

You can also make a call using the phone's keypad or phone book (if, for example, your phone does not support voice dialling).

To make a call using the phone keys

1. Make sure the phone and the Headset are on and within range of each other.
2. Enter the number as you normally would.
3. With an Ericsson phone with built-in *Bluetooth* capability: When the call has been set up, transfer the sound to the Headset by pressing the Headset button.
   With a *Bluetooth* phone adapter from Ericsson: When the call has been set up, the sound is automatically transferred to the Headset.
4. End the call by pressing the Headset button or the **NO** key on the phone.

Answering Calls

To answer a call using the Headset button

1. When the Headset rings, press the Headset button once.

Note: *If the phone rings first, wait until the Headset rings, then press the Headset button.*

2. End the call by pressing the Headset button, or the **NO** key on the phone.

To answer a second call

- You have to use the phone keypad to answer and handle a second call, but you can still use the Headset for talking and listening. You cannot use the Headset button during a second call. Refer to the phone's user documentation on how to handle more than one call simultaneously.

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Transferring Sound from Phone to Headset

If you make a call without using the Headset, you can transfer the sound to the Headset if the Headset is on, paired with the phone and within range.

To transfer the sound to the Headset

- With an Ericsson phone with built-in *Bluetooth* capability: During an ongoing call, press the Headset button to transfer the sound to the Headset.
- With a *Bluetooth* phone adapter from Ericsson: If you make a call without using the Headset, the message **Sound transferred to headset** is displayed. The sound is then automatically transferred to the Headset.

  If the Headset is turned on after a call has been initiated, you can transfer the sound to the Headset by pressing the Headset button.

Transferring Sound from Headset to Phone

Ericsson phone with built-in Bluetooth capability

- During an ongoing call, scroll to **Ongoing Call**, **YES**, **Transfer Sound**, **YES**.

Ericsson phone with a Bluetooth phone adapter

- During an ongoing call **Transfer sound to phone?** appears in the display. Press **YES** to transfer the sound to the phone.

  or

- During an ongoing call, scroll to **Extras**, **YES**, **Accessories**, **YES**, **DBA-10**, **YES**, **Transfer sound**, **YES**.

Lost Connection to Headset

If the connection to the Headset is lost during an ongoing call, **Connection to headset lost** is displayed. You must confirm the sound transfer to the phone by pressing **YES**, otherwise the call is disconnected after 30 seconds.

If the Headset and the phone are within range you can try to transfer the sound to the Headset by pressing the Headset button.

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Using the Phone's Extras Menu

If you are using an Ericsson mobile phone that supports *Bluetooth* wireless technology, you will find an additional set of menus under the **Extras** menu, when you have paired the phone with the Headset. The Headset has to be turned on and within range of the Ericsson phone. From these menus, you can control certain features of the Headset. This chapter describes the different menu options.

Note: *For some Ericsson non-GSM phones the Bluetooth menu options might be situated on a menu other than the Extras menu. Please refer to the User's Guide for your phone.*

Right or Left Ear

You can wear the Headset on either ear. It is preset for right-ear use. If you want to change it to left-ear use, you also have to change the orientation of the volume button. See "Right or Left Ear" on page 5 for instructions on how to change the orientation of the ear hook.

To change the volume button orientation

1. Scroll to **Extras**, **YES**, **Accessories**, **YES**, **HBH**, **YES**, **Settings**, **YES**, **Orientation**, **YES**.
2. Select which ear you want to wear the Headset on and press **YES**.

Selecting Which Device to Use

You select which device you want the Headset to communicate with from the paired devices list in the **Paired Devices** menu. You can also delete devices.

You can pair the Headset with up to eight different devices. However, only one device can be selected at a time. If you for example have added the Headset to the list of paired devices in your phone and your PC, you can select which device you want to use together with your Headset in the **Paired Devices** menu without having to enter the passkey for that device. You can consequently use your Ericsson phone to select which device you want the Headset to communicate with.

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To select a device

1. Scroll to **Extras**, **YES**, **Accessories**, **YES**, **HBH**, **YES**, **Paired Devices**, **YES**, **Select Device**, **YES**.
2. Scroll to the device you want the Headset to communicate with and press **YES**.

You can add devices to the list of paired devices. When you choose to add a device, *Bluetooth* pairing is enabled in the Headset. If the device is accepted, it is added to the list. The new device becomes the selected device.

To add a device

- You add a device by pairing it with the Headset. See "Pairing the Headset" on page 9.

To delete a device

1. Scroll to **Extras**, **YES**, **Accessories**, **YES**, **HBH**, **YES**, **Paired Devices**, **YES**, **Delete Device**, **YES**.
2. Scroll to the device you want to delete and press **YES**. The next device in the list becomes the selected device.

Adjusting the Volume

Listening Volume

You can adjust the volume in the Headset earpiece via either the Headset volume buttons or by using the phone.

To change the listening volume using the phone

1. During an ongoing call, scroll to **Extras**, **YES**, **Accessories**, **YES**, **HBH**, **YES**, **Settings**, **YES**, **Listening Volume**, **YES**.
2. Use ◄ to increase the volume, or ► to decrease the volume.
3. Press **YES** to save the settings.

Ring Volume

The Headset always starts to ring at low volume. The volume then increases in steps to the volume level you have set in this menu.

To set the ring volume

1. Scroll to **Extras**, **YES**, **Accessories**, **YES**, **HBH**, **YES**, **Settings**, **YES**, **Ring Volume**, **YES**.
2. Use ◄ to increase the volume, or ► to decrease the volume.
3. Press **YES** to save the settings.

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Headset Battery Status

The Headset comes with a built-in battery. You can check the status of the battery.

To check the battery status

1. Scroll to **Extras**, **YES**, **Accessories**, **YES**, **HBH**, **YES**, **Battery Status**, **YES**.
2. The battery status is indicated by one of these three levels:
   - **High**
   - **Medium**
   - **Low**

Changing the Passkey

The Headset is delivered with a preset passkey. However, you can change this passkey to any other four-digit number. The passkey is not a PIN to prevent someone from using the Headset, but a key to ensure that two devices can create a unique connection, without interference from other devices.

To change the Headset passkey

1. Scroll to **Extras**, **YES**, **Accessories**, **YES**, **HBH**, **YES**, **Settings**, **YES**, **Passkey**, **YES**.
2. Enter the current passkey and press **YES**.
3. Enter the new passkey and press **YES**.
4. Enter the new passkey a second time and press **YES**.

Changing the Headset Name

The Headset is delivered with a preset name.This name appears in other devices when they search for the Headset. However, you can change this name. For the name change to take effect in a previously paired device, you have to pair the Headset with that device again.

To change the name

1. Scroll to **Extras**, **YES**, **Accessories**, **YES**, **HBH**, **YES**, **Settings**, **YES**, **Name**, **YES**.
2. Edit the name and press **YES**. You delete characters by pressing C.

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Additional Information

Troubleshooting

This section lists some problems that you might encounter while using your Headset.

No Sound Contact between Headset and Other Device

The Headset and the device you are using with it have to be paired to recognize each other.

They also have to be within range of each other. Make sure the Headset and the device you are using with it are no more than 10 m./30 ft. apart.

The Headset Indicator Light Flashes Red

This indicates that the Headset has only limited speech and standby time left. Put the Headset into the charging cradle and charge it for approximately 1 to 1.5 hours.

No Indication of Charging Is Shown

If you charge a Headset battery that is empty, or has not been used for a long time, it may take several minutes before a light to indicate charging (a steady red light) appears.

I Have Forgotten the Passkey

Reset the Headset. Please note that all paired connections that the Headset has with other devices will be deleted. See "Resetting the Headset" on page 11 for more information.

Some Headset Functions Do Not Work

If you notice that you cannot make use of all the features in the HBH-10 Headset, please check that your Ericsson phone has the right software version. For more information, contact a Certified Service Centre or an Ericsson Service Point, or visit the HBH-10 page on http://mobileinternet.ericsson.com.

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Ericsson Mobile Internet

When you are on the move and in need of communication and information, the **Mobile Internet** is the answer.

The **Mobile Internet** is a service supplied by Ericsson to make it easier for you to communicate and receive information quickly, wherever you are. It gives you access to various messaging services, on-line customer services, user manuals and other useful information. With the **Mobile Internet** you can also download communications software to ensure you get the best out of your Ericsson products.

The Ericsson **Mobile Internet** address is:
http://mobileinternet.ericsson.com.

Guidelines for Safe and Efficient Use

Note: *Read this information before using your Bluetooth Headset.*

Product Care and Maintenance

Your *Bluetooth* Headset is a highly sophisticated electronic device. To get the most out of your Headset read this text about product care, safe and efficient use.

For any exceptions, due to national requirements or limitations, when using *Bluetooth* equipment, please visit www.bluetooth.com.

Product Care

Note: *Only Certified Service Centres or Ericsson Service Points are to remove or replace the battery.*

- Do not expose your product to liquid or moisture.
- Do not expose your product to extreme hot or cold temperatures.
- Do not expose your product to lit candles, cigarettes, cigars, open flames, etc.
- Do not drop, throw or try to bend the product since rough treatment could damage your product.
- Do not use any other accessories than Ericsson originals. Failure to do so may result in loss of performance, damage to the product, electric shock or injury, and will void warranty.
- Do not attempt to disassemble your product. Doing so will void warranty. The product does not contain consumer serviceable or replaceable components. Service should only be performed by Certified Service Centres or Ericsson Service Points.
- Do not paint your product as the paint could prevent normal use.

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- Do not keep the product in an area prone to dust and dirt. Only use a soft damp cloth to clean your product.
- Do not allow children to play with your product. Children could hurt themselves or others and also damage the unit.
- Always keep your product in its case when not in use, in order to keep it well protected.
- If you will not be using the product for a while, store it in a place that is dry, free from damp, dust and extreme heat and cold.

Radio Frequency Exposure

This *Bluetooth* Headset contains a small radio transmitter and receiver. During a call, it communicates with the mobile phone by receiving and transmitting radio frequency (RF) electromagnetic fields (microwaves) in the frequency range 2400 to 2500 MHz. The output power of the radio transmitter is very low, 0.001 watt.

When using the Headset, you will be exposed to some of the transmitted RF energy. This exposure is well below the prescribed limits in all national and international RF safety standards and regulations.

Driving

Check the laws and regulations on the use of phones in the areas where you drive.

- Give full attention to driving.
- Pull off the road and park before making or answering a call if driving conditions so require.

RF energy may affect some electronic systems in motor vehicles such as car stereos, safety equipment etc.

Electronic Equipment

Most modern electronic equipment, for example, equipment in hospitals and cars, is shielded from RF energy. However, certain electronic equipment is not. Therefore:

- Do not use any electronic device near medical equipment without requesting permission.

Aircraft

- Turn off your electronic device before boarding any aircraft.
- Do not use it in an aircraft without crew permission.

To prevent interference with communications systems, you must not use your electronic device while the plane is in the air.

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Blasting Areas

Turn off your electronic device when in a blasting area or in areas posted "turn off two-way radio" to avoid interfering with blasting operations. Construction crews often use remote control RF devices to set off explosives.

Potentially Explosive Atmospheres

Turn off your electronic device when in any area with a potentially explosive atmosphere. It is rare, but your electronic device could generate sparks. Sparks in such areas could cause an explosion or fire resulting in bodily injury or even death.

Areas with a potentially explosive atmosphere are often, but not always, clearly marked. They include fuelling areas, such as petrol stations, below deck on boats, fuel or chemical transfer or storage facilities, and areas where the air contains chemicals or particles, such as grain, dust, or metal powders.

Do not transport or store flammable gas, liquid, or explosives in the compartment of your vehicle containing an electronic device.

Power Supply

- Connect the power supply only to designated power sources as marked on the product.
- To reduce risk of damage to the electric cord, remove it from the outlet by holding onto the AC adapter rather than the cord.
- Make sure the cord is positioned so that it will not be stepped on, tripped over or otherwise subjected to damage or stress.
- To reduce risk of electric shock, unplug the unit from any power source before attempting to clean it.
- The charger must not be used outdoors or in damp areas.

Children

Do not allow children to play with your Headset since it contains small parts that could become detached and create a choking hazard.

Emergency Calls

IMPORTANT!

This Headset and the electronic device connected to the Headset operate using radio signals, cellular and landline networks as well as user-programmed functions, which cannot guarantee connection under all conditions. Therefore you should never rely solely upon any electronic device for essential communication (e.g. medical emergencies).

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Remember that in order to make or receive calls, the Headset and the electronic device connected to it must be switched on and in a service area with adequate cellular signal strength. Emergency calls may not be possible on all cellular phone networks or when certain network services and/or phone features are in use. Check with your local service provider.

Battery Information

New Batteries

The battery delivered with your Headset is not fully charged. We recommend that you fully charge it before you use it for the first time.

Battery Use and Care

Note: *Only Certified Service Centres or Ericsson Service Points are able to remove or replace the battery in a proper way.*

A rechargeable battery has a long service life if treated properly.
A new battery, or one that has not been used for a long period of time, could have reduced capacity the first few times it is used.

- Use only Ericsson original accessories. Using non-original Ericsson accessories could be dangerous and the warranty does not cover product failures which have been caused by use of non-Ericsson original accessories.
- Do not expose your battery to extreme temperatures and never above +55°C (+131°F). For maximum battery capacity, use your battery in room temperature. If the battery is used in cold temperatures, the battery capacity is reduced.
- The battery can only be charged when the temperature is between +10°C (+50°F) and +45°C (+113°F).

Recycling the Battery in Your Headset

The battery in your Headset contains toxic parts. It must be disposed of properly and should never be placed in municipal waste. The Certified Service Centre removing or replacing the battery will dispose of it according to local regulations.

Limited Warranty

Thank you for purchasing this Ericsson Product. To get the most out of your new product, we recommend that you follow a few simple steps:

- Read the Guidelines for safe and efficient use.
- Read all the terms and conditions of your Ericsson Warranty.
- Save your original receipt. You will need it for warranty repair claims. Should your Ericsson Product need warranty service, you should return it to the dealer from whom it was purchased or contact your local Ericsson Call-Centre to get further information.

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Our Warranty

Ericsson warrants this Product to be free from defects in material and workmanship at the time of its original purchase by a consumer, and for a subsequent period of one (1) year.

All accessories for the Product are covered by a warranty for a period of one (1) year from the date of its original purchase by a consumer.

What We Will Do

If, during the warranty period, this Product fails to operate under normal use and service, due to improper materials or workmanship, Ericsson subsidiaries, authorized distributors or Certified Service Centres or Ericsson Service Points will, at their option, either repair or replace the Product in accordance with the terms and conditions stipulated herein.

Conditions

1. The warranty is valid only if the original receipt issued to the original purchaser by the dealer, specifying the date of purchase and serial number, is presented with the Product to be repaired or replaced. Ericsson reserves the right to refuse warranty service if this information has been removed or changed after the original purchase of the Product from the dealer.
2. If Ericsson repairs or replaces the Product, the repaired or replaced Product shall be warranted for the remaining time of the original warranty period or for ninety (90) days from the date of repair, whichever is longer. Repair or replacement may be via functionally equivalent reconditioned units. Replaced faulty parts or components will become the property of Ericsson.
3. This warranty does not cover any failure of the Product due to normal wear and tear, misuse, including but not limited to use in other than the normal and customary manner, in accordance with Ericsson's instructions for use and maintenance of the Product, accident, modification or adjustment, acts of God, improper ventilation and damages resulting from liquid.
4. This warranty does not cover Product failures due to repair installations, modifications or improper service performed by a non-Ericsson Certified Service Centre or the opening of the Product by non-Ericsson certified persons.
5. The warranty does not cover Product failures which have been caused by use of non-Ericsson original accessories.
6. Tampering with any of the seals on the Product will void the warranty.

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7. THERE ARE NO OTHER EXPRESS WARRANTIES, WHETHER WRITTEN OR ORAL, OTHER THAN THIS PRINTED LIMITED WARRANTY. ALL IMPLIED WARRANTIES, INCLUDING WITHOUT LIMITATION THE IMPLIED WARRANTIES OR MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED TO THE DURATION OF THIS LIMITED WARRANTY. IN NO EVENT SHALL ERICSSON BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY NATURE WHATSOEVER, INCLUDING BUT NOT LIMITED TO LOST PROFITS OR COMMERCIAL LOSS TO THE FULL EXTENT THOSE DAMAGES CAN BE DISCLAIMED BY LAW.

International Services

If your Ericsson Product needs service in another country than the one you bought it in you can have your Ericsson Product serviced within the warranty period in any country where this **identical** Product is sold by an authorised Ericsson distributor. To find out if your Product is sold in the country you are in please call the local Call-Centre. In order to be granted service you have to present your original receipt. Please observe that certain services may not be possible to have made elsewhere than in the country of original purchase for example due to the fact that your Ericsson Product may have an interior or exterior which is different from equivalent models sold in other countries. There may also be limited possibilities to repair SIM-locked Products.

Some countries do not allow the exclusion or limitation of incidental or consequential damage, or limitation of the duration of implied warranties, so the preceding limitations or exclusions may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which may vary from country to country.

Bluetooth Capability Statement

This product is manufactured to meet the Bluetooth Specification 1.0.

The following *Bluetooth* functions are supported:

- Headset Profile

Important Information

Caution! Changes or modifications not expressly approved by Ericsson will void the user's authority to operate the equipment.

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Declaration of Conformity

We, **Ericsson Mobile Communications AB** of
Torshamnsgatan 27
S-164 80 Stockholm, Sweden

declare under our sole responsibility that our product

Ericsson type 8404003-BV, and
Ericsson type 8505001

to which this declaration relates is in conformity with the appropriate standards ETS 300 328, ETS 300 342-1, ETS 300 826 and EN 60950 following the provisions of Radio Equipment and Telecommunication Equipment directive **1995/5/EC** with requirements covering EMC directive **89/336/EEC** and Low voltage directive **73/23/EEC**.

Stockholm, June 2000
Place and date of issue

Anders Torstensson, President BU GSM

CE0682 !

FCC Statement

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

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Samsung Electronics Co., Ltd. et al. v. One-E-Way, Inc.
IPR2025-01541

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/356,949	01/24/2012	C. Earl Woolfork	1028.6	2299

68533 7590 05/04/2015

MEGAN LYMAN
1816 SILVER MIST CT.
RALEIGH, NC 27613

EXAMINER	
FLANDERS, ANDREW C	

ART UNIT	PAPER NUMBER
2656	

NOTIFICATION DATE	DELIVERY MODE
05/04/2015	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Notice of Allowability	Application No. 13/356,949	Applicant(s) WOOLFORK, C. EARL	
	Examiner Andrew C. Flanders	Art Unit 2656	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *the amendment filed 20 February 2015*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on_____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *1-12*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov .
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some *c) ☐ None of the:
   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☐ Examiner's Amendment/Comment
6. ☒ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

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The present application is being examined under the pre-AIA first to invent provisions.

EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Megan E. Lyman on 31 March 2015.

The application has been amended as follows:

1. (Currently Amended) A mobile wireless digital audio receiver, configured to receive a unique user code and an original audio signal representation in the form of packets, said unique user code ~~configured~~ used to spread a spectrum of said signal and further configured for independent CDMA communication operation, said receiver independent of the operation of another receiver, said mobile wireless digital audio receiver comprising:

a direct conversion module configured to capture packets and a correct bit sequence within the packets aided by lowering signal detection error through reduced intersymbol interference coding of said original audio signal representation, said

packets embedded in the received spread spectrum signal, the captured packets corresponding to the unique user code;

a decoder operative to decode the reduced intersymbol interference coding of said original audio signal representation wherein each user has their audio receiver configured to communicate with their own separate audio transmitter, and said receiver virtually free from interference from transmission and reception device ~~transmitted~~ signals operating in the shared spectrum.

2. (Currently Amended) A wireless digital audio headphone for receipt of a unique user code and a digital audio signal representation in the form of a packet, said unique user code ~~configured~~ used to spread a spectrum of said signal and further configured for independent CDMA communication operation, said headphone independent of the operation of another headphone, said wireless digital audio headphone comprising:

a direct conversion module configured to capture packets and the correct bit sequence within the packets aided by lowering signal detection error through reduced intersymbol interference coding of said digital audio signal representation, said packets embedded in the received spread spectrum signal, the captured packets corresponding to the unique user code;

a decoder operative to decode the reduced intersymbol interference coding of said original audio signal representation;

a digital-to-analog converter generating an audio output of said original audio signal representation; and

a module adapted to produce said generated audio output, wherein each user has their audio headphone configured to communicate with their own separate audio transmitter, and said audio virtually free from interference from transmission and reception device ~~transmitted~~ signals operating in a shared wireless headphone spectrum.

3. (Currently Amended) A wireless digital audio headphone comprising:

a digital audio headphone receiver configured to receive an unique user code bit sequence and a original audio signal representation in the form of packets, said digital audio headphone receiver, capable of mobile operation and configured for direct digital coded wireless spread spectrum communication with a mobile digital audio transmitter, and said user has their headphone configured to communicate with their own transmitter;

a direct conversion module configured to capture packets and the correct bit sequence within the packets aided by lowering signal detection error through reduced intersymbol interference coding of said original audio signal representation said packets embedded in the received spread spectrum signal, the captured packets corresponding to the unique user code;

a digital demodulator configured for independent CDMA communication operation wherein a user has their own transmitter and receiver;

a decoder operative to decode the reduced intersymbol interference coding of original audio signal representation;

a digital-to-analog converter (DAC) generating an audio output of said original audio signal representation; and

a module responsive to the unique user code bit sequence to produce said generated audio output wherein each user has their audio headphone configured to communicate with their own separate audio transmitter, said output virtually free from interference from transmission and reception device ~~transmitted~~ signals operating in the shared wireless headphone spectrum.

5. (Currently Amended) A mobile wireless digital audio receiver, configured to receive a unique user code and an original audio signal representation in the form of packets, said unique user code ~~configured~~ used to spread the spectrum of said signal and further configured for independent CDMA communication operation, said receiver independent of the operation of another receiver, said mobile wireless digital audio receiver comprising:

a direct conversion module configured to capture packets and the correct bit sequence within the packets aided by lowering signal detection error through reduced intersymbol interference coding of said original audio signal representation respective to said mobile digital audio receiver, said packets embedded in the received spread spectrum signal, the captured packets corresponding to the unique user code;

a decoder operative to decode the reduced intersymbol interference coding of said original audio signal representation;

a digital-to-analog converter generating an audio output of said original audio signal representation; and

a module adapted to produce said generated audio output, wherein each user has their audio receiver configured to communicate with their own separate audio transmitter, and said audio virtually free from interference from transmission and reception device ~~transmitted~~ signals operating in the shared spectrum.

6. (Currently Amended) A mobile wireless digital audio receiver, configured to receive a unique user code and an original audio signal representation in the form of packets, said unique user code ~~configured~~ used to spread the spectrum of said signal and further configured for independent CDMA communication operation, said receiver independent of the operation of another receiver, said mobile wireless digital audio receiver comprising:

fuzzy set membership functionality to enhance detection of said unique user code;

a direct conversion module configured to capture packets and the correct bit sequence within the packets aided by lowering signal detection error through reduced intersymbol interference coding of said audio signal representation, said packets embedded in the received spread spectrum signal, the captured packets corresponding to the unique user code;

a decoder operative to decode reduced intersymbol interference coding of said original audio signal representation;

a digital-to-analog converter generating an audio output of said original audio signal representation; and

a module adapted to produce said generated audio output, wherein each user has their audio receiver configured to communicate with their own separate audio transmitter, and said audio virtually free from interference from transmission and reception device ~~transmitted~~ signals operating in a shared spectrum.

7. (Currently Amended) A wireless digital audio receiver, configured to receive an unique user code and a original audio signal representation, said unique user code ~~configured~~ used to spread a spectrum of said signal and further configured for independent CDMA communication operation, said receiver independent of the operation of another receiver, said wireless digital audio receiver comprising:

fuzzy set membership functionality to enhance detection of said unique user code;

a direct conversion module configured to capture the correct bit sequence embedded in the received spread spectrum signal;

a module adapted to produce said original audio signal representation, wherein each user has their audio receiver configured to communicate with their own separate audio transmitter, and said audio virtually free from interference from transmission and reception device ~~transmitted~~ signals.

8. (Currently Amended) A wireless digital coded music audio spread spectrum transmitter operatively coupled to a music audio source and configured to transmit a unique user code and an original audio signal representation in the form of packets, wherein said digital coded music audio transmitter coupled to said music audio source, and configured to be directly communicable with a mobile digital audio spread spectrum receiver, is capable of being moved in any direction during operation, said wireless digital coded audio transmitter comprising:

encoding operative to encode said original audio signal representation to reduce intersymbol interference and aid in lowering signal detection error of said audio representation signal respective to said receiver and mobile said transmitter coupled to said music audio source;

a digital modulator module configured for independent code division multiple

access communication operation, wherein [[a]] each user has their own separate transmitter configured to communicate with their receiver, said transmitter configured to wirelessly transmit said audio to be reproduced virtually free from interference from transmission and reception device ~~transmitted~~ signals operating in the wireless digital audio transmitter shared spectrum.

9. (Currently Amended) A mobile wireless digital audio receiver capable of being moved in any direction during operation and configured to receive a unique user code and an original audio signal representation in the form of packets, said unique user code ~~configured~~ used to spread a spectrum of said signal and further configured for

independent CDMA communication operation, said receiver independent of the operation of another receiver, said wireless digital audio receiver comprising:

a spread spectrum receiver module configured to capture packets and a correct bit sequence within the packets aided by lowering signal detection error through reduced intersymbol interference coding of said original audio signal representation, said packets embedded in the received spread spectrum signal, the captured packets corresponding to the unique user code;

a decoder operative to decode the reduced intersymbol interference coding of said original audio signal representation, wherein each user has their audio receiver configured to communicate with their own separate audio transmitter, and said audio virtually free from interference from transmission and reception device ~~transmitted~~ signals operating in the shared spectrum.

10. (Currently Amended) A wireless digital coded audio spread spectrum transmitter operatively coupled to a audio source and configured to transmit a unique user code and an original audio signal representation in the form of packets, wherein said digital coded audio transmitter coupled to said audio source, and configured to be directly communicable with a mobile digital audio spread spectrum receiver, is capable of being moved in any direction during operation, said wireless digital coded audio transmitter comprising:

an encoding module operative to encode said original audio signal representation to reduce intersymbol interference and aid in lowering signal detection error of said audio signal representation, said transmitter coupled to said audio source;

a digital modulator module configured for independent code division multiple access communication operation, [[a]] each user has their own separate transmitter configured to communicate with their receiver, said transmitter configured to wirelessly transmit said audio to be reproduced virtually free from interference from transmission and reception device ~~transmitted~~ signals operating in the wireless digital audio transmitter shared spectrum.

11. (Currently Amended) The wireless digital audio receiver of Claim ~~9~~ 8, wherein the spread spectrum receiver module is further configured to utilize differential phase shift keying (DPSK) to demodulate said audio signal representation.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Andrew C. Flanders whose telephone number is (571)272-7516. The examiner can normally be reached on M-F 8:30 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Curtis Kuntz can be reached on (571) 272-7499. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Andrew C Flanders/
Primary Examiner, Art Unit 2656

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13356949	WOOLFORK, C. EARL
	Examiner	**Art Unit**
	ANDREW C FLANDERS	2656

CPC						
Symbol					**Type**	**Version**
H04R	/	1	/	1083	F	2013-01-01
H04R	/	5	/	033	A	2013-01-01
H04R	/	2420	/	07	A	2013-01-01

CPC Combination Sets								
Symbol					**Type**	**Set**	**Ranking**	**Version**

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 12	
/ANDREW C FLANDERS/ Primary Examiner.Art Unit 2656 (Primary Examiner)	04/06/2015 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 1

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Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13356949	WOOLFORK, C. EARL
	Examiner	**Art Unit**
	ANDREW C FLANDERS	2656

US ORIGINAL CLASSIFICATION		INTERNATIONAL CLASSIFICATION	
CLASS	SUBCLASS	CLAIMED	NON-CLAIMED
700	94	G 0 6 F 17 / 00	

CROSS REFERENCE(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	12	
/ANDREW C FLANDERS/ Primary Examiner.Art Unit 2656	04/06/2015	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

U.S. Patent and Trademark Office

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	ANDREW C FLANDERS	2656

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☒ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1														
2	2														
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10	10														
11	11														
12	12														

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 12	
/ANDREW C FLANDERS/ Primary Examiner.Art Unit 2656 (Primary Examiner)	04/06/2015 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 1

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Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13356949	WOOLFORK, C. EARL
	Examiner	Art Unit
	ANDREW C FLANDERS	2656

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
700	94	12/16/14	acf

SEARCH NOTES		
Search Notes	Date	Examiner
see history attached	10/2/13	acf
reviewed and repeatedsearch history of entire family; 10/027,391 10/648,012 12/144,729 12/570,343 12/940,747	10/2/13	acf
eDan, EAST and PALM inventor search for double patenting	10/2/13	acf
google.com patents search	10/2/13	acf
updated	5/1/14	acf
updated	12/16/14	acf
updated	4/6/15	acf

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
700	94	4/6/15	acf

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13356949	WOOLFORK, C. EARL
	Examiner	Art Unit
	ANDREW C FLANDERS	2656

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☒ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	10/02/2013	05/01/2014	12/16/2014	04/06/2015					
1	1	✓	✓	✓	=					
2	2	✓	✓	✓	=					
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4	4	✓	✓	✓	=					
5	5	✓	✓	✓	=					
6	6	✓	✓	✓	=					
7	7	✓	✓	✓	=					
8	8	✓	✓	✓	=					
9	9		✓	✓	=					
10	10		✓	✓	=					
11	11			✓	=					
12	12				=					

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13/356,949	01/24/2012	C. Earl Woolfork	1028.6	2299

7590 05/12/2015

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1816 SILVER MIST CT.
RALEIGH, NC 27613

EXAMINER	
FLANDERS, ANDREW C	

ART UNIT	PAPER NUMBER
2656	

NOTIFICATION DATE	DELIVERY MODE
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NOTICE OF NON-COMPLIANT INFORMATION DISCLOSURE STATEMENT

An Information Disclosure Statement (IDS) filed 4/22/15 in the above-identified application fails to meet the requirements of 37 CFR 1.97(d) for the reason(s) specified below. Accordingly, the IDS will be placed in the file, but the information referred to therein has not been considered.

The IDS is not compliant with 37 CFR 1.97(d) because:

☑ The IDS lacks a statement as specified in 37 CFR 1.97(e).

☐ The IDS lacks the fee set forth in 37 CFR 1.17(p).

☐ The IDS was filed after the issue fee was paid. Applicant may wish to consider filing a petition to withdraw the application from issue under 37 CFR 1.313(c) to have the IDS considered. See MPEP 1308.

LH

571-272-4200 or 1-888-786-0101
Application Assistance Unit
Office of Data Management

FORM PTOM327-B (Rev. 02/08)

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PTO/SB/08a (01-10)
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	Application Number	13356949
	Filing Date	2012-24-01
	First Named Inventor	C. Earl Woolfork
	Art Unit	2656
	Examiner Name	Andrew Flanders
	Attorney Docket Number	

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	5722071		1998-02-24	Berg,Roger	
	2	6424820		2002-07-23	Burdick,Wayne	
	3	6487240		2002-11-26	Chen,Weizhong	
	4	5848095		1998-12-08	Duetsch,Brian	
	5	5528623		1996-06-18	Foster, Robert	
	6	6397037		2002-05-28	Franklin,David	
	7	6563892		2003-05-13	Haartsen, Jacobus	
	8	6574455		2003-06-03	Jakobsson, Bjorn	

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	Filing Date	2012-24-01
	First Named Inventor	C. Earl Woolfork
	Art Unit	2656
	Examiner Name	Andrew Flanders
	Attorney Docket Number	

	9	6973297		2005-12-06	Manku, Tajinder	
	10	5193102		1993-03-09	Meidan, Reuven	
	11	5822440		1998-10-13	Oltman, Randy	
	12	5418813		1995-05-23	Schaffner, Terry	
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	15	5892792		1999-04-06	Walley, John	
	16	6006115		1999-12-21	Wingate, Richard	
	17	5769032		1998-06-23	Yarnall, Robert	
	18	5907582		1999-05-25	Yi, Byung	
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	Art Unit	2656
	Examiner Name	Andrew Flanders
	Attorney Docket Number	

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20010031622		2001-10-18	Kivela, Seppo	
	2	20020009124		2002-01-24	Li, Daoben	
	3	20030118122		2003-06-26	Nefedov, Nikolai	
	4	20020132585		2002-09-19	Palermo, Vincent	
	5	20030073460		2003-04-17	Van Pelt, Engelbert	
	6	20020039424		2002-04-04	Watanuki, Masanori	

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	1	W0 9939445			1999-08-05	Bergstrom,Scott		☐
	2	2000-0006888			2000-04-25	Ham, In Wha		☐

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	Art Unit	2656
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	3	GB 2343332			2000-05-03	Hulbert		☐
	4	EP 1096717 A2			2000-10-20	Lee, Young		☐
	5	2000309004			2000-10-10	Terajima, Kazuhiko		☐

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T5
	1	Alagha, Nader, Generalized Raised-Cosine Filters, July 1999	☐
	2	Bray, Jennifer, Bluetooth Connect Without Cables, 2001	☐
	3	DeCourville, Marc, Motorola Labs: An OFDM based solution granting compatibility between next G of high rate WPANs and WLANs	☐
	4	Eliezer, Oren, Bluetooth and Wi-Fi coexistence schemes strive to avoid chaos, November 2001	☐
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	6	Gupta, Rajesh, Design Technology for Building Wireless Systems, 1997	☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	Examiner Name	Andrew Flanders
	Attorney Docket Number	

	7	Karaoguz, Jeyhan, Project: IEEE 802.15 Working Group for Wireless Personal Area Network (WPANs), July 2000	☐
	8	Mattisson, Sven, Low-Power Considerations in the Design of Bluetooth, 2000	☐
	9	Nafie, Mohammed, Enhancements to the Bluetooth Specification, 2001	☐
	10	Pickholtz, Raymond, Spread Spectrum for Mobile Communications, May 1991	☐
	11	Reynolds, Daryl, Low Complexity Turbo Equalization for Diversity Channels, April 2001	☐
	12	Rios, Carlos, Project: IEEE 802.15 Working Group for Wireless Personal Area Networks (WPANs), September 2000	☐
	13	Skylar, Bernard, Digital Communications, 1988	☐
	14	Wang, hongfeng, Overview of Bluetooth Technology, July 2001	☐
	15	Zimmerman, T, Personal Area Networks: Near-field intrabody communication	☐

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13356949
	Filing Date	2012-24-01
	First Named Inventor	C. Earl Woolfork
	Art Unit	2656
	Examiner Name	Andrew Flanders
	Attorney Docket Number	

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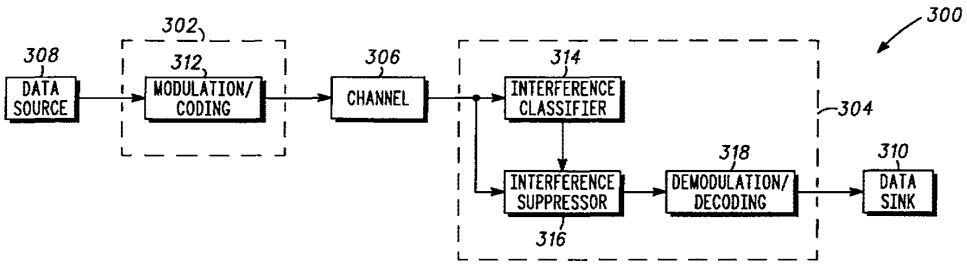
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(57) Abstract

The invention relates to a communication system (300) having a receiver (304) that is capable of performing targeted interference suppression. An interference classifier (314) within the receiver (304) analyzes a signal received from a channel (306) and identifies and classifies interference components within the signal. An interference suppressor (316) then suppresses the interference components in the signal based on interference type. The interference suppressor (316) includes a plurality of interference suppression modules that are each optimal for suppressing certain interference types. In one embodiment, one or more of the interference suppression modules perform interference suppression using modal moment estimates to identify different modes within the signal.

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PRIOR_ART_004462

INTERFERENCE SUPPRESSION USING MODAL MOMENT ESTIMATES

Field of the Invention

The invention relates in general to communications systems and, more particularly, to communications systems having interference mitigation capabilities.

Background of the Invention

Digital cellular communications systems, paging systems, land mobile radio, and mobile battlefield communication systems are called upon to operate effectively in increasingly adverse spectral environments. Obstacles to digital mobile communications include non-stationary co-site interference, ambient communication signals, and hostile jamming interference. Typical interference levels can be very high, especially in a tactical environment, and can often exceed the desired signal by 60 decibels or more. Such levels overwhelm the operational capabilities of current tactical and commercial radio systems. Furthermore, PCS, paging, and cellular communication networks that incorporate spread-spectrum technologies, such as CDMA, increasingly face capacity limitation caused in part by growing spectral clutter. The presence of ambient high power partialband and narrowband signals often precludes frequency reuse by spread-spectrum communication systems.

Therefore, there is a need for a method and apparatus for reducing the impact of undesirable spectral components in a communications system.

Brief Description of the Drawings

FIG. 1 is a high level block diagram illustrating a communication system in accordance with one embodiment of the present invention;

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FIG. 2 is a block diagram illustrating a communication system in accordance with another aspect of the present invention;

FIG. 3 is a block diagram illustrating elements within the disturbance classification unit 74 of FIG. 2;

FIG. 4 is a joint time frequency (JTF) feature plane diagram illustrating inbound communication signal interferers versus time;

FIG. 5 is a cross section of a feature plane transformation diagram for a five FSK interference signal;

FIG. 6 is a flowchart illustrating a transformation masking method in accordance with one embodiment of the present invention;

FIGS 7-11 are graphs illustrating a method for performing preclassification filtering in accordance with one embodiment of the present invention;

FIGS. 12 and 13 are cross-sections of feature plane signal transformations illustrating the beneficial effects of using phase domain filtering;

FIG. 14 is a spectrum diagram illustrating a method for determining a baud rate for a binary phase shift keying (BPSK) signal in accordance with one embodiment of the present invention;

FIG. 15 illustrates a linear array of alternating Kronecker deltas that is used to determine a baud rate for an frequency shift keying (FSK) signal in accordance with one embodiment of the present invention;

FIG. 16 is a spectrum diagram illustrating a method for determining a baud rate for an FSK signal in accordance with one embodiment of the present invention;

FIG. 17 is a plot illustrating modal moment estimates for a data signal corrupted by a partial band noise jammer in accordance with one embodiment of the present invention;

FIG. 18 is a flowchart illustrating a process for deriving modal moment estimates in accordance with one embodiment of the present invention;

FIG. 19 is a spectrum diagram illustrating a number of bands WsN for use in frequency hopping in accordance with one embodiment of the present invention;

FIG. 20 is a flowchart illustrating a method for performing frequency hop masking in accordance with one embodiment of the present invention;

FIG. 21 is a flowchart illustrating the operation of an inverse whitening function in accordance with one embodiment of the present invention;

FIG. 22 is a spectrum diagram illustrating the spectrum of a spread spectrum data signal corrupted by a PSK partial band jammer 122;

FIG. 23 is a flowchart illustrating the operation of an adaptive inverse weight interference suppression method in accordance with one embodiment of the present invention;

FIG. 24 is a flowchart illustrating the operation of an adaptive excision interference suppression method in accordance with one embodiment of the present invention;

FIG. 25 is a flowchart illustrating a cascaded interference suppression procedure in accordance with one embodiment of the present invention; and

FIGS. 26-28 are spectrum diagrams illustrating a cascaded suppression procedure in accordance with one embodiment of the present invention.

Detailed Description of the Drawings

The present invention relates to a communications system that is capable of reducing the impact of undesirable spectral components (e.g., noise, interference, and jamming) in a receive signal. The system includes an interference classifier for classifying each of the undesired spectral components (if any) by interference-type and an interference suppressor for suppressing the undesired interference components in the receive signal using one or more interference suppression methods that may be "targeted" to the specific type of interference. By targeting interference suppression by

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interference-type, a superior level of interference suppression performance is achieved as compared to prior art systems that use a common suppression method for all types of interference. In one embodiment of the invention, the interference classification and suppression functions are performed automatically.

The invention is capable of operating in real time on a short sample set, with power consumption that is within the capabilities of modern digital signal processors (DSP). In addition, the invention is capable of optimizing bit error rate (BER) performance given a variety of interferers without sacrifice of bandwidth or system capacity and, in some cases, can improve the bit error rate (BER) of a communications system by multiple orders of magnitude. The invention is of relatively low complexity and can be implemented using computationally efficient recognition/cancellation routines. In one embodiment, the invention is used to provide for frequency reuse in a situation where a spread spectrum communications system is overlaying one or more narrowband and/or partialband systems.

As described in more detail below, the principles of the present invention can be, and preferably are, implemented in a spread spectrum communications system. A spread spectrum communications system is a system where the bandwidth of the transmitted radio frequency signal is wider than that required by the data rate and modulation type of the underlying information signal. That is, a second layer of modulation is used that "spreads" the spectrum of the modulated information signal to provide a number of important advantages. For example, spread spectrum systems are generally better at rejecting interference than are other types of communications systems. In addition, spread spectrum systems can support the use of code division multiple access (CDMA) techniques to provide a plurality of separate communication channels in a given bandwidth. Another advantage of spread spectrum techniques is that they are conducive to signal hiding in secure communications applications. Spread spectrum systems are also capable of high resolution ranging. Various methods, such

as direct sequence spread spectrum (DSSS) and frequency hopping spread spectrum (FHSS), can be used to spread the bandwidth of the transmit signal.

FIG. 1 is a high level block diagram illustrating a system 300 in accordance with one embodiment of the present invention. As illustrated, the system 300 includes a transmitter 302 which communicates with a receiver 304 through a channel 306. The transmitter 302 receives data from a data source 308 and processes the data to create a transmit signal that is delivered to the channel 306. The receiver 304 receives a signal from the channel (which is a modified form of the transmit signal) and processes the signal to recover the original data. The recovered data is then delivered to the data sink 310.

The transmitter 302 includes, among other things, a modulation/coding unit 312 that applies modulation and/or coding to the data from the data source 308. For example, the modulation /coding unit 312 can apply source coding, channel coding, interleaving, and/or upconversion to the data signal. In a spread spectrum system, the modulation/coding unit can also apply signal spreading to the signal using methods that are well known in the art.

The receiver 304 includes an interference classifier 314, an interference suppressor 316, and a demodulation/ decoding unit 318. The receiver 304 receives the signal from the channel 306 in a signal receptor (not shown), such as an antenna. The interference classifier 314 analyzes the signal received from the channel 306 and identifies and classifies interference components within the signal. The interference components can be from any of a number of different sources, such as nearby communications systems and/or hostile entities attempting to jam transmissions from the transmitter 312. The interference classifier 314 outputs a signal indicative of the interference classification of each of the identified interference components. The interference suppressor 316 receives both the classification signal from the interference classifier 314

and the signal received from the channel 306. The interference suppressor 316 then selects one or more suppression methods that work best for the types of interference identified and uses the selected methods to suppress interference in the receive signal. After the interference components have been suppressed, the receive signal is transferred to the demodulation/decoding unit 318 to remove all modulation and/or coding from the signal. The signal is then delivered to the data sink 310.

FIG. 2 is a more detailed block diagram illustrating a spread spectrum communications system 10 in accordance with one embodiment of the present invention. As illustrated, the system 10 includes an input device 12, a transmitter 14, a channel 16, a receiver 18, and an output device 20. The transmitter 14 receives an input signal from the input device 12 and processes the signal into a form for transmission into the channel 16. The channel 16 carries the signal from the transmitter 14 to the receiver 18. Receiver 18 processes the signal received from the channel to recover the original information that was generated by the input device 12. This recovered information is then transferred to the output device 20.

The input device 12 can include virtually any type of information source. That is, the input device 12 can provide, for example, audio information (such as speech), computer data, or video information. In the illustrated embodiment, input device 12 comprises a microphone for converting speech into an analog electrical signal indicative thereof.

The transmitter 14 includes: analog to digital (A/D) converter 22, encoder 24, multiplier 26, digitally controlled oscillator (DCO) 28, N level chip sequence generator 30, chip shaping filter 32, frequency hopping (FH) adaptation module 34, and processing gain adaptation module 36. A/D converter 22 is operative for digitizing the analog signal from the input device. That is, the A/D converter 22 samples the analog signal from the input device 12 and creates digital values (i.e., samples) that are each indicative of the magnitude of the analog signal at a particular instant in time (i.e., the sampling time). It should be appreciated that an A/D converter 22 is

only necessary if the input device 12 is providing analog input. The encoder 24 receives the digital signal from the A/D converter 22 and encodes it using any of a number of different digital encoding methods such as, for example, differential phase shift keying (DPSK), minimum shift keying (MSK), quaternary phase shift keying (QPSK), and quadrature amplitude modulation (QAM). Multiplier 26 receives the encoded data signal from encoder 24 and multiplies the signal with a radio frequency (RF) carrier signal and a pseudo noise (PN) sequence to create the transmit signal that is transmitted into the channel 16. It should be appreciated that multiple layers of multiplication may be performed in the multiplier 26 to achieve the transmit signal using the three inputs.

Multiplication by the RF carrier signal upconverts the encoded data signal to an RF frequency range centered about the carrier frequency. DCO 28 generates the RF carrier signal in response to a digital control signal from the frequency hopping (FH) adaptation module 34 (and/or from the processing gain adaptation module 36). The N level chip sequence generator 30 and chip shaping filter 32 generate the pseudo noise (PN) sequence that is used to spread the transmit signal in frequency in a process known as direct sequence spread spectrum (DSSS). The N level chip sequence generator 30 produces a multi-level PN sequence in a manner that is well known in the art. The chip shaping filter 32 filters the PN sequence in a manner that insures low probability of intercept/low probability of detection (LPI/LPD). After filtering, the PN sequence exhibits a more Gaussian time domain distribution which makes hostile detection and parameter extraction more difficult. Further, the chip shaping filter 32 band limits the PN sequence to the channel, which reduces adjacent channel interference. Note that a preferred embodiment of the invention can include frequency hopping (FH) adaptation and processing gain (PG) adaptation in concert, exclusively, or no adaptation. Without FH or PG adaptation, no feedback path is required.

The FH adaptation module 34 is operative for implementing adaptive frequency hopping spread spectrum techniques in the system 10. The FH adaptation module 34 delivers a digital signal to DCO 28 instructing it to change the center frequency of the carrier signal based upon a frequency hopping sequence. By periodically changing center frequency, a number of advantages are obtained, such as increased resistance to jamming. In the preferred embodiment, the FH adaptation module 34 receives feedback from the receiver 18 which indicates, among other things, the type(s) and spectral location(s) of interference that currently exists in the channel 16. The FH adaptation module 34 can determine from the feedback signals received from the interference suppression processor 42 that a particular frequency hopping band is occupied by interference that is difficult and/or impossible to overcome. The FH adaptation module 34 can then remove that frequency band from the frequency hopping sequence via frequency masking. When it is determined that the frequency band is no longer in an unsatisfactory condition, the FH adaptation module 34 can again enter the frequency band into the frequency hopping sequence. In the preferred embodiment, both the FH adaptation module and the N level chip sequence generator 30 are synchronized by a sync signal 35 in a manner that is well known in the art.

The processing gain adaptation module 36 is operative for adaptively controlling the level of spreading that is imparted to the modulated carrier signal. In this regard, the processing gain adaptation module 36 delivers control signals to both the N level chip sequence generator 30 and the chip shaping filter 32 to set the level of spreading. Like the FH adaptation module 34, the processing gain adaptation module 36 receives feedback signals from the receiver 18 that are indicative of the type(s) and spectral location(s) of interference presently in the channel 16. The processing gain adaptation module 36 uses this information to determine an appropriate processing gain for the transmit signal in light of the identified interference. For example, if a narrow band interference signal is detected in the channel 16, the processing gain adaptation module 36 may decide to spread the

modulated carrier an additional amount to further reduce the effect of the interfering signal. On the other hand, if little or no interference is detected in the channel 16, the processing gain adaptation module 36 may decide to reduce the level of processing gain (i.e., reduce spreading).

In a preferred embodiment of the present invention, the channel 16 is a wireless RF link. It should be appreciated, however, that the principles of the present invention can be implemented in communication systems having virtually any type of channel, including both wired and wireless channels. As illustrated in FIG. 2, the channel 16 includes an additive noise source 38 and a source of interference/jamming signals 40. Additive noise source 38 represents all sources of random noise in the channel 16. That is, additive noise source 38 includes, for example, sources of thermal noise, atmospheric noise, galactic noise, and others. Frequency selective fading or other types of fading can also occur in the channel 16. Interference source 40 represents the sources of all man-made interference in the channel 16. For example, interference source 40 can include partial band noise jammers, spread spectrum co-channel sources, wideband noise jammers, bauded co-site signal sources, chirp jammers, multitone jammers, non-bauded co-site signals, and others. Signals from both additive noise source 38 and interference source 40 combine with the transmit signal in the channel 16 to produce a modified signal. The modified signal is then received by the receiver 18.

The receiver 18 includes: interference suppression processor 42, co-processor module 44, jammer signal of interest (JSOI) memory 46, conjugate and complex multiply (CCM) unit 48, N level chip sequence generator 50, chip shaping filter 52, fast Fourier transform (FFT) unit 54, inverse FFT unit 56, detector 58, decoder 60, post processor 62, digital to analog converter (DAC) 64, and performance estimator 66. As will be described in more detail, the interference suppression processor 42 receives the modified signal from the channel 16 and suppresses the interference/jamming components therein using targeted interference

suppression. Co-processor module 44 provides supplemental processing power (such as, e.g., to perform complex signal arithmetic) to the interference suppression processor 42 for increasing processing speed and thereby improving data throughput. JSOI memory 46 stores, among other things, a library of feature plane representations corresponding to different jamming and interference types that may be encountered in the channel 16. Interference suppression processor 42 uses the information stored in the JSOI memory 46 to identify and classify interference components in the receive signal. As will be described in more detail, the interference classifications are used by the interference suppression processor 42 to determine an appropriate form of interference suppression for the receive signal.

After the interference/jamming signals in the receive signal have been suppressed, the interference suppression processor 42 outputs the restored spread spectrum signal for despreading, demodulation, and decoding. Correlation of the output signal (i.e., to remove the pseudo noise modulation) is performed in the frequency domain (although other embodiments can use time domain correlation). The N level chip sequence generator 50 and the chip shaping filter 52 are operative for creating the same PN sequence that was created in the transmitter 14 by N level chip sequence generator 30 and chip shaping filter 32. Operation of the N level chip sequence generator 50 is synchronized using sync signal 100, which is a clock signal that is synchronized with the transmitter sync. signal, as will be familiar to those of skill in the art. The output of the chip shaping filter 52 is delivered to FFT unit 54 where it is converted to a frequency domain representation. Before conversion, the FFT unit 54 applies weighting to the pseudo noise sequence to reduce FFT edge effects.

CCM 48 receives the frequency domain output signal from the interference suppression processor 42 and the frequency domain PN information from FFT unit 54. The CCM 48 determines the complex conjugate of the data from the interference suppression processor 42 and

then convolves this conjugate data with the frequency domain PN information. For reasons that are apparent to a person of ordinary skill in the art, a significant time uncertainty can exist between the PN sequence produced in the N level chip sequence generator 50 and chip shaping filter 52 and the PN sequence used to modulate the transmit signal in the transmitter 14. Use of frequency domain correlation in the receiver 18, rather than time domain correlation, provides significant computational savings when sample timing uncertainty is large. The convolved signal is delivered to inverse FFT 56 to be converted from a frequency domain representation to a time domain representation.

Detector 58 receives the time domain correlated data from the inverse FFT 56 and detects significant correlation energy to produce detected data. In the preferred embodiment of the invention, detector 58 uses ensemble integration to perform the detection function. That is, detector 58 combines the magnitude squared of the inverse FFT 56 output. At zero or negative signal to noise ratio (SNR) conditions, symbols must be combined in an ensemble fashion and compared to a noise based threshold. The threshold is computed and updated dynamically during non-transmission periods in order to maintain an apriori bit error rate (BER) relative to ambient noise. Further processing may also be performed to adjust threshold levels during minimal background interference conditions.

Following detection, the detected data is decoded and/or synthesized in decoder 60 to produce reconstructed data. Decoder 60 can perform adjustments to the multilevel code timing or phase in order to maximize the correlation peak of the signal. In this manner, the multi-symbol buffering nature of the detection process compliments blockwise, processor based frequency tuning offset correction methods, further improving correlation results. Decoder 60 produces in-phase and quadrature values from the detected data which are used to compute an instantaneous phase angle. The instantaneous phase angle is dealiased in the decoder 60 and decoding is performed via symbol based integration in order to produce the

reconstructed data. The reconstructed data is then passed to the post processor 62 where operations such as adaptive post filtering enhancement or frequency de-emphasis may be performed, producing conditioned, reconstructed data. The conditioned reconstructed data is delivered to the DAC 64 where it is converted to an analog signal for output to output device 20.

Performance estimator 66 receives the reconstructed data from the decoder 60 and analyzes the data to calculate one or more performance metrics. These performance metrics are then transferred back to the interference suppression processor 42 for use in fine tuning the interference suppression function. In a preferred embodiment, signal to noise ratio (SNR), bit error rate (BER), and spectral distortion (SD) are used as performance metrics, although other metrics may also be used.

As described above, the interference suppression processor 42 is used to determine the type of interference that is present in the receive signal and to perform interference suppression on the signal based on the types of interference identified. The interference suppression processor 42 delivers signals back to the FH adaptation module 34 and the processing gain adaptation module 36 in the transmitter that are indicative of interference type and spectral location. Interference suppression processor 42 includes: frequency hopping tuner 68, FFT unit 70, signal memory 72, disturbance classification unit 74, jammer parameter extraction unit 76, and targeted interference suppression unit 78. Frequency hopping tuner 68 receives the receive signal and processes the signal based on the known frequency hopping sequence of the transmitter 14. Frequency hopping tuner 68 also receives sync signal 100 to aid in signal processing. Frequency hopping tuner 68 outputs a time domain data signal that includes both desired information from the transmitter 14 and noise/interference/jamming signals from the channel 16. In an alternate embodiment, frequency hopping is not performed in the transmit unit 14 or

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the receive unit 18 and the FH tuner 68 and the FH adaptation module 34 are not required.

The output signal from the frequency hopping tuner 68 is weighted (to minimize FFT edge effects) and processed in FFT unit 70 to convert it to a frequency domain representation. The frequency domain representation is then stored in the signal memory 72 for later use. Disturbance classification unit 74 receives both the frequency domain information from FFT unit 70 and the time domain information from the frequency hopping tuner 68 and uses the information to identify and classify the interference/jamming components in the input receive signal. Classification information from the disturbance classification unit 74 is then delivered to the jammer parameter extraction unit 76 which determines parameters describing the interference/jamming components based upon the classifications. That is, the parameter extraction method (i.e., the types of parameters that are extracted and the method of calculating them) that is used in the jammer parameter extraction unit 76 depends on the type of interference identified. By tailoring the parameter extraction method to the type of interference, the jammer parameter extraction unit 76 is able to determine signal characteristics that are specific to the interference (e.g., baud rate, bandwidth, deviation, etc.).

The targeted interference suppression unit 78 includes a library of software modules that are each capable of suppressing or removing undesired interference components from a subject signal. Each of the modules in the targeted interference suppression unit 78 works best with a particular type or class of interference/jamming. For example, one module may be best at suppressing spread spectrum co-channel signals while another is best at suppressing the effects of frequency selective fading. The targeted interference suppression unit 78 receives the classification output signal from the disturbance classification unit 74 and the parameter signals from the jammer parameter extraction unit 76 and uses this information to determine which module is best for suppressing the interference in the receive signal. If more than one type of interference is present in the receive

signal, the targeted interference suppression unit 78 may choose more than one module to process the signal. After appropriate modules have been chosen by the targeted interference suppression unit 78, the unit 78 retrieves the frequency domain and/or time domain receive signal information from the signal memory 72 and processes it using the appropriate modules. After processing, targeted interference suppression unit 78 outputs a frequency domain spread spectrum signal having suppressed interference. This signal is processed in the remainder of the receiver unit 18, as described above, to produce a data signal which is delivered to output device 20.

As is apparent from the above description, the system 10 illustrated in FIG. 2 provides a hybrid system for interference mitigation. That is, three distinct mitigation subsystems (targeted interference suppression, FH adaptation and processing gain adaptation) are implemented to handle virtually any type of interference that can occur. The interference suppression processor 42 provides a receiver based pre-processor function for the removal of undesired jamming signals, effectively optimizing bit error rate performance without the sacrifice of bandwidth or system capacity. The interference suppression processor 42 targets narrow band and partial band jammers such as partial band noise jammers, spread spectrum co-channel signals, bauded co-site and ambient signals, chirp jammers, multitone jammers, and non-bauded co-site and ambient signals. The FH adaptation module 34 provides a supplementary means of interference mitigation via interference masking and/or randomization of signal errors. Processing gain adaptation module 36 provides additional anti-jam protection by means of chip rate adjustment. Chip rate adjustments are especially effective in the presence of wideband jammer or co-channel spread spectrum interference that cannot be canceled or suppressed via other methods. In applications where size, weight, power, and bandwidth limitations are important, such as handheld or manpack systems, the FH adaptation and processing gain adaptation components of the system 10 can be omitted. Such an omission

removes the need for the FH adaptation module 34, the processing gain adaptation module 36, the feedback channel from the interference suppression processor 42, the frequency hopping tuner 68, and the digitally controlled oscillator 28 (which can be replaced by a single frequency oscillator).

The disturbance classification unit 74 processes the time and/or frequency domain receive signal data to produce a maximum likelihood estimate of the disturbance class superset and/or subset classes. Class supersets can include narrow band, partial band and wideband classes. Class subsets, on the other hand, can include single tone, multi-tone, swept tone, bauded communication signal, non-bauded communication signal, partial band noise, or wideband noise. Interference may also be classified by modulation type, such as, for example, FSK, NRZ-ASK, and BPSK modulation. The disturbance classification unit 74 can utilize any of a number of techniques to recognize jammer and/or interference signals. For example, the disturbance classification unit 74 can employ tree based classification, multi-layer perceptron classification (MLP), or other methods of classification.

FIG. 3 is a block diagram illustrating the disturbance classification unit 74 in one embodiment of the present invention. As illustrated, the disturbance classification unit 74 includes a feature extraction unit 80 and a classifier 92. The feature extraction unit 80 receives time domain and/or frequency domain representations of the receive signal and processes this data to derive certain features and parameters that are unique to the interference/jamming components within the receive signal. These features and parameters are then delivered to the classifier 92 for use in classifying the interference and jamming components. In the illustrated embodiment, the feature extraction unit 80 includes: super class recognition unit 82, adaptive super class masking unit 84, subclass feature extraction unit 86, subclass interference suppression unit 88, and subclass parameter extraction unit 90. Superclass recognition unit 82 is operative for deriving

parameters that are useful in classifying the interference/jamming components according to superclass. The superclass masking unit 84 is operative for signal separation, for example, to separate FSK, ASK and PSK signals. The subclass feature extraction unit 86 performs feature plane transformations on the receive signal to aid in the classification of interference/jamming components based on subclass. Subclass interference suppression unit 88 is operative for SNR improvement for the isolated signal. Subclass parameter extraction unit 90 determines subclass parameters from the input data based on the features identified by the subclass feature extraction unit 86.

The classifier 92 receives the features and parameters determined in the feature extraction unit 80 and uses them to classify the interference/jamming components in the receive signal. To expedite the classification process and facilitate real-time operation, a separate co-processor module 44 can be utilized by the classifier 92 and block 80. As part of the classification process, the classifier 92 compares features and parameters determined by the feature extraction unit 80 to those of known interference/jamming types that are stored in the JSOI memory 46. Use of a JSOI memory 46 allows new interference types to be added to the system in a quick and efficient manner in contrast to prior art methods that are fixed, "hard wired" implementations. In one embodiment of the invention, a content addressable memory (CAM) is utilized to both store the known interference types and to perform the required comparisons. As is well known in the art, a CAM is capable of comparing an input signal to the contents of a plurality of memory locations simultaneously. The CAM then outputs a signal indicating all memory locations that include the input signal. The classifier 92 outputs a signal that is indicative of the type of interference in the receive signal. Such classification can include, but is not limited to, the following bauded and unbauded signals of interest:

Amplitude Modulation

PAM (Pulse Amplitude Modulation)

ASK (Amplitude Shift Keying)

Phase Modulation

M-ary PSK (Phase Shift Keying)

Offset M-ary PSK

PPM (Pulse Position Modulation)

Frequency Modulation

M-ary FSK (Frequency Shift Keying)

MSK (Minimum Shift Keying)

FDM/FM (Frequency Division Multiplexing/ Frequency Modulation) (non-bauded)

Amplitude/Phase Modulation (AM/PM)

M-QAM (Quadrature Amplitude Modulation)

In one embodiment of the present invention, the superclass and subclass feature extraction and interference suppression functions are combined into a single unit and all recognition functions are performed by the disturbance classification unit 74.

In the preferred embodiment of the invention, the feature extraction unit 80 performs an efficient data analysis using circa 50 data transitions. For extremely low baud rates, feature extraction unit 80 also performs a feature accumulation function whereby features of contiguous signal sources are saved until sufficient data transitions have been accumulated for identification. In a preferred embodiment of the invention, a general-purpose set of classification parameters are computed by feature extraction unit 80. Classification parameters are computed in the feature extraction unit 80 using at least one of a plurality of feature plane transformations. In

one embodiment, the feature plane transformations are computed from a joint time-frequency (JTF) matrix H of order n,m where n represents a contiguous time index and m represents a contiguous spectral index.

FIG. 4 illustrates a JTF feature plane showing three discrete interference components versus time. The first component 102 corresponds to an FSK signal, the second component 103 corresponds to an non return to zero (NRZ)-ASK signal, and the third component 104 corresponds to a PSK signal. JTF matrix H quantifies the information in the JTF graph. The JTF matrix can be represented as follows:

$$\mathbf{H} = \begin{bmatrix} h(0,0) & h(1,0) & h(2,0)..... & h(m-1,0) \\ h(0,1) & . & . & . \\ h(0,2) & & & \\ . & . & . & . \\ . & & & \\ h(0,n-1) & . & . & h(m-1,n-1) \end{bmatrix} \qquad \textbf{Eq. 1}$$

The feature plane transformations are performed by using the JTF matrix H to compute a plurality of transformation matrices. The following are some transformation matrices, TN, that may be used in this regard (although other similar transformations can also be used):

Transformation Matrix 1

$$\mathbf{T\ 1} = \begin{bmatrix} a(0,1) & a(0,2) & a(0,3) & a(0,m-1) \\ 0 & a(1,2) & a(1,3) & a(1,m-1) \\ 0 & 0 & a(2,3) & a(2,m-1) \\ . & . & . & . \\ 0 & . & . & a(m-2,m-1) \end{bmatrix} \qquad \textbf{Eq. 2}$$

where

$$a(I,J) = \frac{\sum_{i=0}^{n-1} h(I,i)\,h(J,i) - \left(\sum_{i=0}^{n-1} h(I,i)\right)\left(\sum_{i=0}^{n-1} h(J,i)\right)/n}{\left[\left(\sum_{i=0}^{n-1} h(J,i)^2 - \left(\sum_{i=0}^{n-1} h(J,i)\right)^2/n\right)\left(\sum_{i=0}^{n-1} h(I,i)^2 - \left(\sum_{i=0}^{n-1} h(I,i)\right)^2/n\right)\right]^{1/2}}$$

Eq. 3

Transformation Matrix 2

$$T2 = \begin{bmatrix} b(0,1) & b(0,2) & b(0,3) & b(0,n-1) \\ 0 & b(1,2) & b(1,3) & b(1,n-1) \\ 0 & 0 & b(2,3) & b(2,n-1) \\ . & . & . & . \\ 0 & . & . & b(n-2,n-1) \end{bmatrix}$$

Eq. 4

where

$$b(I,J) = \frac{\sum_{i=0}^{m-1} h(i,I)\,h(i,J) - \left(\sum_{i=0}^{m-1} h(i,I)\right)\left(\sum_{i=0}^{m-1} h(i,J)\right)/m}{\left[\left(\sum_{i=0}^{m-1} h(i,J)^2 - \left(\sum_{i=0}^{m-1} h(i,J)\right)^2/m\right)\left(\sum_{i=0}^{m-1} h(i,I)^2 - \left(\sum_{i=0}^{m-1} h(i,I)\right)^2/m\right)\right]^{1/2}}$$

Eq. 5

Transformation Matrix 3

$$T3 = [p_1, p_2, p_3 \ldots\ldots p_{m-1}], \text{ where } p_k = \max h(k,i)^2 \;\forall\, i$$

Eq. 6

Transformation Matrix 4

$$T4 = [\mu_0, \mu_1, \mu_2 \ldots\ldots\ldots \mu_{m-1}], \text{ here } \mu_k = \text{mean } h(k,i)^2 \;\forall\, i$$

Eq. 7

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Transformation Matrix 5

$$\mathbf{T5} = \begin{bmatrix} d(0,0) & d(1,0) & d(2,0)\ldots\ldots & d(m-1,0) \\ d(0,1) & . & . & . \\ d(0,2) & & & \\ . & . & . & . \\ . & & & \\ d(0,n-1) & . & . & d(m-1,n-1) \end{bmatrix} \qquad \textbf{Eq. 8}$$

where $d(I,J) = +1,\ h(I,J)^2 > c^*P_{max}$

$d(I,J) = 0,$ otherwise

Transformation Matrix 6

T6 = $[\mu_0, \mu_1, \mu_2 \ldots\ldots\ldots \mu_{m-1}]$, where μ_k = mean d(k,n) $\forall$ n **Eq. 9**

Transformation Matrix 7

In addition to the transformation matrices set out above, computationally efficient signal mapping methods are used in accordance with the present invention to generate unique stationary patterns in order to supplement classification, while eliminating carrier frequency offset errors. Since the exact carrier frequency is undetermined before the mapping procedure, a balanced multiplication is used in order to cancel the carrier components. Representing the input in-phase and quadrature signal samples as x(i) and y(i), and the transformation in-phase and quadrature samples as px(i) and py(i), the transformation is as follows:

$$px(j) = y(i+\tau)[y(i)-x(i)] + x(i+\tau)[x(i) + y(i)] \qquad \textbf{Eq. 10}$$

$$py(j) = x(i+\tau)[x(i)-y(i)] + y(i+\tau)[y(i) + x(i)] \qquad \textbf{Eq. 11}$$

where:

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τ = delay, in samples
i = 1 to N
j = 1 to N - τ

For PSK signal formats, the desired delay τ is equal to the bit period. By up sampling to achieve a 10 to 1 oversampling, a close approximation to the desired delay can be obtained. Projection of the histogrammed polar space defined by the above transformation to a Cartesian space S gives the following transformation matrix which defines the unique signal signature, where L and Q are arbitrary integer constants corresponding to magnitude (L) and phase (Q) dimensions.

$$\mathbf{T7} = \begin{bmatrix} S(0,0) & S(1,0) & S(2,0)..... & S(Q-1,0) \\ S(0,1) & . & . & . \\ S(0,2) & & & \\ . & . & . & . \\ . & & & \\ S(0,L-1) & . & . & S(Q-1,L-1) \end{bmatrix} \quad \textbf{Eq. 12}$$

T7 projections provide additional feature transformation data, as shown in Equations 13 and 14 below.

Transformation Matrix 8

$$\mathbf{T8} = [\mu_0, \mu_1, \mu_2 \ldots\ldots\ldots \mu_{Q-1}], \textbf{ where } \mu_k = \textbf{mean } \mathbf{S(k,l)} \quad \forall \mathbf{l} \qquad \textbf{Eq. 13}$$

Transformation Matrix 9

$$\mathbf{T9} = [\mu_0, \mu_1, \mu_2 \ldots\ldots\ldots \mu_{L-1}], \textbf{ where } \mu_k = \textbf{mean } \mathbf{S(q,k)} \quad \forall \mathbf{q} \qquad \textbf{Eq. 14}$$

For FSK signal formats, the desired delay τ is not necessarily equal to the bit period. The pattern is not stationary as in the PSK case where the pattern peaks remain relatively fixed in the phase coordinate dimension.

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The changing characteristic of the pattern structure for FSK formats can be used to distinguish signal formats that have phase slopes versus fixed phase states during the bit periods. This characteristic is made part of the signal descriptive vector and used to identify FSK formats. For pattern structures that change, phase derivative processing is used to derive a second signal pattern.

In order to obtain the optimum delay for a PSK signal, a baud rate estimate is employed. A delay of approximately one half bit, as estimated by the pre-filter process spectrum width determination, is used. The actual baud rate is determined by performing a spectrum analysis of the transform output. From this baud rate, the proper one bit delay time can be determined. Methods for baud rate calculation are discussed below.

FIG. 5 illustrates a cross-section of a typical feature plane signal transformation for a five FSK interference signal, obtained using equations 10, 11, 12, and 13 above. It should be appreciated that the full feature plane transformation is a three dimensional representation and the two dimensional cross-section of FIG. 5 is presented for ease of illustration. Feature plane transformations, such as the one in FIG. 5, de-emphasize the random components of the signal and emphasize the invariant features, supporting accurate classification of signal type by producing a unique signal signature. Note that the transformation includes five distinct frequency modes that aid in identification of interference type. A plurality of feature plane transformations representing different interference types can be stored in the JSOI memory 46 for comparison with transformations derived from receive signals to classify interference components in the receive signals.

Since the signal processing required to perform the signal transformations includes non-linear processing, it is desirable to implement as much signal to noise ratio (SNR) improvement ahead of the signal processing as possible. In one embodiment of the invention, SNR improvement is performed before non-linear processing in the H transform domain, as well as after non-linear processing in the TN transform domain.

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It is highly desirable that the SNR improvement not distort the signal features that produce the pattern for signal recognition. Furthermore, it is desirable to separate co-existent signals in order to minimize feature aliasing. Two methods of SNR processing that can be employed are preclassification filtering and phase domain filtering. In the preferred embodiment of the present invention, both methods are used.

FIG. 6 is a flowchart illustrating a superclass classification and masking method to perform preclassification filtering in accordance with one embodiment of the present invention. Prior to the operations performed by FIG. 6, it is assumed that the H matrix and transformations T1 through T9 have been computed. Superclass classification begins with Select Min T1 260, which searches the array to produce the smallest correlation. Next, orthogonal 262 decision compares the value produced by Select Min T1 to an apriori negative constant to determine if a significant negative correlation is present. If so, decision block 264 examines T5 for detection. If detection is positive nonzero, Mask SC0 266 then determines signal bandwidth from T1 indices n and m, which represent the signal extent for Super Class O. As a further step, class SC0 may be confirmed by comparing the peak power from columns n and m for consistency. Finally, Mask SC0 266 filters the SC0 signal by zeroing the identified band, and stores the mask location to memory. Following consideration of all T1 (i.e., all SC0), the Superclass Classification continues with Select T6 SS 270, which examines the T6 transformation for near steady state (SS) values by comparison against an apriori constant. For SS T6, the maximum signal energy is determined from Find Max T4, which coarsely locates the center frequency of the candidate signal, producing a peak index. Next, decision block 274 examines T5 for detection. If detection is positive nonzero, Orthogonal Proximity 276 compares T1 (corresponding to the index from Find Max T4 and proximity indices) against a second apriori negative constant to determine if significant negative correlation is present. If so, then Mask SC1 determines the bandwidth of the signal bounded by the contiguous detected SS values

about the max T4 index, and filters the SC1 signal by zeroing the identified band, and stores the SC1 mask location to memory. If significant negative correlation is not present, then Mask SC2 280 determines the bandwidth of the signal and filters the SC2 signal by zeroing the identified band, and stores the SC2 mask location to memory. Next, if all distinct steady state regions have been considered (i.e., all candidate signals within the analysis band), then all T6 SS 282 branches to End. In this discussion SC0 represents an FSK signal superclass, SC1 refers to bauded signal superclasses (e.g., PSK), and SC2 represents non-bauded continuous wave (CW) signals. The masking and classification process of FIG. 6 serves as preliminary signal separation and recognition prior to sub-class parameter extraction and final classification.

After signal separation and superclass classification, the following sub-class parameters may be computed, although others may also be appropriate:

1	Dynamic Range,	DR
2	Amplitude Modes,	AM
3	Amplitudes RMS,	AR
4	Discriminator Deviation,	DD
5	Phase Modes,	PM
6	Discriminator Mean,	DM
7	Outlier to Mean Ratio,	OM
8	Outlier to RMS Ratio,	OR
9	Baud Rate,	BR
10	Superclass,	SC
11	Frequency Bandwidth,	BW
12	Frequency Modes,	FM
13	Frequency Center,	FC

Transformations T7, T8, and T9 may be used to compute mode information by tabulation of peak information, for example, using derivatives of filtered transformations. Alternatively, the modes may be determined in a similar fashion using filtered histograms of dealiased phase information, magnitude information, or discriminator output. Discriminator output also provides signal bandwidths and center frequencies. The above-described features provide sufficient information for classification into multiple signal types including, but not limited to: CW, FSK, MPSK, QPSK, MASK, and FM Unbauded. It should be appreciated that preclassification filtering can be used to perform functions other than signal separation.

In one embodiment of the present invention, preclassification filtering is performed by isolating the narrow band interference signal of interest, estimating the bandwidth of the signal of interest, and prefiltering the signal of interest before classification functions are invoked. FIGS. 7-11 illustrate this method. First, as illustrated in FIG. 7, the signal of interest is converted into a frequency domain representation using a frequency transformation, such as a discrete Fourier transform (DFT) or a fast Fourier transform (FFT). The spectrum illustrated in FIG. 7 represents an MSK signal. The frequency coefficients found using the frequency transformation are converted to power spectrum and smoothed by a moving average filter, or similar device, to achieve the smooth spectrum illustrated in FIG. 8. The smooth spectrum is histogrammed, as illustrated in FIG. 9, to determine the noise floor level of the interference signal of interest (i.e., the peak of the histogram). Using the peak spectrum location from the histogram as the location of the signal noise floor 96, the signal bandwidth at the noise power level is measured as illustrated in FIG. 10 producing bandwidth 98. This width is corrected to a null-to-null bandwidth by assuming the signal spectrum shape as sin(x)/x and utilizing the peak SNR reference to determine where on the sin(x)/x curve the width was measured. FIG. 11 illustrates the spectrum of the MSK signal after the prefiltering operation.

As described previously, phase domain filtering is another technique that can be used to improve SNR before nonlinear processing. Phase domain filtering involves filtering the de-aliased phase components of the signal of interest using a moving average filter although other filter embodiments can also be used. The moving average filter that is used should possess sufficient bandwidth to prevent distortion of the signals of interest. In one embodiment of the present invention, a three point moving average filter was found to possess sufficient bandwidth. The following equation describes one embodiment of a discrete time averaging filter that may be used to perform phase domain filtering:

$$y(n) = \frac{1}{(M+1)} \sum_{m=0}^{M} x(n-m)$$

The moving average filter is preferably applied repeatedly to the signal of interest. Phase domain filtering has been found to be effective on FSK, MSK, and PSK signals. Use with other types of signals is also possible.

FIGS. 12 and 13 are cross-sections of feature plane signal transformations illustrating the beneficial effects of using phase domain filtering. FIG. 12 illustrates the T7 transform projection that is obtained using a five tone FSK signal at 1 dB SNR (after spectral excision interference suppression, as will be described shortly). Such a transform should display five distinct feature peaks. As illustrated in FIG. 12, these peaks are not present with enough signal power to discern the presence of the five tone FSK signal. FIG. 13 illustrates the feature plane transform for the same signal after phase domain filtering is applied. Note that the five distinct frequency peaks are clearly visible. As can be appreciated, use of the transformation illustrated in FIG. 13 significantly enhances the likelihood of proper signal classification. The phase domain filtering has effectively increased the SNR of the transform information by approximately 6 to 7 dB. Classification and baud rate procedures can then be used to process the

improved transform. In order to overcome the noise enhancement effects introduced by derivative computation, phase domain filtering may be performed prior to application of the discriminator.

As described previously, the baud rate of the interference signal of interest can be one of the extracted features that is delivered to the classifier 92 for use in classifying the signal of interest. In accordance with the present invention, methods are provided for determining the signal baud rate of the interfering signal of interest based on the modulation method of the signal of interest. That is, first it is necessary to determine the type of modulation being used (e.g., frequency modulation or phase modulation) and then a baud rate determination method is chosen based on modulation type. If an interfering signal of interest is found to have phase modulation, baud rates are determined by analyzing the frequency content of the T7 feature space of the signal of interest represented by equations 10 and 11. That is, first a T7 feature space transformation is found for the signal of interest and then the feature transformation is converted to a frequency domain representation using, for example, an FFT. The frequency domain representation is then analyzed to isolate a rate line corresponding to the baud rate. Even without prefiltering, a rate line can be detected at low SNRs (i.e., 0db and below) using this method. FIG. 14 is a graph illustrating the spectrum of the T7 feature space of a BPSK signal at 0dB SNR. Note that the rate line 94, corresponding to 250 kHz, is clearly visible in FIG. 14 and may be readily extracted by a simple search algorithm.

For frequency modulation (FM) signals, a rate line may be established by observing the transitions in the T7 space. The transitions are used to generate a linear array of alternating Kronecker deltas as illustrated in FIG. 15 in connection with a five tone FSK signal. A frequency transformation of the transition sequence produces a frequency spectrum (see FIG. 16) that clearly indicates the desired baud rate line 95.

As described previously, the targeted interference suppression unit 78 includes a plurality of interference suppression modules that can be used

to suppress interference/jamming components within the receive signal. In accordance with the present invention, a plurality of interference suppression techniques are provided that can be implemented as modules within the targeted interference suppression unit 78. These techniques are (1) the inverse whitening function technique, (2) the adaptive inverse weight technique, and (3) the adaptive excision technique. In addition to these interference suppression techniques, as described previously, the system 10 also provides frequency hopping adaptation and processing gain adaptation functionality to help it adapt to hostile spectral environments. The above techniques will now be described.

In a preferred embodiment of the invention, first and second order statistics of the receive signal spectrum are derived prior to application of interference mitigation methods. That is, non-arithmetic modal moment estimates are used to describe different "modes" in the spectrum. Each mode corresponds to a single component in the receive signal including the fundemental communication signal and interference components. Modal moment estimates avoid jammer induced power bias that can arise when using arithmetic estimates. Modal moment estimates also allow multimode spectra to be accurately described and ultimately suppressed. Modal mode estimates are also tolerant of wide dynamic range fluctuations.

FIG. 17 is a plot illustrating typical modal moment estimates for a data signal corrupted by a partial band noise jammer. The x axis of the plot represents the spectral magnitude of the receive signal. The y axis of the plot represents the frequency with which the receive signal achieved a particular magnitude. That is, the y axis is related to the number of samples in the input data that are within a particular magnitude range. As such, the plot represents a magnitude distribution for the frequency domain representation of the signal. As shown in FIG. 17, two modes are apparent from the plot. The first mode corresponds to the fundamental data signal (i.e., the desired information from the transmitter). The second mode corresponds to the partial band noise jammer. In accordance with one

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embodiment of the present invention, these two modes are described using modal estimates μ and σ, wherein μ is the mean magnitude and σ is the magnitude standard deviation of the mode. An adaptive limit α can also be determined from the plot to describe a limitation point for the first mode. In a preferred embodiment of the present invention, the adaptive limit α for the fundamental data signal is equal to $k\sigma+\mu$, where k is a constant.

FIG. 18 is a flowchart illustrating a process for deriving the modal moment estimates from the receive signal. A signal is first received from the channel (step 130). The receive signal is transformed to a frequency domain representation using a frequency transformation, such as an FFT (step 132). Magnitudes of the frequency transformed signal are then computed (step 134) and a modal envelope is developed (step 136). The modal envelope is then filtered (step 138) and a derivative is taken to aid in the detection of modes within the envelope (step 140). For example, the derivative will equal zero at the peaks of the modal envelope. Once the modes are identified, the mean magnitude μ of each mode is located (step 142). A standard deviation σ is then measured for each mode (step 144). When modal moment estimates for each of the modes have been computed, an adaptive limit α is calculated (steps 146 and 148). The modal estimates are then stored for use in interference suppression (step 150).

As described above, in one embodiment of the present invention the adaptive limit α is calculated as the sum of (1) the mean magnitude of the fundamental data signal μ_1, and (2) the product of a constant k and the magnitude standard deviation σ_1 of the fundamental data signal. In one embodiment of the invention, the constant k can be changed based on various factors, such as the type of interference that is present. For example, the constant k can be changed based on an estimate of relative jammer signal strength and bandwidth in order to obtain near optimum bit error rate performance.

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Before discussing interference suppression methods, an expanded description of FH and processing gain adaptation will be made. FIG. 19 is a spectrum diagram illustrating a number of bands WsN for use in frequency hopping. Although only four bands are shown, it should be appreciated that N can be virtually any number depending on the application. The bands WsN all occur within a communication system bandwidth Wt. As illustrated, each band WsN includes an interference signal. That is, band Ws1 includes a frequency selective fade 110, band Ws2 includes a partial band noise jammer 112, band Ws3 includes multiple tone jammers 114, and band Ws4 includes bauded interference 116. As described above, the frequency hop adaptation module 34 will sequence through a predetermined hop sequence during normal operation, wherein the frequency of operation of the system 10 will alternate among bands WsN. In accordance with one aspect of the present invention, a particular band can be removed from the frequency hop rotation based on the interference content within the band. For example, the system 10 can determine that effective communications cannot be carried out in band Ws2, due to the presence of the relatively powerful noise jammer 112, and Ws2 is removed from the frequency hopping sequence.

FIG. 20 is a flowchart illustrating one method for performing frequency hop masking. First, the transmitter 14 hops to the next frequency band in the hop sequence (step 152). The transmitter 14 then transmits a signal into the channel 16 within the new frequency band (step 154). For example, the transmitter 14 may transmit a spread spectrum signal within band Ws2 illustrated in FIG. 19. The signal is received from the channel 16 by the receiver 18 and is processed to determine interference classification (step 156). Modal estimates μ and σ are then determined for each of the modes identified (step 158). The modal estimates are then used to determine estimates for interference power and interference bandwidth for each of the identified modes (steps 160 and 162). Next, the signal is classified (step 163). An estimate of the bit error rate that will be achieved by demodulating

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and decoding the receive signal without interference suppression is calculated using the estimated power and bandwidth information and the classification information (step 164). The estimated bit error rate is then compared to a maximum tolerable bit error rate BER_{max} (step 166). If the BER does not exceed the maximum tolerable bit error rate, the system 10 hops to the next frequency band and the process is repeated. If the BER exceeds the maximum tolerable BER, the present hop band WsN is masked from the hop sequence so that it is no longer used by the frequency hopping adaptation module 34 (until the interference condition changes) (step 170) and the system 10 then hops to the next frequency band.

The procedure outlined in the flowchart of FIG. 20 can also be used for processing gain adaptation. That is, instead of changing the hop sequence in step 170, the processing gain parameters determined by the processing gain adaptation module 36 can be changed based on the identified interference signals. In general, new processing gain parameters will be chosen to minimize the effect of the identified interference. The decision on whether to use frequency hopping adaptation or processing gain adaptation will depend on both the type or classification, spectral location, and level of the interference identified by the disturbance classification unit 74 and the jammer parameter extraction unit 76 and the desired performance goals of the system 10. Circumstances may exist, for example, when both frequency hopping adaptation and the processing gain adaptation are performed.

In a preferred embodiment, the above-described FH/processing gain adaptation procedure is performed every time a receive signal is received from the channel 16. Alternatively, as will be described shortly, the procedure will only be performed if the selected interference suppression method does not achieve desirable results. In such an embodiment, the interference modules will access an FH/processing gain adaptation module if a predetermined performance goal (such as a predetermined BER) is not

achieved. A description of the interference suppression methods of the present invention is now made.

INVERSE WHITENING FUNCTION

The inverse whitening function suppression method makes use of the fact that direct sequence spread spectrum data transmissions generally have a spectrum similar to that of band limited white noise. Based on this fact, perturbations in the channel serve to color or distort the spectral characteristic of the channel from this white noise model. The inverse whitening function removes this distortion from the white noise model. FIG. 21 is a flowchart illustrating the operation of the inverse whitening function in one embodiment of the present invention. A signal is first received from the channel 16 (step 174). An estimate of the spectral envelope of all interfering signals within the receive signal is then obtained (step 176). In order to insure that the underlying phase information is undisturbed, an all-pole spectral envelope estimate is required. In one embodiment of the present invention, the following all-pole spectral model is implemented:

$$H(Z) = \frac{1}{1 + \sum_{k=1}^{n} a_k Z^{-k}} \qquad \textbf{Eq.15}$$

Where a_k represents the prediction coefficients for an nth order model. The prediction coefficients may exemplify the periodic state estimate that is obtained by an adaptation processor using, for example, classic auto-correlation and durbin recursion.

After the spectral envelope is estimated, the receive signal is inverse filtered using the inverse of the spectral envelope to remove the interference components (step 178). In one embodiment of the invention, the inverse whitening filter is represented by the following equation:

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$$y(n) = x(n) + \sum_{k=1}^{N} a(k)x(n-k) \qquad \textbf{Eq.16}$$

After whitening, the whitened spectrum is delivered to the CCM 48 to initiate despreading and demodulation as described above (step 180). The inverse whitening procedure is then repeated for the next receive signal.

If the signal having the whitened spectrum still results in a relatively high BER, the system may want to perform FH or processing gain adaptation. In this regard, the following steps are also performed. Using the time domain residual signal and the receive signal, interference power estimates are calculated (step 184). The power estimates and interference classifiction are used to estimate the BER that will be achieved (step 186). If the estimated BER exceeds a maximum BER, then frequency hop adaptation or processing gain adaptation can be performed as described above (step 188). BER estimates can also be computed using the modal approach of Fig. 20.

In an alternate embodiment, the inverse whitening approach is applied in the frequency domain. The interfering signal is located using modal estimates and subsequenct noise floor characterization. The location of the interfering signal, the bandwidth of the signal, and the classification of the signal are used to apply an inverse filter envelope obtained from an apriori family of such envelopes. FIG. 22 is a spectrum diagram illustrating the spectrum of a spread spectrum data signal 120 corrupted by a PSK partial band jammer 122. In accordance with the invention, estimates are made of the spectral envelope of the PSK jammer 122 and an inverse matched filter estimate is derived (not shown). As illustrated in FIG. 22, the bandwidth (BW) and the center frequency (fo) of the jammer 122 are estimated, and an inverse sin(x)/x matched filter response (not shown) is generated. The receive signal is applied to the inverse matched filter to obtain the whitened output spectrum with no reduction in system throughput. The inverse whitening function interference suppression method can be

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used to suppress a wide range of narrowband and partialband interference types, including tones, communication signals, and jammers. In addition, the inverse whitening function method is capable of improving bit error rate performance at high interference power level to signal power level ratios. The inverse whitening function method can also be used to remove the damaging effects of frequency selective fading from the received signal.

ADAPTIVE INVERSE WEIGHT

In the adaptive inverse weight interference suppression method, the modal moment estimates are used to selectively target all spectral outliers that exceed the adaptive modal limit α. As described earlier, the adaptive modal limit can be calculated as $\mu+k\sigma$. Only those signals that exceed this limit are affected by the anti-jam suppression. For example, with reference to FIG. 17, only those points to the right of adaptive limit α on the graph are affected by the interference suppression method. An inverse weight ω is applied to each of these samples that, in one embodiment, is inversely proportional to the observed deviation from α (i.e., inversely proportional to mag(sample) - α). In one embodiment of the invention, the weights ω are determined by the following equation:

$$\omega = \alpha / \left[\alpha + (\delta - \alpha)^m\right] \qquad \textbf{Eq.17}$$

where m is an integer.

The adaptive inverse weight method can also be applied to proximity samples surrounding each spectral outlier sample, thereby further improving performance by enhancing the attenuation of the interference envelope. That is, an inverse weighting can be applied to +/- n samples on either side of each sample that exceeds the adaptive limit α. The adaptive inverse weight interference suppression method is effective for reducing the BER for signals containing a myriad of different interference types, including

intentional hostile jammers, and bauded and non-bauded interference. Also, the adaptive inverse weight method is effective at very high jammer power to signal power ratios.

FIG. 23 is a flowchart illustrating the operation of the adaptive inverse weight interference suppression method. First, a signal is received from the channel 16 in the receiver 18 (step 194). The signal is then frequency transformed to achieve a frequency domain representation and modal estimates μ,σ are computed for each of the identified modes (step 196). Next, an adaptive limit α is calculated using the modal estimates of the fundamental data signal (step 198). Each of the samples from the frequency domain information is then compared to the adaptive limit α (step 200). If the magnitude of a spectrum sample is greater than the adaptive limit, an inverse weight filter is applied to that sample (and optionally to proximity samples) as described above (steps 202 and 204). When all of the samples have been processed, the filtered signal is delivered to the CCM 48 to initiate despreading and demodulation (steps 206 and 208). Processing is then initiated for the next received signal.

To determine whether to perform FH or processing gain adaptation, interference power is estimated using the received signal and the adaptive limited data (step 212). The BER is estimated (step 214) and, if the BER is greater than a maximum value, frequency hopping or processing gain adaptation is performed (step 216).

Using the adaptive inverse weight interference suppression method, improved signal fidelity is obtained without sacrificing throughput. In general, the interference is suppressed without significant distortion of the underlying spread spectrum data.

ADAPTIVE EXCISION

In the adaptive excision method, the modal moment estimates are used to locate and characterize the interference signal components. An

estimate of jammer signal bandwidth is then used to excise (i.e., remove) a portion of the signal spectrum from the receive signal, including both interferer and signal. Unlike the adaptive inverse weight method, the adaptive excision method removes a portion of the spread spectrum signal spectrum from below the adaptive limit α. Consequently, the adaptive excision method does not achieve the bit error rate reductions that the adaptive inverse weight method is capable of. However, the adaptive excision method is simpler to implement than the adaptive inverse weight method.

In one embodiment, a filter response modeling an ideal notch filter is used to remove the portion of the spectrum occupied by the interfering signal or signals. Other filter configurations, such as sinusoidal rolloff functions, can alternatively be used to minimize adverse affects during reverse frequency transformation caused by sharp spectral edges. As with the other methods, the adaptive excision method improves signal fidelity without sacrificing bandwidth.

FIG. 24 is a flowchart illustrating one embodiment of the adaptive excision interference suppression method. A signal is first received from the channel 16 (step 220) and the signal is processed to compute the modal estimates μ, σ (step 222). The adaptive limit α is then calculated using the modal estimates for the fundamental data signal (step 224). The frequency domain signal samples are then each compared to the adaptive limit α (step 225). If the magnitude of a sample is greater than α, a notch like filter response is applied to the sample (steps 226 and 228). Once all of the frequency domain samples have been processed, the frequency domain information is delivered to the CCM 48 to initiate despreading and demodulation of the data (step 230 and 232). As with the other methods, processing is also performed to determine whether frequency hop or processing gain adaptation is to be performed (steps 234-240).

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As described previously, each of the above described interference suppression methods can be implemented in the targeted interference suppression unit 78. In addition, other interference suppression methods, such as prior art methods, can be implemented in the targeted interference suppression unit 78. The unit 78 will determine which method to use based upon the type or types of interference detected in the disturbance classification unit 74 and the jammer parameter extraction unit 76. It should be appreciated that it is also possible to cascade suppression methods in accordance with the present invention. That is, two or more suppression methods can be implemented in the targeted interference suppression unit 78 if it is determined that this is the best way to mitigate interference. FIG. 25 is a flowchart illustrating one such cascaded interference suppression procedure. The signal is received from the channel 16 in the receiver 18 (step 240). An adaptive inverse weight method is applied to the receive signal to remove one type of detected interference from the signal (step 242). An inverse whitening function is then applied to the receive signal to remove another type of interference from the signal (step 244). After the cascaded processing is complete, the restored signal is delivered to the CCM 48 to initiate despreading and demodulation (step 246). Processing of the next received signal is then initiated.

FIGS 26-28 are spectrum diagrams illustrating a cascaded suppression procedure. FIG. 26 represents a received signal after being transformed to a frequency domain representation. As illustrated, the received signal includes both narrow band jammers 250 and frequency selective fading 252. Adaptive inverse weighting is first applied to remove the narrow band jammers 250 and the spectrum of FIG. 27 results. An inverse whitening function is then applied to the signal to remove the frequency selective fading 252 and the spectrum of FIG. 28 results. Virtually any combination of interference suppression methods can be implemented in the targeted interference suppression unit 78 in accordance with the present invention.

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The principles of the present invention can be used in a wide range of applications, such as commercial paging, commercial cellular and PCS, spread spectrum wireless LAN, satellite uplink/crosslink/downlink, small unit operations, digital battlefield, code division multiple access (CDMA), and others. In one embodiment, the invention is implemented in full duplex, handheld communicators in a mobile communications system. In another embodiment, the invention is used in a spread spectrum PCS system which is overlaid on existing commercial/military narrowband systems to provide simultaneous frequency reuse. In a further embodiment, the invention is used in a spread spectrum digital paging system which is overlaid on existing commercial/military narrowband systems. Other applications are also possible.

It should be appreciated that the interference suppressor 316 of the present invention can be used without the interference classifier 314. That is, criteria other than precise interference type can be used to determine which of the interference suppression methods within the interference suppressor 316 should be used to perform suppression.

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CLAIMS

What is claimed is:

1. An apparatus for reducing interference components in a received signal in a spread spectrum communications system, comprising:

a signal receptor for receiving a signal from a communications channel;

a modal moment estimator for determining modal moment estimates for components in said signal, said modal moment estimates including a mean magnitude estimate and a standard deviation estimate; and

an interference suppressor for suppressing an interference component in said signal using said modal moment estimates.

2. The apparatus, as claimed in claim 1, wherein:

said modal moment estimator includes means for obtaining a frequency domain representation of said signal, said frequency domain representation indicating a magnitude level for each of a plurality of frequencies in said signal.

3. The apparatus, as claimed in claim 2, wherein:

said modal moment estimator includes means for deriving a magnitude distribution using said frequency domain representation, said magnitude distribution indicating how often each of a plurality of magnitude levels are reached in said frequency domain representation.

4. The apparatus, as claimed in claim 3, wherein:

said modal moment estimator includes means for locating modes within said magnitude distribution, each mode corresponding to a signal component.

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5. The apparatus, as claimed in claim 1, wherein:

said interference suppressor includes means for determining an adaptive limit value using said modal moment estimates for a first mode.

6. The apparatus, as claimed in claim 5, wherein:

said adaptive limit value equals a weighted sum of said mean magnitude of said first mode and said standard deviation of said first mode.

7. The apparatus, as claimed in claim 5, wherein:

said interference suppressor includes means for applying an inverse weighting to first portions of said frequency domain representation that exceed said adaptive limit.

8. The apparatus, as claimed in claim 5, wherein:

said interference suppressor includes means for excising portions of said frequency domain representation that exceed said adaptive limit.

9. A method for reducing interference components within a received signal in a spread spectrum communications system, said method comprising the steps of:

receiving a signal from a channel;

determining modal moment estimates for components within said signal, said modal moment estimates including a mean magnitude estimate and a standard deviation estimate; and

suppressing an interference component in said signal using said modal moment estimates.

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10. The method, as claimed in claim 9, wherein said determining step includes:

obtaining a frequency domain representation of said signal, said frequency domain representation indicating a magnitude level for each of a plurality of frequencies in said signal;

determining a magnitude distribution for said frequency domain representation, said magnitude distribution indicating how often each of a plurality of magnitude levels are reached in said frequency domain representation;

locating modes within said magnitude distribution, each mode corresponding to a signal component;

finding a mean magnitude for each of said modes; and

finding a standard deviation for each of said modes.

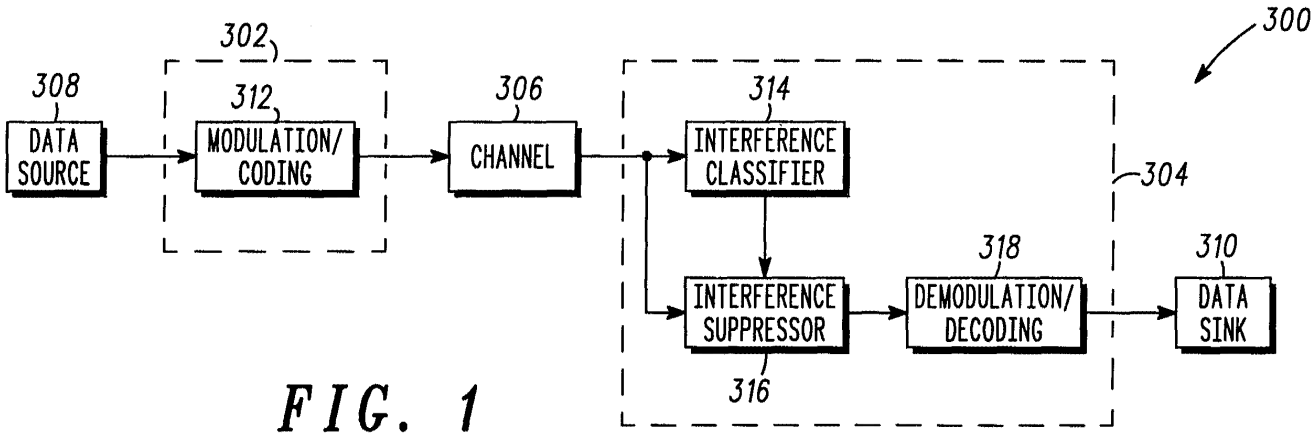


FIG. 1

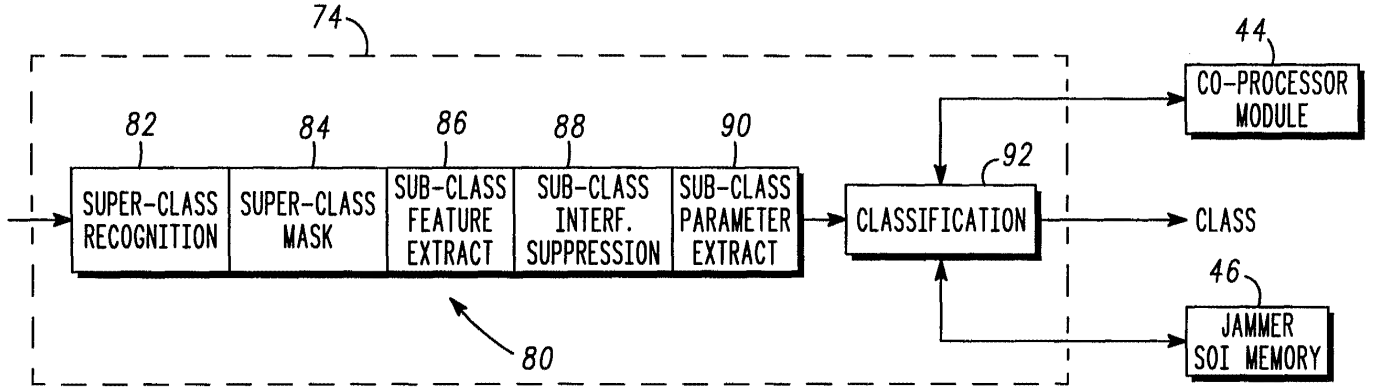


FIG. 3

PRIOR_ART_004504

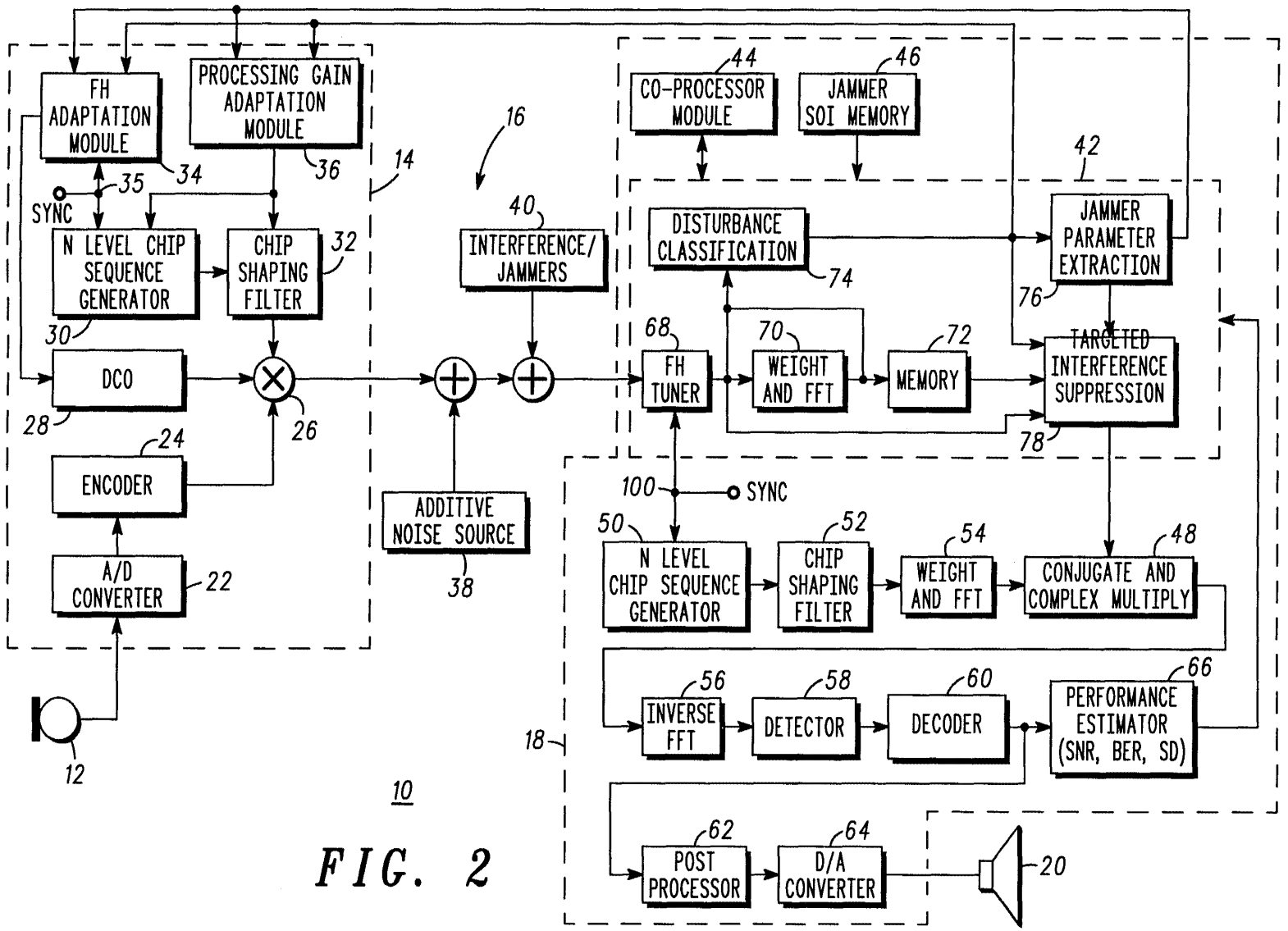


FIG. 2

PRIOR_ART_004505

FIG. 4

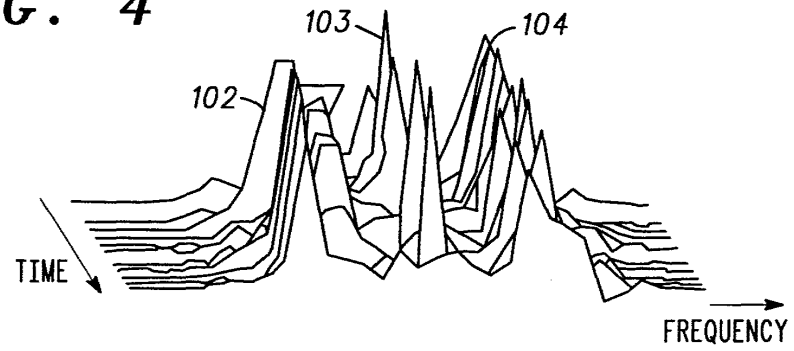


FIG. 5

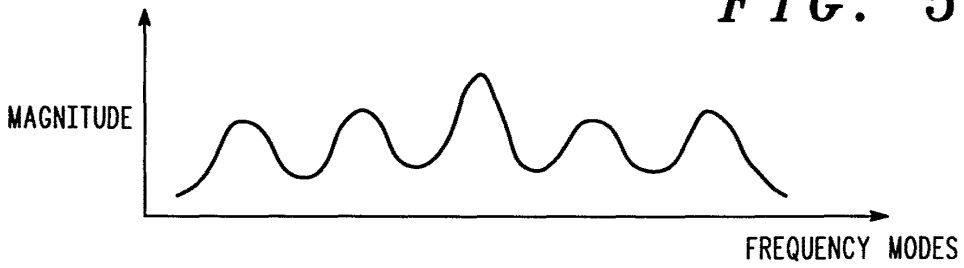
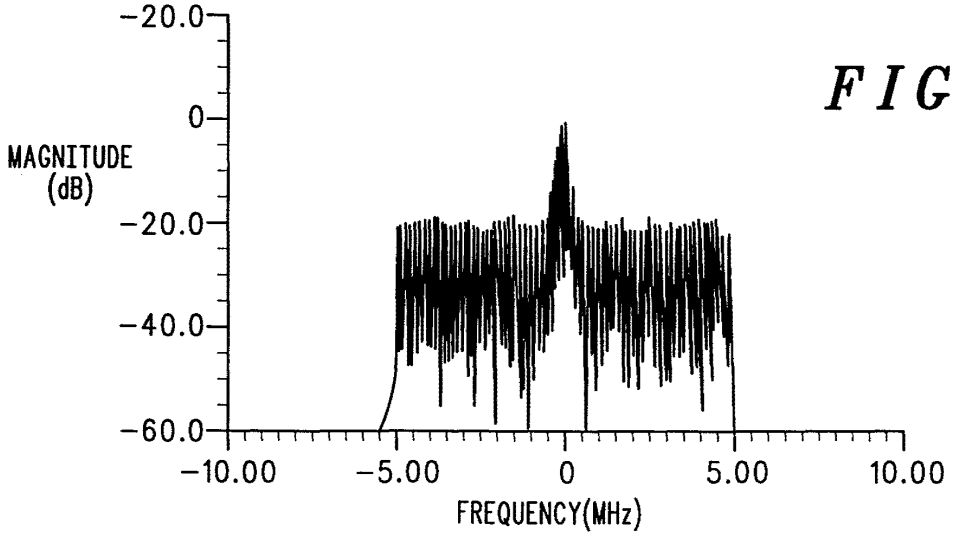


FIG. 7



PRIOR_ART_004506

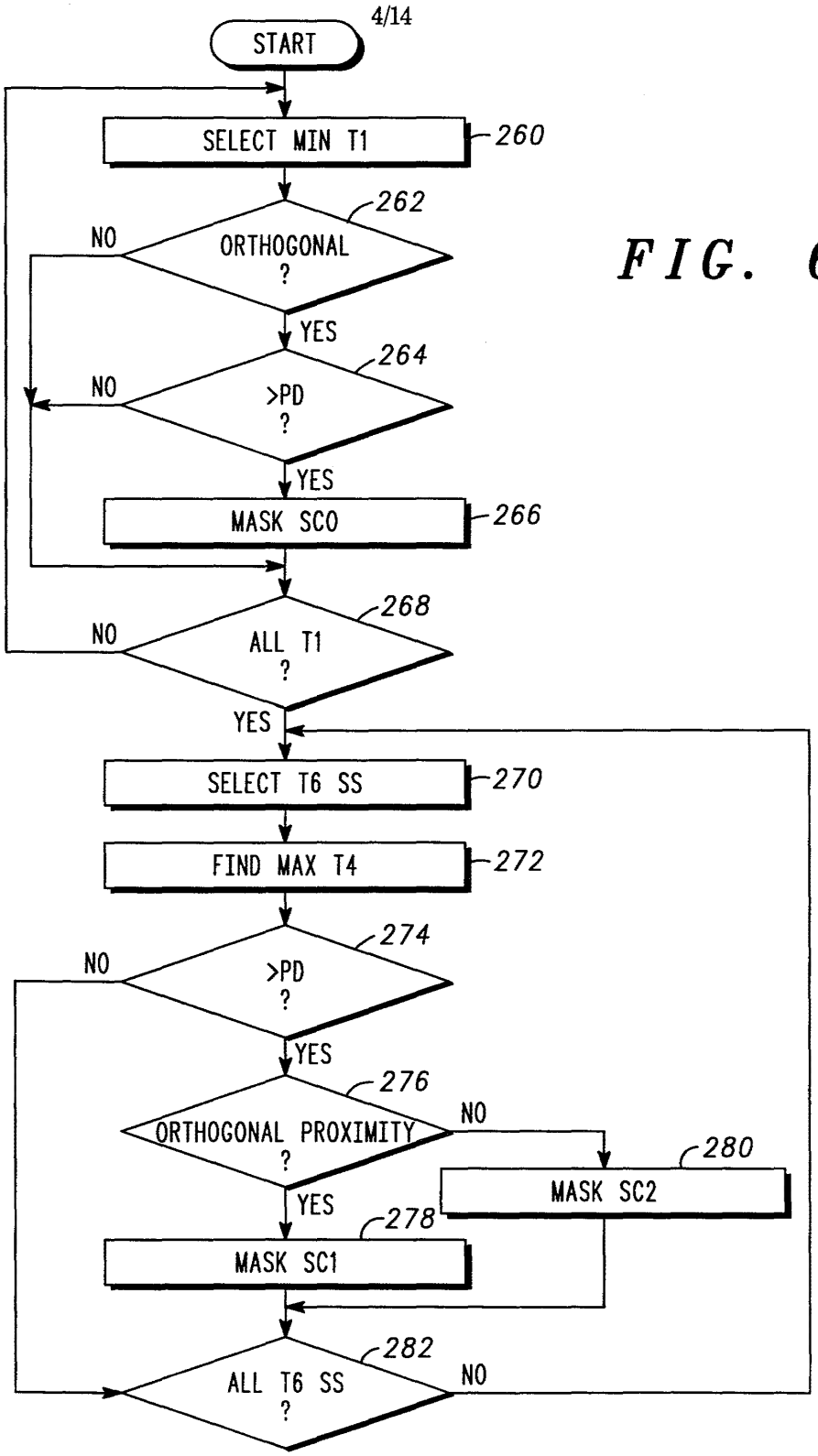


FIG. 6

PRIOR_ART_004507

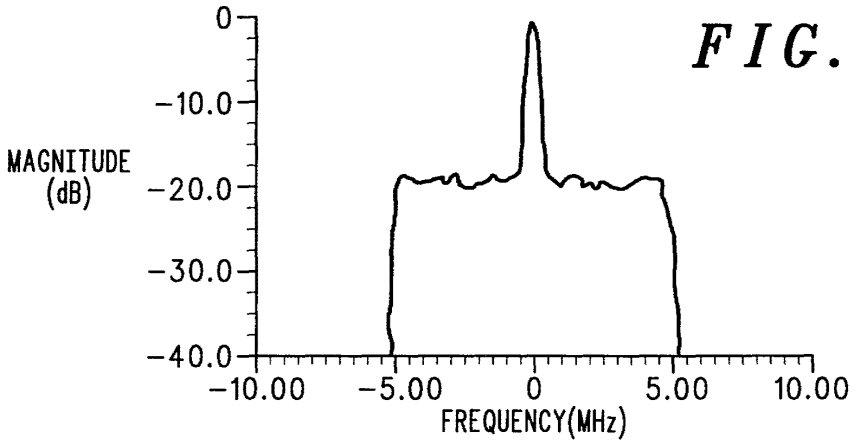


FIG. 8

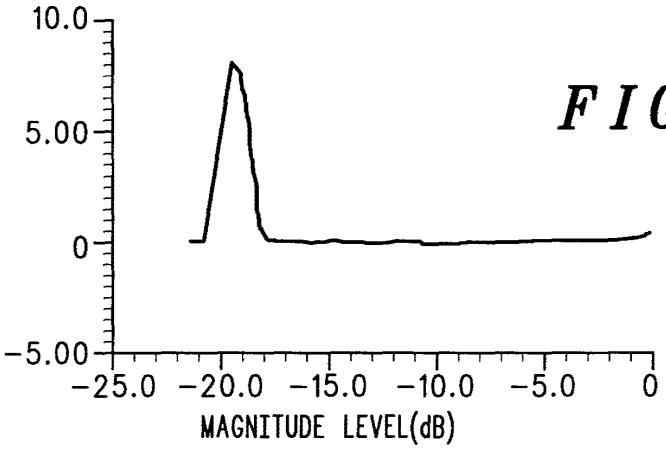


FIG. 9

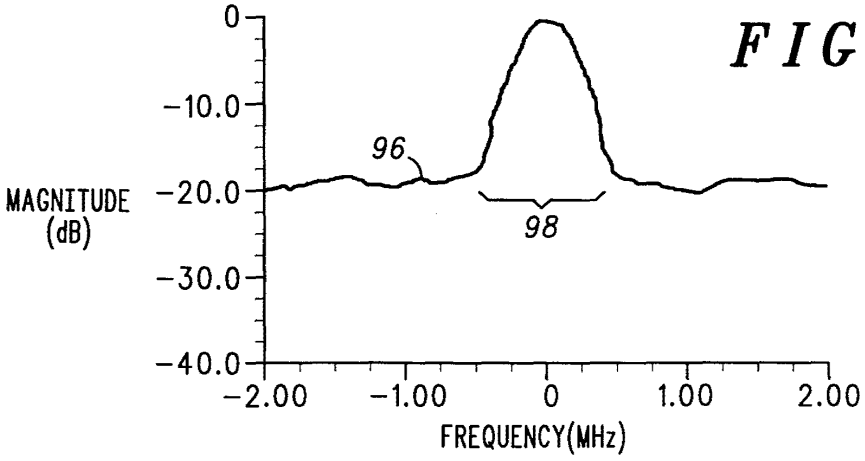


FIG. 10

PRIOR_ART_004508

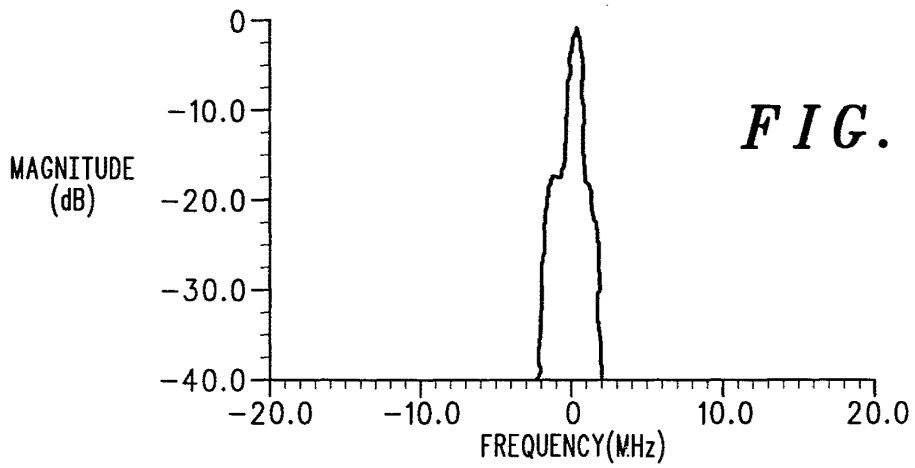


FIG. 11

FIG. 12

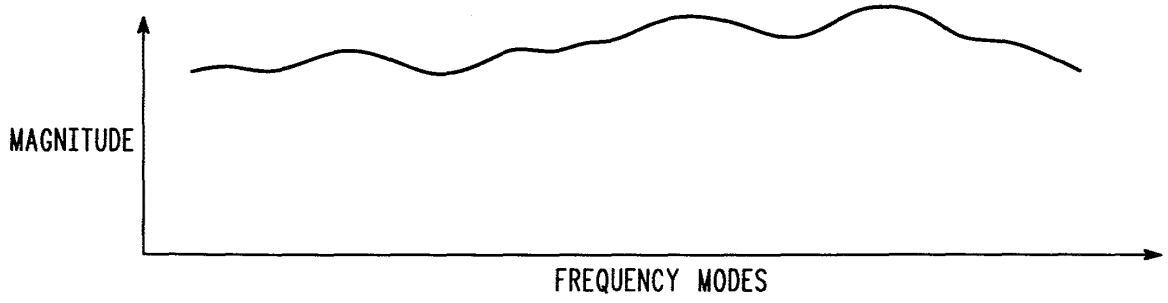
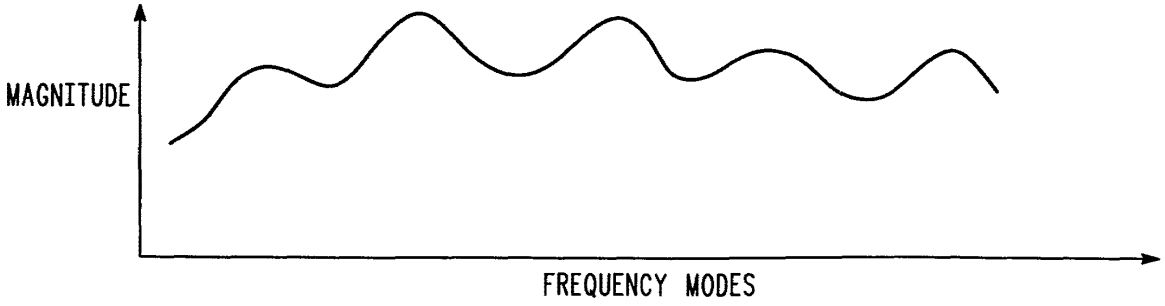


FIG. 13



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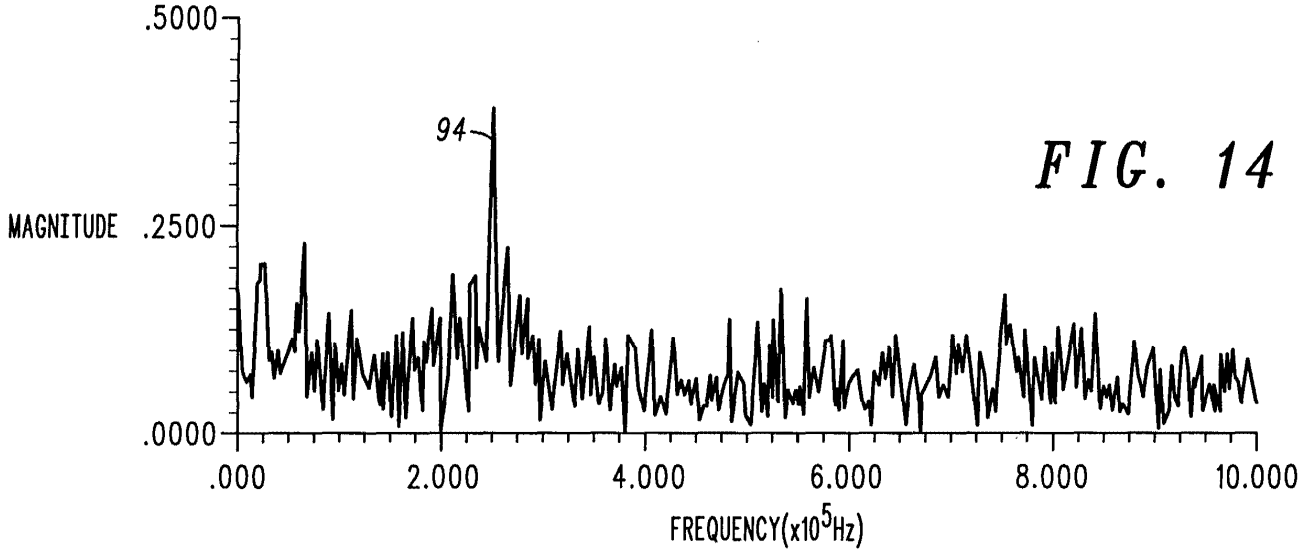


FIG. 14

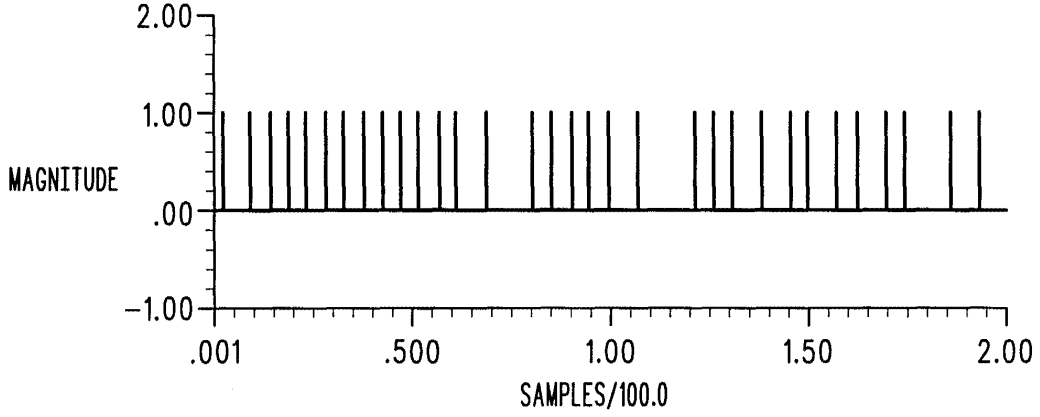


FIG. 15

PRIOR_ART_004510

FIG. 16

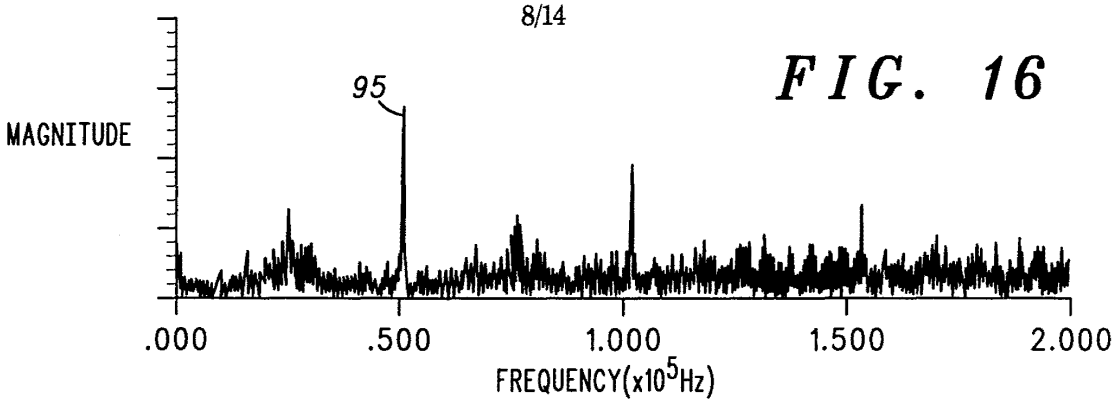


FIG. 17

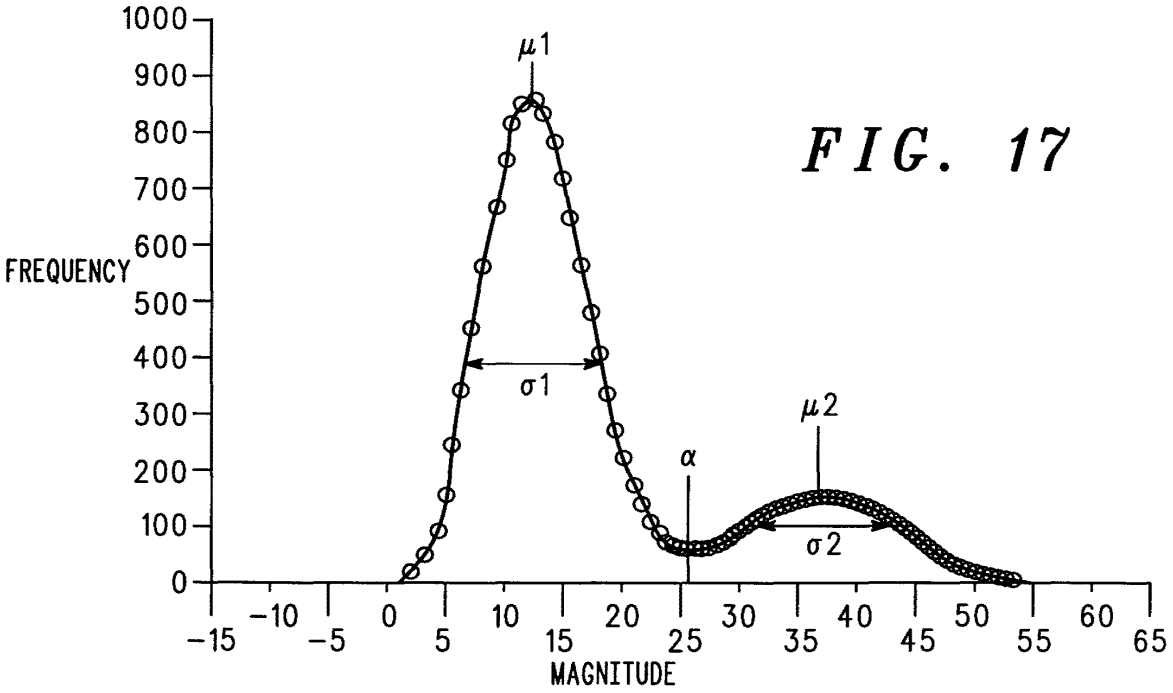
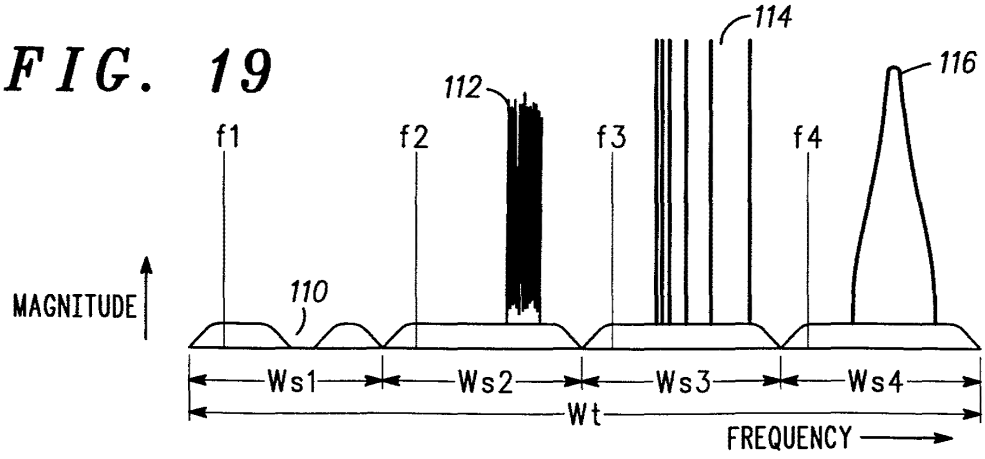


FIG. 19



PRIOR_ART_004511

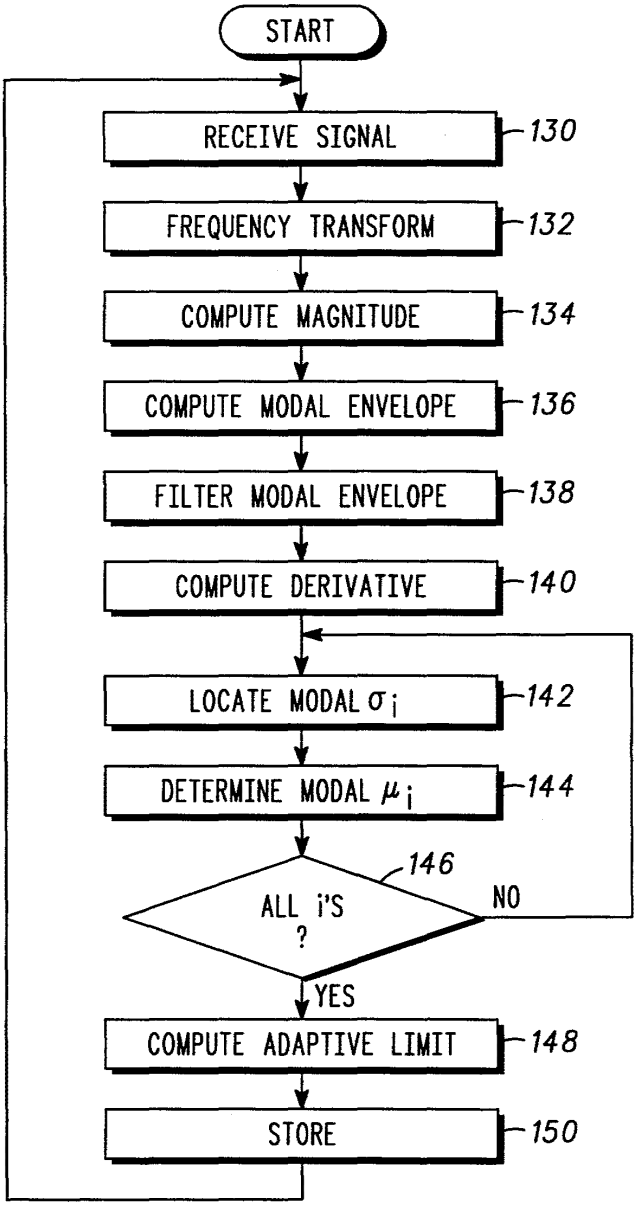


FIG. 18

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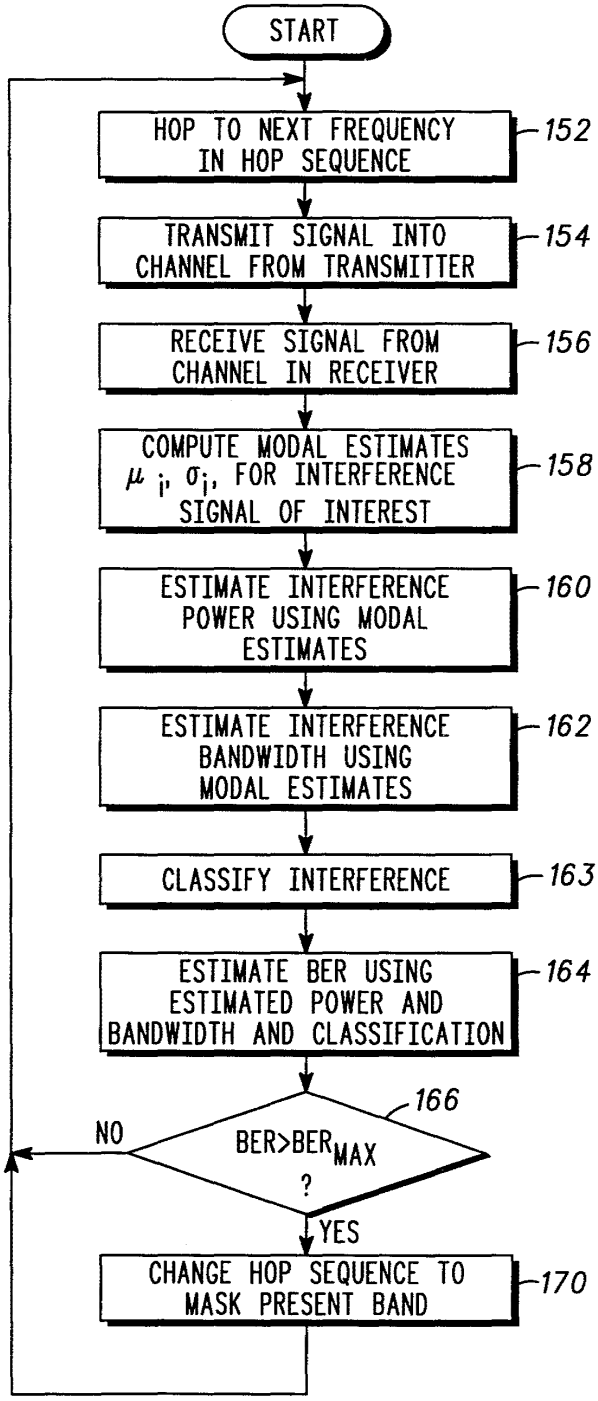


FIG. 20

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FIG. 21

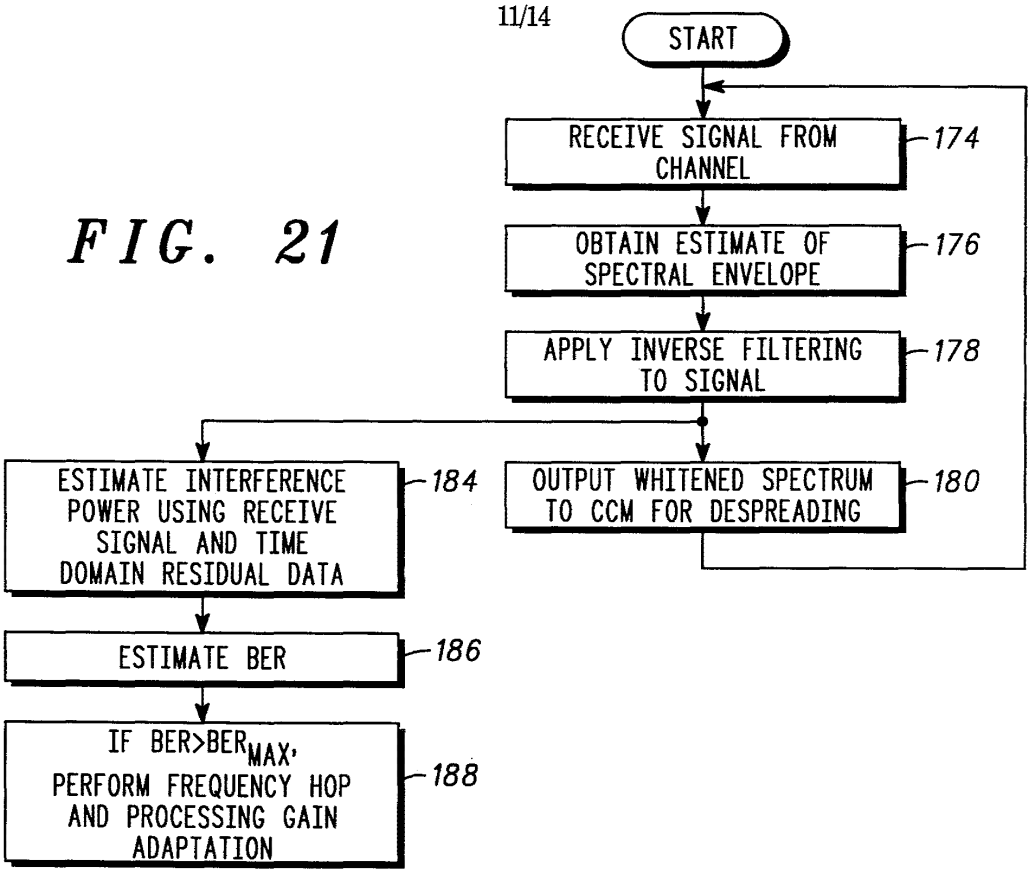
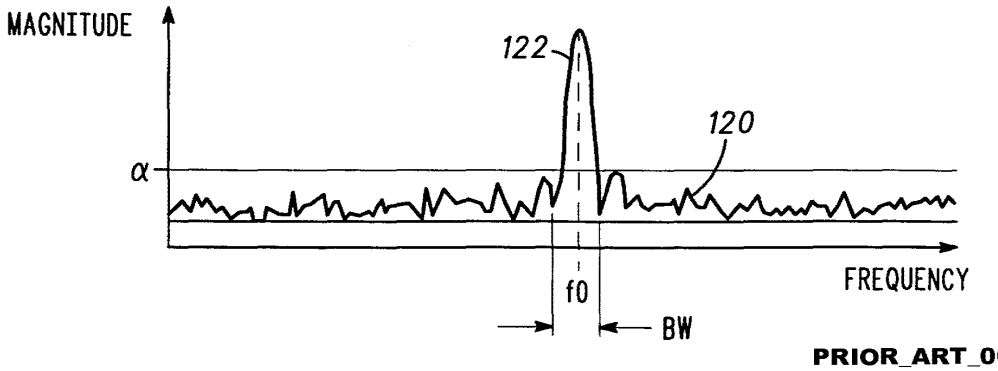


FIG. 22



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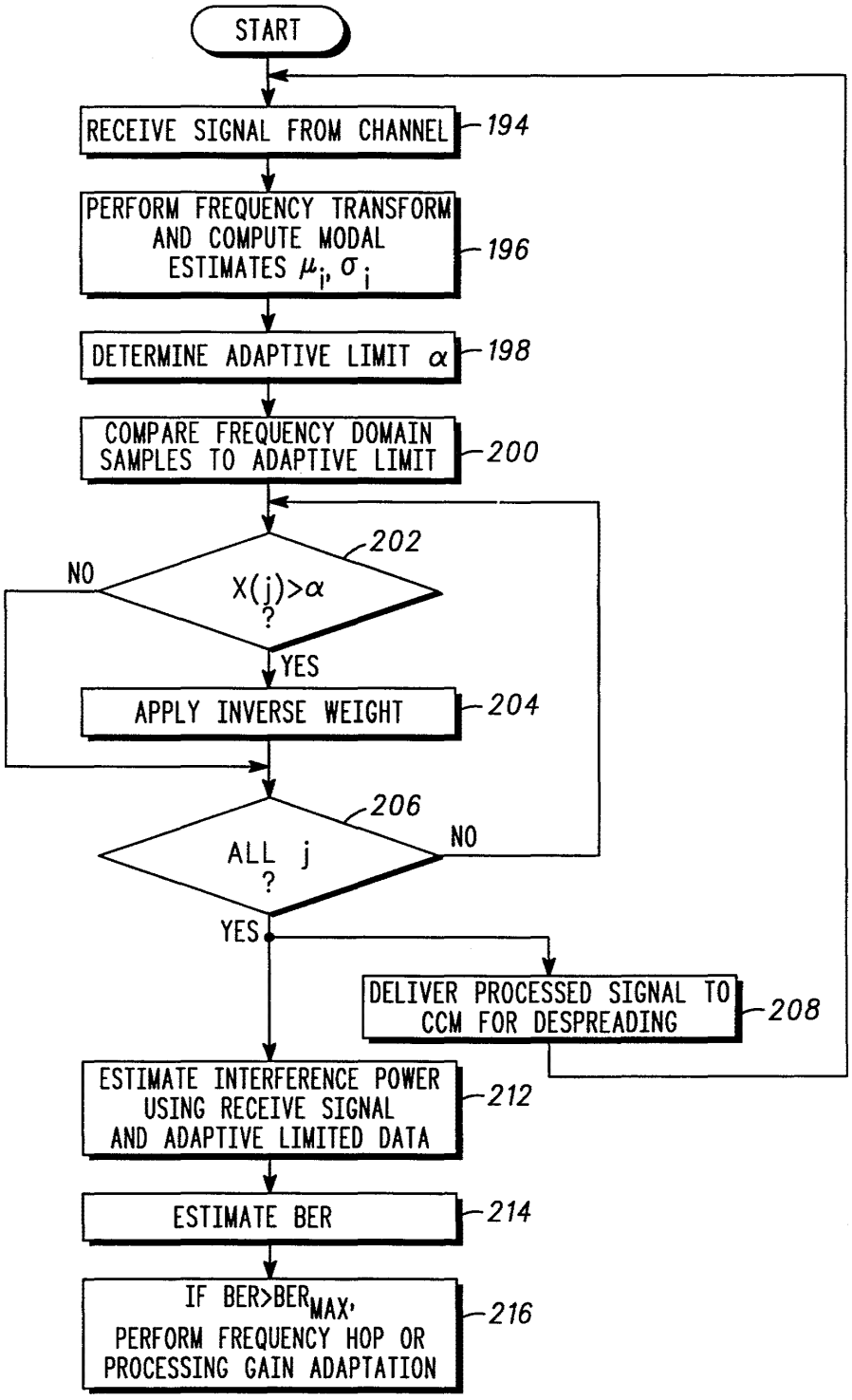


FIG. 23

PRIOR_ART_004515

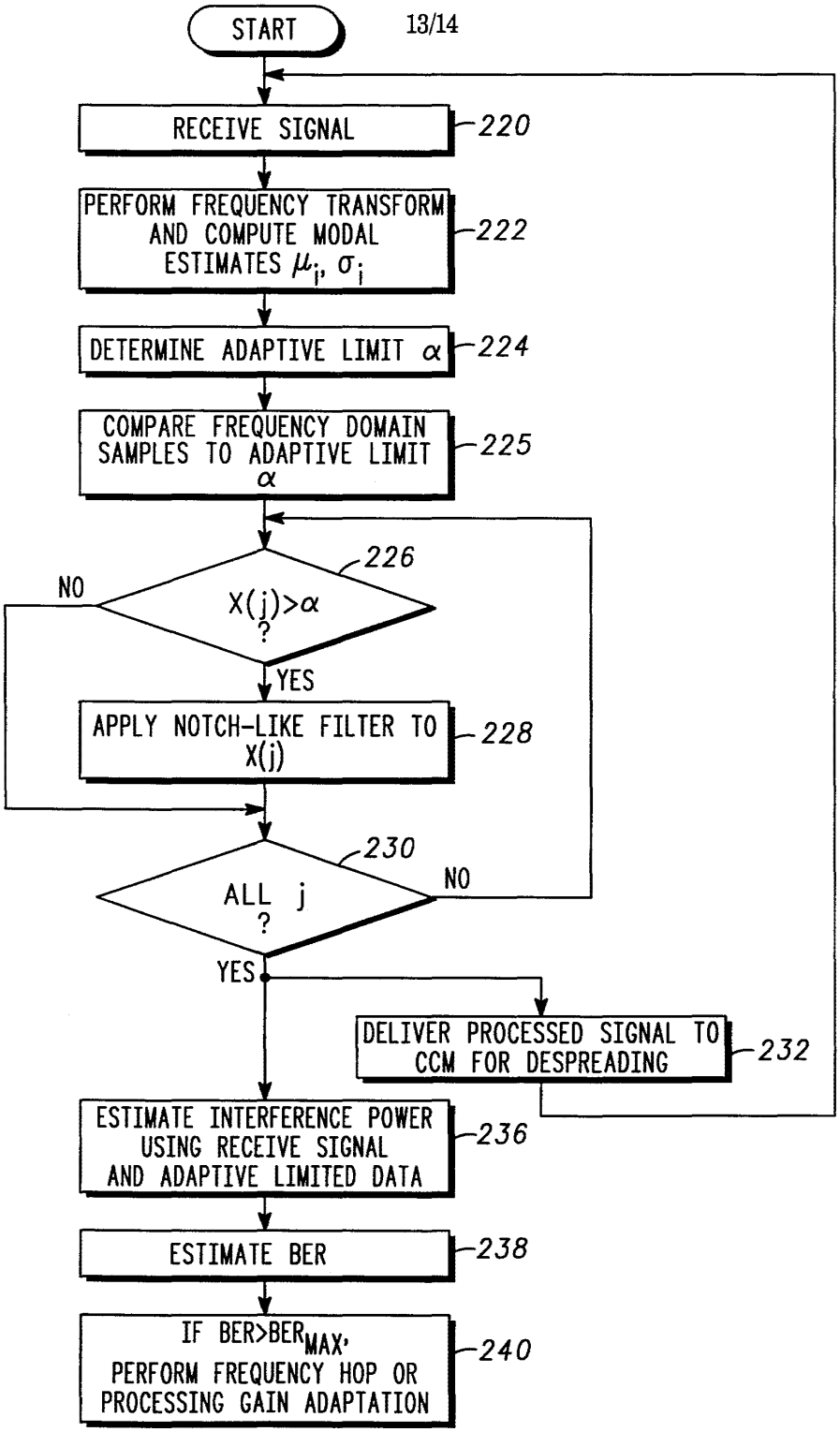


FIG. 24

PRIOR_ART_004516

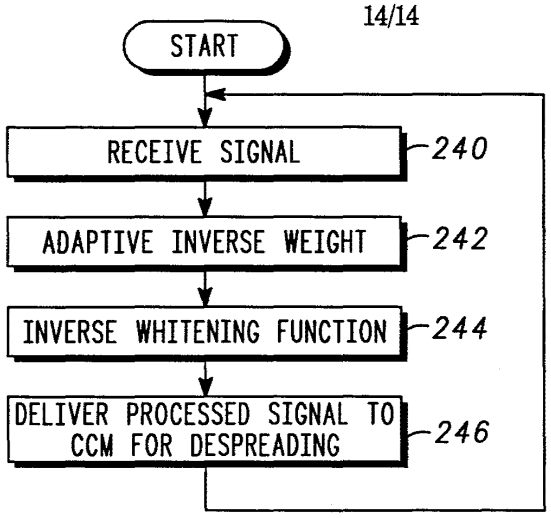


FIG. 25

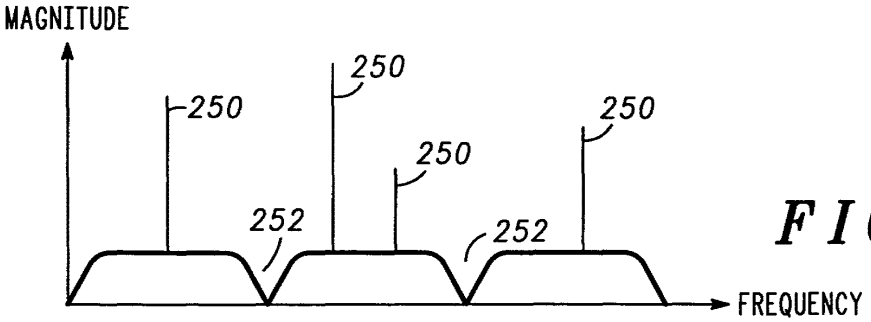


FIG. 26

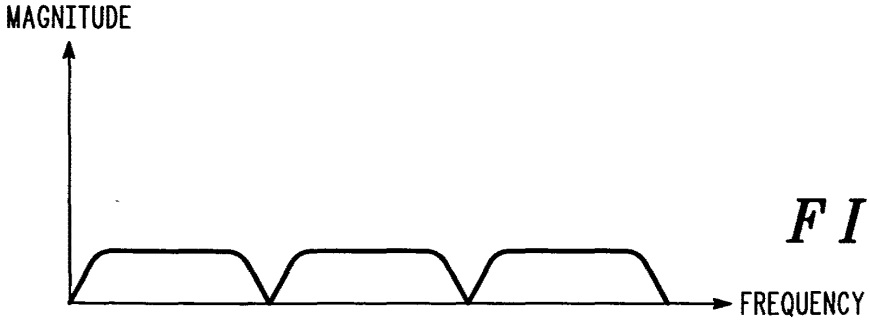


FIG. 27

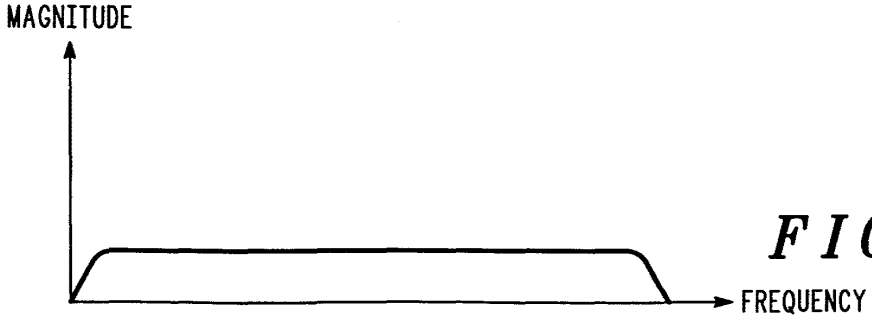


FIG. 28

PRIOR_ART_004517

INTERNATIONAL SEARCH REPORT

Internal Application No
PCT/US 99/01897

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04B1/12 H04B1/713 H04B7/005 H04K3/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04B H04K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 271 038 A (CAI KHIEM V) 14 December 1993 see abstract see column 1, line 54 - column 2, line 16 see column 2, line 28 - line 34 see column 5, line 32 - line 53 see column 7, line 50 - column 8, line 8 see column 9, line 24 - line 29 see figures 2A-2D see claim 1 --- -/--	1-6,8-10

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28 May 1999	07/06/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Lustrini, D

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PRIOR_ART_004518

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Samsung Electronics Co., Ltd. et al. v. One-E-Way, Inc.
IPR2025-01541

INTERNATIONAL SEARCH REPORT

Interna. .al Application No
PCT/US 99/01897

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 613 978 A (KURTH RICHARD R ET AL) 23 September 1986 see abstract see column 3, line 63 - line 66 see column 4, line 3 - line 14 see column 4, line 24 - line 28 see column 7, line 4 - line 43 see claim 1 ---	1-6,8-10
A	US 5 289 194 A (SCHLOSSER THOMAS W) 22 February 1994 see abstract see column 2, line 7 - line 37 see column 3, line 56 - line 66 see column 5, line 61 - column 6, line 23 ---	1,4,6,7, 9
A	US 5 018 088 A (HIGBIE JAMES H) 21 May 1991 see abstract see column 4, line 4 - line 18 see column 8, line 5 - line 12 see column 9, line 8 - line 16 see column 10, line 24 - line 36 see column 13, line 17 - line 22 see column 15, line 7 - line 20 ---	1-4,9,10
A	US 3 833 797 A (GROBMAN L ET AL) 3 September 1974 see abstract see column 1, line 42 - line 46 see column 2, line 49 - line 53 see column 4, line 26 - line 30 ---	1-4,9,10
A	WONG R S C ET AL: "DENOISING OF LOOW SNR SIGNALS USING COMPOSITE WAVELET SHRINKAGE" STAHL UND EISEN,20 August 1997, pages 302-305, XP000804652 see abstract see paragraph I - paragraph II -----	1,9

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

PRIOR_ART_004519

Samsung Exhibit 1002, Page 768 of 880
Samsung Electronics Co., Ltd. et al. v. One-E-Way, Inc.
IPR2025-01541

INTERNATIONAL SEARCH REPORT

Information on patent family members

Internal Application No
PCT/US 99/01897

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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US 4613978 A	23-09-1986	NONE	
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US 3833797 A	03-09-1974	NONE	

PRIOR_ART_004520

(12) UK Patent Application (19) GB (11) 2 343 332 (13) A

(43) Date of A Publication 03.05.2000

(21) Application No 9827747.8

(22) Date of Filing 17.12.1998

(30) Priority Data
(31) 9823326 (32) 26.10.1998 (33) GB

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(51) INT CL[7]
H04B 1/10 // H04B 1/707

(52) UK CL (Edition R)
H4L LFNB

(56) Documents Cited
GB 2277218 A EP 0696852 A2 EP 0542520 A2
US 5339455 A

(58) Field of Search
UK CL (Edition Q) H3U UGX, H4L LECTP LFM LFNB
LFNC LFNX
INT CL[6] H03H 17/06, H04B 1/10 1/707
ONLINE: WPI,EPODOC,JAPIO

(54) Abstract Title
Adaptive filter structures

(57) An adaptive filter structure matches its response closely to the received signal pulse shape when there is a high level of co-channel or adjacent channel interference, and provides a less accurate match when there are low interference levels, to reduce the computational load and power consumption in, eg a portable phone receiver. A first adder provides a partial output providing a centre response. A second adder provides a tail response. For a full output in the presence of interference, the outputs of adders are combined. In the absence of interference the partial output from the first filter will suffice, enabling circuitry associated with the second adder to be inhibited, saving on power consumption. The power consumed by computation is determined by the number of gates required to carry out a computation and how often each gate switches. By altering the overall number of gate switches, power consumption is reduced.

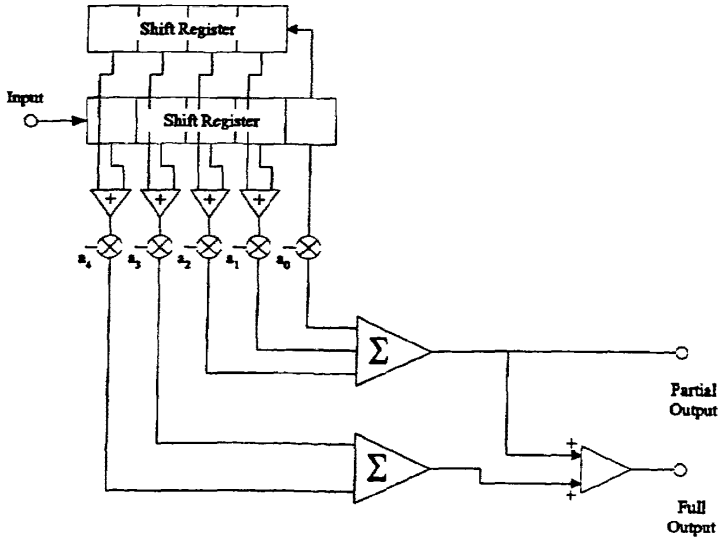


Figure 3 Adaptive FIR Filter Structure

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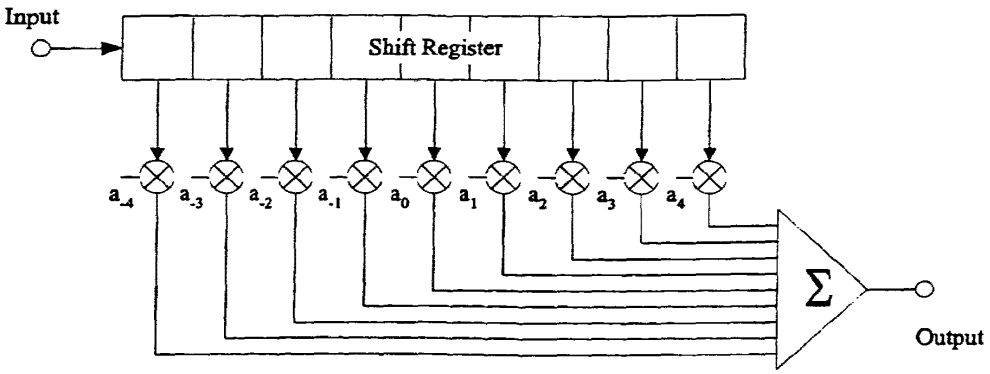


Figure 1 General FIR Structure

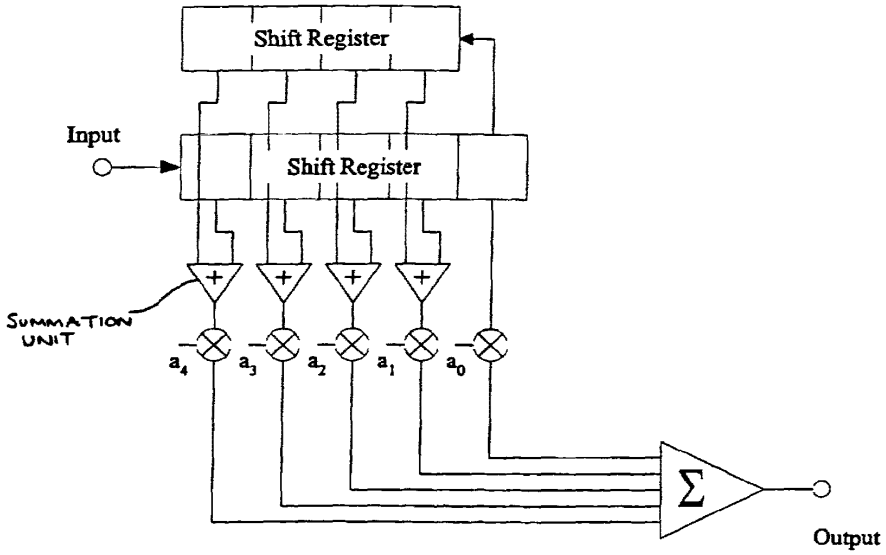


Figure 2 Simplified FIR Structure for Symmetrical Impulse Response

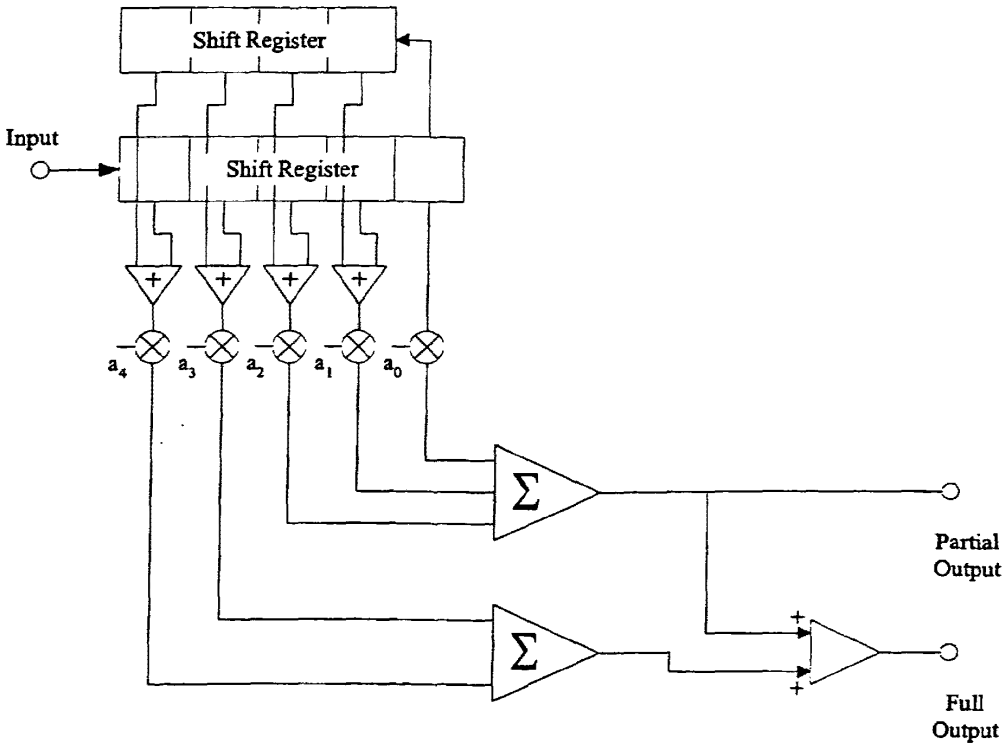


Figure 3 Adaptive FIR Filter Structure

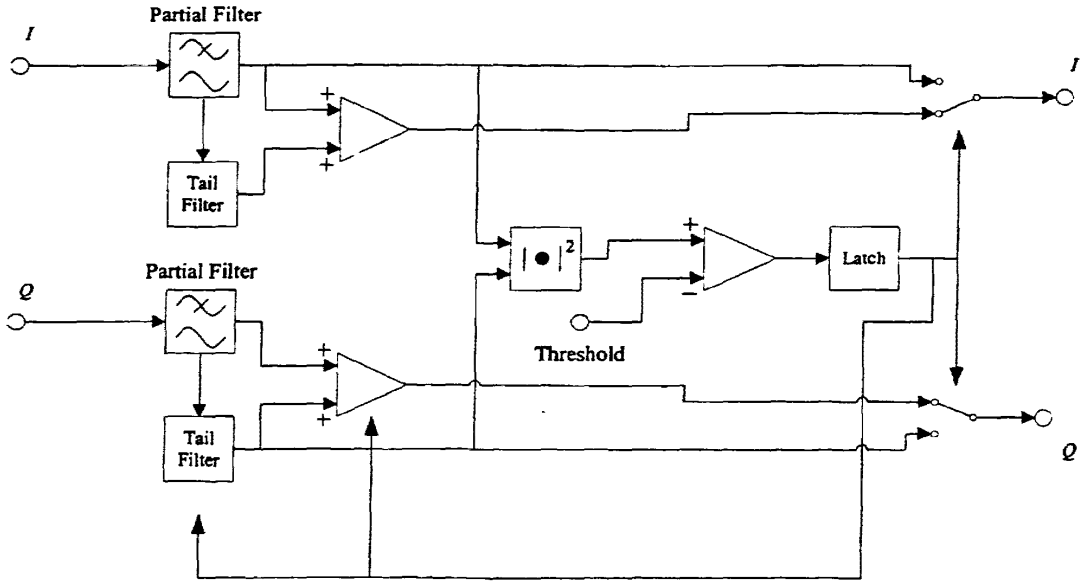


Figure 4 Automatic Filter Adaption

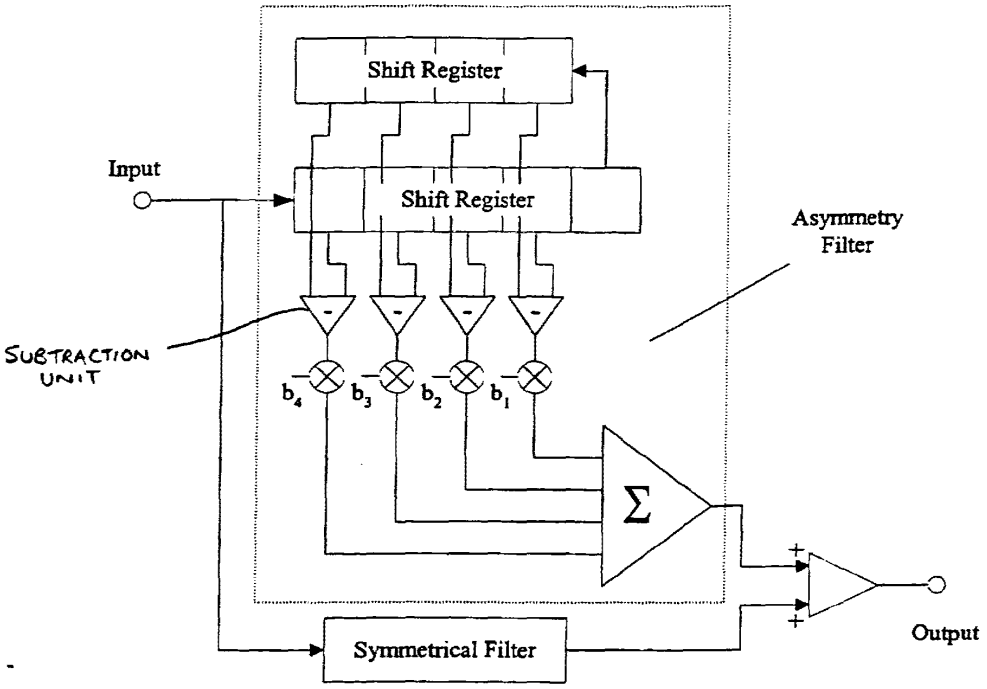


Figure 5 Asymmetry Filter

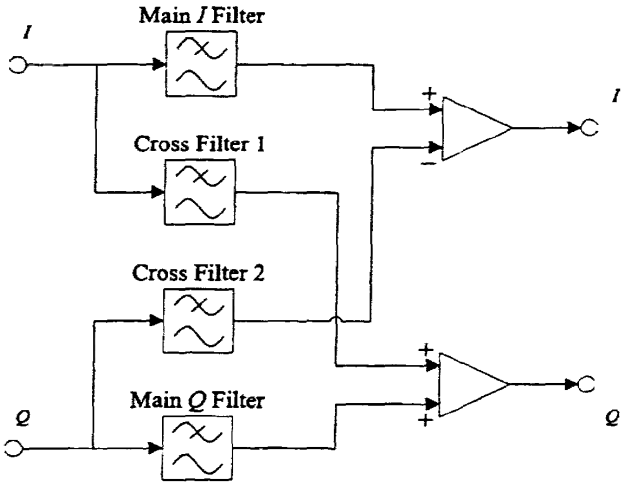


Figure 6 Complex Filter

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ADAPTIVE FILTER STRUCTURES

The present invention relates to adaptive filter structures.

Modern radio receivers for digital information frequently contain an analogue and a digital part. The analogue part typically takes the signal from the antenna, amplifies it and downconverts it to a frequency suitable for digitisation. The analogue part will also contain some filtering, possibly at an intermediate frequency, which serves to provide a measure of receiver selectivity and also to attenuate frequencies which would be aliased by the sampling process associated with the digitisation.

Following the sampler and analogue to digital conversion (ADC), further digitally implemented filtering is usually applied. Almost invariably this is applied at complex baseband with one lowpass filter on the in-phase (I) channel and one on the quadrature (Q) channel. This will typically provide matched filtering to the pulse shape which was transmitted. If a pulse shape satisfying Nyquist 1 requirements is used then an ideal matched filter would also result in there being no interference between the received data symbols for a linear data modulation scheme (zero intersymbol interference).

Low intersymbol interference is important for conventional, that is, non spread spectrum, modulation in order to minimise the irreducible error floor. In a simple direct sequence spread spectrum system, low intersymbol interference (which in this case becomes inter-chip interference) is relatively unimportant because its effect is suppressed by the so called processing gain. However, in a code division multiple access (CDMA) system using orthogonal codes there may be a requirement to receive a weak wanted signal in the presence of one or more strong unwanted signals where the latter are spread using codes which are orthogonal to the codes used by the wanted signal. In this case it, again, is vital that the inter-chip interference should be very low.

The transmit pulse shape is also usually selected so that the ideal matched filter would provide very good, if not perfect, adjacent channel rejection. Thus, a filter which well approximated the ideal matched filter response would also have excellent stop band rejection. This will be important in the presence of one or more strong adjacent channel interferers.

In many types of system, in the absence of adjacent channel interference, near optimum performance can be obtained from a relatively poor approximation to the matched filter response. This poor approximation will also suffice for an orthogonal spread spectrum system when the total level of orthogonal interference to the wanted signal is relatively low. However, if there are one or more strong adjacent channel signals or, in an orthogonal spread spectrum system, if the total orthogonal interference to the wanted signal is relatively high, it will be important for the filter to be a good approximation to the matched filter response. Thus, depending on the interference environment, the accuracy of the matched filter response may need to be very good or a relatively poor accuracy may be adequate.

It is therefore an object of the present invention to provide an improved filter which can adapt in accordance with the presence of adjacent channel interference.

It is another object of the present invention to provide an improved filter which can adapt automatically.

In accordance with one aspect of the present invention, there is provided a method of reducing the power requirements of a receiver in accordance with interference from adjacent channels or orthogonal co-channels, the method comprising the steps of:

a) determining the presence of adjacent channel or co- channel interference in an input signal, and

b) filtering the input signal in accordance with the interference to provide an output signal.

Step b) may comprise applying a threshold to the input signal to determine a level of interference, the output signal being produced in accordance therewith.

The method may further comprise the step of producing at least one signal component, the output signal comprising said at least one signal component or a sum of said signal components. In one embodiment, the method further comprises the step of selecting the signal components for the output signal in accordance with the level of interference. In a preferred embodiment, the number of signal components produced is in accordance with the level of interference.

In accordance with another aspect of the present invention, there is provided a filter arrangement comprising at least two elements arranged to contribute to the filtration of a signal, each element performing a number of gate switches per second, and selection means arranged to selectively alter the contribution to the filtration of the signal from at least one of the elements to alter the number of gate switches per second.

The alteration of the number of gate switches per second may comprise a reduction in the number of gate switches per second.

The selection means may be arranged to selectively remove at least one of the elements arranged to contribute to the filtration of the signal.

It should be understood that the term "filter arrangement" can include one or more filters, where the elements can be a part of a filter or a complete filter, respectively.

A reduced computation filter is used when the levels of interfering signals are small enough to permit this. The interfering signals may be adjacent channel or orthogonal co-channel (for spread spectrum) signals. When the

interfering signals are above a predetermined value, the filtering function must be improved to achieve the required wanted signal reception capability in the presence of the interfering signals. The aim of doing this to minimise the receiver filter power consumption and thereby, for example, improve the battery life of terminal equipment incorporating such filtering. Over the period of the battery life, the receiver is likely to encounter conditions under which the reduced computation filtering is adequate for a high proportion of the time.

It will be readily understood by a person skilled in the art that the power consumed by computation can be expressed in terms of the number of gates required to carry out the computation and how often each gate switches. The overall gate switches per second can be expressed as the average number of gate switches per second for all gates multiplied by the total number of gates. The overall number of gate switches per second is directly related to the current taken during the computation for complementary metal oxide semiconductors (CMOS) technology. Therefore, by reducing the computation, the power taken is also reduced.

In accordance with a further aspect of the present invention, there is provided a receiver having a filter arrangement as described above, the receiver further comprising interference determining means for determining the presence of adjacent channel or orthogonal co-channel interference, the selection means operating in accordance with the determination of the interference determining means.

In accordance with the present invention, there is also provided a mobile terminal having a receiver as described.

For a better understanding of the present invention, reference will now be made, by way of example only, to the accompanying drawings in which:-

Figure 1 illustrates the structure of a general finite impulse response (FIR) filter;

Figure 2 illustrates a simplified FIR filter structure for symmetrical impulse response;

Figure 3 illustrates an adaptive FIR filter in accordance with the present invention;

Figure 4 illustrates automatic filter adaptation;

Figure 5 illustrates an asymmetry filter; and

Figure 6 illustrates a complex filter.

Digital low pass filters which implement approximate match filtered response are almost invariably implemented as finite impulse response (FIR) filters. A standard FIR structure 10 is shown in Figure 1. The filter 10 comprises a shift register 12 connected to input 14. The shift register 12 comprises nine elements, 12a, 12b, 12c, 12d, 12e, 12f, 12g, 12h, 12i, each element being connected to a respective multiplier 16a, 16b, 16c, 16d, 16e, 16f, 16g, 16h, 16i. Each multiplier 16a, 16b, 16c, 16d, 16e, 16f, 16g, 16h, 16i has a respective tap weight or coefficient a_{-4}, a_{-3}, a_{-2}, a_{-1}, a_0, a_1, a_2, a_3, a_4 as shown. Respective outputs 18a, 18b, 18c, 18d, 18e, 18f, 18g, 18h, 18i from the multipliers 16a, 16b, 16c, 16d, 16e, 16f, 16g, 16h, 16i are passed to an adder 20 which provides an output 22. It will be appreciated that the shift register may contain a different number of elements to nine according to the particular application.

Since the requirement is frequently for a linear phase filter, the required impulse response is symmetrical in time. This means that in Figure 1, $a_i = a_{-i}$. The most computationally intensive operations in the filter are the multiplications. By using symmetry, it is possible to (almost) halve the number of multiplications required. This is shown in Figure 2.

In Figure 2, a shift register 30 is effectively split into two halves 32, 34, but still has nine elements 30a, 30b, 30c, 30d, 30e, 30f, 30g, 30h, 30i. In this case, as the filter is symmetrical, that is, $a_i = a_{-i}$, the outputs from the shift

register 30 are grouped in pairs to form inputs to summing units 40, 42, 44, 46. As shown, outputs from element 30a and element 30i form the inputs to summing unit 40, outputs from element 30b and element 30h form the inputs to summing unit 42, outputs from element 30c and element 30g form the inputs to summing unit 44, and outputs from element 30d and element 30f form the inputs to summing unit 46. Outputs from summing units 40, 42, 44, 46 are respectively passed to multipliers 50, 52, 54, 56 where respective coefficients a_4, a_3, a_2, a_1 are applied. The output from bit 30e passes directly to multiplier 58 where coefficient a_0 is applied. Outputs 60, 62, 64, 66, 68 from multipliers 50, 52, 54, 56, 58 are passed to an adder 70 which provides output 72. It will be appreciated that for an even order filter, the number of multiplications is reduced by a factor exactly equal to two. This approach is well established in the prior art.

In accordance with the present invention, a filter 80 which can be used in the case where strong adjacent channel interference may or may not be present is shown in Figure 3. Components which have been previously described with reference to Figure 2 are numbered alike and no further explanation to their operation will be given.

When comparing Figure 3 to Figure 2, it will readily be seen that two separate overall adders 82, 84 are used. One adder 82 provides the sum of terms multiplied by coefficients a_{-2}, a_{-1}, a_0, a_1 and a_2 from multipliers 54, 56, 58 (where $a_{-i} = a_i$ as before) as output 86, and the other adder 84 provides the sum of terms multiplied by coefficients a_{-4}, a_{-3}, a_3 and a_4 from multipliers 50, 52 (again where $a_{-i} = a_i$) as output 88. Thus, output 86 provides the centre impulse response and output 88 provides the tail response respectively of the filter 80. Thus, the partial output 86 provides a truncated filter response. For a full output 90 from the filter 80, outputs 86 and 88 are added together in adder 92.

When there is little or no adjacent channel interference, the partial output 86 will suffice and all of the circuitry associated with adder 84 (apart from elements 30a, 30b, 30h, 30i in shift registers 32, 34) can be inhibited, thus saving on power consumption. On the relatively rare occasions of significant adjacent channel interference, the additional circuitry associated with adder 84 can be enabled to provide the full response.

However, in order for filter 80 to be useful, it is necessary to provide a means for automatically inserting the extra filter tail response when needed and removing it when it is not needed. There may be many arrangements which make this possible. One such arrangement is shown in Figure 4.

In Figure 4, input *I* and *Q* signal components are assumed to have been adjusted to a fixed power level by the operation of automatic gain control (AGC). This is normal for this type of receiver and is necessary to ensure that the best use is made of the quantisation in the analogue-to-digital converter (ADC). The AGC will fix the level of the sum of the wanted signal and any additional co-channel and adjacent channel interferers. If, for example, the filter has unity gain in the passband and there is little or no adjacent channel interference, the level at the output of the filter will be close to the same as that at the input, apart from any attenuation of noise. However, if adjacent channel interference is present, even the simplified filter will attenuate this somewhat. Thus, the power at the output of the filter will be lower than at the input under this condition. A certain power level at the output of the filter will correspond to the presence of adjacent channel interference at the maximum level which the simplified filter can acceptably attenuate. A threshold is set at this level and a comparison performed.

In more detail, the *I* and *Q* signal components are passed through respective partial filters 100, 102 to provide respective first outputs 104, 106. Further outputs 108, 110 from partial filters 100, 102 pass through respective

tail filters 112, 114 as shown to provide outputs 116, 118. Outputs 104 and 116 and 106 and 118 are summed in respective adders 120, 122 to provide respective second outputs 124, 126 as shown. The power of the signal is determined from outputs 104, 118 (box 128) and is passed to one input of a comparator 130. The second input of the comparator 130 has a threshold value 132 applied to it. When the measured power (computed by the $|\bullet|^2$ operation (box 128) which denotes $I^2 + Q^2$) is lower than threshold value 132, an output signal 134 is generated and passed to latch 136. Latch 136 controls respective switch elements 138, 140 connected between outputs 104, 124 and 118, 126 respectively to provide respective output signals 142, 144 for the I and Q signal elements as shown. Latch 136 is also connected to tail filter 114 and adder 122 of the Q signal element so that the tail filter 114 is enabled and the outputs incorporating this tail filter are used.

Instead of a simple truncation of the filter response, it may be better to use a different set of coefficients for the truncated filter from those used in the centre portion of the non-truncated filter. In this case, it would also be possible to switch the filter coefficients. Here, after switching over to the non-truncated filter, the measurements would be performed on this output. The automatic filter switching would still be effective.

The present invention is equally applicable to multiple truncations corresponding to more than two levels of filter complexity. In this case, the invention may relate to adaptation of the filter length according to variation in adjacent channel interference. However, it will be appreciated that other types of adaptation may also be implemented.

Analogue filtering prior to digitisation may introduce variations in amplitude and/or phase over the passband. By the term 'passband' is meant any frequencies of nominally non-zero attenuation of the ideal matched filter response. If this is the case, it may be desirable to build compensation for these

variations into the digital filtering. If the variations are only in amplitude and if these variations are symmetrical about the centre frequency of the filter (which is also aligned on the centre of the received signal) then this variation may be compensated by a trivial change in the FIR filter tap weights or coefficients. However, if one, other or both of these conditions is not satisfied then significant additional complexity can arise in the digital filtering if full compensation is required.

Consider first the phase variations in the filter. In order to compensate for these, it becomes necessary for the FIR filters to have an asymmetrical impulse response. In this case, the reduced complexity architecture of Figure 2 cannot be used and it becomes necessary to revert to the structure of Figure 1. It would be possible, however, to construct the response by a combination of the structure of Figure 2 and an 'asymmetry filter' as shown in Figure 5. Components which have been previously described with reference to Figure 2 are numbered alike and no further explanation to their operation will be given.

In Figure 5, input 14 is applied to an asymmetrical filter 150 and a symmetrical filter 152. Respective outputs 154, 156 from filters 160, 162 form inputs for an adder 160 which provides an output signal 162. Asymmetric filter 150 comprises the shift register 30 of Figure 2 where outputs from elements 30a, 30b, 30c, 30d, 30f, 30g, 30h, 30i are grouped in pairs to form inputs to subtraction units 170, 172, 174, 176. As shown, outputs from element 30a and element 30i form the inputs to subtraction unit 170, outputs from element 30b and element 30h form the inputs to subtraction unit 172, outputs from element 30c and element 30g form the inputs to subtraction unit 174, and outputs from element 30d and element 30f form the inputs to subtraction unit 176. Outputs from subtraction units 170, 172, 174, 176 are respectively passed to multipliers 180, 182, 184, 186 where respective coefficients b_4, b_3, b_2, b_1 are applied.

Outputs 190, 192, 194, 196 from multipliers 180, 182, 184, 186 are passed to an adder 198 which provides an output 154 for the asymmetrical filter 150.

Here, the coefficients b_i are given by the difference between the equivalent positive and negative indexed coefficients, that is, $b_i = a_i - a_{-i}$. This structure is marginally more complex than that of Figure 1, having the same number of multiplications but about twice as many additions. Note that the shift registers can be shared between the symmetrical and asymmetrical filter components. The reason for considering such a structure is that the asymmetric filter can be disabled whenever it is not necessary to compensate the phase response of the analogue filter.

Considering the orthogonal CDMA case, the asymmetry filter can be enabled whenever the despread wanted signal is weaker than the total co-channel composite signal by greater than a certain factor, determined according to the acceptable performance degradation. One possible structure would be similar to that of Figure 4, except that the thresholding of the power would be performed after despreading the wanted signal. It would, of course, be necessary to take account of any gain adjustments associated with adjacent channel interference.

Now consider the effect of analogue filter frequency asymmetry. In this case, in order to compensate this, a fully complex digital filter would be required. Such a structure is shown in Figure 6.

In Figure 6, a complex filter 200 is shown which comprises four filter elements 202, 204, 206, 208. Each filter element 202, 204, 206, 208 is a real FIR structure. As shown, filter elements 202, 204 are connected to receive the *I* signal component and filter elements 206, 208 to receive the *Q* signal component. Filter elements 202 and 208 comprise main filters for their respective signal components and filter elements 204 and 206 comprise cross filters for their respective signal components. Each filter element 202, 204,

206, 208 provides respectively an output 212, 214, 216, 218. As shown, outputs 212, 216 form inputs to a first adder 220, and outputs 214, 218 form inputs to a second adder 222. Outputs 224, 226 from respective adders 220, 222 comprise the output I and Q signal components respectively.

The present invention can be applied here in exactly the same way as for the phase compensation. The two cross filters 204, 206 can be enabled whenever the despread wanted signal is weaker than the total co-channel composite signal by greater than the a certain factor, which may be the same as that specified for the phase response although this is not necessarily the case.

Although the present invention has been described with reference to specific embodiments, it will readily be appreciated that this invention may also extend to any combination of any implementations of the filter adaptations for adjacent channel selectivity, compensation of the phase linearity of the analogue filter and compensation of frequency response asymmetry in the analogue filter.

It may be that in a combined usage, some of the operations are mutually exclusive. For example, it may be desired that the asymmetric filter compensating for the non linear phase response in the analogue filter to be implemented with limited precision arithmetic. This would be adequate to improve orthogonality of signals but would at the same time compromise the stopband attenuation of the filter. Thus, it may not be desirable to switch in the asymmetric filter component at the same time as strong adjacent channel signal have been detected. It is not likely that strong adjacent channel and strong orthogonal co-channel signals will be encountered at the same time as most deployment scenarios preclude this eventuality. Thus, the adaptive filter structure proposed in this invention confers additional advantages by allowing the inclusion of low complexity phase compensation structures only when this

will not degrade adjacent channel performance in the presence of strong adjacent channel signals.

CLAIMS:

1. A method of reducing the power requirements of a receiver in accordance with interference from adjacent channels or orthogonal co-channels, the method comprising the steps of:

a) determining the presence of adjacent channel or co- channel interference in an input signal, and

b) filtering the input signal in accordance with the interference to provide an output signal.

2. A method according to claim 1, wherein step b) comprises applying a threshold to the input signal to determine a level of interference, the output signal being produced in accordance therewith.

3. A method according to claim 2, further comprising the step of producing at least one signal component, the output signal comprising said at least one signal component or a sum of said signal components.

4. A method according to claim 3, further comprising selecting the signal components for the output signal in accordance with the level of interference.

5. A method according to claim 3, wherein the number of signal components is produced in accordance with the level of interference.

6. A filter arrangement comprising at least two elements arranged to contribute to the filtration of a signal, each element performing a number of gate switches per second, and selection means arranged to selectively alter the

contribution to the filtration of the signal from at least one of the elements to alter the number of gate switches per second.

7. A filter arrangement according to claim 6, wherein the alteration of the number of gate switches per second comprises a reduction in the number of gate switches per second.

8. A filter arrangement according to claim 6 or 7, wherein the selection means is arranged to selectively remove at least one of the elements.

9. A receiver having a filter arrangement according to any of claims 5 to 8, the receiver further comprising interference determining means for determining the presence of adjacent channel or orthogonal co-channel interference, the selection means operating in accordance with the determination of the interference determining means.

10. A mobile terminal having a receiver according to claim 9.

11. A filter arrangement substantially as hereinbefore described with reference to Figures 3 to 6 of the accompanying drawings.

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Application No:	GB 9827747.8	**Examiner:**	Robert Macdonald
Claims searched:	1-5,9 and 11	**Date of search:**	5 May 1999

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): H4L(LECTP, LFM, LFNB, LFNC LFNX)

Int Cl (Ed.6): H04B(1/10, 1/707)

Other: ONLINE: WPI, EPODOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	EP 0696852 A2	(PIONEER) Whole document.	1, at least
X	EP 0542520 A2	(NOKIA) See lines 24-25 of column 3, especially.	1-4, at least.
A	US 5339455	(BLAUPUNKT) Whole document.	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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The Patent Office

INVESTOR IN PEOPLE

Application No:	GB 9827747.8	**Examiner:**	Robert Macdonald
Claims searched:	6-10	**Date of search:**	21 June 1999

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Further Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): H4L(LECTP, LFM, LFNB, LFNC LFNX); H3U(UGX)

Int Cl (Ed.6): H03H(17/06); H04B(1/10, 1/707)

Other: ONLINE: WPI, JAPIO, EPODOC

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
A	GB 2277218 A	(ROKE MANOR RESEARCH) Whole document.	
X	EP 0696852 A2	(PIONEER) See whole document.	6-9

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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(54) Data recovery for a wireless digital audio transmitting system

(57) A system for transmitting digitized samples of analog signals while concealing unrecoverable digitized samples of analog signals to maintain a level of fidelity in reproducing the analog signals. The digitized samples of the analog signals are burst transmitted such that the probability of interference with the transmission and thus corruption of the digitized samples of the analog signals is minimized. The digitized samples are received without synchronizing a receiving clock with a transmitting clock to capture the digitized samples of the analog signals. The digitized samples are converted from various sampling rates to digitized samples of the analog signals having a rate. Any large groups of digitized samples that are in error or corrupted in transmission are softly muted to avoid annoying clicks. Any long term difference between a transmit clock and a receive clock is tracked and the digitized samples are interpolated or decimated to eliminate any underrun or overrun of the digitized samples.

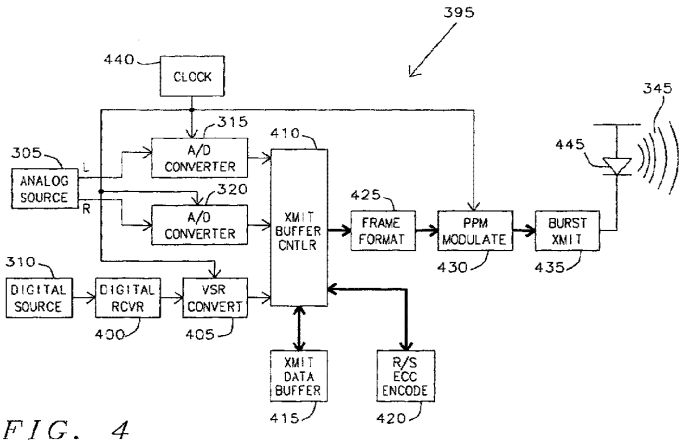


FIG. 4

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Description

Technical field of the Invention

[0001] This invention is generally related to electronic circuits and systems that transmit and receive digitally sampled analog signals. More particularly, this invention relates to electronic circuits and systems that transmit and receive digital audio signals.

Background art

[0002] The transmission of analog signals between a source of the analog signals and a reproduction of the analog signals at an output transducer is well known in the art. U.S. Patent 5,596,648 (Fast) describes a wireless infrared audio transmission system where infrared LED emitters are activated by a frequency modulated pulse wave transmitted as light to a receiver. The audio analog signal modulates the frequency modulated pulse wave.

[0003] U.S. Patent 5,596,603 (Haupt, et al.) illustrates a another device for wireless transmission of audio signals. Refer now to Fig. 1 for an overview of this structure. The analog source **5** provides a left channel **L** and a right channel **R**. The analog source **5** would be microphones, a FM tuner/receiver, or an analog recording media. The left channel **L** and the right channel **R** are inputs to analog-to-digital converters **15** and **20**. It is well known in the art that the analog sources can provide any number of channels. The left channel **L** and right channel **R** are chosen for illustration purposes.

[0004] Additionally, the analog signals from the analog source **5** can have been previously converted to digitized samples and then provided by the digital source **10**. The digitized samples of the analog signals are retained in a data buffer **25**. The digitized samples are then formatted in data frames in the data formatting unit **30**. In Haupt, et al. a data frame is 128 bits in length for each channel (left channel **L** or right channel **R**). The data frames are then transferred to the date modulator **35**. A carrier signal is then modulated with the data frames.

[0005] In the case of Haupt, et al., the data frames are changed from a 4 bit audio data to a 5 bit transmission data, which is used to activate and deactivate an infrared light emitting diode. The modulated carrier signal is transferred to a transmitter and then conveyed to the communication medium **45**. The infrared light is then radiated through the open atmosphere to a receiving light sensitive diode. In this case, the communication medium **45** is the open atmosphere.

[0006] It is well known that the transmitter **40** can produce radio frequency waves in addition to light. Further, the communication medium **45** can be either wire such as coaxial cable, twisted-pair cable or other forms of metallic (copper) inter-connection. Additionally, the communication medium **45** may be a fiber optic cable.

[0007] The receiver **50** will recover the modulated carrier signal from the communication medium **45**. Typically, a clocking or timing signal is included in the data frame and the modulated carrier signal. A clock extraction circuit **55** will develop the embedded clocking or timing signal and synchronize the receiving subsystem **100** with transmitting subsystem **95**. Classically, the clock extraction circuit **55** incorporates a phase locked oscillator, which can malfunction if there are errors in the transmitted modulated carrier signal.

[0008] The recovered modulated carrier signal is transferred to the demodulator **60** to extract the data frames. The data frames are then reformatted in the receive data formatter **65** to recreate the digitized samples of the analog signals. The recreated digitized samples are then transferred to the digital-to-analog converters **70** and **75** to reproduce the analog signals **80** and **85**. Alternately, the digitized samples of the analog data can be transferred **95** to external circuitry for further processing.

The wireless transmission as shown in Fig. 1 is subject to corruption of the digitized samples during transmission. For instance, noise from an electronically ballasted halogen lamp would completely breakdown recovery of the transmission of the modulated carrier signal.

[0009] A solution to the corruption of the modulated carrier signal is to provide a level of redundancy for the digitized samples. U.S. Patent 5,832,024 (Schotz, et al.) shows the use of forward error correction codes using the well known Reed-Solomon Coding. This will eliminate errors of relatively short duration, but will not prevent disruption of the output analog signals **80** and **85** due to long term digitized sample corruption.

[0010] To eliminate longer corruption of the digitized samples Schotz, et al. employs a convolutional interleaving circuit to separate the digitized samples of the analog signal that would normally be transmitted together. This allows the greater probability that a longer term error can be to be corrected.

[0011] If the error correction coding and the convolutional interleaving of the digitized samples cannot insure corrected digitized samples of the analog signals, the analog signal will be reproduced (especially in audio signals) as annoying cracks and pops in a speaker. To eliminate the cracks and pops, Schotz, et al. suggests that the digitized samples can be brought to a null level or muted. However, if the muting is activated suddenly, it is distracting and is annoying to the listener in an audio application.

[0012] U.S. Patent 5,602,669 (Chaki) provides a digital transmitter-receiver that transmits a digital audio signal within a specified frequency band, and receives the specified frequency band. Chaki modulates a fundamental frequency using Quadrature Phase Shift Keying (QPSK). The QPSK modulated signal is transferred to an infrared emitter for transmission.

[0013] U. S. Patent 5,420,640 (Munich, et al.) describes a memory efficient method and apparatus for

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synchronization detection within a digital data stream over a communication path. The digital data is arranged as a sequence of frames, each frame including a plurality of lines of data. The beginning of each frame is indicated by a frame synchronization word. The beginning of each line is indicated by a horizontal synchronization byte. An encoder, before transmission, interleaves the data. The decoder contains circuitry for locating the horizontal and frame synchronization data and contains circuitry for deinterleaving the digital data. Both the synchronization locating circuitry and the deinterleaving circuitry require access to a memory, but not at the same time. Therefore, a single memory is used with the synchronization recovery circuitry and deinterleaving circuitry alternately addressing the memory. The digital data stream of Munich, et al. pertains to video, audio and other related services of subscriber based television systems.

[0014] U. S. Patent 5,745,582 (Shimpuku, et al.) teaches an audio signal transmitting and receiving system which can perform optical transmission of a digital format audio signal with small deterioration of the sound quality over the transmission path. The audio signal transmitting system has circuits to add an error correction signal to a digital audio signal. The digital audio signal with the error correction signal is then encoded and interleaved to generate an audio transmission signal. Repeating a digital control signal, which is to be used for the reproduction of the digital audio transmission signal, generates a continuous signal. A multiplexer combines the audio transmission signal and the continuous signal to generate a multiplexed signal. A modulation circuit then modulates a carrier signal similar to that described above with the multiplexed signal by a predetermined digital modulation method to generate a modulated signal within a predetermined frequency band. The modulated signal is transmitted by an optical transmission signal. A differential type QPSK modulation method creates the modulated signal preferably. Shimpuku, et al. further describes an audio signal receiving circuit for reproducing a digital audio signal and a digital control signal from the optical transmission signal. The audio signal receiving circuit has an optical receiver to convert the optical transmission signal to an electric reception signal. The modulated signal is then reproduced to permit demodulation of the reception signal by a digital demodulation method corresponding to the predetermined digital modulation method to reproduce the multiplexed signal. A separating circuit separates the audio transmission signal and the continuous signal from the multiplexed signal. The audio transmission signal is then deinterleaved and error correction based on the added error correction signal is performed to reproduce the digital audio signal

[0015] The digital source **10** is often a compact audio disk (CD), a Moving Picture Expert Group Audio Layer 3 (MP3) data file, a digital audio tape (DAT), a Digital Video Disk (DVD), or a digital satellite receiver (DSR). The format of the digitized samples from a digital source **10** commonly complies with the Sony/Phillips Digital Interface (S/PDIF). International standards that have developed from this standard are the Audio Engineering Society (AES) AES-3, the European Broadcasters Union (EBU) Tech. 3250-E, the Japanese Electronic Industries Alliance (EIAJ) CP-340, and the International Electronic Commission (IEC) IEC60958. While these standards are similar, they are not necessarily identical. However, the data format as shown in Fig. 3 is common for each standard. The allowed sampling frequencies or sampling rates of the audio analog signals to create the digitized samples are the 44.1 kHz for CD and MP3, 48 kHz for DAT and DVD, and 32 kHz for DSR.

[0016] Refer now to Fig. 2 to discuss the data format of the S/PDIF family of international standards. A frame consists of two subframes **200** and **205** containing the samples from an **A** channel or left channel and a **B** channel or right channel. Each subframe has a synchronizing preamble **A SYNC** and **B SYNC**. The synchronizing preamble identifies the contents of the subframe as being either a word containing a sample of the **A** channel at the beginning of a block **215**, the **A** channel within a block, or the **B** channel.

[0017] The digitized audio samples for channel **A** and channel **B** can contain up to 24 bits representing the amplitude of a sample of the analog audio signal. Normally for CD applications, only the 16 bits **A8** through **A23** are employed to convey the digitized audio samples. The bits **AV** and **BV** are the validity indicating if the digitized audio sample is in error. The bits **AU** and **BU** are user defined bits which when collected from many samples indicate running time, track number, etc. The bits **AC** and **BC** are channel status bits defining such information as emphasis, sampling rate, and copy permit. The bits **AP** and **BP** are parity bits for error detection to verify reception of the data samples.

[0018] The digitized audio samples are encoded using a commonly known biphase mark or Manchester coding technique. The samples are transferred serially at a rate of 2.8 MHz for a sampling rate of 44.1 kHz, 2 MHz for a sampling rate of 32 kHz, and 3.1 MHz for a sampling rate of 48 kHz.

[0019] A block of the digitized audio samples consists of 192 frames concentrated together.

[0020] U. S. Patent 5,889,820 (Adams) describes a circuit for SPDIF-AES/EBU digital audio data recovery. The circuit decodes an input signal. The circuit includes a measurement sub-circuit having an input to receive a timing clock signal that is asynchronous with clocking of the input signal. The asynchronous timing clock signal measures the duration of a plurality of pulses received on the input signal in relation to frequency of the timing clock signal. A decode circuit decodes the input signal into digital data. The invention of Adams permits use of all digital components for decoding digital audio data encoding using biphase-mark encoded data according to the S/PDIF or AES/EBU standards.

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Summary of the Invention

[0021] An object of this invention is to provide a system for transmitting, digitized samples of analog signals.

[0022] Further, another object of this invention is to transmit the digitized samples of the analog signals such that the probability of interference with the transmission and thus corruption of the digitized samples of the analog signals is minimized by transmitting the digitized samples as bursts shorter period than the time of the analog signals represented by the transmitted digitized samples.

[0023] Even still further, another object of this invention is to convert the digitized samples of the analog signals from an external source that has various sampling rates to digitized samples of the analog signals having a fixed rate.

[0024] To accomplish these and other objects, a digital communication system for transmitting digitized samples of analog signals is comprised of a transmission subsystem for transmitting the digitized samples a communication medium to convey the transmitted digitized samples having various sampling rates, and a receiving system to receive and reproduce the transmitted digitized samples. The transmission subsystem receives the digitized samples having a variable sampling rate from an external signal source and then converts the digitized samples having a variable sampling rate to digitized samples with a fixed rate. The digitized samples have error correction codes generated to allow correction of any errors in the fixed digitized samples that may occur during transmission of the digitized samples. The digitized samples are formatted into groups of interleaved digitized samples with appended error correction codes. A preamble timing signal and a start signal is then appended to the group of interleaved digitized samples to form a transmit frame. A carrier signal is then modulated with the transmit frame and the modulated carrier signal is then transmitted to the communication medium.

[0025] A receiving subsystem is connected to the communication medium to receive and recover the modulated carrier signal. The modulated carrier signal is then demodulated to recover the transmit frame and to extract the group of interleaved digitized samples and the error correction codes from the transmit frame. The group of interleaved digitized samples with the error correction codes are checked, and the group of interleaved digitized samples with errors are corrected. If any of the group of interleaved digitized samples are uncorrectable, an estimated sample value of those uncorrectable digitized samples is created by interpolating from adjacent interleaved digitized samples to conceal any effect of the uncorrectable digitized samples. Any of the digitized samples that are not concealable or unrecoverable or are invalid are soft muted. The digitized samples are then transferred to a digital-to-analog converter for restoration of the analog signal.

[0026] The transmission subsystem has a sampled data receiver to receive the digitized samples of the analog signals from the external source of the digitized samples of the analog signals. A variable sampling rate converter is connected to the sampled data receiver to convert the digitized samples of the analog signals that are sampled at the one rate of the various sampling rates to digitized samples of the analog signals sampled at a fixed rate. A plurality of the digitized samples of the analog signals is retained in a data buffer. A data buffer controller is connected to the variable sampling rate converter and the data buffer to control the placement and removal of the plurality of digitized samples of the analog signals within the data buffer. An error correction code generator is connected to the data buffer controller to receive multiple digitized samples of the analog signals through the data buffer controller from the data buffer. The error correction code generator generates an error correction word that appended to the multiple digitized samples of the analog signals, and then returns the multiple digitized samples of the analog signals with the appended error correction word through the data buffer controller to the data buffer. The error correction code generator creates a Reed-Solomon error correction code with a the error correction code word that has a data block size of 238 bytes and one control byte and 16 parity bytes. A frame formatter is connected to the data buffer controller to receive an interleaved group of the multiple digitized samples of the analog signals with the appended error correction codes and appends a preamble timing signal and a start signal before the interleaved group of the multiple digitized samples of the analog signals to form a transmit frame. A pulse position modulator is connected to the frame formatter to receive the transmit frame and modulate a carrier signal according to a pulse position modulation with the transmit frame. A burst transmitter is connected between the pulse position modulator and the communication medium to convey a modulated carrier signal to the communication medium. The modulated carrier signal is transmitted as a burst within a short time period to minimize probability of interference on the communication medium.

[0027] The communication medium may be either wireless or wired and the modulated carrier signal may be transmitted as light or as Radio Frequency energy. The wired communication media may be either fiberoptic cable, coaxial cable, or two wire twisted pair cable.

[0028] The receiving subsystem has a receiver connected to the communication medium to sense and amplify the modulated carrier signal and to recover the transmit frame. A demodulator is connected to the receiver to demodulate the modulated carrier signal and extract the groups of interleaved multiple digitized samples of the analog signals with the appended error correction code. The demodulator is connected to a received data buffer to retain the group of interleaved multiple digitized samples of the analog signals with the ap-

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pended error correction code. A received data buffer controller is connected to the demodulator and the received data buffer to control transfer of the groups of interleaved multiple digitized samples of the analog signals with the appended error correction code from the demodulator to the received data buffer. An error check and correction circuit is connected to the received data buffer controller to receive one group of the multiple digitized samples of the analog signals with the appended error correction code. The error check and correction circuit checks and corrects any errors that occur in transmission in the one group of the multiple digitized samples of the analog signals and then replaces the corrected group of the multiple digitized samples of the analog signals to the received data buffer. Any non-correctable digitized samples of the multiple digitized samples of the analog signals are identified for concealing. A block recovery circuit is connected to the received data buffer controller to receive and interpolate the non-correctable digitized samples of the analog signals to conceal an effect of the non-correctable digitized samples analog signals. A soft muting circuit is connected to the received data buffer controller to access those groups of the multiple digitized samples that were not correctly received and declared invalid and those of the multiple digitized samples of the analog signals with non-recoverable and non-concealable errors. The soft muting circuit, further, accesses those of the multiple digitized samples of the analog signals that are correct and adjacent to those of the multiple digitized samples of the analog signals that are invalid or with non-correctable and non-concealable errors. The soft muting circuit then applies a smoothing function to the multiple digitized samples of the analog signals to bring those of the multiple digitized samples of the analog signals that are invalid or with the non-correctable and non-concealable error to a null value.

[0029] The receiving subsystem has a jitter tracking circuit to compare the block transmission timing signal with a clock signal of the receiver subsystem to determine overrun and underrun of the contents of the group of interleaved multiple digitized samples of the analog signals with the appended error correction code. The block transmission signal indicates a boundary of groups of interleaved multiple digitized samples of the analog signals with the appended error correction codes. The number of words within each group of interleaved multiple digitized samples of the analog signals with the appended error correction codes must contains the correct number of digitized samples of analog signals. An interpolation and decimation circuit is connected to the jitter tracking circuit and the received data buffer controller to generate or eliminate digitized samples of the analog signals if the jitter tracking circuit indicates overrun or underrun of the contents of the group of interleaved multiple digitized samples analog signals.

[0030] An interface circuit is connected to the received data buffer controller to translate the digitized samples of the analog signals to a format acceptable by subsequent circuitry.

[0031] The digitized samples having variable sampling rates are sampled at sampling rates of 32 kHz, 44.1 kHz, and 48 kHz.

[0032] The transmission subsystem may have at least one analog-to-digital converter connected between the external source and the data buffer controller to receive the analog signals and to generate the digitized samples analog signals. The fixed sampling rate is approximately 48 kHz or alternately 44.1kHz.

[0033] The interleaved group of the multiple digitized samples is comprised of a plurality of least significant bytes of the even designated digitized samples of the group of multiple digitized samples, a plurality of most significant of the even designated digitized samples, a first command byte, a first plurality of error correction parity bytes, a plurality of least significant bytes of the odd designated digitized samples, a plurality of most significant bytes of the odd designated digitized samples, a second command byte, and a second plurality of error correction parity bytes.

[0034] The carrier signal is modulated with a pulse positioned modulation by positioning of a pulse of the carrier signal within a period of the carrier signal according to a binary value of a plurality of bits within the transmit frame. The plurality of bits of this invention is two bits.

[0035] The digitized samples are encoded in a non-return to zero (NRZ) format.

[0036] The burst transmitter includes an infrared light emitting diode and a diode switching circuit connected between the pulse position modulator and the infrared light emitting diode to activate and deactivate the infrared light emitting diode with the modulated carrier signal.

[0037] The receiver comprises a light sensitive diode that receives light radiated from the infrared light emitting diode.

[0038] The demodulator demodulates the modulated carrier signal by oversampling the modulated carrier signal to determine an evaluation point of the modulated carrier signal to recover the transmit frame.

Description of the Drawings

[0039] Fig. 1 is a block diagram of a transmitting and receiving system for digitized samples of analog signals of the prior art.

[0040] Fig. 2 is a diagram of the format of the S/PDIF interface.

[0041] Fig. 3 is a block diagram of a transmitting and receiving system for digitized samples of analog signals of this invention.

[0042] Fig. 4 is a block diagram of the transmitting system for digitized samples of analog signals of this invention.

[0043] Fig. 5 is a block diagram of the receiving system for digitized samples of analog signals of this invention.

[0044] Fig. 6 is a diagram of the format of a block of

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frames of the digitized samples of analog signals to be transmitted and received by the transmitting and receiving system of this invention.

[0045] Fig. 7 is a diagram illustrating the conversion of the non-return to zero coding to the pulse position modulation of this invention.

[0046] Fig. 8 is a diagram of the buffer addressing of the transmitter and receiver buffer of this invention.

[0047] Fig. 9 is a timing diagram of the operation of the transmitter buffer of this invention.

[0048] Fig. 10 is a timing diagram illustrating the oversampling recovery of the received digitized samples of analog signals of this invention.

[0049] Fig. 11 is a flow diagram illustrating the method of transmitting digitized samples of analog signals of this invention.

[0050] Fig. 12 is a flow diagram of the method of receiving, recovering, concealing, and reproducing digitized samples of analog signals of this invention.

Detailed Description of the Invention

[0051] Refer now to Fig 3 for a discussion of the structure of the transmitting and receiving system of this invention. A source **305** of an analog signal generates analog signals to the left channel **L** and the right channel **R**. The analog source 305 may be microphones, a radio receiver/tuner, or analog recording media. The analog signals from the left channel **L** and the right channel **R** respectively are the inputs to the analog-to-digital converters **315** and **320**. The analog-to-digital converters **315** and **320** sample the analog signals at a fixed rate. The fixed rate in the preferred embodiment is 48 kHz and in an alternate embodiment the fixed rate is 44.1kHz.

[0052] The digital source **310** provides digitized samples of the analog signal that have been previously sampled and recorded or stored on a media such as a compact disk, digital audio tape, or other digital storage medium. The sampling rates of the digitized sample may differ from the fixed rate of the preferred embodiment. In the case of digital source **310**, complying with the industry standards that implement the S/PDIF format, the sampling rates will be, as described above, 44.1 kHz, 48 kHz, and 32 kHz.

[0053] The digitized samples of analog signals are transferred to the transmitter **395**. The transmitter **395** converts those digitized samples generated from differing sampling rates to digitized samples generated from the fixed rate.

[0054] The digitized samples are reorganized to interleave the digitized samples such that those digitized samples that are adjacent are separated such that they will be transmitted at different times. This separation minimizes the probability that any interference with the transmission prevents correction and reconstruction of the digitized samples.

[0055] Refer now to Fig. 8 for a discussion of the data structure of the digitized samples of this invention. In this invention, the data samples consist of two bytes (16 bits) of the possible data samples. The remaining byte (8 bits) of the S/PDIF format is discarded. The first group **810** of 238 bytes consists of the alternating least significant bytes of the left channel **L** (A channel) and the least significant bytes of the right channel **R** (B channel) of the even designated samples. The second group **815** of 238 bytes consists of the alternating most significant bytes of the left channel **L** and the most significant bytes of the right channel **R** of the even designated samples. The third group **820** of 238 bits consists of the alternating least significant bytes of the left channel **L** and the least significant bytes of the right channel **R** of the odd designated samples. The fourth group **825** consists of the alternating most significant bytes of the left channel **L** and the most significant bytes of the right channel **R** of the odd designated samples. As can be seen, the bytes of one digitized sample are separated by 238 bytes during a transmission. Further, two adjacent of the digitized samples are separated by at least 238 bytes. While this structure is adequate for the preferred embodiment, other interleaving patterns are possible and still are in keeping with the intent of this invention.

[0056] Returning to Fig. 3, the transmitter **395** generates error correction codes (ECC) **825** and **845** to be appended to the group of most significant bytes **810** and the group of most significant bytes **820** of the odd designated samples **805**. The ECC codes **835** and **845** are forward error correction codes employing the Reed-Solomon method of error correction encoding. The ECC codes of this invention **835** and **845** have a symbol size of 8 bits or one byte and will have a Galois field GF(2^m) or GF(2^8). The block length (n) of the ECC codes **835** and **845** of this invention is 255 bytes (2^8). The number of correctable errors is chosen to be 8 and therefore the message size is 239 bytes, which is 238 of the most significant bytes 815 and 825 of the even samples **800** and the odd samples **805** and one command and control byte **830** and **840**.

[0057] The preferred embodiment allows correction of only the most significant bytes **815** and **820** of the digitized samples. It would be apparent to one skilled in the art that a different Galois field GF (2^m) could be chosen and that a different number of correctable errors could further be chosen and still be in keeping with the intent of this invention.

[0058] The interleaved digitized samples with the appended ECC code of Fig. 8 are formed for serial transmission as shown in Fig. 6. Each frame is divided into two subframes, an even subframe **610** and an odd subframe **615**. The even subframe **610** is structured as described in Fig. 8 as the group of even designated digitized samples **800** and the odd subframe **615** is structure as described in Fig. 8 as the odd designated digitized samples **805**. The ECC code **835** is appended to the even designated digitized samples to complete the subframe **610** and the ECC code **845** is appended to

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the odd designated digitized samples **805**.

[0059] A timing preamble **620** and **630** and a start flag signal **625** and **635** are appended respectively before the even subframe **610** and the odd subframe **615**. The timing preambles **620** and **630** each consist of up to **16** bytes of a unique pattern which identifies the beginning of each subframe **610** and **620**. The timing preamble **620** and **630** pattern is a unique pattern that violates the normal pulse position modulation hereinafter described. The unique patternof the timing preamble **620** and **630** is sufficiently long to allow the receiver to identify the timing preamble **620** and **630** and "lock" onto the timing preamble 620 and 630. The start flag signals **625** and **635** each consist of two bytes of a unique pattern indicating the beginning of the even subframes **610** and **615**.

The formatted groups of the digitized samples of the analog signals are then used to modulate a carrier signal within the transmitter. In the preferred embodiment, the modulation is a pulse position modulation (PPM) as shown in Fig. 7. The plot **725** shows the possible combinations of voltage levels that comprise a basic raw non-return to zero encoded data of the digitized samples. Each bit time Tbpm **700, 705, 710,** and **715** is divided into four phases ϕ_1, ϕ_2, ϕ_3, ϕ_4. The plot **720** shows the resulting pulse position modulation codes of this invention. The NRZ code (00) illustrated in the bit time **700** places a logic level 1 in the phase slot ϕ_1; NRZ code (01) illustrated in the bit time **705** places a logic level 1 in the phase slot ϕ_2, the NRZ code (10) illustrated in the bit time **710** places a logic level 1 in the phase slot ϕ_3; and the NRZ code (11) illustrated in the bit time **715** places a logic level in the phase slot ϕ_4.

[0060] The modulated carrier signal is then burst transmitted to a communication medium **345**. The modulated carrier signal is transmitted as light or a radio frequency (RF) radiated into the atmosphere in wireless communication or is transmitted also as light or a radio frequency transferred to a transmission cable in wired communication. If the modulated carrier signal is transmitted as light, it is transmitted on a fiberoptic cable. If the modulated carrier signal is transmitted as RF, it is transmitted on a cable such as coaxial cable or simple twisted pair two wire cable.

[0061] The **476** digitized samples that compose a frame of the digitized samples represent 119 samples of a stereo music presentation or 2.479 milliseconds of the presentation. The transmission frequency of the modulated carrier signal in the preferred embodiment is at 2.0 MHz. Thus the transmission of **476** digitized samples coupled with the timing preamble, the start flag signal, the ECC code word, and the command and control byte (493) byte) requires 1.972 milliseconds to complete. The transmitter will not be transmitting or will be idle for 20.5 % of the time. This will minimize the probability that any burst of noise will interfere with the transmission. If the transmission frequency is increased or the period of a burst of the digitized samples decreased, the time of transmission decreases and the idle time increases, further improving the probability of having no interference.

[0062] The modulated carrier signal that is transmitted on the communication medium **345** is conveyed to the receiver **300**. The receiver will recover the modulated carrier signal by converting the light or RF signal to electrical signals. The modulated carrier signal is then demodulated to recover the transmitted frame of the groups of digitized samples of the analog signals.

[0063] The receiver of this invention does not extract a transmitted clock from the modulated carrier signal to synchronize the receiver **300** with the transmitter **395**. The receiver **300** has a clock that is independent of the transmitter clock. The receiver dock is specified to be nominally identical with the transmitter clock, but because of tolerancing and phasing differences between the two clocks, the received modulated carrier signal is not always received correctly and causes errors.

[0064] To minimize the errors, the receiver recovers the modulated carrier signal to extract the transmit frame of the digitized samples of the analog signal by oversampling the modulated carrier signal. Oversampling is sensing the logic level at a rate that is a relatively large multiple of the frequency of the carrier signal. When a relatively large number of oversampling results indicate a series of samples having one logic level after an opposite logic level in the received modulated carrier signal, a starting evaluation point is arbitrarily assumed and each successive evaluation occurs at the frequency of the modulated carrier signal after the arbitrarily assumed evaluation point. The evaluated data is compared with the expected timing preamble. If a mismatch occurs between the evaluated data and the expected timing preamble, the starting evaluation point is adjusted and the data reevaluated. This process is repeated until the timing preamble is recovered from the received modulated carrier signal.

If the total timing preamble is then detected correctly, the timing of the recovering is determined to be locked. Once the receiving timing is locked to the received modulated carrier signal, the start flag signal is sought from the received modulated carrier signal. If the start flag signal is not found, the frame is declared invalid and brought to a null level. If the start flag signal is recovered from the received modulated carrier signal, the transmit frame is then recovered from the received modulated carrier signal.

[0065] Refer to Fig. 11 for a more complete overview of the selection of the evaluation point to determine the locking of the timing of the receiver **300** with the received modulated carrier signal **750**. The recovery clock **755** has a frequency or rate of sampling that is, for the preferred embodiment, a factor of six times the frequency of the carrier signal **760**. The timing clock **755** sets the sampling time of the modulated carrier signal **750**. The recovered data **765** is the logic level of the modulated carrier signal **750** at the sampling time of the timing clock

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755. As described above, the first logic level after an opposite logic level (logic level 0 in this case) starts the count to establish the arbitrary evaluation point **750**. The successive evaluation points will be at the rate of the carrier signal **760** or in this case every sixth occurrence of the timing clock **755**.

[0066] It is apparent to those skilled in the art that the frequency of the timing clock **755** can be modified to a multiple factor of the frequency of the carrier signal and still be in keeping with the intent of this invention.

[0067] The recovered transmit frame is then demodulated in the receiver **300** to extract the raw non-return encoded date of the digitized samples from the pulse position modulated code of the transmit frame.

[0068] The pulse position modulated code of the transmit frame is reconverted as explained in Fig. 7 to the raw non-return encoded data of the digitized samples to recover the transmit frame.

[0069] The interleaved digitized samples of the analog signals and the ECC codes are then checked, and any of the interleaved digitized samples that have been corrupted during transmission are corrected.

[0070] The ECC check and correction employs Reed-Solomon Error Correction methods that are well known in the art. In the preferred embodiment, 8 symbols or bytes are correctable in each of the group of 238 most significant bytes **810** and **820** of Fig. 8 plus one command and control byte. The method to accomplish the ECC checking and correcting begins with calculating the syndromes indicating any errors in the groups of most significant bytes **810** and **820**. For those groups of most significant bytes **820** and **820** with error, Berlekamp's iterative algorithm is invoked to find the error locator polynomial. The Chien search method is then used to locate the roots of the error locator polynomial and the Forney algorithm is used to compute the error magnitudes to reconstruct the correct data. If there are more errors than are correctable by the Reed-Solomon Error Correction Method, in the case of the preferred embodiment 8 bytes, those non-correctable groups of the most significant bytes **810** and **820** are identified for further processing to conceal those errors.

[0071] The digitized samples of analog signals that are identified as having uncorrectable errors and their adjacent correct digitized samples are then combined to interpolate an estimate of the magnitude of the sample of the analog signal. It is well known that generally adjacent samples do not vary greatly in magnitude and that interpolating between adjacent samples will conceal any non-recoverable errors. In audio applications, the perception of the sound will not be affected, even though there may be some high frequency distortion.

[0072] If any frames of the digitized samples of the analog signals have uncorrectable and non-concealable errors, or if frames of the received modulated carrier signal are declared invalid, those frames are soft muted to prevent any "clicks" from unrecoverable errors. The soft muting employs a Hanning window to weight the frames of the digitized samples of analog signals adjacent to those frames that have uncorrectable errors and non-concealable errors or that are invalid to weight the amplitude of the adjacent frames to slowly decrease the amplitude of the analog signal to a null value.

[0073] Further, muting is achieved by programming a delay to null subsequent digitized samples of the analog signals. The extended nulling of the subsequent digitized samples of the analog signals avoid repetitive interference from such sources as infrared remote controls for television, video tape recorders, and audio systems. The infrared remote controls send a burst of data that can last from 0.2 - 1.0 seconds.

[0074] Each frame of the digitized samples of the analog signal must maintain a constant number of digitized samples. Even with the method of oversampling as described above, the differences between the clock of the transmitter **395** and the receiver **300** causes there to be an "overrun" (more digitized samples received in a frame) or "underrun" (fewer digitized samples received in a frame) of the digitized samples received in a transmit frame. An overrun causes more digitized samples to be in a transmit frame while an underrun causes fewer digitized samples to be received in a transmit frame. The receiver tracks the jitter or misalignment between the frequency of the carrier signal and the frequency of the transmit frame to detect any of the frames of the digitized samples having either an overrun or underrun. When an overrun or underrun occurs, the receiver **300** interpolates or decimates the frame of digitized samples to insure the constant number of digitized samples in a frame.

[0075] The frames of the digitized samples of the analog signals are transferred **390** to an external circuitry for further processing or are formatted to the appropriate order to be transferred to the digital-to-analog converters **370** and **375**. Those digitized samples of the analog signal **370** of the left channel **L** are transferred to the digital-to-analog converter **370** that in turn reproduces the analog signal **380** for the left channel **L**. Those digitized samples of the right channel **R** are transferred to the digital-to-analog converter **375** that in turn reproduces the analog signal **385** for the right channel **R**.

[0076] Refer now to Fig. 4 for a discussion of the transmitter system **395** of this invention. The analog source **305**, as described above, provides the left channel **L** and right channel **R** analog signals. The analog-to-digital converters **315** and **320** respectively sample the left channel **L** and right channel **R** analog signals and generate the digitized sample of the analog signals. Additionally, as described above, the digital source **310** provides digitized samples of the analog signal.

[0077] The digitized samples of the analog signals from the digital source **310** are transferred to the digital receiver **400**. The digital receiver **400** acquires the digitized samples at the sampling rate at which they are retained within the digital source (e.g. 44.1 kHz for CD and MP3, 48 kHz for DAT and DVD, and 32 kHz for

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DSR). The digitized samples of the analog signals are transferred to the variable sampling rate (VSR) converter **405**. The VSR converter **405** modifies the digitized samples of the analog signals to digitized samples of the analog signals sampled at a fixed rate. In the preferred embodiment, the fixed rate is 48 kHz. Thus, the digitized samples for CD are modified from a sampling rate of 44.1 kHz to that of 48 kHz. An alternate embodiment employs a fixed rate of 44.1kHz.

[0078] A method to accomplish this is to send the digitized samples of the analog signals to a digital-to-analog converter to reproduce the original analog signal. The reproduced analog signal is then an input to an analog-to-digital converter that samples the reproduced analog signal at the fixed rate or 48 kHz for the preferred embodiment. In the alternate embodiment, the fixed rate may be another frequency such as 44.1kHz.

[0079] The digitized samples of the analog signal are then transferred from the analog-to-digital converters **315** and **320** or the variable sampling rate converter through the transmit data buffer controller **410** to the transmit data buffer **415**.

[0080] The transmit data buffer controller **410** controls the access to and the retrieving from the transmit data buffer **415** of the digitized samples of the analog signals. The transmit data buffer **415** is a random access memory (RAM). In the preferred embodiment, the transmit data buffer **415** is a static RAM. However, other memory structures such as dynamic RAM (DRAM) or synchronous DRAM can be used for the transmit data buffer **415** and still be in keeping with the intent of this invention.

[0081] Refer now to Fig. 8 to discuss the structure of the transmit data buffer **415** and the assignments of the component bytes of the digitized samples of the analog signals. The transmit data buffer **415** is segmented into groups of buffer blocks. In the preferred embodiment, there are three buffer blocks, buffer 1 **850**, buffer 2 **870**, and buffer 3 **890**. The digitized samples of the analog signals placed in each buffer, as described above, with 238 least significant bytes of the even designated digitized samples **810** of the analog signals occupy the first address segment **852** of the first buffer block **850**. The 238 most significant bytes of the even designated digitized samples **815**, the command and control byte **830**, and the ECC code **840** occupy the second address segment **854** of the first buffer block **850**. The 238 least significant bytes of the odd designated digitized samples **820** occupy the third address segment **856** of the first buffer block **850**. The most significant bytes of the odd designated digitized samples **825** occupy the fourth address segment **858** of the first buffer block **850**. This structure enables the interleaving of the digitized samples to allow the correction and concealment of errors during transmission.

[0082] Additional frames of the digitized samples are likewise retained in the buffer block 2 **870** and buffer block 3 **890** in the same organization as described for buffer block 1 **850**. This allows operations (receiving from the external sources **305** and **310**, ECC encoding, and transmitting) to be accomplished in parallel.

[0083] Each of the groups of most significant bytes **815** and **820** and the command and control bytes **830** and **840** are read from the transmit data buffer **415** transferred through the transmit data buffer controller to the Reed-Solomon Error Correction Encoder **420**. The ECC encoder **415** generates the symbol code work with a Galois Field GF (2^8). Each symbol is a byte, as above described, and the code allows 8 bytes to be corrected.

[0084] The ECC codes **840** and **845** are each appended respectively to the most significant bytes **815** and **825** of the even and the odd designated digitized samples **800** and **805** in the second address segment **854** and the fourth address segment **858**.

[0085] The interleaved digitized samples are retrieved from each buffer block **850, 870**, and **890** of the transmit data buffer **415** individually transferred to through the transmit data buffer controller **410** to the frame formatter **425**. The frame formatter appends the timing preambles **620** and **630** and the start flag signals **625** and **635** of Fig. 6 to assemble the subframes of each transmit frame **605** of the interleaved group of digitized samples of the analog signals.

[0086] Fig. 9 shows the access and retrieval pattern of the transmit data buffer **415** of Fig. 4 over time. The first group of digitized samples from the analog-to-digital converter **305** or the digital source **310** are stored in the first buffer block **850** at the first time segment **900**. The second group of digitized samples from the analog-to-digital converter **305** or the digital source **310** are stored in the second buffer block **870** during the second time segment **905**. During the second time segment **905**, the ECC encoder **420** accesses the first buffer block **850**, generates the ECC codes **840** and **845**, and stores the ECC codes **840** and **845** in the first buffer block **850**. In the third time segment **910**, a third group of digitized samples is stored in the third buffer block **890**, the ECC codes are generated and stored in the second buffer block **870**, and the first group of digitized samples with the appended ECC codes are transferred to the frame formatter **425** and on for transmission. During the fourth time segment **915**, a fourth group of digitized samples are placed in the first buffer block **850**, the group of digitized samples in the second buffer block **870** are sent on for transmission, and the ECC codes for the group of digitized samples in the third buffer block **890** are generated and stored back to the third buffer block **890**.

[0087] This pattern or storing and accessing the transmit data buffer **415** continues for all following segments **920, 925** and forces simultaneous access and storing to the buffer blocks **850, 870** and **890**. The transmit data buffer controller **410** must appropriately arbitrate the accesses and storing to ensure there are no conflicts.

[0088] From the frame formatter **425**, the formatted transmit frame is transferred to the pulse position modulator **430**. The pulse position modulator **430** encodes each pair of bits of the transmit frame as described

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above in Fig. 7. In the preferred embodiment, the frequency of the carrier signal modulated by the transmit frame is at least 2.0 MHz.

[0089] As described above, the period of time of the audio analog signal represented by the transmit frame is 2.479 milliseconds and with the carrier signal being 2 MHz, each transmit frame has a duration of 1.972 milliseconds. As described above, the burst transmitter **435** is activated to transmit the modulated carrier signal. In the preferred embodiment of this invention, the burst transmitter **435** is a switching circuit that activates and deactivates a light emitting diode **445** to send light to the atmosphere which acts as the communication medium **345**.

[0090] As stated above, the communication medium **345** may be wired or wireless. The wired communication medium may be fiber optic cable, coaxial cable, or a two wire twisted pair cable. The burst transmitter **435** may transmit either light or RF signals into the wired or wireless communication medium **345**.

[0091] The clock circuit **440** provides the necessary timing signals to the analog-to-digital converters **315** and **320** to ensure the fixed rate of 48 kHz (or the alternate fixed rate of 44.1kHz). The clock circuit **440** provides the necessary timing signals to convert those digitized samples of the analog signal taken at rates other than the fixed rate to be converted to the digitized samples of the analog signal sampled at the fixed rate.

[0092] The clock circuit **440** generates the 2 MHz carrier signal and transfers it to the pulse position modulator **340** to create the modulated carrier signal that is the input to the burst transmitter **435**.

[0093] The clock circuit **440** is fixed frequency timing generation circuit that eliminates the need for a phase locked loop oscillator at either the transmitter **395** or the receiver **300** of Fig. 4.

[0094] Refer now to Fig. 5 for a description of the receiving system **300** of this invention. The modulated carrier signal is transferred onto the communication medium **345** to a receiver **505** that recovers the modulated carrier signal. In the preferred embodiment, the light transferred through the atmosphere impacts upon a light sensitive diode **500**. Changes in the light sensitive diode **500** are sensed and amplified in the receiver **505** to recover the modulated carrier signal. The receiver **505** locks on to the modulated carrier signal and completes the recovery by the oversampling of the modulated carrier signal to capture the groups of the digitized samples of the analog signals as above-described in Fig. 11. The demodulator **510** converts the pulse position modulated digitized samples to the raw non-return to zero encoded data of the digitized samples as above-described in Fig. 7.

[0095] The demodulated digitized samples now have the frame format of the interleaved digitized samples of Fig. 8 and are transferred from the demodulator **510** through the receive data buffer controller **515** to the receive data buffer **520**.

[0096] The receive data buffer **520** is structured as the transmit data buffer **415** of Fig. 4. The receive data buffer **520** is a random access memory, which, in the preferred embodiment of this invention, is a static RAM. However, other memory structures such as DRAM or synchronous DRAM can be used as the receive data buffer **520** and still be in keeping with the intent of this invention.

[0097] The structure of the receive data buffer **520** is identical to that of the transmit data buffer **415** as described in Fig. 8. The receive data buffer **520** has the groups of buffer blocks **850, 870**, and **890**. Each of the buffer blocks **850, 870,** or **890** has address segments **852, 854, 856**, and **858** to retain the frame of the interleaved digitized samples of the analog signal.

The most significant bytes of the even designated samples of the analog signal **815** and the most significant bytes of the odd designated samples of the analog signal **825** with the respective appended ECC codes **840** and **845** are retrieved by the receive data buffer controller **515** from the receive data buffer **520** and transferred to the Reed-Solomon EEC decoder **525**. The Reed-Solomon EEC decoder **525** checks and corrects the most significant bytes of the even and odd designated digitized samples **815** and **825** using the Reed-Solomon ECC method as described above. The corrected most significant bytes of the even and odd designated digitized samples **815** and **825** are stored through the receive data buffer controller **515** to the receive data buffer **520**. Those of the even and odd most significant bytes of the digitized samples having uncorrectable errors (more than 8 bytes in error as described above) are identified for further processing to conceal the effect of the errors on the reproduced analog signal.

[0098] Those of the digitized samples identified as having uncorrectable errors are retrieved with their adjacent correct digitized samples of the analog signals from the receive data buffer **520** and transferred through the receive data buffer controller **515** to the block recovery circuit **530**. The block recovery circuit **530** interpolates an estimate of the uncorrectable digitized sample from the adjacent digitized samples of the analog signal to conceal the uncorrectable error in the digitized sample. The preferred embodiment employees a linear interpolation between adjacent digitized samples to insure an ease of hardware implementation. It is in keeping with the invention to use more complex interpolation methods.

[0099] The interpolated estimate of a correct magnitude of the uncorrectable digitized sample is transferred from the block recovery circuit **530** through the receive data buffer controller **515** to be stored in the location of the uncorrectable digitized samples with the receive data buffer **520.**

[0100] Any of the digitized samples that have errors that are neither correctable nor concealable are identified for soft muting.

[0101] Those buffer blocks segments containing

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invalid frames or uncorrectable and non-concealable digitized samples are transferred to the soft muting circuit **535** with a number of adjacent frames of the digitized samples of the analog signal. The soft muting circuit **535** applies a Hanning window to the frames of the digitized samples to weight the frames adjacent to the invalid frames or frames with uncorrectable and non-concealable errors to eliminate any "clicking" noise as described above.

[0102] The jitter tracking circuit **545** compares a block transmission timing signal with sampling timing of the receiver **505** to identify any misalignment between the block transmission timing signal and the sampling timing of the receiver **505** that indicates the above-described overrun or underrun of the digitized samples with a frame. The block transmission timing indicates a boundary between groups of adjacent frames of the digitized samples of the analog signal. The synchronization circuit **540** provides any adjustment of the sampling timing within the receiver **505** if necessary. The synchronization circuit **505** further retrieves a frame of the digitized samples and interpolates or decimates any underrun or overrun of digitized samples with the frame to provide the correct number of digitized samples of the analog signal within the frame.

[0103] Each frame of the digitized samples of the analog signal is then transferred from the receive data buffer **520** through the receive data buffer controller **515** to the data out interface **550**. In the preferred embodiment, the data out interface is the I^2S interface that is known in the art for digital audio transmission. The data out interface **550** transfers the digitized samples of the analog signals to the digital-to-analog converters **370** and **375**. The digital-to-analog converters **370** and **375** reproduce the analog signal out **380** for the left channel **L** and the analog signal out **385** for the right channel **R**. The data out interface also provides the frame of digitized samples in a digital format **390** for further processing by external circuitry.

[0104] One implementation of the preferred embodiment of the receiving system **300** is as a portable remote system for headphones to reproduce audio signals. In this application, the receiving system must be disabled when not in use. The power management circuit **565** will sense when no frames of digitized samples of the analog signal are received for a relatively long period. The power management circuit **565** then removes the power supply voltage source from the receiving system. When this happens, the soft muting circuit **535** is engaged to prevent noise during the disabling of the power supply voltage source.

[0105] The receiving clocking circuit **560** provides the oversampling timing signal to the receiver **505** to recover the modulated carrier signal and to lock the receiving system **300** to ensure the recovery of the modulated carrier signal. As described prior, the receiving clock circuit **560** is nominally identical to the clock of the transmitting system **440** of Fig. 4. Any difference in the receiving clock circuit **560** and the transmitting clock circuit **440** are the tolerance and phase differences of the two circuits and is tracked and corrected in the jitter tracking circuit **545** and the synchronization circuit **540**.

[0106] The command and control byte **830** and **840** of Fig. 8 contains command and control data that is accessible in the receive buffer **520** of Fig. 5. The command and control circuit **555** has an external connection (not shown) to an interface to external circuitry. The command and control circuit accesses the command and control circuit bytes in the receive buffer, then decodes the command and control byte and transfers appropriate command and control signals to the external circuitry. In the preferred embodiment the external connection is a serial interface to provide volume control to a remote speaker or for text transmission to a panel display.

[0107] As is known by one skilled in the art, many of the functions of the transmitting system **395** of Fig. 4 and the receiving system **300** of Fig. 5 could be incorporated as methods executed within a computer system such as a microprocessor, a digital signal processor, or a microcontroller. Refer now to Figs. **11** and **12** for a review of the method for transmitting digitized samples of an analog signal, receiving the digitized samples of the analog signal and reproducing the analog signal.

[0108] The method of transmitting begins receiving **1100** of the digitized samples of the analog signal. The digitized samples have the format as described for the international standards that define the S/PDIF format. Those digitized samples that are collected at a sampling rate other than the fixed rate of this invention must be converted **1115** to digitized samples collected at the fixed rate. In the preferred embodiment the fixed rate is 48kHz and in the alternate embodiment the fixed rate is 44.1kHz.

[0109] Alternative to receiving **1100** the digitized samples from a digital source such as a CD, MP3, DAT, DVD, etc., is receiving **1110** the analog signal and performing an analog-to-digital conversion **1120** at the fixed rate to generate the digitized samples of the analog signal. The analog signal may have multiple channels. For instance, the analog signal of stereo audio has a left channel and a right channel. Each channel is separately converted **1120** from analog-to-digital to form a left channel set of digitized samples and a right channel set of digitized samples.

[0110] The digitized samples of the analog signal are stored **1125** in a buffer and organized into the interleaved structure of Fig. 8. As described in Fig. 8, the least significant bytes of the even designated digitized samples are placed in a first segment of the buffer. The least significant bytes of the left channel set of digitized samples are alternated with the right channel set of digitized samples within the first segment. The most significant bytes of the alternated left channel and right channel set of even designated digitized samples are placed in the second segment of the buffer. The least significant

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bytes of the alternated left channel and right channel set of the odd designated digitized samples are placed in a third segment of the buffer. The most significant bytes of the alternated left channel and right channel of the odd designated digitized samples are placed in a fourth segment of the buffer. This structure interleaves the digitized samples such that adjacent samples are separated to reduce the probability of an error condition totally disrupting groups of digitized samples and the errors that occur can be corrected or concealed. To allow parallel processing of the digitized samples, the buffer has multiple segments to retain multiple frames of the interleaved groups of digitized samples.

An error correction code is generated **1130** for the group of digitized samples and appended to the groups of digitized samples within the buffer. In the preferred embodiment of this invention, the ECC code is generated **1130** for the second segment of the buffer or the most significant bytes of the even designated samples and for the fourth segment of the buffer or the most significant bytes of the odd designated samples.

[0111] The ECC generation **1130** employs a Reed-Solomon method on a codeword of 255 bytes have a Galois Field GF (2^8) where 238 of the most significant bytes of the digitized samples and one command and control byte are the data to be protected. The ECC code is 16 bytes and provides correction up to 8 bytes within the code word.

[0112] Each frame of the groups of interleaved digitized samples are formatted **1135** to form the transmit frame. The transmit frame is structured as shown in Fig. 6. As described in Fig. 6, a first timing preamble and a first start flag signal are appended before the even designated digitized samples to form a first subframe. A second timing preamble and a second start flag signal are appended before the odd designated digitized samples to form a second subframe and to complete a frame.

[0113] The transmit frame then pulse position modulates **1145** a carrier signal. The pulse position modulation **1145** converts the raw non-return to zero encoding of the digitized samples to the pulse position coding as shown in Fig. 7. In the preferred embodiment, the carrier signal has a frequency of at least 2 MHz. The positioning of the pulse is determined by the value of pairs of bits of the transmit frame.

[0114] The modulated carrier signal then activates a driver circuit to transmit **1150** the modulated carrier signal on a communication medium. As described above, the communication medium may be wired or wireless, transmitting either light or RF energy. The wired communication medium may be fiber optic cable, coaxial cable, or common two wire twisted pair cable.

[0115] The burst transmitter **1150** is transmitting the entire modulated carrier signal for a relatively short period when compared with the period of the analog signal included in the frame of the digitized samples. In the preferred embodiment, 238 samples of the left channel and the right channel are included in each frame. Since the samples of the left channel and the samples of the right channel are created simultaneously, 119 samples of the analog signal or 2.479 milliseconds of the analog signal are transmitted. With the frequency of the carrier signal being 2 MHz, each frame is transmitted in 1.972 milliseconds. The transmission is then idle 20.5 % of the time. This minimizes any effect of burst noise in the transmission medium and improves the probability that the transmission is received **1155**. If the frequency of the carrier signal increases or the period of the burst of the digitized signals decreases, the idle time will increase accordingly.

[0116] The modulated carrier signal is received **1155** by sensing and amplifying the modulated carrier signal. In the preferred embodiment, the modulated carrier signal is transmitted **1150** as infrared light created by activating and deactivating a light emitting diode to radiate the infrared light to the atmosphere. A light sensitive diode receives **1155** the infrared light, converts the infrared light to electrical impulses that are sensed and amplified. The received modulated carrier signal is recovered by oversampling the received modulated carrier signal to determine a position to lock onto to capture the modulated carrier signal. The timing preamble is tested to find the correct lock position to correctly retrieve the timing preamble, the start flag signal sensed, and the frame of the groups of interleaved digitized samples are recovered.

[0117] The recovered modulated groups of the interleaved digitized samples are demodulated **1160** to recover raw non-return to zero encoding of the digitized samples.

[0118] The frames of the digitized samples are stored **1170** in a buffer as described in Fig. 8. The most significant bytes of the even designated digitized samples and the most significant bytes of the odd designated digitized samples and their respective ECC codewords have an ECC check and correction **1175** performed to find and repair any errors to the digitized samples within a frame. The ECC check and correction **1175** is the known Reed-Solomon method as described above.

[0119] Any of the groups of most significant bytes of the even designated or odd designated digitized samples that cannot be corrected are identified to be recovered **1185** by concealing the error. The groups are tested **1180** for having errors. If there are errors, the digitized samples with errors and the adjacent digitized samples that are error-free are examined and an estimate of the digitized sample in error is generated by linearly interpolating between the adjacent digitized samples that are error-free.

[0120] The corrected or recovered digitized samples are then stored **1190** in the buffer in the location containing errors. Any unrecoverable errors are identified for soft muting.

[0121] The frames of the digitized samples are checked **1195** for invalid data, unrecoverable errors

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1200, and for synchronization **1215** and conveyed to a digital-to-analog converter to reproduce **1225** the analog signal. If the frames of the digitized samples are invalid **1195** or unrecoverable **1200**, the invalid or unrecoverable frames and adjacent correct frames of the digitized data are soft muted **1205.** Soft muting **1205** applies a Hanning window to the invalid or unrecoverable frames of digitized samples and to the adjacent correct frames to weight the adjacent correct frames to slowly bring to null the reproduced analog signal. This eliminates an annoying effect that occurs if only the invalid or unrecoverable frame is muted in an audio application.

[0122] During the recovery **1155** and demodulation **1160** of the modulated carrier signal, the difference between the frequency of the evaluation point of the oversampling clock and the carrier signal is tracked to determine synchronization. The jitter tracking **1210** is tested **1215** to ensure there is no overrun or underrun of the number of samples. If there is an overrun or underrun, the frames of digital data are decimated or interpolated to synchronize **1220** the digitized samples before they are converted **1225** to reproduce the analog signals. The decimated or interpolated digitized samples insure that there are the correct number of digitized samples in each frame.

Claims

1. A transmission system for transmitting digitized samples of analog signals on a communication medium comprising:

   a sampled data receiver to receive said digitized samples from the external source of the digitized samples;
   a data buffer to retain a plurality of the digitized samples;
   a data buffer controller connected to the data buffer to control the placement and removal of the plurality of digitized samples within the data buffer;
   an error correction code generator connected to the data buffer controller to receive multiple digitized samples through said data buffer controller from said data buffer, to generate an error correction word to be appended to said multiple digitized samples, and to return the multiple digitized samples with the appended error correction word through the data buffer controller to the data buffer;
   a frame formatter connected to the data buffer controller to receive an interleaved group of the multiple digitized samples and append a preamble timing signal and a start signal before said interleaved group of the multiple digitized samples to form a transmit frame;
   a pulse position modulator connected to the frame formatter to receive the transmit frame and modulate according to a bit value of the transmit frame a pulse position within a carrier signal; and
   a burst transmitter connected between the pulse position modulator and the communication medium to convey a modulated carrier signal to said communication medium, whereby said modulated carrier signal is transmitted as a burst within a short time period to minimize probability of interference on said communication medium.

2. The transmission system of claim 1 whereby said digitized samples are digitized measurements of an analog signal sampled at one of a plurality of sampling rates and the transmission system further comprises a variable sampling rate converter connected to said sampled data receiver to convert the digitized samples at the one rate of a plurality of sampling rates to digitized samples sampled at a fixed rate ,

3. The transmission system of claim 1 wherein the digitized samples of the analog signals are audio signals digitized and encoded as non-return zero digitized samples of the analog signals.

4. The transmission system of claim 1 wherein the communication medium is selected from the communication media consisting of wired media, such as coaxial cable, fiber optic cable, and two wire audio cable.

5. The transmission system of claim 1 wherein the modulated carrier signal is transmitted as light or as a radio frequency signal.

6. The transmission system of claim 1 wherein the transmission subsystem is further comprising at least one analog-to-digital converter connected between the external source and the data buffer controller to receive the analog signals and to generate the digitized samples analog signals.

7. The transmission system of claim 6 wherein the digitized samples are sampled at a fixed sampling rate.

8. The transmission system of claim 7 wherein the fixed sampling rate is 48 kHz or 44.1 kHz.

9. The transmission system of claim 1 wherein the error correction code generator generates the error correction word, which is a forward error correction code word generated using a Reed-Solomon encoder circuit.

10. The transmission system of claim 9 wherein the er-

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ror correction code word has a data block size of 238 bytes and one control byte and 16 parity bytes.

11. The transmission system of claim 1 wherein the interleaved group of the multiple digitized samples comprises a plurality of least significant bytes of the even designated digitized samples of the group of multiple digitized samples, a plurality of most significant of the even designated digitized samples, a first command byte, a first plurality of error correction parity bytes, a plurality of least significant bytes of the odd designated digitized samples, a plurality of most significant bytes of the odd designated digitized samples, a second command byte, and a second plurality of error correction parity bytes.

12. The transmission system of claim 1 wherein said carrier signal is modulated with a pulse positioned modulation whereby said pulse positioned modulation is positioning of a pulse of said carrier signal within a period of said carrier signal according to a binary value of a plurality of bits within said transmit frame.

13. The transmission system of claim 12 wherein said plurality of bits is a pair of bits within said transmit frame.

14. The transmission system of claim 1 wherein said burst transmitter comprises an infrared light emitting diode and a diode switching circuit connected between the pulse position modulator and the infrared light emitting diode to activate and deactivate said infrared light emitting diode with the modulated carrier signal.

15. A method for transmitting, receiving, and recovering digitized samples of analog signals comprising the steps of:

acquiring said digitized samples;
interleaving the digitized samples to separate adjacent digitized samples decreasing a probability of loss of fidelity of said analog signal due to unrecoverable errors;
generating an error correction code to provide a group of interleaved digitized samples with redundancy to recover the interleaved digitized samples having errors created during transmitting and receiving;
forming a transmit frame with a plurality of groups of interleaved digitized samples, error correction codes, a preamble timing signal, and a start signal;
modulating a carrier signal with said transmit frame;
transmitting as a burst the modulated carrier signal on a communication medium, whereby said burst is a short period of time relative to a time of sampling represented by said digitized samples within the transmit frame;
receiving the modulated carrier signal;
demodulating said modulated carrier signal to recover said transmit frame;
extracting the plurality of groups of interleaved digitized samples and the error correction codes from the recovered transmit frame;
checking and correcting the groups of interleaved digitized samples;
if any of the digitized samples have uncorrectable errors, concealing any effect of said uncorrectable errors by interpolating from adjacent correct digitized samples an estimate of a sample value of said digitized samples with uncorrectable errors;
soft muting any of the digitized samples that have uncorrectable or non-concealable errors; and
transferring the digitized samples to a digital-to-analog converter to restore the analog signal.

16. The method of claim 15 further comprising the steps of:

digitizing said analog signals, and
formatting the digitized analog signal as a non-return to zero encoding of the digitized samples of the analog signal.

17. The method of claim 15 wherein the communication medium is selected from a wired media such as a coaxial cable, fiber optic cable, and two wire audio cable..

18. The method of claim 18 wherein the modulated carrier signal is transmitted as light or as a radio frequency signal.

19. The method of claim 15 further comprising the steps of receiving the analog signal and converting said analog signal to digitized samples, with a sampling rate selected from a plurality of sampling rates.

20. The method of claim 19 further comprising the step of converting said digitized samples to digitized samples having a fixed rate, such as 48 KHz or 44.1 KHz. .

21. The method of claim 19 wherein the plurality of sampled rates of 32 kHz, 44.1 kHz, and 48 kHz.

22. The method of claim 15 wherein the error correction code is generated using a Reed-Solomon error correction method.

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23. The method of claim 22 wherein the error correction code has a data block size of 238 bytes and 1 control byte and 16 parity bytes.

24. The method of claim 15 wherein the group of interleaved digitized samples are comprised of a plurality of least significant bytes of the even designated digitized samples of the group of multiple digitized samples, a plurality of most significant of the even designated digitized samples, a first command byte, a first plurality of error correction parity bytes, a plurality of least significant bytes of the odd designated digitized samples, a plurality of most significant bytes of the odd designated digitized samples, a second command byte, and a second plurality of error correction parity bytes.

25. The method of claim 15 wherein modulating said carrier signal comprises the step of positioning a pulse positioned modulation whereby said pulse positioned modulation is positioning of a pulse of said carrier signal within a period of said carrier signal according to a binary value of a plurality of bits within said transmit frame.

26. The method of claim 15 where demodulating the carrier signal comprises the step of oversampling said modulated carrier signal to determine an evaluation point of said modulated carrier signal to recover said transmit frame.

27. The method of claim 18 wherein extracting the plurality of groups of interleaved digitized samples and error correction codes comprises the step of detecting the preamble timing signal and the start signal to indicate a location of the interleaved group of the multiple digitized samples of the analog signals within the transmit frame.

28. The method of claim 15 wherein the smoothing function applies a Hanning window to those of the multiple digitized samples of the analog signals with non-recoverable and non-concealable errors and those of the multiple digitized samples of the analog signals that are correct and adjacent to those of the multiple digitized samples of the analog signals with non-recoverable and non-concealable errors to smoothly decrease those of the multiple digitized samples of the analog signals that are correct and adjacent to those of the multiple digitized samples of the analog signals with non-recoverable and non-concealable errors to allow a gentle muting.

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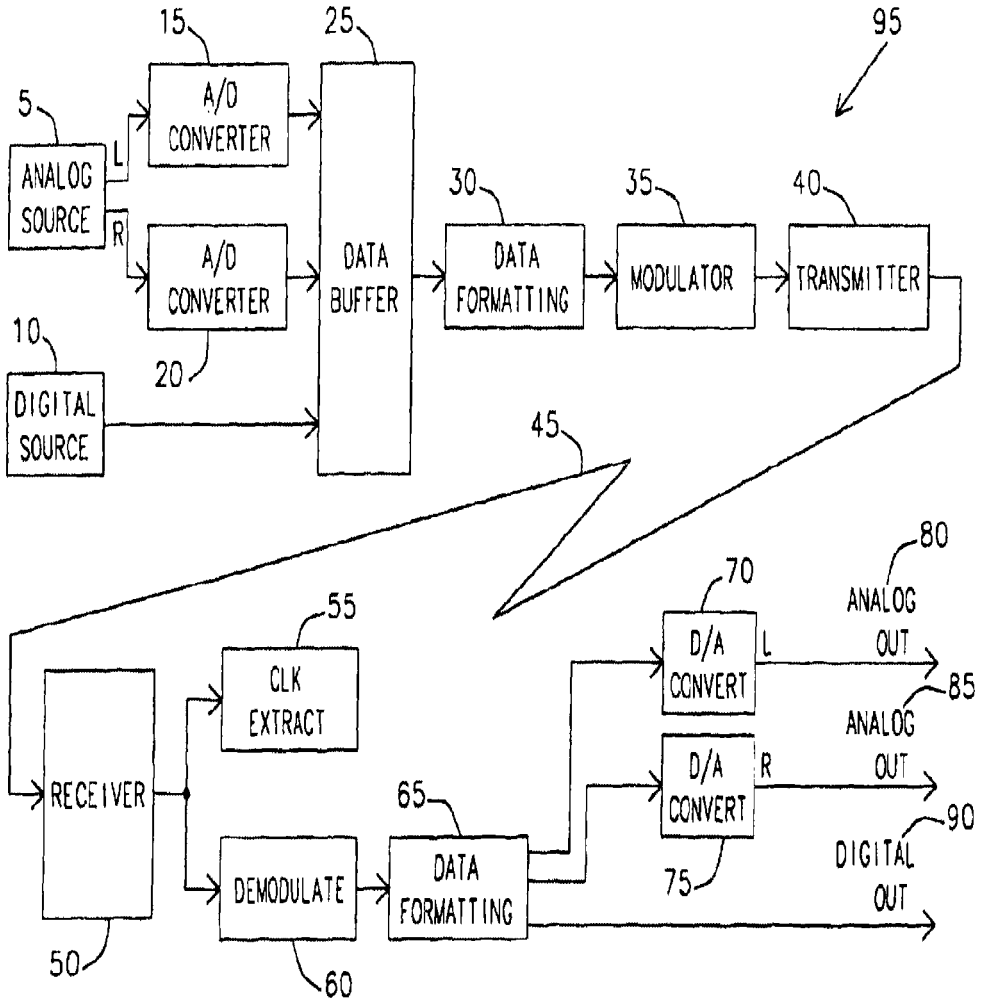


FIG. 1 - Prior Art

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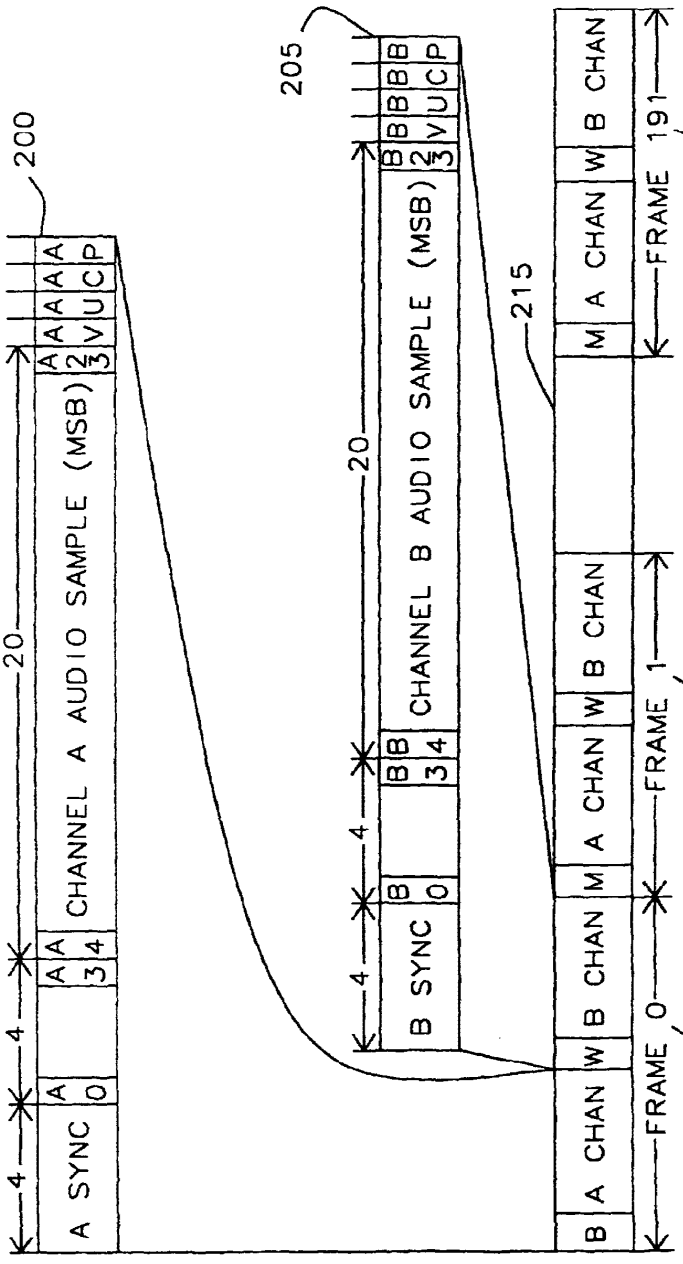


FIG. 2 - Prior Art

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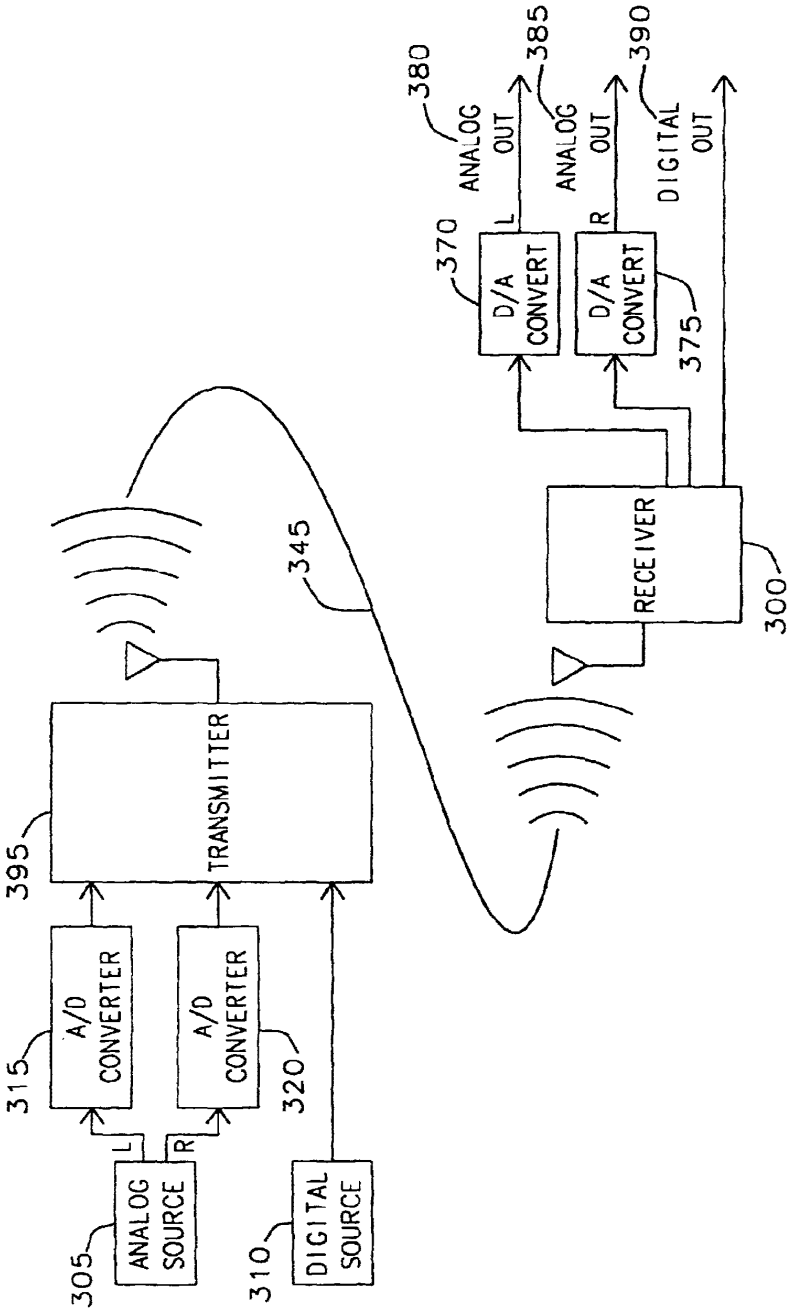


FIG. 3

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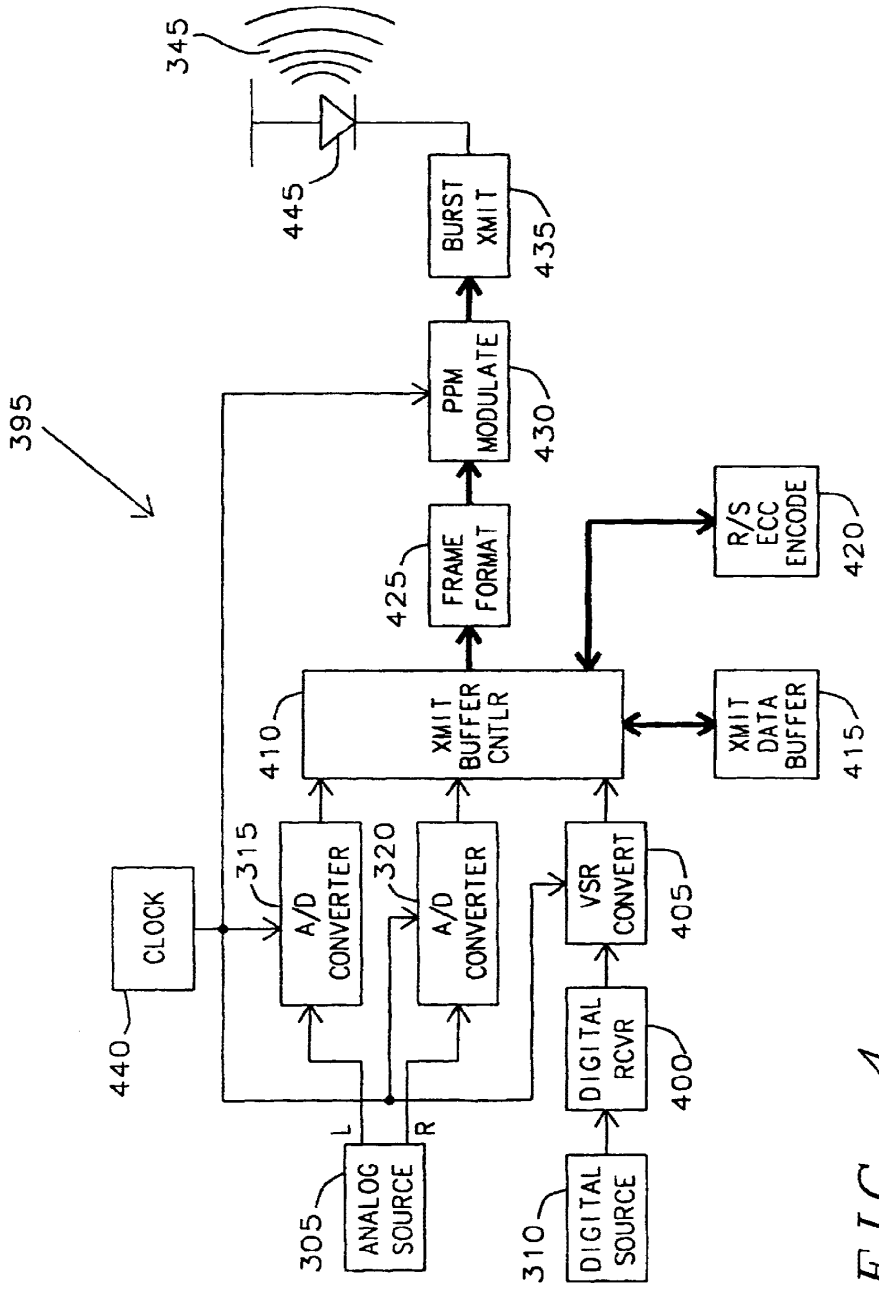


FIG. 4

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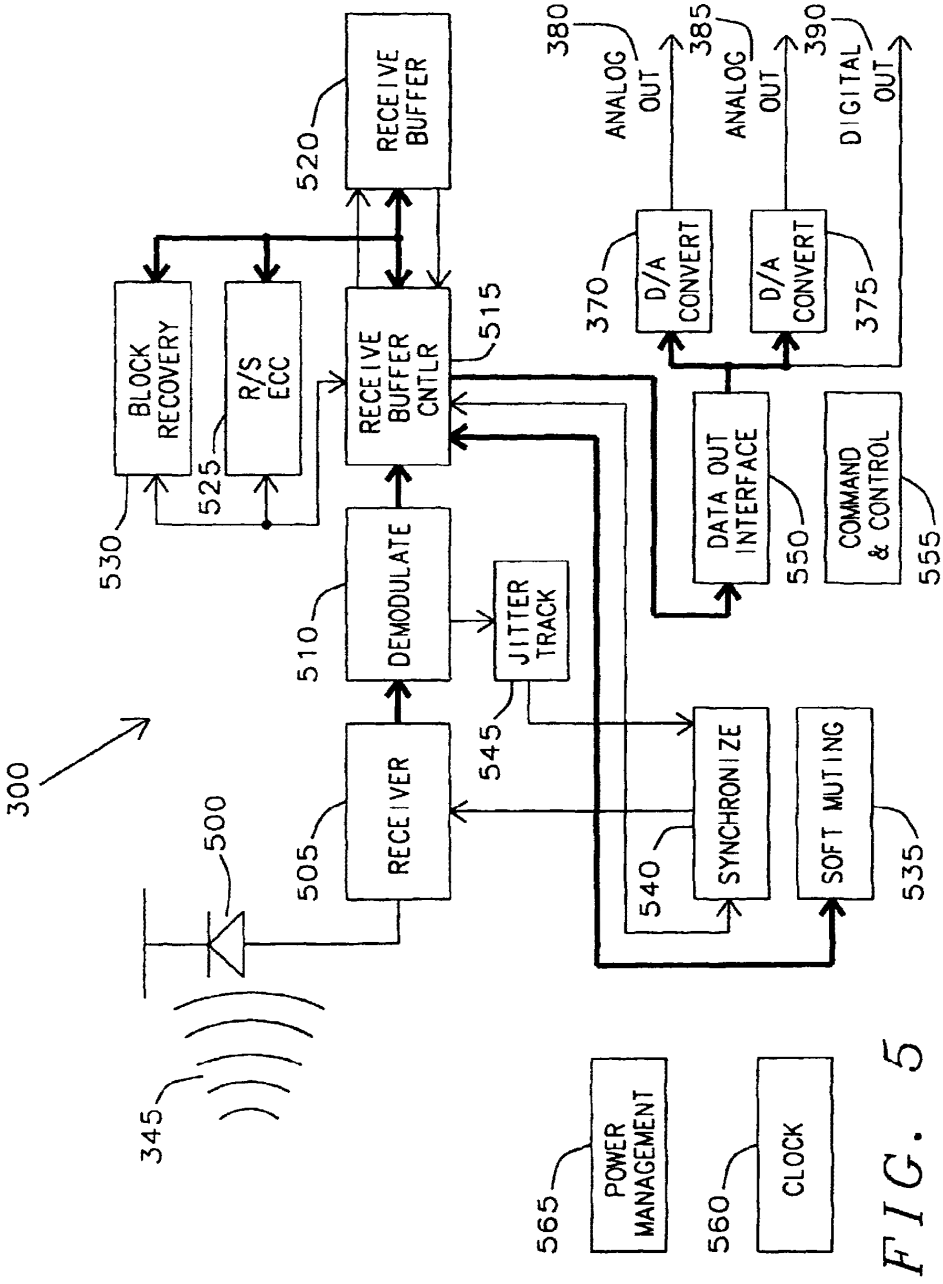


FIG. 5

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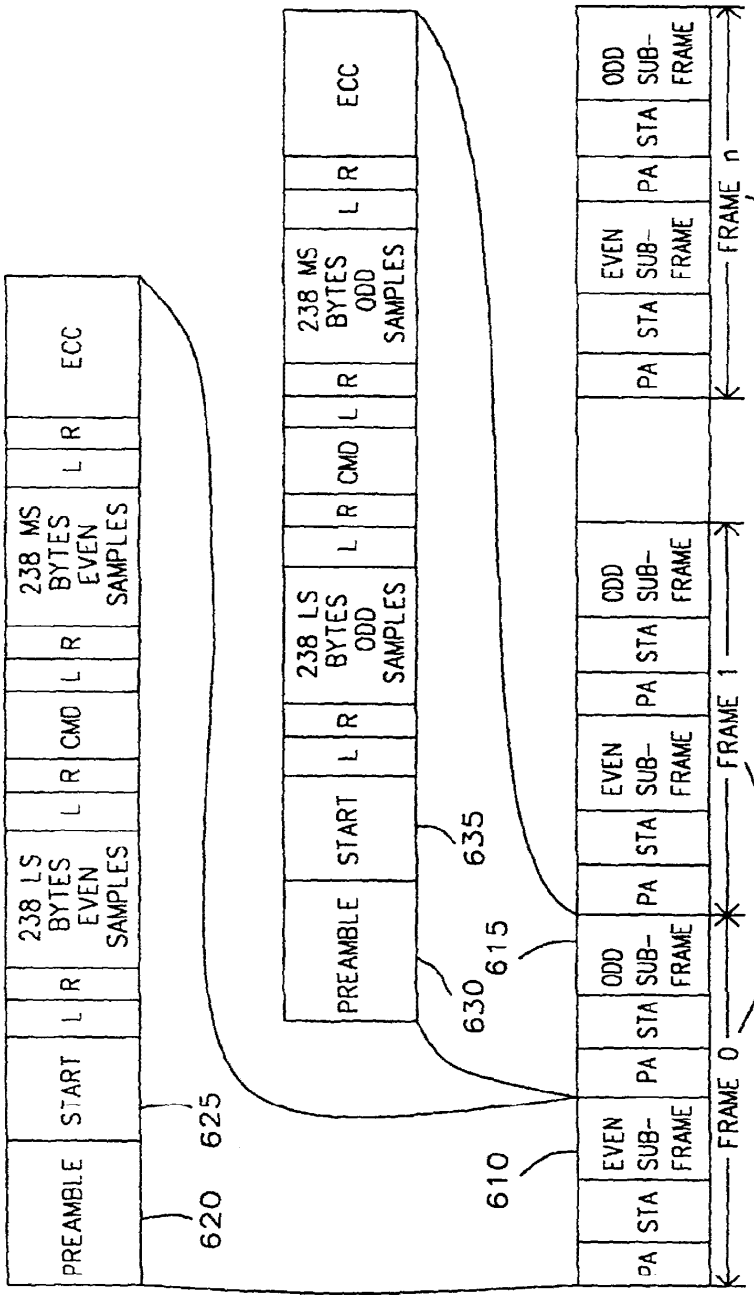


FIG. 6

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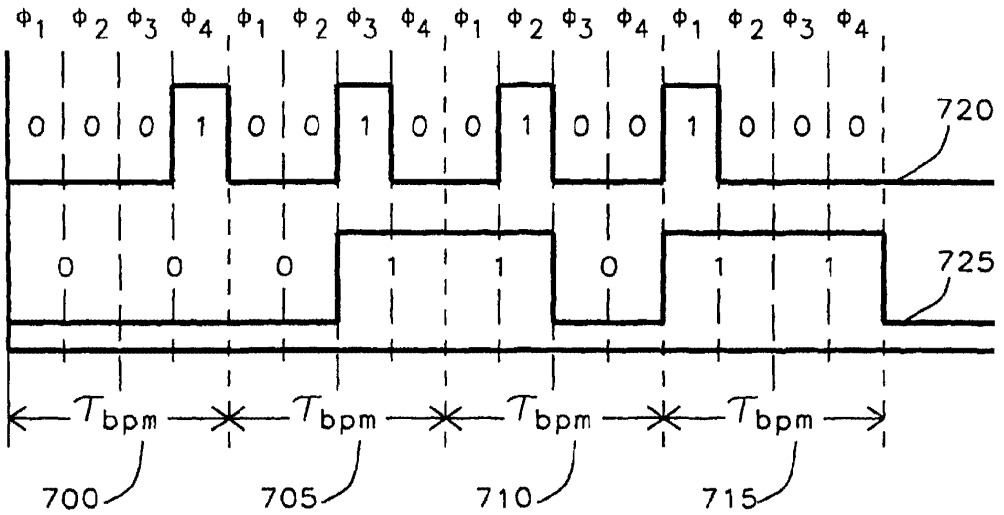


FIG. 7

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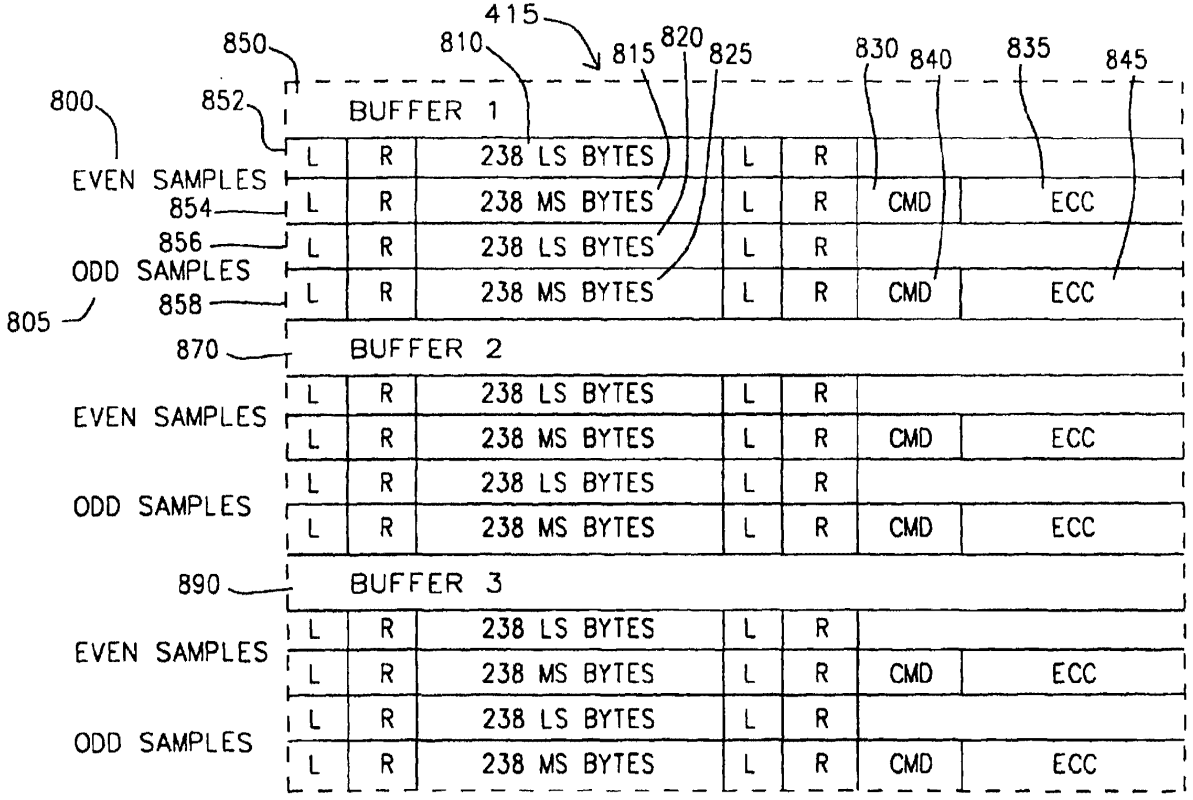


FIG. 8

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FIG. 9

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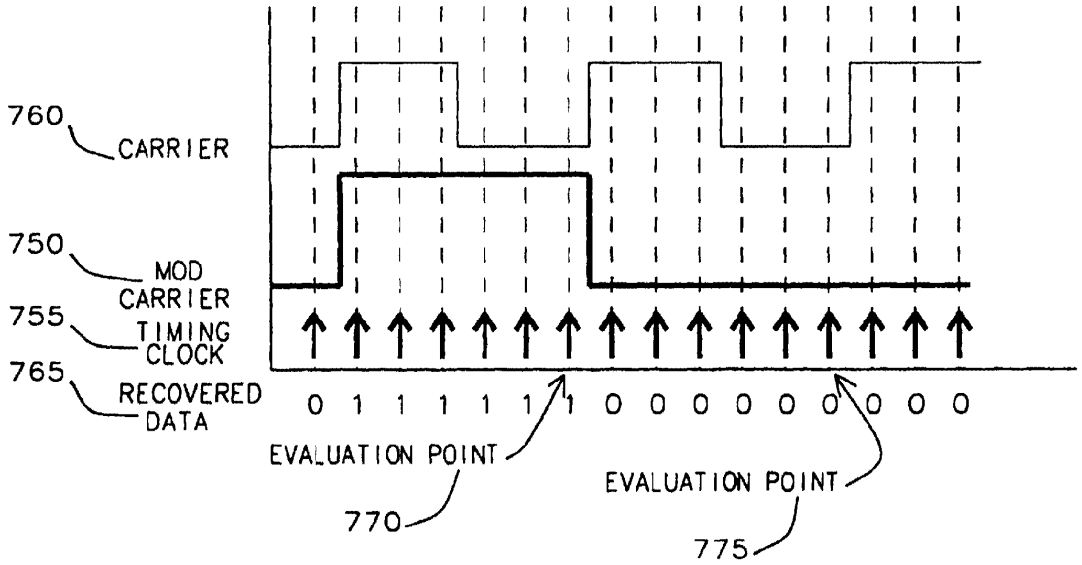


FIG. 10

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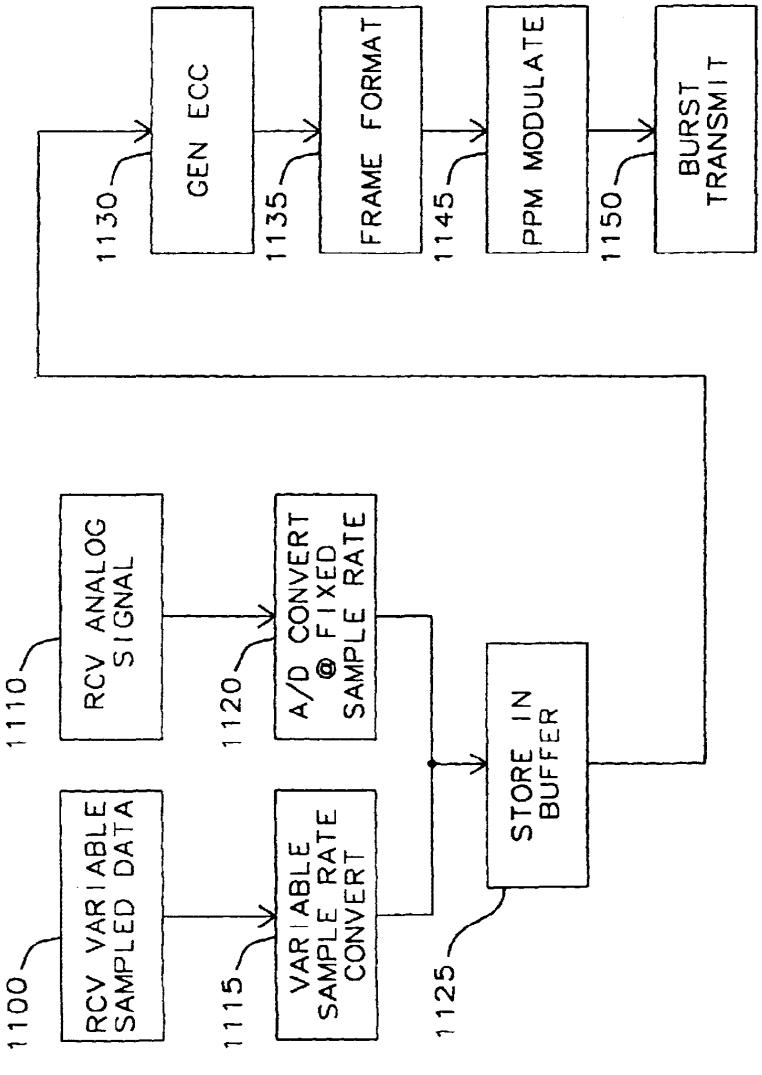


FIG. 11

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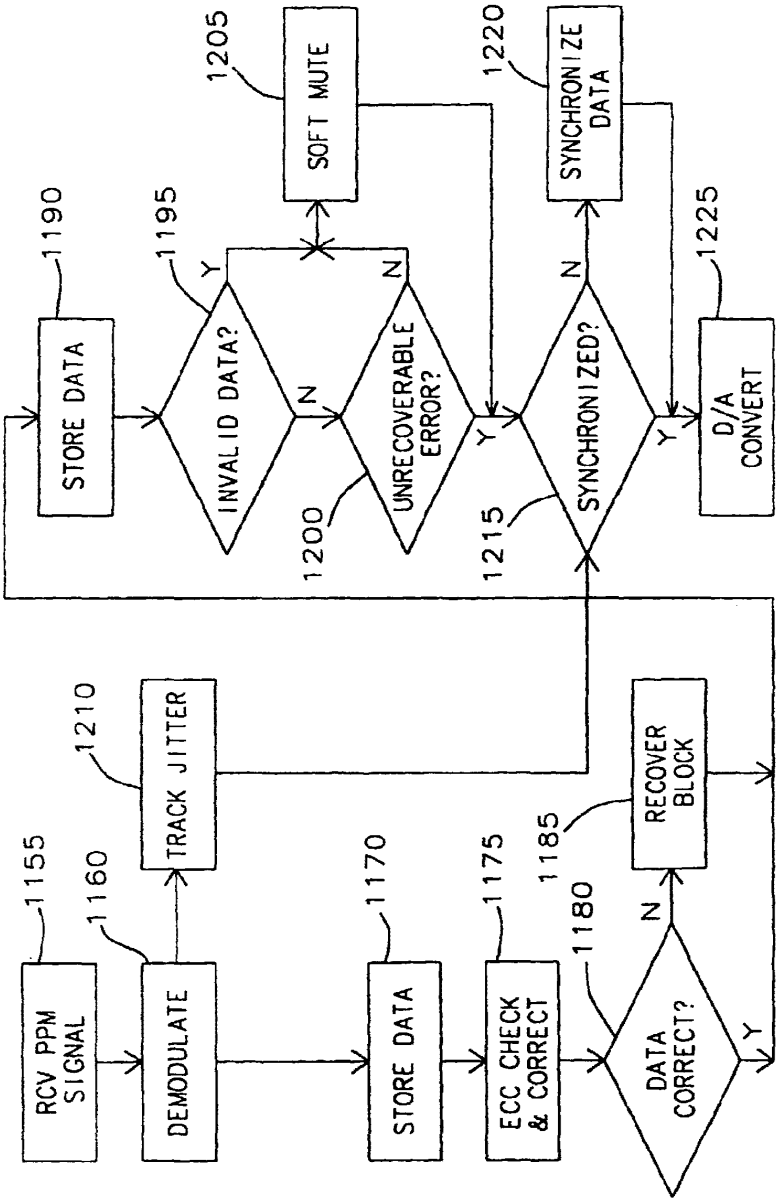


FIG. 12

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Examination Requested

(54) Code Division-Based Transmission Circuit and Wireless Headphone Reception Circuit

Abstract

The present device relates to a code division-based transmission circuit and a code division-based wireless headphone reception circuit, for transmitting and receiving signals in a code division scheme. The present device includes a codec 7 for encoding a signal applied by a signal source 8; a central control modem 6 for effecting error correction with an output of said codec 7 as an input and for spreading a band of the signal; a base band 5 for effecting conversion to an intermediate frequency with an output of said central control modem 6 as an input and for outputting the converted signal, wherein the transmission circuit amplifies and filters the signal output from the base band 5, controls a gain of the signal, and transmits the signal to the antenna

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A. Moreover, for the code division-based wireless headphone reception circuit, the code division-based wireless headphone reception circuit for amplifying and filtering a signal wirelessly applied through an antenna A, controlling a gain of the signal and outputting an audio signal to an output 9 is characterized by including a base band 5 for effecting processing to an intermediate frequency with said signal having the controlled gain as an input; a central control modem 6 for effecting error correction and removing a pseudo random code with an output of said base band 5 as an input; a codec 7 for decoding an input audio signal with an output of said central control modem 6 as an input; and an amplifier 1c for effecting amplification with a signal output from said codec 7 as an input and for outputting the amplified audio signal to said output 9.

Representative drawing

Fig. 1

Specification

Brief Description of the Drawings

Fig. 1 is a block diagram of a code division-based transmission circuit according to the present device.

Fig. 2 is a block diagram of a code division-based wireless headphone reception circuit according to the present device.

Explanation of Reference Numerals for Main Portions in Drawings

1a: First amplifier	1b: Second amplifier
1c: Third amplifier	2a: First filter
2b: Second filter	3: Converter
4: Gain control	5: Base band
6: Central control modem	7: Codec
8: Signal source	

Detailed Description of the Device

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Object of the Device

Technical Field Pertinent to the Device and Prior Art

The present device relates to transmission and reception circuits for a wireless headphone, and more particularly, to a code division-based transmission circuit and a code division-based wireless headphone reception circuit, for transmitting and receiving signals using a Code Division Multiple Access (CDMA) scheme.

Generally, a headphone is an apparatus used for receiving an audio signal in a wireless or wired manner and providing audio only to a user who uses the headphone; and moreover, the Code Division Multiple Access scheme (hereinafter, abbreviated to "code division scheme") is a scheme of sharing a frequency by spreading a signal to a frequency band much wider than a bandwidth for a required amount of information. That is, orthogonality is maintained using a unique code assigned to a signal itself while sharing all of a frequency and time. At this time, the code division scheme spreads a signal to be transmitted, by receiving an assigned unique pseudo random (PN) code.

A headphone according to the prior art is connected in a wireless or wired manner to an amplifier or the like of an audio apparatus, receives an audio signal provided by the amplifier of the audio apparatus, and provides a user with the audio signal.

However, since the aforementioned headphone according to the prior art is effected in an analog FM modulation manner, an infrared manner or the like, there are problems in that the quality of an audio signal output from the headphone is lowered due to interference or collision with adjacent frequencies in a predetermined frequency band and it is difficult to implement the high quality of the audio signal due to a [1]pading phenomenon.

Technical Problems to be solved by the Device

An object of the present device is to provide a code division-based wireless headphone reception circuit having a channel separation of 90dB or higher and a distortion factor of 0.01% or higher, which correspond to those of a compact disk, and a data transmission rate of 1.5Mbps in order to overcome noise and interference of an analog wireless headphone when an audio

[1] It is believed that the term "pading" stated within parentheses in the original document is a typo of "fading."

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signal is intended to be wirelessly received and played back in high quality of sound.

Further, another object of the present device is to apply a spread-spectrum modulation scheme, which is a CDMA scheme, by using a transmission rate of 14.4 kbps and a frequency band of 902 MHz to 928 MHz in a PCS that is a personal cell phone.

Constitution and Operation of the Device

As for a code division-based transmission circuit according to the present device for accomplishing the above objects, a code division-based transmission circuit for wirelessly transmitting a signal through an antenna A is characterized by including a codec 7 for encoding a signal applied by a signal source 8; a central control modem 6 for effecting error correction with an output of said codec 7 as an input and for spreading a band of the signal; a base band 5 for effecting conversion to an intermediate frequency with an output of said central control modem 6 as an input and for outputting the converted signal, wherein the transmission circuit amplifies and filters the signal output from the base band 5, controls a gain of the signal, and transmits the signal to the antenna A.

As for a code division-based wireless headphone reception circuit according to the present device for accomplishing the above objects, a code division-based wireless headphone reception circuit for amplifying and filtering a signal wirelessly applied through an antenna A, controlling a gain of the signal and outputting an audio signal to an output 9 is characterized by including a base band 5 for effecting processing to an intermediate frequency with said signal having the controlled gain as an input; a central control modem 6 for effecting error correction and removing a pseudo random code with an output of said base band 5 as an input; a codec 7 for decoding an input audio signal with an output of said central control modem 6 as an input; and an amplifier 1c for effecting amplification with a signal output from said codec 7 as an input and for outputting the amplified audio signal to said output 9.

Hereinafter, an operation of the code division-based transmission circuit according to the present device configured as described above will be explained.

Fig. 1 is a block diagram showing a code division-based transmission circuit according to the present device. As shown in the figure, the code division-based transmission circuit according to the present device includes a signal source 8, a codec 7, a central control modem 6,

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a base band 5, an automatic gain control (AGC) 4, a converter 3, first and second filters 2a and 2b, first and second amplifiers 1a and 1b, and an antenna A.

In the code division-based transmission circuit according to the present device configured as described above, stereo (left (L) and right (R)) analog or digital audio signals applied from the signal source 8, which is an audio apparatus, are applied to the codec 7.

The codec 7 encodes the applied audio signals, converts the encoded signals into digital signals, and applies the digital signals to the central control modem 6.

The central control modem 6 allows the applied signals to undergo error correction coding so that the signals are processed to be resistant to and thus not to be affected by noise generated in a communication channel, and spreads a high-speed pseudo random code leading to a wider band so as to maintain signals, which have been modulated using a DBPSK or DQPSK scheme, in a sound quality of high-fidelity, wherein each of the signals spread as such is scrambled to generate I and Q signals separated between channels.

Furthermore, it is disclosed herein for reference that I and Q underlying-data, which are two digital signals of the generated I and Q signals, enter an I digital/analog converter (DAC) (not shown in the figure) at a rising edge where a transmission clock rises, and are applied to a Q digital/analog converter (DAC) (not shown in the figure) at a falling edge where the transmission clock falls.

The aforementioned I and Q signals are applied to the base band 5 for their transmission. The base band 5 converts the applied signals so as to be at an intermediate frequency (IF). The gain of the signals converted to be at the intermediate frequency is controlled by the gain control 4. As such, the code division multiple access scheme is used, and accordingly, the signals modulated to be at the intermediate frequency (IF) on which code division multiple access data are carried are applied to the gain control 4, so that the gain is automatically controlled.

A signal that has the gain controlled by and is output from the gain control 4 is applied to an input port of the converter 3. For the signal applied to the converter 3, a local oscillation signal and an intermediate frequency signal are mixed to generate a sum signal and a difference signal of the two signals, wherein the sum signal is applied at a transmission frequency to the second filter 2b. A signal, which results from removal of noise and a pass of only a predetermined band of transmission frequency after the application to the second amplifier 2b,

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passes through the second amplifier 1b and the first filter 2a, so that the signal is amplified and noise is again removed therefrom. Then, the signal passes through the first amplifier 1a, which is a power amplifier, and the first filter 2a, so that the weakened signal is amplified and noise is removed therefrom, whereby the signal is transmitted through the antenna A.

Fig. 2 is a block diagram showing a code division-based wireless headphone reception circuit according to the present device.

The code division-based wireless headphone reception circuit according to the present device includes an antenna A, first and second filters 2a and 2b, first and second amplifiers 1a and 1b, a converter 3, a gain control 4, a base band 5, a central control modem 6, a codec 7, a third amplifier 1c, and an output 9.

The output 9 is preferably a speaker provided in a wireless headphone.

Hereinafter, an operation of the code division-based wireless headphone reception circuit according to the present device configured as described above will be explained.

A signal transmitted through the antenna A shown in Fig. 1 is wirelessly applied as a stereo analog audio signal or a stereo digital audio signal through the antenna A shown in Fig. 2. The wirelessly applied signal is processed in reverse order with respect to the signal processing in the transmission circuit shown in Fig. 1.

That is, a weak audio signal applied to the antenna A of the headphone is amplified by the first amplifier 1a, which is a power amplifier, amplified and subjected to removal of noise through the first filter 2a, the second amplifier 1b and the second filter 2b, and applied to the converter 3.

The signal applied to the converter 3 undergoes conversion in frequency, and the gain of the signal is controlled through the gain control 4 that is an automatic gain control.

The signal of which the gain has been controlled as described above is processed to be at an intermediate frequency through the base band 5 and then applied to the central control modem 6. The central control modem 6 removes a carrier-wave pseudo random code from the applied signal. A signal that results from the removal of the noise code in the central control modem 6 is applied to the codec 7. The codec 7 decodes the applied signal to decrypt the encoded signal and outputs the decrypted signal to the third amplifier 1c.

The audio signal input into the third amplifier 1c is amplified and then applied to the

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output 9, which is a speaker of the wireless headphone, so that it is transferred to the ears of a user as a stereo voice signal of high sound quality.

The descriptions of the drawings and the specification are only for illustrative purposes and are not used to limit meaning or to constrain the scope of the present device stated in the claims but are used only for the purpose of explaining the present device. Therefore, it will be understood by those skilled in the art that various modifications and other equivalent embodiments can be made therefrom. Accordingly, the true technical scope of the present device should be defined by the technical spirit of the appended claims.

Effects of the Device

According to the present device, there is a feature in that noise and interference are prevented in an audio signal applied to a speaker of a headphone so that high-quality audio is provided to a user, since a high-quality data transmission capability is provided by making a data transmission rate in a grade of 1.5 Mbps when the code division scheme is used to provide a channel separation of 90 dB or higher and a distortion factor of 0.01% or higher that correspond to the sound quality of audio utilizing a compact disk.

(57) Claims

1. A code division-based transmission circuit for wirelessly transmitting a signal through an antenna (A), the transmission circuit characterized by comprising:

a codec (7) for encoding a signal applied by a signal source (8);

a central control modem (6) for effecting error correction with an output of said codec (7) as an input and for spreading a band of the signal;

a base band (5) for effecting conversion to an intermediate frequency with an output of said central control modem (6) as an input and for outputting the converted signal,

wherein the transmission circuit amplifies and filters the signal output from the base band (5), controls a gain of the signal, and transmits the signal to the antenna (A).

2. A code division-based wireless headphone reception circuit for amplifying and filtering a signal wirelessly applied through an antenna (A), controlling a gain of the signal and outputting

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an audio signal to an output (9), the wireless headphone reception circuit characterized by comprising:

a base band (5) for effecting processing to an intermediate frequency with said signal having the controlled gain as an input;

a central control modem (6) for effecting error correction and removing a pseudo random code with an output of said base band (5) as an input;

a codec (7) for decoding an input audio signal with an output of said central control modem (6) as an input; and

an amplifier (1c) for effecting amplification with a signal output from said codec (7) as an input and for outputting the amplified audio signal to said output (9).

Drawings

Figure 1

1a: First amplifier

2a: First filter

1b: Second amplifier

2b: Second filter

3: Converter

4: Gain control

5: Base band

6: Central control modem

7: Codec

8: Signal source

Figure 2

1a: First amplifier

2a: First filter

1b: Second amplifier

2b: Second filter

3: Converter

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4: Gain control

5: Base band

6: Central control modem

7: Codec

1c: Third amplifier

9: Output

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VERIFICATION

I, Yoon-Ho Song, hereby declare that I am well-qualified as a translator of the Korean and English languages and that I have carefully prepared the attached English translation. I certify to the best of my knowledge and belief the following is a true and correct English translation of the document "Korean Utility Model Laid-Open Publication No. 2000-0006888."

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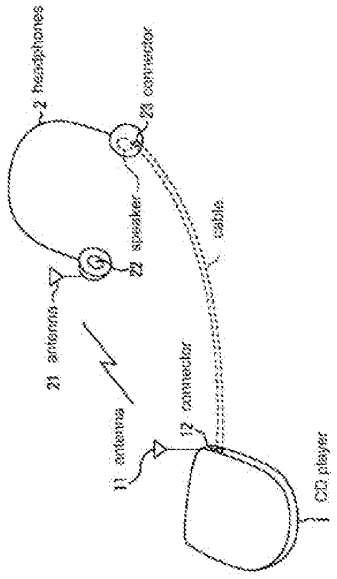
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(54) **[Title of the Invention] Device and Method for Communication and Recording Medium**

(57) **[Abstract]**

[Problem to Be Solved] To allow wired exchange of information for the purpose of establishing wireless communication synchronization.

[Means for Solving the Problem] A CD player 1 plays back audio content recorded on a CD that has been loaded therein, and transmits an audio signal that is produced as a result to a headphone 2, via an antenna 11, with a CDMA system serving as a wireless interface. The headphone 2 receives the signal that has been transmitted from the CD player 1, via an antenna 21, with the CDMA system serving as a wireless interface, and outputs an audio signal corresponding to the received signal from speakers 22, which are housed therein. Thus, the CD player 1 and the headphone 2 send and receive audio signal wirelessly, but the CD player 1 and the headphone 2 also have a connector 12 and a connector 23, respectively, and exchange information for the purpose of establishing wireless interface synchronization via a wire (cable or the like) that is connected to these.



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[CLAIMS]

[Claim 1] A communication device characterized by comprising:
a first determination means that determines a spreading code type;
a first generation means that generates a generation timing for said spreading code;
a second generation means that generates a spreading code of said type that was determined by said first determination means, at said generation timing that was generated by said first generation means;
a modulation means that modulates transmission data using said spreading code that was generated by said second generation means;
a second determination means that determines a channel for wireless communication;
a third generation means that generates a carrier corresponding to said channel, using a reference clock;
a connection means that connects to a reception device that demodulates a reception signal, via a wire, using a spreading code that is identical to, and synchronous with, said spreading code that was generated by said second generation means;
a provision means that provides said channel, said reference clock, and said type and said generation timing of said spreading code, via said wire, to said reception device that has been connected, via said wire, by way of said connection means, for the purpose of establishing synchronization for the purpose of said wireless communication; and
a transmission means that mixes said transmission data that has been modulated by said modulation means with said carrier that has been generated by said third generation means, converts this to a wireless frequency, and wirelessly transmits this to said reception device.

[Claim 2] The communication device recited in claim 1, characterized in that:
an acquisition means is further provided, which acquires the result of detecting the communication quality of the reception signal, which is provided from said reception device, via said wire;
for the purpose of improving said communication quality, said first determination means changes said type, on the basis of said detection result;
for the purpose of improving said communication quality, said second determination means changes said channel, on the basis of said detection result;
for the purpose of improving said communication quality, said transmission means amplifies said wireless frequency at an amplification factor that is based on said detection result, and wirelessly transmits to said reception device.

[Claim 3] The communication device recited in claim 1, characterized in that, when connected to said reception device via said wire by said connection means, said first determination means first determines said spreading code type to be a predetermined type as an initial state;
said second determination means first determines said channel for wireless communication to be a predetermined channel as an initial state; and
said transmission means first amplifies said wireless frequency at a predetermined amplification factor as an initial state, and wirelessly transmits to said reception device.

[Claim 4] The communication device recited in claim 2, characterized in that: a storage means is further provided, which stores said type that was changed by said first determination means, said channel that was changed by said second determination means, and said amplification factor based on the detection result; and
when once again connected to said reception device via said wire by said connection means,
said first determination means first determines said spreading code type to be said type that is stored in said storage means;
said second determination means first determines said channel for wireless communication to be said channel that is stored in said storage means; and
said transmission means first amplifies said wireless frequency at said amplification factor that is stored in said storage means, and wirelessly transmits to said reception device.

[Claim 5] The communication device recited in claim 1, characterized in that: a third determination means that determines a ciphering method for said transmission data, and
a fourth generation means that generates a ciphering pattern by applying said ciphering method to a predetermined ciphering key are further provided;
said modulation means scrambles said transmission data with said ciphering pattern; and
said provision means provides said ciphering method and said ciphering key to said reception device.

[Claim 6] A communication method characterized by comprising: a first determination step of determining a spreading code type;
a first generation step of generating a generation timing for said spreading code;
a second generation step of generating a spreading code of said type that was determined by the processing of said first determination step, at said generation timing that was generated by the processing of said first generation step;
a modulation step of modulating transmission data using said spreading code that was generated by the processing of said second generation step;
a second determination step of determining a channel for wireless communication;
a third generation step of generating a carrier corresponding to said channel, using a reference clock;
a connection step of connecting, via a wire, to a reception device that demodulates a reception signal using a spreading code that is identical to, and synchronous with, said spreading code that was generated by the processing of said second generation means;
a provision step of providing said channel, said reference clock, and said type and said generation timing of said spreading code, via said wire, to said reception device that has been connected, via said wire, by the processing of said connection step, for the purpose of establishing synchronization for the purpose of said wireless communication; and
a transmission step of mixing said transmission data that has been modulated by the processing of said modulation step with said carrier that has been generated by the processing of said third generation step, converting this to a wireless frequency, and wirelessly transmitting this to said reception device.

[Claim 7] A recording medium on which is recorded a computer readable program characterized by comprising:
a first determination step of determining a spreading code type;
a first generation step of generating a generation timing for said spreading code;
a second generation step of generating a spreading code of said type that was determined by the processing of said first determination step, at said generation timing that was generated by the processing of said first generation step;
a modulation step of modulating transmission data using said spreading code that was generated by the processing of said second generation step;
a second determination step of determining a channel for wireless communication;
a third generation step of generating a carrier corresponding to said channel, using a reference clock;
a connection step of connecting to a reception device that demodulates a reception signal, via a wire, using a spreading code that is identical to, and synchronous with, said spreading code that was generated by the processing of said second generation means;
a provision step of providing said channel, said reference clock, and said type and said generation timing of said spreading code, via said wire, to said reception device that has been connected, via said wire, by the processing of said connection step, for the purpose of establishing synchronization for the purpose of said wireless communication; and
a transmission step of mixing said transmission data that has been modulated by the processing of said modulation step with said carrier that has been generated by the processing of said third generation step, converting this to a wireless frequency, and wirelessly transmitting this to said reception device.
[Claim 8] A communication device characterized by comprising:
an acquisition means that acquires a spreading code type, a spreading code generation timing and a channel used in wireless communication, and a reference clock, which are provided from a transmission device, via a wire;
a first generation means that generates a carrier corresponding to said channel, using said reference clock;
a reception means that receives a reception signal by way of tuning based on said carrier;
a second generation means that generates a spreading code of said type at said generation timing; and
a demodulation means that demodulates said reception signal, using said spreading code that was generated by said second generation means.
[Claim 9] The communication device recited in claim 8, characterized by comprising:
a detection means that detects the communication quality of said reception signal; and
a provision means that provides the results of detection by said detection means to said transmission device, via said wire.
[Claim 10] The communication device recited in claim 8, characterized in that said acquisition means acquires a ciphering method and a ciphering key, provided from said transmission device, via said wire; and
said demodulation means descrambles said reception signal with a ciphering pattern generated by applying said ciphering method to said ciphering key.
[Claim 11] A communication method characterized by comprising:
an acquisition step of acquiring a spreading code type, a spreading code generation timing, a channel used in wireless communication, and a reference clock, which are provided from a transmission device, via a wire;
a first generation step of generating a carrier corresponding to said channel, using said reference clock;
a reception step of receiving a reception signal by way of tuning based on said carrier;
a second generation step of generating a spreading code of said type at said generation timing; and
a demodulation step of demodulating said reception signal, using said spreading code that was generated by the processing of said second generation step.
[Claim 12] A recording medium on which is recorded a computer readable program characterized by comprising:
an acquisition step of acquiring a spreading code type, a spreading code generation timing, a channel used in wireless communication, and a reference clock, which are provided from a transmission device, via a wire;
a first generation step of generating a carrier corresponding to said channel, using said reference clock;
a reception step of receiving a reception signal by way of tuning based on said carrier;
a second generation step of generating a spreading code of said type at said generation timing; and
a demodulation step of demodulating said reception signal, using said spreading code that was generated by the processing of said second generation step.
[Detailed Description of the Invention]
[0001]
[Technical Field of the Invention] The present invention relates to a device and a method for communication and to a recording medium, and in particular relates to a device and a method for communication and a recording medium adapted so as to allow wired exchange of information for establishing wireless communication synchronization.
[0002]
[Prior Art] In communications systems using the CDMA method (code division multiple access) as a wireless interface, it is possible to achieve high-quality communication that is not readily subject to the influence of noise.
[0003] Here, demodulation processing is performed on the reception side of this communication system, such as inverse spreading using a spreading code that is identical to, and synchronous with, that on the transmission side. For this reason, it is necessary to establish synchronization between the transmission side and the reception side prior to wireless communication. Conventionally, the data serving to establish the synchronization was also transmitted and received wirelessly according to the CDMA method.

[0004]

[Problems to Be Solved by the Invention] However, there was a problem in that, if the data serving to establish synchronization is transmitted and received wirelessly in this manner, the circuits for performing this processing become complex, even in so-called private communications such as communications between a CD player and wireless headphones, and thus it is difficult to miniaturize the device.

[0005] Furthermore, if spreading codes with long periods are used, it is possible to minimize interference and improve ciphering, but if spreading codes with long periods are used when data serving to establish synchronization is transmitted and received wirelessly, synchronization establishment will be difficult, and therefore it was conventionally necessary to use spreading codes with relatively short periods. Thus, ultimately, in the past, there was a problem in that it was difficult to improve ciphering.

[0006] The present invention is a reflection of such a situation, and allows for the wired exchange of data serving to establish synchronization.

[0007]

[Means for Solving the Problems] A first communication device of the present invention is characterized by comprising: a first determination means that determines a spreading code type; a first generation means that generates a generation timing for the spreading code; a second generation means that generates a spreading code of the type that was determined by the first determination means, at the generation timing that was generated by the first generation means; a modulation means that modulates transmission data using the spreading code that was generated by the second generation means; a second determination means that determines a channel for wireless communication; a third generation means that generates a carrier corresponding to the channel, using a reference clock; a connection means that connects to a reception device that demodulates a reception signal, via a wire, using a spreading code that is identical to, and synchronous with, the spreading code that was generated by the second generation means; a provision means that provides the channel, the reference clock, and the type and the generation timing of the spreading code, via the wire, to the reception device that has been connected, via the wire, by way of the connection means, for the purpose of establishing synchronization for the purpose of the wireless communication; and a transmission means that mixes the transmission data that has been modulated by the modulation means with the carrier that has been generated by the third generation means, converts this to a wireless frequency, and wirelessly transmits this to the reception device.

[0008] It is possible that: an acquisition means is further provided, which acquires the result of detecting the communication quality of the reception signal, which is provided from the reception device, via the wire; for the purpose of improving the communication quality, the first determination means changes the type, on the basis of the detection result; for the purpose of improving the communication quality, the second determination means changes the channel, on the basis of the detection result; for the purpose of improving the communication quality, the transmission means amplifies the wireless frequency at an amplification factor that is based on the detection result, and wirelessly transmits to the reception device.

[0009] It is possible that: when connected to the reception device via the wire by the connection means, the first determination means first determines the spreading code type to be a predetermined type as an initial state; the second determination means first determines the channel for wireless communication to be a predetermined channel as an initial state; and the transmission means first amplifies the wireless frequency at a predetermined amplification factor as an initial state, and wirelessly transmits to the reception device.

[0010] It is possible that: a storage means is further provided, which stores the type that was changed by the first determination means, the channel that was changed by the second determination means, and the amplification factor based on the detection result; and when once again connected to the reception device via the wire by the connection means, the first determination means first determines the spreading code type to be a the type that is stored in the storage means; the second determination means first determines the channel for wireless communication to be the channel that is stored in the storage means; and the transmission means first amplifies the wireless frequency at the amplification factor that is stored in the storage means, and wirelessly transmits to the reception device.

[0011] It is possible that: a third determination means that determines a ciphering method for the transmission data, and a fourth generation means that generates a ciphering pattern by applying the ciphering method to a predetermined ciphering key are further provided; the modulation means scrambles the transmission data with the ciphering pattern; and the provision means provides the ciphering method and the ciphering key to the reception device.

[0012] A first communication method of the present invention is characterized by comprising: a first determination step of determining a spreading code type; a first generation step of generating a generation timing for the spreading code; a second generation step of generating a spreading code of the type that was determined by the processing of the first determination step, at the generation timing that was generated by the processing of the first generation step; a modulation step of modulating transmission data using the spreading code that was generated by the processing of the second generation step; a second determination step of determining a channel for wireless communication; a third generation step of generating a carrier corresponding to the channel, using a reference clock; a connection step of connecting, via a wire, to a reception device that demodulates a reception signal using a spreading code that is identical to, and synchronous with, the spreading code that was generated by the processing of the second generation means; a provision step of providing the channel, the reference clock, and the type and the generation timing of the spreading code, via the wire, to the reception device that has been connected, via the wire, by the processing of the connection step, for the purpose of establishing synchronization for the purpose of the wireless communication; and a transmission step of mixing the transmission data that has been modulated by the processing of the modulation step with the carrier that has been generated by the processing of the third generation step, converting this to a wireless frequency, and wirelessly transmitting this to the reception device.

[0013] A first program on a recording medium of the present invention is characterized by comprising: a first determination step of determining a spreading code type; a first generation step of generating a generation timing for the spreading code; a second generation step of generating a spreading code of the type that was determined by the processing of the first determination step, at the generation timing that was

generated by the processing of the first generation step; a modulation step of modulating transmission data using the spreading code that was generated by the processing of the second generation step; a second determination step of determining a channel for wireless communication; a third generation step of generating a carrier corresponding to the channel, using a reference clock; a connection step of connecting, via a wire, to a reception device that demodulates a reception signal using a spreading code that is identical to, and synchronous with, the spreading code that was generated by the processing of the second generation means; a provision step of providing the channel, the reference clock, and the type and the generation timing of the spreading code, via the wire, to the reception device that has been connected, via the wire, by the processing of the connection step, for the purpose of establishing synchronization for the purpose of the wireless communication; and a transmission step of mixing the transmission data that has been modulated by the processing of the modulation step with the carrier that has been generated by the processing of the third generation step, converting this to a wireless frequency, and wirelessly transmitting this to the reception device.

[0014] In the first communication device, method and program on a recording medium of the present invention: the type of spreading code is determined; the spreading code generation timing is determined; a spreading code of the determined type is generated at the generated generation timing; transmission data is modulated using the generated spreading code; a channel for wireless communication is determined; a carrier corresponding to the channel is generated using a reference clock; a connection is made, via a wire, to a reception device that demodulates a reception signal using a spreading code that is identical to, and synchronous with, the generated spreading code; the channel, the reference clock, and the type and generation timing of the spreading code are provided, via the wire, to the reception device that has been connected via the wire for the purpose of establishing synchronization for the purpose of the wireless communication; the modulated transmission data is mixed with the generated carrier, converted to a wireless frequency and wirelessly transmitted to the reception device.

[0015] A second communication device of the present invention is characterized by comprising: an acquisition means that acquires a spreading code type, a spreading code generation timing and a channel used in wireless communication, and a reference clock, which are provided from a transmission device, via a wire; a first generation means that generates a carrier corresponding to the channel, using the reference clock; a reception means that receives a reception signal by way of tuning based on the carrier; a second generation means that generates a spreading code of the type at the generation timing; and a demodulation means that demodulates the reception signal, using the spreading code that was generated by the second generation means.

[0016] It is possible that a detection means that detects the communication quality of the reception signal, and a provision means that provides the results of detection by the detection means to the transmission device, via the wire, are provided.

[0017] It is possible that: the acquisition means acquires a ciphering method and a ciphering key, provided from the transmission device, via the wire; and the demodulation means descrambles the reception signal with a ciphering pattern generated by applying the ciphering method to the ciphering key.

[0018] A second communication method of the present invention is characterized by comprising: an acquisition step of acquiring a spreading code type, a spreading code generation timing, a channel used in wireless communication, and a reference clock, which are provided from a transmission device, via a wire; a first generation step of generating a carrier corresponding to the channel, using the reference clock; a reception step of receiving a reception signal by way of tuning based on the carrier; a second generation step of generating a spreading code of the type at the generation timing; and a demodulation step of demodulating the reception signal, using the spreading code that was generated by the processing of the second generation means.

[0019] A second program on a recording medium of the present invention is characterized by comprising: an acquisition step of acquiring a spreading code type, a spreading code generation timing, a channel used in wireless communication, and a reference clock, which are provided from a transmission device, via a wire; a first generation step of generating a carrier corresponding to the channel, using the reference clock; a reception step of receiving a reception signal by way of tuning based on the carrier; a second generation step of generating a spreading code of the type at the generation timing; and a demodulation step of demodulating the reception signal, using the spreading code that was generated by the processing of the second generation means.

[0020] In the second communication device, method and program on a recording medium of the present invention: the type of spreading code, the spreading code generation timing, a channel for wireless communication, and a reference clock, which are provided from a transmission device, via a wire, are acquired; a carrier is generated corresponding to the channel, using the reference clock; a reception signal is received by way of tuning based on the carrier; a spreading code of the type is generated at the generation timing; and the reception signal is demodulated, using the spreading code that was generated.

[0021]

[Modes of Embodiment of the Invention] FIG. 1 shows an example of usage of a CD player 1 and a headphone 2, to which the present invention has been applied.

[0022] The CD player 1 plays back audio content recorded on a CD (not shown) that has been loaded therein, and transmits the audio signal produced as a result to the headphone 2, via an antenna 11, with a CDMA system as the wireless interface.

[0023] The headphone 2 is a so-called wireless headphone, wherein a signal that has been transmitted from the CD player 1 is received via an antenna 21, with a CDMA system as the wireless interface, and an audio signal corresponding to the received signal is output from speakers 22, which are housed therein.

[0024] Thus, the CD player 1 and the headphone 2 wirelessly transmit and receive the audio signal, but the CD player 1 and the headphone 2, which respectively have a connector 12 and a connector 23, can also be connected to each other via a wire (cable or the like).

When the CD player 1 and the headphone 2 are connected by wire, the information for the purpose of establishing the synchronization of the wireless interface can be exchanged via this wire.

[0025] Thus, as this has been [configured] so that the information serving to establish synchronization is exchanged separately from the wireless [communication], it is possible to exchange only the necessary data between the CD player 1 and the headphone 2. That is to say, it is consequently possible to configure the circuit serving to establish synchronization in a simple manner, so that the CD player 1 and the headphone 2 can easily be miniaturized.

[0026] Furthermore, in this case, it is possible to transmit and receive the audio signal using a spreading code with a long period, whereby wireless communication can be achieved with little interference and with excellent ciphering.

[0027] FIG. 2 shows an example of the configuration of the CD player 1.

[0028] The connector 12 comprises terminal 12A through terminal 12 H, and these terminals are respectively connected to terminals 23A through 23H of the connector 23 in the headphone 2 (FIG. 3).

[0029] A CD playback unit 31 plays back the audio content recorded on the CD that has been loaded, and the audio signal that is produced as a result is provided to a baseband modulation unit 32.

[0030] The baseband modulation unit 32 scrambles the audio signal from the CD playback unit 31 with a ciphering pattern from a ciphering pattern generation unit 40 and performs narrowband modulation on a high-frequency signal with the signal that is produced as a result, then performs spread modulation with a spreading code supplied from a spreading code generation unit 38, and subsequently outputs this to a transmission unit 33.

[0031] The transmission unit 33 mixes the signal from the baseband modulation unit 32 with a signal (carrier) from a synthesizer 34, converts this to a wireless frequency, and amplifies this on the basis of control from a transmission output control unit 36, so as to generate a transmission signal, which is output to the antenna 11. The transmission signal that is output to the antenna 11 is transmitted to the headphone 2.

[0032] The synthesizer 34 generates a carrier corresponding to the channel used in communication with the headphone 2, which is made known by the control unit 41, using a clock [signal] (reference clock) from an oscillator 35, and outputs this to the transmission unit 33.

[0033] The oscillator (TCXO) 35 oscillates at a predetermined oscillation frequency, serving as a reference clock in the communication between the CD player 1 and the headphone 2, and outputs this to the synthesizer 34 and the terminal 12C of the connector 12.

[0034] The transmission output control unit 36 controls the transmission unit 33 in accordance with instructions from a control unit 41, and amplifies the transmission signal so as to be received at the headphone 2 with no less than a predetermined field intensity.

[0035] The timing generation unit 37 has a counter; the value of this counter indicates the timing for the spreading code generation, and is output to a spreading code generation unit 38 and the terminal 12E of the connector 12.

[0036] The spreading code generation unit 38 generates a spreading code of the type made known by the control unit 41 (for example, a predetermined period) on the basis of the count value from the timing generation unit 37, and outputs this to the baseband modulation unit 32.

[0037] A ciphering key storage unit 39 stores a ciphering key supplied by the control unit 41, and outputs this to the ciphering pattern generation unit 40 at a predetermined timing.

[0038] The ciphering pattern generation unit 40 generates a ciphering pattern for the ciphering key from the ciphering key storage unit 39, by applying the pattern made known by the control unit 41, and outputs this to the baseband modulation unit 32.

[0039] The control unit 41 controls the various units and outputs a signal indicating a channel that is the same as that made known to the synthesizer 34 during synchronization establishment processing (described below) to the terminal 12A of the connector 12, and also outputs a signal indicating the start or end of synchronization establishment processing to the terminal 12B. The control unit 41 also outputs, to the terminal 12D, a signal indicating the same spreading code type as that made known to the spreading code generation unit 38, outputs, to the terminal 12F, a signal indicating the same pattern as that made known to the ciphering pattern generation unit 40, and outputs, to the terminal 12 G, the same ciphering key as that provided to the ciphering key storage unit 39.

[0040] The control unit 41 references a signal indicating the communication quality of the reception signal received by the headphone 2, which is input from the terminal 12H of the connector 12 during synchronization establishment processing and, based on the results of this referencing, performs processing that changes the channel, the type of spreading code or the transmission signal amplification factor.

[0041] FIG. 3 shows an example of the configuration of the headphone 2.

[0042] A reception unit 51 amplifies a reception signal received via the antenna 21, then mixes this with the signal (carrier) from the synthesizer 53, to generate an IF signal, which is output to a baseband demodulator 52.

[0043] The baseband demodulator 52 performs inverse spreading on the signal from the reception unit 51, on the basis of a spreading code from a spreading code generation circuit 60, and then after passing through a narrowband filter (not shown) demodulates the signal that is produced as a result. The baseband demodulation unit 52 also descrambles the signal that is produced as a result of demodulation (the scrambled signal) with the ciphering pattern that is provided from a ciphering pattern generation unit 62, and outputs the audio signal that is produced as a result to an amplification unit 64.

[0044] During synchronization establishment processing, the synthesizer 53 generates a carrier corresponding to the channel indicated in the signal from the CD player 1, which is input via the terminal 23A of the connector 23, using the signal (clock) from the oscillator 54,

and supplies this to the reception unit 51.

[0045] The oscillator (VCO) 54 oscillates at an oscillation frequency (clock) corresponding to an applied voltage that is provided from a D/A converter 56, and provides output to the synthesizer 53 and a frequency comparator 58.

[0046] An AFC (automatic frequency control) unit 55 detects discrepancy in the clock [signal] from the oscillator 54 and outputs a signal (digital signal) to a selector 57, as a result of this detection.

[0047] During synchronization establishment processing, the selector 57 selects input from the frequency comparator 58 or the AFC unit 55 depending on a signal (signal indicating the start or the end of synchronization establishment processing) from the CD player 1, which is input via the terminal 23B of the connector 23, and provides output to the D/A converter 56.

[0048] The frequency comparator 58 compares the frequency of the reference clock from the CD player 1, which is input via the terminal 23C of the connector 23, and the frequency of the clock from the oscillator 54, detects discrepancy therein, and outputs a digital signal to the selector 57 as a result of this detection.

[0049] During synchronization establishment processing, the timing generation unit 59 outputs, to the spreading code generation unit 60, a clock value [sic] serving as the spreading code generation timing, from the CD player 1, which is input via the terminal 23E of the connector 23.

[0050] During synchronization establishment processing, the spreading code generation unit 60 generates a spreading code of the type indicated in a signal from the CD player 1, which is input via the terminal 23D of the connector 23, on the basis of a count value from the timing generation unit 59, which is output to the baseband demodulation unit 52.

[0051] During synchronization establishment processing, the ciphering key storage unit 61 stores a ciphering key from the CD player 1, which is input via the terminal 23G of the connector 23, and outputs this to a ciphering pattern generation unit 62, at a predetermined timing.

[0052] During synchronization establishment processing, the ciphering pattern in generation unit 62 generates a ciphering pattern for the ciphering key that is supplied from the ciphering key storage unit 61, by applying the pattern indicated in the signal from the CD player 1, which is input via the terminal 23F of the connector 23, and outputs this to the baseband demodulation unit 52.

[0053] During synchronization establishment processing, a communication quality detection unit 63 measures of the field intensity of the reception signal, from the signal from the baseband demodulation unit 52, judges the measurement result against a predetermined threshold value, and outputs a signal corresponding to the judgment result (comparison result) to the terminal 23H of the connector 23.

[0054] An amplification unit 64 amplifies the audio signal from the baseband demodulation unit 52, and outputs this via a speaker 22.

[0055] Next, the order of the synchronization establishment processing is described with reference to the flowchart in FIG. 4. Note that, at the start of this processing, the connector 12 of the CD player 1 and the connector 23 of the headphone 2 are connected by a cable.

[0056] In step S1, a control unit 41 of the CD player 1 outputs a signal indicating that synchronization establishment processing is to start, to the headphone 2, via the terminal 12B of the connector 12.

[0057] In step S2, the selector 57 in the headphone 2 selects the frequency comparator 58 as the input side connection target, in accordance with the signal indicating the start of synchronization establishment processing that was sent from the CD player 1 in step S1, which was input via the terminal 23B of the connector 23. Consequently, the output of the frequency comparator 58 is provided to the D/A converter 56, via the selector 57.

[0058] Next, in step S3, the oscillator 35 in the CD player 1 begins to oscillate at the oscillation frequency (reference clock). Consequently, the reference clock is provided to the synthesizer 34 and the headphone 2, via the terminal 12 C of the connector 12.

[0059] In step S4, synchronization is established between the clock of the headphone 2 and the reference clock of the CD player 1.

[0060] Specifically, the frequency comparator 58 in the headphone 2 detects the difference between the frequency of the reference clock that is provided by the CD player 1 in step S3 and the frequency of the clock that is input from the oscillator 54, and provides the result of this detection to the D/A converter 56 via the selector 57. The D/A converter 56 converts the signal (digital signal) from the selector 57 to an analog signal, and provides this to the oscillator 54. That is to say, an applied voltage is provided to the oscillator 54, in accordance with the detection result from the frequency comparator 58, and thus ultimately, the clock that is generated by the oscillator 54 and the reference clock that is generated by the oscillator 35 in the CD player 1 will be synchronized.

[0061] Next, in step S5, the control unit 41 of the CD player 1 provides, to the ciphering pattern generation unit 40, a signal indicating the type of ciphering pattern (pattern) for scrambling the transmission signal, and provides to the headphone 2 (ciphering pattern generation unit 62, via the terminal 23F of the connector 23), via the terminal 12F of the connector 12, a signal indicating the type of ciphering pattern (pattern) for descrambling that scramble.

[0062] In step S6, the control unit 41 of the CD player 1 provides, to the ciphering key storage unit 39, a signal indicating the ciphering key necessary to generate the ciphering pattern, and provides this to the headphone 2 (ciphering key storage unit 61, via the terminal 23G of the connector 23), via the terminal 12G of the connector 12.

[0063] Consequently, a ciphering pattern is generated in the CD player 1 and the headphone 2. Specifically, the ciphering key storage unit 39 in the CD player 1 stores the ciphering key indicated in the signal provided from the control unit 41 in step S6, and provides this to the ciphering pattern generation unit 40. The ciphering pattern generation unit 40 generates a ciphering pattern for the ciphering key from the ciphering key storage unit 39

by applying the pattern indicated in the signal provided from the control unit 41 in step S5, and provides this to the baseband modulation unit 32.

[0064] Meanwhile, the ciphering key storage unit 61 in the headphone 2 stores the ciphering key indicated in the signal provided from the CD player 1 in step S6, and provides this to the ciphering pattern generation unit 62. The ciphering pattern generation unit 62 generates a ciphering pattern for the ciphering key from the ciphering key storage unit 61 by applying the pattern indicated in the signal provided from the CD player 1 in step S5, and provides this to the baseband demodulation unit 52.

[0065] Next, in step S7, the control unit 41 in the CD player 1 determines the type of spreading code and provides a signal indicating this type to both the spreading code generation unit 38 and the headphone 2 (spreading code generation unit 60, via the terminal 23D of the connector 23) via the terminal 12 the of the connector 12.

[0066] In step S8, the timing generation unit 37 of the CD player 1 begins timing generation in order to generate a spreading code. Consequently, a count value serving as the spreading code generation timing, which was generated by this timing generation unit 37, is provided to the headphone 2 (spreading code generation unit 60, via the terminal 23E of the connector 23 and the timing generation unit 59) via the spreading code generation unit 38 and the terminal 12E of the connector 12.

[0067] As a result, a spreading code is generated in the CD player 1 and the headphone 2. Specifically, the spreading code generation unit 38 in the CD player 1 generates a spreading code of the type indicated in the signal provided from the control unit 41 in step S7, on the basis of the clock value [sic] supplied from the timing generation unit 37 in step S8, and provides this to the baseband modulation unit 32.

[0068] Meanwhile, the spreading code generation unit 60 in the headphone 2 generates a spreading code of the type indicated in the signal provided from the CD player 1 in step S7, on the basis of the clock value [sic] provided from the timing generation unit 59 in step S8, and provides this to the baseband demodulation unit 52.

[0069] Next, in step S9, the control unit 41 of the CD player 1 determines a predetermined channel and provides a signal indicating that channel to the synthesizer 34 and the headphone 2 (synthesizer 53, via the terminal 23A of the connector 23) via the terminal 12A of the connector 12.

[0070] In step S10, the control unit 41 of the CD player 1 determines the amplification factor for signal amplification in the transmission unit 33 at an initial value, and makes this known to the transmission output control unit 36. Consequently, the transmission output control unit 36 controls the transmission unit 33 so as to perform signal amplification at the amplification factor (initial value) that was made known. As a result, wireless communication begins between the CD player 1 and the headphone 2.

[0071] Next, in step S11, the control unit 41 of the CD player 1 references the input (result of the detection from the communication quality detection unit 63, provided via the terminal 23H of the connector 23 in the headphone 2) from the terminal 12H of the connector 12, and determines whether or not communication quality improvement is necessary. Specifically, if the detection result indicates that the field intensity of the reception signal is less than a predetermined threshold value, the control unit 41 determines that communication quality improvement is necessary, and if this indicates that this is greater than or equal to the same, it determines that improvement is not necessary.

[0072] If it is determined that communication quality improvement is necessary in step S11, which is to say if the quality detection result from the communication quality detection unit 63 in the headphone 2 indicates that the field intensity of the reception signal is less than the predetermined threshold value, [the program] advances to step S12, and the control unit 41 of the CD player 1 executes processing for improving the communication quality.

[0073] For example, the communication quality can be improved by increasing the amplification factor for the signal amplification, changing the channel used, or changing the type of spreading code.

[0074] Thereafter [the program] returns to step S11 and the subsequent processing is repeatedly executed until it is determined that there is no need for improvement of communication quality in step S11.

[0075] If it has been determined in step S11 that communication improvement is not necessary, [the program] advances to step S13 and the control unit 41 in the CD player 1 outputs, to the headphone 2, a signal indicating that synchronization establishment processing has ended, via the terminal 12B of the connector 12. Note that, the control unit 41 stores the conditions at this time (for example the amplification factor, the channel or the spreading code type at this time) in a built-in memory, as communication quality history, and when synchronization establishment processing is once again executed (when the CD player 1 and the headphone 2 are once again connected by way of a wire) those conditions are set as initial values.

[0076] In step S14, the selector 57 in the headphone 2 selects the AFC unit 55 as the input side connection target, in accordance with the signal indicating the end of synchronization establishment processing, that was sent from the CD player 1 in step S13, which was input via the terminal 23B of the connector 23. Consequently, signal processing is performed along the route of the AFC unit 55, the selector 57, the D/A converter 56 and the oscillator 54, allowing for tuning.

[0077] Thereafter, the processing ends.

[0078] The series of processes described above can be implemented by way of hardware, but can also be implemented by way of software. If the series of processes is implemented by way of software, a program in which this software is configured is installed in a computer and that program is executed by the computer, whereby the communication device described above is functionally implemented.

[0079] FIG. 5 is a block diagram showing the configuration of one mode of embodiment of a computer 101 that functions as a communication device such as described above.

An input/output interface 116 is connected to a CPU (central processing unit) 111, via a bus 115; when commands are input by a user to the CPU 111, via an input unit 118 comprising a keyboard, mouse and the like via the input/output interface 116, a program that is stored, for example, in a recording medium such as a ROM (read-only memory) 112, a hard disk 114 or a magnetic disk 131, an optical disk 132 or an magneto-optical disk 133, which is loaded in a drive 120, or a semiconductor memory 134 or the like, is loaded into a RAM (random access memory) 113 and executed. Consequently, the various processes described above (for example the processing illustrated by way of the flowchart in FIG. 4) are executed. In addition, the CPU 111 outputs the results of this processing, for example, to a display unit 117 consisting of an LCD (liquid crystal display) and the like, as necessary, via the input/output interface 116. Note that, the program can be stored in a hard disk 114 or a ROM 112 in advance and provided to the user integrated with the computer 101, or can be provided as packaged media such as a magnetic disk 131, an optical disk 132, a magneto-optical disk 133 or a semiconductor memory 134, or can be provided to the hard disk 114 via a communication unit 119 from a satellite, network or the like.

[0080] Note that, it is a matter of course that the steps that describe the program that is provided on the recording medium in the present specification encompass processing that is performed chronologically according to the order described, but this does not necessarily have to be chronological processing, and processing that is executed in parallel or discretely is encompassed.

[0081] Furthermore, the term, system, in the present invention, indicates an overall device that comprises a plurality of devices.

[0082]

[Effects of the Invention] According to the first communication device, method and program on a recording medium to which the present invention has been applied: the type of spreading code is determined; the spreading code generation timing is generated; a spreading code of the determined type is generated at the generated generation timing; transmission data is modulated using the generated spreading code; a channel for wireless communication is determined; a carrier corresponding to the channel is generated using a reference clock; for the purpose of establishing synchronization for the purpose of wireless communication, the channel, the reference clock, and the type and generation timing of the spreading code are provided, via a wire, to a reception device that demodulates a reception signal using a spreading code that is identical to, and synchronous with, the generated spreading code; and the modulated transmission data is mixed with the generated carrier, converted to a wireless frequency and wirelessly transmitted to the reception device, whereby synchronization can easily be established.

[0083] According to the second communication device, method and program on a recording medium of the present invention: the type of spreading code, the spreading code generation timing, a channel for wireless communication, and a reference clock are acquired; a carrier is generated corresponding to the channel, using the reference clock; a reception signal is received by way of tuning based on the carrier; a spreading code of the type is generated at the generation timing; and the reception signal is demodulated, using the spreading code that was generated, whereby synchronization can easily be established.

[Brief Description of the Drawings]

[FIG. 1] This is a figure showing an example of use of a CD player 1 and a headphone 2, in which the present invention is presented.

[FIG. 2] This is a block diagram showing an example of the configuration of the CD player 1 in FIG. 1.

[FIG. 3] This is a block diagram showing an example of the configuration of the headphone 2 in FIG. 1.

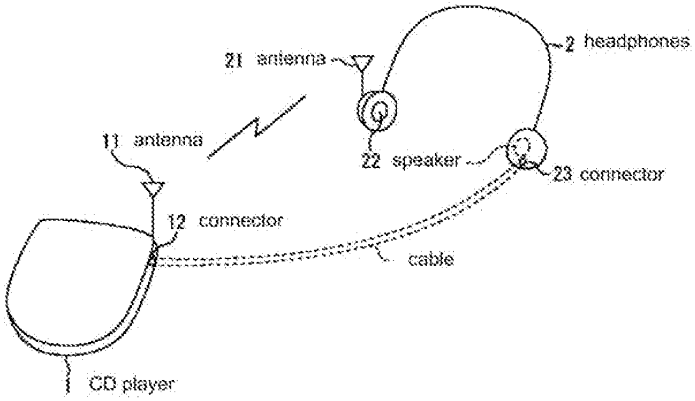
[FIG. 4] This is a flowchart describing synchronization establishment processing.

[FIG. 5] This is a block diagram showing an example of the configuration of the computer 101.

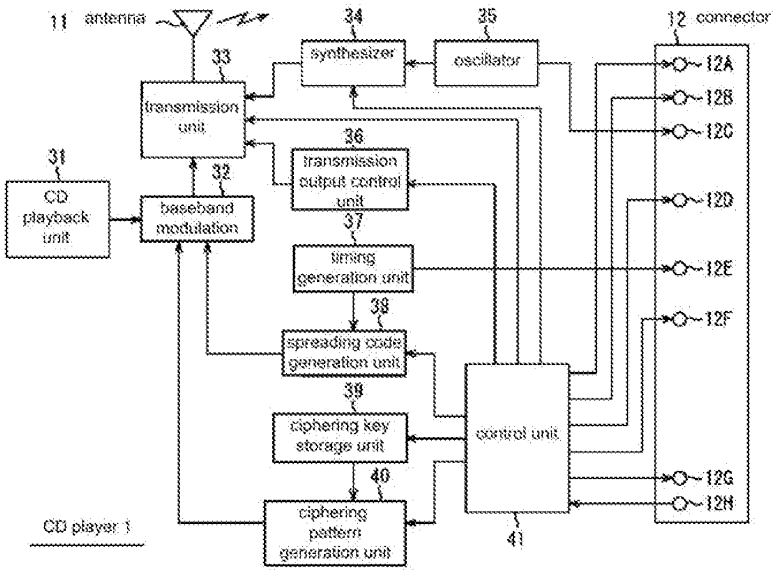
[Explanation of the Symbols]

1 CD player, 2 headphone, 11 antenna, 12 connector, 21 antenna, 22 speaker, 23 connector, 31 CD playback unit, 32 baseband modulation unit, 33 transmission unit, 34 synthesizer, 35 oscillator, 36 transmission output control unit, 37 timing generation unit, 38 spreading code generation unit, 39 ciphering key storage unit, 40 ciphering pattern generation unit, 41 control unit, 51 reception unit, 52 baseband demodulation unit, 53 synthesizer, 54 oscillator, 55 AFC unit, 56 D/A converter, 57 selector, 58 frequency comparator, 59 timing generation unit, 60 spreading code generation unit, 61 ciphering key storage unit, 62 ciphering pattern generation unit, 63 communication quality detection unit, 64 amplifier

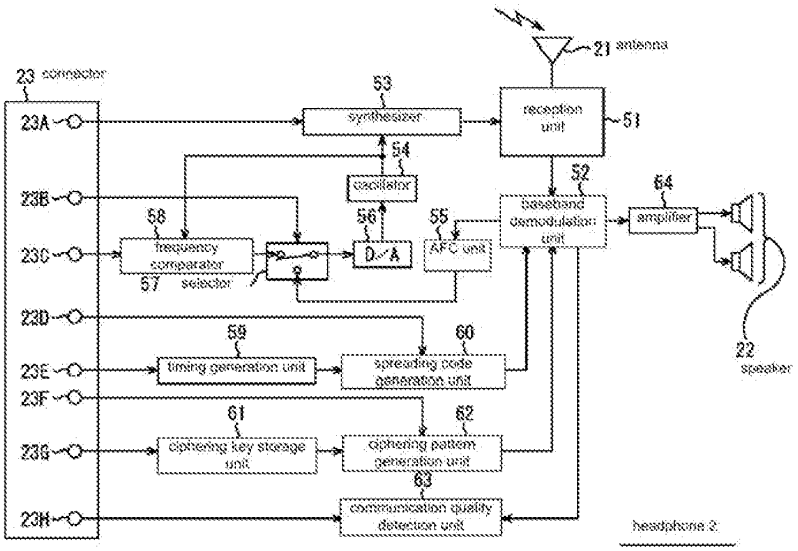
[FIG. 1]


21 antenna
2 headphones
11 antenna
22 speaker
23 connector
12 connector
cable
CD player

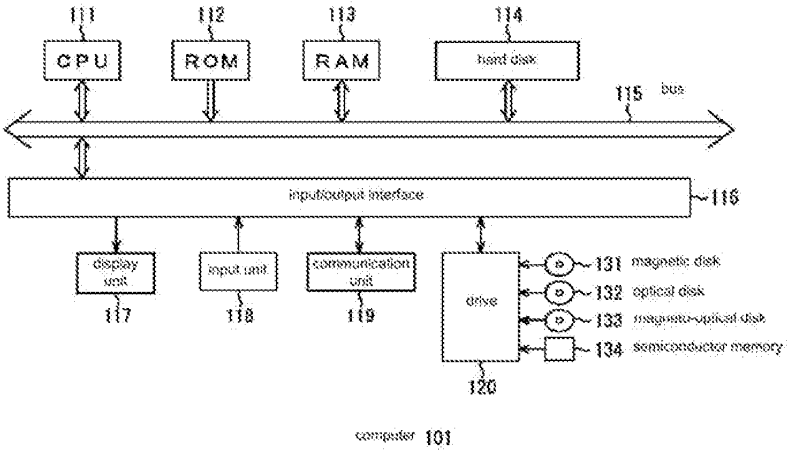
[FIG. 2]


11 antenna
34
35
12 connector
synthesizer
oscillator
33
transmission unit
36
transmission output control unit
31
32
CD playback unit
baseband modulation
37
timing generation unit
38
spreading code generation unit
39
ciphering key storage unit
control unit
40
ciphering pattern generation unit
41
CD player 1
12A
12B
12C
12D
12E
12F
12G
12H

[FIG. 3]



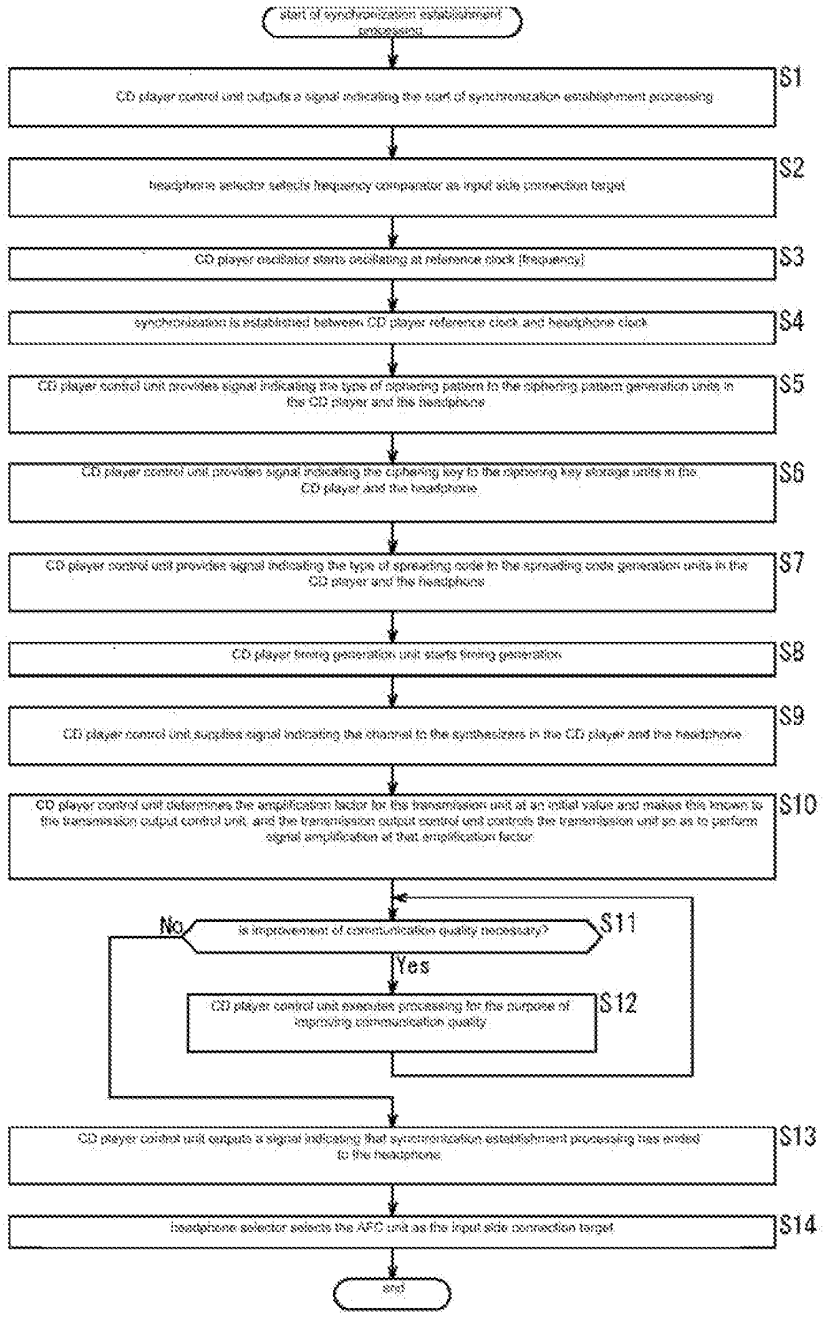
[FIG. 5]



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[FIG. 4]



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Certification of Translation

Translator's Declaration: May 22, 2015

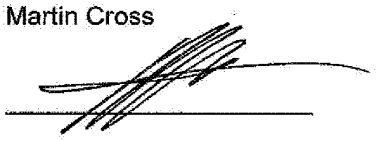
I, Martin Cross, hereby declare:

That I possess advanced knowledge of the Japanese and English languages. My qualifications are as follows:

- over 25 years as a Japanese-English translator focusing primarily on patents, and technical and scientific documents
- co-author of the *Japanese Patent Translator's Handbook*, published by American Translators Association
- United States district court recognition as an expert in Japanese technical translation for patent litigation
- work experience including design and testing of electronic circuits for Research and Development Laboratories Waterloo Ltd.

The attached translation is, to the best of my knowledge and belief, a true and accurate translation from Japanese to English of Japanese Unexamined Patent Application Number 2002-118497. I understand that willful false statements and the like are punishable by fine or imprisonment, or both (18 U.S.C. 1001), and may jeopardize the validity of the application or any patent issuing thereon. I declare under penalty of perjury that all statements made herein of my own knowledge are true, and all statements made on information and belief are believed to be true.

Martin Cross



PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
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Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99**)		
	Application Number	13356949
	Filing Date	2012-24-01
	First Named Inventor	C. Earl Woolfork
	Art Unit	2656
	Examiner Name	Andrew Flanders
	Attorney Docket Number	

U.S.PATENTS						Remove
Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	5722071		1998-02-24	Berg,Roger	
	2	6424820		2002-07-23	Burdick,Wayne	
	3	6487240		2002-11-26	Chen,Weizhong	
	4	5848095		1998-12-08	Duetsch,Brian	
	5	5528623		1996-06-18	Foster, Robert	
	6	6397037		2002-05-28	Franklin,David	
	7	6563892		2003-05-13	Haartsen, Jacobus	
	8	6574455		2003-06-03	Jakobsson, Bjorn	

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	Art Unit	2656
	Examiner Name	Andrew Flanders
	Attorney Docket Number	

	9	6973297		2005-12-06	Manku, Tajinder	
	10	5193102		1993-03-09	Meidan, Reuven	
	11	5822440		1998-10-13	Oltman, Randy	
	12	5418813		1995-05-23	Schaffner, Terry	
	13	6378101		2002-04-23	Sinhu, Deepen	
	14	7054296		2006-05-30	Sorrells, David	
	15	5892792		1999-04-06	Walley, John	
	16	6006115		1999-12-21	Wingate, Richard	
	17	5769032		1998-06-23	Yarnall, Robert	
	18	5907582		1999-05-25	Yi, Byung	
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	Application Number	13356949
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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20010031622		2001-10-18	Kivela, Seppo	
	2	20020009124		2002-01-24	Li, Daoben	
	3	20030118122		2003-06-26	Nefedov, Nikolai	
	4	20020132585		2002-09-19	Palermo, Vincent	
	5	20030073460		2003-04-17	Van Pelt, Engelbert	
	6	20020039424		2002-04-04	Watanuki, Masanori	

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	1	W0 9939445			1999-08-05	Bergstrom,Scott		☐
	2	2000-0006888			2000-04-25	Ham, In Wha		☐

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13356949
	Filing Date	2012-24-01
	First Named Inventor	C. Earl Woolfork
	Art Unit	2656
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	Attorney Docket Number	

	3	GB 2343332			2000-05-03	Hulbert		☐
	4	EP 1096717 A2			2000-10-20	Lee, Young		☐
	5	2000309004			2000-10-10	Terajima, Kazuhiko		☐

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T5
	1	Alagha, Nader, Generalized Raised-Cosine Filters, July 1999	☐
	2	Bray, Jennifer, Bluetooth Connect Without Cables, 2001	☐
	3	DeCourville, Marc, Motorola Labs: An OFDM based solution granting compatibility between next G of high rate WPANs and WLANs	☐
	4	Eliezer, Oren, Bluetooth and Wi-Fi coexistence schemes strive to avoid chaos, November 2001	☐
	5	GN Netcom Incorporated, Project: GN Netcom Bluetooth Headset, June 2000	☐
	6	Gupta, Rajesh, Design Technology for Building Wireless Systems, 1997	☐

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	Art Unit	2656
	Examiner Name	Andrew Flanders
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	7	Karaoguz, Jeyhan, Project: IEEE 802.15 Working Group for Wireless Personal Area Network (WPANs), July 2000	☐
	8	Mattisson, Sven, Low-Power Considerations in the Design of Bluetooth, 2000	☐
	9	Nafie, Mohammed, Enhancements to the Bluetooth Specification, 2001	☐
	10	Pickholtz, Raymond, Spread Spectrum for Mobile Communications, May 1991	☐
	11	Reynolds, Daryl, Low Complexity Turbo Equalization for Diversity Channels, April 2001	☐
	12	Rios, Carlos, Project: IEEE 802.15 Working Group for Wireless Personal Area Networks (WPANs), September 2000	☐
	13	Skylar, Bernard, Digital Communications, 1988	☐
	14	Wang, hongfeng, Overview of Bluetooth Technology, July 2001	☐
	15	Zimmerman, T, Personal Area Networks: Near-field intrabody communication	☐

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EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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	Application Number	13356949
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	Attorney Docket Number	

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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	Filing Date	2012-24-01
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	Art Unit	2656
	Examiner Name	Andrew Flanders
	Attorney Docket Number	

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ None

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Megan Lyman/	Date (YYYY-MM-DD)	2012-06-18
Name/Print	Megan Lyman	Registration Number	57054

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt

EFS ID:	22692471
Application Number:	13356949
International Application Number:	
Confirmation Number:	2299
Title of Invention:	Wireless Digital Audio Music System
First Named Inventor/Applicant Name:	C. Earl Woolfork
Customer Number:	68533
Filer:	Megan Elizabeth Lyman
Filer Authorized By:	
Attorney Docket Number:	1028.6
Receipt Date:	21-JUN-2015
Filing Date:	24-JAN-2012
Time Stamp:	15:07:38
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	June2015IDSform.pdf	613744 c7beb441d65975216e987fd86a9a218aaf32b8a8	no	8

Warnings:	
Information:	

Total Files Size (in bytes):	613744

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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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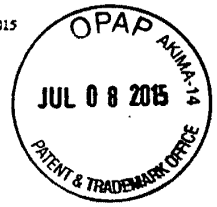
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Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE
Commissioner for Patents
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Alexandria, Virginia 22313-1450
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INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

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68533 7590 04/13/2015
MEGAN LYMAN
1816 SILVER MIST CT.
RALEIGH, NC 27613



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Megan Lyman	(Depositor's name)
	(Signature)
07/08/15	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/356,949	01/24/2012	C. Earl Woolfork	1028.6	2299

TITLE OF INVENTION: Wireless Digital Audio Music System

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$480	$0	$0	$480	07/13/2015

EXAMINER	ART UNIT	CLASS-SUBCLASS
FLANDERS, ANDREW C	2656	700-094000

07/09/2015 APEREZA1 00000022 13356949
01 FC:2501 480.00 OP

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required.

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
1 Megan E. Lyman
2
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: One-E-Way, Inc.
(B) RESIDENCE: (CITY and STATE OR COUNTRY): Pasedena, CA

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:
- ☒ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)
- ☐ A check is enclosed.
- ☒ Payment by credit card. Form PTO-2038 is attached.
- ☐ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)
- ☐ Applicant certifying micro entity status. See 37 CFR 1.29 — NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
- ☐ Applicant asserting small entity status. See 37 CFR 1.27 — NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
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Authorized Signature _____ Date 07/08/2015
Typed or printed name Megan Lyman Registration No. 57054

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PAGE 1/2 * RCVD AT 7/8/2015 2:53:36 PM [Eastern Daylight Time] * SVR:W-PTOFAX-002/16 * DNIS:2732885 * CSID:9193410241 * DURATION (mm-ss):01-47

Samsung Exhibit 1002, Page 850 of 880
Samsung Electronics Co., Ltd. et al. v. One-E-Way, Inc.
IPR2025-01541

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/356,949	01/24/2012	C. Earl Woolfork	1028.6	2299

7590 07/09/2015

MEGAN LYMAN
1816 SILVER MIST CT.
RALEIGH, NC 27613

EXAMINER	
FLANDERS, ANDREW C	

ART UNIT	PAPER NUMBER
2656	

NOTIFICATION DATE	DELIVERY MODE
07/09/2015	ELECTRONIC

NOTICE OF NON-COMPLIANT INFORMATION DISCLOSURE STATEMENT

An Information Disclosure Statement (IDS) filed 6/21/15 in the above-identified application fails to meet the requirements of 37 CFR 1.97(d) for the reason(s) specified below. Accordingly, the IDS will be placed in the file, but the information referred to therein has not been considered.

The IDS is not compliant with 37 CFR 1.97(d) because:

☐ The IDS lacks a statement as specified in 37 CFR 1.97(e).

☑ The IDS lacks the fee set forth in 37 CFR 1.17(p).

☐ The IDS was filed after the issue fee was paid. Applicant may wish to consider filing a petition to withdraw the application from issue under 37 CFR 1.313(c) to have the IDS considered. See MPEP 1308.

Utt

571-272-4200 or 1-888-786-0101
Application Assistance Unit
Office of Data Management

FORM PTOM327-B (Rev. 02/08)

Samsung Exhibit 1002, Page 851 of 880
Samsung Electronics Co., Ltd. et al. v. One-E-Way, Inc.
IPR2025-01541

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MEGAN LYMAN
1816 SILVER MIST CT.
RALEIGH, NC 27613

EXAMINER	
FLANDERS, ANDREW C	

ART UNIT	PAPER NUMBER
2656	

NOTIFICATION DATE	DELIVERY MODE
07/09/2015	ELECTRONIC

NOTICE OF NON-COMPLIANT INFORMATION DISCLOSURE STATEMENT

An Information Disclosure Statement (IDS) filed 6/19/15 in the above-identified application fails to meet the requirements of 37 CFR 1.97(d) for the reason(s) specified below. Accordingly, the IDS will be placed in the file, but the information referred to therein has not been considered.

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Ltt

For 571-272-4200 or 1-888-786-0101
Application Assistance Unit
Office of Data Management

FORM PTOM327-B (Rev. 02/08)

Samsung Exhibit 1002, Page 852 of 880
Samsung Electronics Co., Ltd. et al. v. One-E-Way, Inc.
IPR2025-01541

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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U.S.PATENTS						Remove
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	Attorney Docket Number	

	9	6973297		2005-12-06	Manku, Tajinder	
	10	5193102		1993-03-09	Meidan, Reuven	
	11	5822440		1998-10-13	Oltman, Randy	
	12	5418813		1995-05-23	Schaffner, Terry	
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	17	5769032		1998-06-23	Yarnall, Robert	
	18	5907582		1999-05-25	Yi, Byung	

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13356949
	Filing Date	2012-24-01
	First Named Inventor	C. Earl Woolfork
	Art Unit	2656
	Examiner Name	Andrew Flanders
	Attorney Docket Number	

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20010031622		2001-10-18	Kivela, Seppo	
	2	20020009124		2002-01-24	Li, Daoben	
	3	20030118122		2003-06-26	Nefedov, Nikolai	
	4	20020132585		2002-09-19	Palermo, Vincent	
	5	20030073460		2003-04-17	Van Pelt, Engelbert	
	6	20020039424		2002-04-04	Watanuki, Masanori	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] ¡	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	W0 9939445			1999-08-05	Bergstrom,Scott		☐
	2	2000-0006888			2000-04-25	Ham, In Wha		☐

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13356949
	Filing Date	2012-24-01
	First Named Inventor	C. Earl Woolfork
	Art Unit	2656
	Examiner Name	Andrew Flanders
	Attorney Docket Number	

	3	GB 2343332			2000-05-03	Hulbert		☐
	4	EP 1096717 A2			2000-10-20	Lee, Young		☐
	5	2000309004			2000-10-10	Terajima, Kazuhiko		☐

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T5
	1	Alagha, Nader, Generalized Raised-Cosine Filters, July 1999	☐
	2	Bray, Jennifer, Bluetooth Connect Without Cables, 2001	☐
	3	DeCourville, Marc, Motorola Labs: An OFDM based solution granting compatibility between next G of high rate WPANs and WLANs	☐
	4	Eliezer, Oren, Bluetooth and Wi-Fi coexistence schemes strive to avoid chaos, November 2001	☐
	5	GN Netcom Incorporated, Project: GN Netcom Bluetooth Headset, June 2000	☐
	6	Gupta, Rajesh, Design Technology for Building Wireless Systems, 1997	☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13356949
	Filing Date	2012-24-01
	First Named Inventor	C. Earl Woolfork
	Art Unit	2656
	Examiner Name	Andrew Flanders
	Attorney Docket Number	

	7	Karaoguz, Jeyhan, Project: IEEE 802.15 Working Group for Wireless Personal Area Network (WPANs), July 2000	☐
	8	Mattisson, Sven, Low-Power Considerations in the Design of Bluetooth, 2000	☐
	9	Nafie, Mohammed, Enhancements to the Bluetooth Specification, 2001	☐
	10	Pickholtz, Raymond, Spread Spectrum for Mobile Communications, May 1991	☐
	11	Reynolds, Daryl, Low Complexity Turbo Equalization for Diversity Channels, April 2001	☐
	12	Rios, Carlos, Project: IEEE 802.15 Working Group for Wireless Personal Area Networks (WPANs), September 2000	☐
	13	Skylar, Bernard, Digital Communications, 1988	☐
	14	Wang, hongfeng, Overview of Bluetooth Technology, July 2001	☐
	15	Zimmerman, T, Personal Area Networks: Near-field intrabody communication	☐

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EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

EFS Web 2.1.17

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13356949
	Filing Date	2012-24-01
	First Named Inventor	C. Earl Woolfork
	Art Unit	2656
	Examiner Name	Andrew Flanders
	Attorney Docket Number	

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	13356949
	Filing Date	2012-24-01
	First Named Inventor	C. Earl Woolfork
	Art Unit	2656
	Examiner Name	Andrew Flanders
	Attorney Docket Number	

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ None

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Megan Lyman/	Date (YYYY-MM-DD)	2015-06-19
Name/Print	Megan Lyman	Registration Number	57054

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

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Electronic Patent Application Fee Transmittal

Application Number:	13356949
Filing Date:	24-Jan-2012
Title of Invention:	Wireless Digital Audio Music System
First Named Inventor/Applicant Name:	C. Earl Woolfork
Filer:	Megan Elizabeth Lyman
Attorney Docket Number:	1028.6

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	2806	1	90	90
		Total in USD ($)		**90**

Electronic Acknowledgement Receipt	
EFS ID:	22891313
Application Number:	13356949
International Application Number:	
Confirmation Number:	2299
Title of Invention:	Wireless Digital Audio Music System
First Named Inventor/Applicant Name:	C. Earl Woolfork
Customer Number:	68533
Filer:	Megan Elizabeth Lyman
Filer Authorized By:	
Attorney Docket Number:	1028.6
Receipt Date:	12-JUL-2015
Filing Date:	24-JAN-2012
Time Stamp:	15:26:06
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$90
RAM confirmation Number	7440
Deposit Account	
Authorized User	
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	IDSSecondStatementandFees.pdf	67929 29c594335d1c46d050fedf9adf86351d03cd7dbc	no	1
Warnings:					
Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	IDSForm.pdf	613879 209a0ce3e7012ef8db8ed9bdc8a5dfbf3681c6d9	no	8
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30137 4f79bb396f48643264acd2301d48dddbc75f94c9	no	2
Warnings:					
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		Total Files Size (in bytes):	711945		

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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Statement and Fee for IDS submitted on 06/19/15

To Whom It May Concern:

An Information Disclosure Statement and attachments was sent to the Patent Office on 06/19/15, the statement was inadvertently not attached and submitted on 06/21/15 (a copy of which is attached hereto). The fee required for the IDS is submitted herewith. Please do not hesitate to contact me with any questions or concerns.

July 12, 2015

Respectfully Submitted,



Megan E. Lyman, Registration No. 57,054
1816 Silver Mist Ct.
Raleigh, NC 27613
melyman@lymanpatents.com
(919) 341-4023 (phone)
(919) 341-0271 (fax)

Samsung Exhibit 1002, Page 865 of 880
Samsung Electronics Co., Ltd. et al. v. One-E-Way, Inc.
IPR2025-01541

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/356,949	01/24/2012	C. Earl Woolfork	1028.6	2299

7590 07/17/2015

MEGAN LYMAN
1816 SILVER MIST CT.
RALEIGH, NC 27613

EXAMINER	
FLANDERS, ANDREW C	

ART UNIT	PAPER NUMBER
2656	

NOTIFICATION DATE	DELIVERY MODE
07/17/2015	ELECTRONIC

NOTICE OF NON-COMPLIANT INFORMATION DISCLOSURE STATEMENT

An Information Disclosure Statement (IDS) filed 7/12/15 in the above-identified application fails to meet the requirements of 37 CFR 1.97(d) for the reason(s) specified below. Accordingly, the IDS will be placed in the file, but the information referred to therein has not been considered.

The IDS is not compliant with 37 CFR 1.97(d) because:

☐ The IDS lacks a statement as specified in 37 CFR 1.97(e).

☐ The IDS lacks the fee set forth in 37 CFR 1.17(p).

☑ The IDS was filed after the issue fee was paid. Applicant may wish to consider filing a petition to withdraw the application from issue under 37 CFR 1.313(c) to have the IDS considered. See MPEP 1308.

LH

For 571-272-4200 or 1-888-786-0101
Application Assistance Unit
Office of Data Management

FORM PTOM327-B (Rev. 02/08)

Samsung Exhibit 1002, Page 866 of 880
Samsung Electronics Co., Ltd. et al. v. One-E-Way, Inc.
IPR2025-01541

PTO/SB/08a (01-10)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	13356949
Filing Date	2012-01-24
First Named Inventor	C. Earl Woolfork
Art Unit	
Examiner Name	Andrew Flanders
Attorney Docket Number	1028.6

U.S.PATENTS						Remove
Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	5668880	A	1997-09-16	Alajajian, Philip	
	2	5721783	A	1998-02-24	Anderson, James	
	3	6115478	A	2000-09-05	Schneider ~~dspfactory Ltd.~~	
Change(s) applied to document, /S.X.S./ 5/4/2015	4	6236862	B1	2001-05-22	Erten, et al. ~~Intersignal LLC~~	
	5	7505823	B1	2009-03-17	Bartlett, et al. ~~Intrasonics Limited~~	
	6	5781542	A	1998-07-14	Tanaka	
	7	6678892	A	2004-08-13	Lavelle	
	8	5491839	A	1996-02-13	Schotz	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /ACF/

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
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	Filing Date	2012-24-01
	First Named Inventor	C. Earl Woolfork
	Art Unit	2656
	Examiner Name	Andrew Flanders
	Attorney Docket Number	

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	1	5822440		1998-10-13	Oltman,Randy	
	2	6104913		2000-08-15	McAllister,Alexander	
	3	5778022		1998-07-07	Walley,John	
	4	5506861		~~1998-09-04~~	Bottomley,Gregory	1996-04
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5/9/2015

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /ACF/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13356949
	Filing Date	2012-01-24
	First Named Inventor	C. Earl Woolfork
	Art Unit	
	Examiner Name	Andrew Flanders
	Attorney Docket Number	1028.6

	1	20020039424	A1	2002-04-04	Watanuki	
	2	20020068610	A1	2002-06-06	Anvekar	
	3	20020080288	A1	2002-06-27	Davies	
	4	20020098878		2002-07-25	Mooney	
	5	20030130016		2003-07-10	Matsuura	
	6	20030223604		2003-12-04	Nakagawa	
	7	20040215808		2004-10-28	Homma	
	8	20040242278		2004-12-02	Tomoda	
	9	20040107271	A1	~~2003-11-21~~	Ahn	2004-06
	10					

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Change(s) applied to document.
/D.D./
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13356949
	Filing Date	2012-01-24
	First Named Inventor	C. Earl Woolfork
	Art Unit	
	Examiner Name	Andrew Flanders
	Attorney Docket Number	1028.6

	9	5539769	A	1996-07-23	Kosko	
	10	5963583	A	1999-10-05	Davidovici	
	11	6028764	A	2000-02-22	Richardson	
	12	6072770	A	2000-06-06	Ho	
	13	6097711	A	2000-08-01	Okawa	
	14	6339706	B1	2002-01-15	Tillgren	
Change(s) applied to document, /D.D./ 5/9/2015	15	~~6366622~~	B1	2002-04-02	Giordano	6366662
	16	6373791	B1	2002-04-16	Ukita	
	17	6978162	B2	2005-12-20	Russell	
	18	~~7035588~~	B1	2006-04-25	Nakajima	7035788
	19	7187948	B2	2007-03-06	Alden	

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Alexandria, Virginia 22313-1450
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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/356,949	08/11/2015	9107000	1028.6	2299

68533 7590 07/22/2015

MEGAN LYMAN
1816 SILVER MIST CT.
RALEIGH, NC 27613

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 153 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

C. Earl Woolfork, Pasadena, CA;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

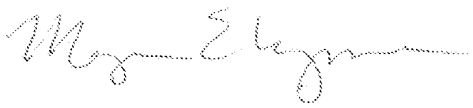
Statement and Fee for IDS submitted on 06/19/15

To Whom It May Concern:

An Information Disclosure Statement and attachments was sent to the Patent Office on 06/19/15, the statement was inadvertently not attached and submitted on 06/21/15 (a copy of which was attached July 12). A second notice from the Patent Office was received on July 17 stating that the IDS was submitted after the issue fee payment. The issue fee payment was made after the IDS with proper oath was submitted on 6/21. Thus, the IDS was in proper form before the issue fee was paid. Additionally, the File Wrapper indicates that the IDS was reviewed and signed by the Examiner in this application. It is requested that a third notice from the Patent Office be released indicating that the IDS has been properly received and reviewed in this application. Please do not hesitate to contact me with any questions or concerns.

July 27, 2015

Respectfully Submitted,



Megan E. Lyman, Registration No. 57,054
1816 Silver Mist Ct.
Raleigh, NC 27613
melyman@lymanpatents.com
(919) 341-4023 (phone)
(919) 341-0271 (fax)

Samsung Exhibit 1002, Page 872 of 880
Samsung Electronics Co., Ltd. et al. v. One-E-Way, Inc.
IPR2025-01541

Electronic Acknowledgement Receipt

EFS ID:	23034657
Application Number:	13356949
International Application Number:	
Confirmation Number:	2299
Title of Invention:	Wireless Digital Audio Music System
First Named Inventor/Applicant Name:	C. Earl Woolfork
Customer Number:	68533
Filer:	Megan Elizabeth Lyman
Filer Authorized By:	
Attorney Docket Number:	1028.6
Receipt Date:	27-JUL-2015
Filing Date:	24-JAN-2012
Time Stamp:	16:58:41
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	IDSThirdStatementandFees.pdf	69181 1bb1c713679cdc0e1f055829302140710d9c2b59	no	1

Warnings:	
Information:	

Total Files Size (in bytes):	69181

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82A (07-13)
Approved for use through 03/31/2021. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	13/356949
Filing Date	January 24, 2012
First Named Inventor	C. Earl Woolfork
Title	WIRELESS DIGITAL AUDIO MUSIC SYSTEM
Art Unit	2656
Examiner Name	Andrew C. Flanders
Attorney Docket Number	1EWAY.009P1C3

SIGNATURE of Applicant or Patent Practitioner

Signature	/Harnik Shukla/	Date (Optional)	
Name	Harnik Shukla	Registration Number	73,097
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☑ *Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82B (07-13)
Approved for use through 01/31/2018. OMB 0651-0035
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
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POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☑ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 20995

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

☑ The address associated with the above-mentioned Customer Number

OR

☐ The address associated with Customer Number:

OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

C. Earl Woolfork

☑ Inventor or Joint Inventor (title not required below)

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

☐ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature		Date (Optional)	
Name	C. Earl Woolfork		
Title			

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ Total of forms are submitted.

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If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Electronic Acknowledgement Receipt

EFS ID:	36943496
Application Number:	13356949
International Application Number:	
Confirmation Number:	2299
Title of Invention:	Wireless Digital Audio Music System
First Named Inventor/Applicant Name:	C. Earl Woolfork
Customer Number:	68533
Filer:	Harnik Shukla/Evelyn Salcido
Filer Authorized By:	Harnik Shukla
Attorney Docket Number:	1028.6
Receipt Date:	21-AUG-2019
Filing Date:	24-JAN-2012
Time Stamp:	19:21:30
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	1EWAY009P1C3_POA.pdf	712239 075834a5decead7e0dcf0b72bf25f6772744 8498	no	2

Warnings:

Information:	
Total Files Size (in bytes):	712239

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

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New International Application Filed with the USPTO as a Receiving Office

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UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
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www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/356,949	01/24/2012	C. Earl Woolfork	1028.6

CONFIRMATION NO. 2299

68533
MEGAN LYMAN
1816 SILVER MIST CT.
RALEIGH, NC 27613

POWER OF ATTORNEY NOTICE

OC000000110803299

Date Mailed: 09/03/2019

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 08/21/2019.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/dgela/

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UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/356,949	01/24/2012	C. Earl Woolfork	1EWAY.009P1C3

CONFIRMATION NO. 2299

20995
KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614

POA ACCEPTANCE LETTER

OC000000110803300

Date Mailed: 09/03/2019

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 08/21/2019.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/dgela/

Samsung Exhibit 1002, Page 880 of 880
Samsung Electronics Co., Ltd. et al. v. One-E-Way, Inc.
IPR2025-01541