

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	application submitted herewith
Filing Date	05/13/2016
First Named Inventor	Joseph Amalan Arul EMMANUEL
Title	DEDICATED BACKHAUL FOR WHOLE HOME COVERAGE
Art Unit	not yet assigned
Examiner Name	not yet assigned
Attorney Docket Number	110729-8058.US00

SIGNATURE of Applicant or Patent Practitioner

Signature	/MAG/	Date (Optional)	
Name	Michael A. Glenn	Registration Number	30176
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.

Netgear, Inc.
Exhibit 2006
TP-Link v. Netgear
IPR2023-01429
Ex. 2006-001

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:

22918

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):

NETGEAR, Inc.



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)

Dec 1, 2013

Name

Brian Busse

Title

Director of Intellectual Property

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 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.

Electronic Patent Application Fee Transmittal

Application Number:				
Filing Date:				
Title of Invention:	DEDICATED BACKHAUL FOR WHOLE HOME COVERAGE			
First Named Inventor/Applicant Name:	Joseph Amalan Arul EMMANUEL			
Filer:	Michael Glenn/Christine Ort			
Attorney Docket Number:	110729-8058.US00			
Filed as Large Entity				
Filing Fees for Provisional				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Provisional Application Filing	1005	1	260	260
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				260

Electronic Acknowledgement Receipt

EFS ID:	25779095
Application Number:	62336503
International Application Number:	
Confirmation Number:	1077
Title of Invention:	DEDICATED BACKHAUL FOR WHOLE HOME COVERAGE
First Named Inventor/Applicant Name:	Joseph Amalan Arul EMMANUEL
Customer Number:	22918
Filer:	Michael Glenn/Christine Ortt
Filer Authorized By:	Michael Glenn
Attorney Docket Number:	110729-8058.US00
Receipt Date:	13-MAY-2016
Filing Date:	
Time Stamp:	20:21:27
Application Type:	Provisional

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$ 260
RAM confirmation Number	5632
Deposit Account	500665
Authorized User	PERKINS COIE LLP

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	110729-8058US00_ADS.pdf	1823102	no	9
			218c47af117819a31b09e9b6d6e4947ee9175c9a9		

Warnings:**Information:**

2		110729-8058US00_Provisional_Application.pdf	2793233	yes	74
			d49a500f0fb6fd1c372016a979edb76b8f2e69a5		

Multipart Description/PDF files in .zip description

	Document Description	Start	End
	Specification	1	25
	Claims	26	72
	Power of Attorney	73	74

Warnings:**Information:**

3	Fee Worksheet (SB06)	fee-info.pdf	30325	no	2
			30f8ed076f44b300f93fb247132e9df590bec7d		

Warnings:**Information:**

Total Files Size (in bytes):			4646660
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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.

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.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	110729-8058.US00
		Application Number	
Title of Invention	DEDICATED BACKHAUL FOR WHOLE HOME COVERAGE		
The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.			

Secrecy Order 37 CFR 5.2:

☐	Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)
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Inventor Information:

Inventor	1				Remove	
Legal Name						
Prefix	Given Name	Middle Name	Family Name	Suffix		
	Joseph	Amalan Arul	EMMANUEL			
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service						
City	Cupertino	State/Province	CA	Country of Residence	US	

Mailing Address of Inventor:

Address 1	350 East Plumeria Drive					
Address 2						
City	San Jose	State/Province	CA			
Postal Code	95134	Country	US			

Inventor	2				Remove	
Legal Name						
Prefix	Given Name	Middle Name	Family Name	Suffix		
	Peiman		AMINI			
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service						
City	Mountain View	State/Province	CA	Country of Residence	US	

Mailing Address of Inventor:

Address 1	350 East Plumeria Drive					
Address 2						
City	San Jose	State/Province	CA			
Postal Code	95134	Country	US			

Inventor	3				Remove	
Legal Name						
Prefix	Given Name	Middle Name	Family Name	Suffix		
	John	KuiYin	RAMONES			
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service						

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	110729-8058.US00
		Application Number	
Title of Invention	DEDICATED BACKHAUL FOR WHOLE HOME COVERAGE		

City	San Ramon	State/Province	CA	Country of Residence	US
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Mailing Address of Inventor:

Address 1	350 East Plumeria Drive				
Address 2					
City	San Jose	State/Province	CA		
Postal Code	95134	Country	US		
Inventor	4				Remove
Legal Name					

Prefix	Given Name	Middle Name	Family Name	Suffix	
	Christopher	V.	FONZO		
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service					
City	Carlsbad	State/Province	CA	Country of Residence	US

Mailing Address of Inventor:

Address 1	350 East Plumeria Drive				
Address 2					
City	San Jose	State/Province	CA		
Postal Code	95134	Country	US		
Inventor	5				Remove
Legal Name					

Prefix	Given Name	Middle Name	Family Name	Suffix	
	Branden		McIntyre		
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service					
City	San Francisco	State/Province	CA	Country of Residence	US

Mailing Address of Inventor:

Address 1	350 East Plumeria Drive				
Address 2					
City	San Jose	State/Province	CA		
Postal Code	95134	Country	US		
All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the Add button. Add					

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a).	
☐ An Address is being provided for the correspondence information of this application.	

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	110729-8058.US00
		Application Number	
Title of Invention	DEDICATED BACKHAUL FOR WHOLE HOME COVERAGE		

Customer Number	22918		
Email Address	patentprocurement@perkinscoie.com	Add Email	Remove Email

Application Information:

Title of the Invention	DEDICATED BACKHAUL FOR WHOLE HOME COVERAGE		
Attorney Docket Number	110729-8058.US00	Small Entity Status Claimed	☐
Application Type	Provisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	47	Suggested Figure for Publication (if any)	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)
☐ Request Not to Publish. I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application has not and will not be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.			
Please Select One:	☒ Customer Number	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
Customer Number	22918		

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	110729-8058.US00
		Application Number	
Title of Invention	DEDICATED BACKHAUL FOR WHOLE HOME COVERAGE		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status		Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button.			Add

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)ⁱ the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

			Remove
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Access Code ⁱ (if applicable)
Additional Foreign Priority Data may be generated within this form by selecting the Add button.			Add

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013. NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number 110729-8058.US00	
	Application Number	
Title of Invention	DEDICATED BACKHAUL FOR WHOLE HOME COVERAGE	

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	110729-8058.US00
		Application Number	
Title of Invention	DEDICATED BACKHAUL FOR WHOLE HOME COVERAGE		

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.			
Applicant	1	Remove	
If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.			
		Clear	
Assignee	Legal Representative under 35 U.S.C. 117	Joint Inventor	
☒ Person to whom the inventor is obligated to assign.		☐ Person who shows sufficient proprietary interest	
If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:			
Name of the Deceased or Legally Incapacitated Inventor:			
If the Applicant is an Organization check here. ☒			
Organization Name	NETGEAR, Inc.		
Mailing Address Information For Applicant:			
Address 1	350 East Plumeria Drive		
Address 2			
City	San Jose	State/Province	CA
Country	US	Postal Code	95134
Phone Number		Fax Number	
Email Address			
Additional Applicant Data may be generated within this form by selecting the Add button. Add			

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	110729-8058.US00
		Application Number	
Title of Invention	DEDICATED BACKHAUL FOR WHOLE HOME COVERAGE		

Assignee	1			
Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.				
Remove				
If the Assignee or Non-Applicant Assignee is an Organization check here. ☐				
Prefix	Given Name	Middle Name	Family Name	Suffix
Mailing Address Information For Assignee including Non-Applicant Assignee:				
Address 1				
Address 2				
City		State/Province		
Country ⁱ		Postal Code		
Phone Number		Fax Number		
Email Address				
Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button. Add				

Signature:[Remove](#)

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). However, if this Application Data Sheet is submitted with the **INITIAL** filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/MAG/		Date (YYYY-MM-DD)	2016-05-13
First Name	Michael	Last Name	Glenn	Registration Number
				30176
Additional Signature may be generated within this form by selecting the Add button. Add				

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	110729-8058.US00
		Application Number	
Title of Invention	DEDICATED BACKHAUL FOR WHOLE HOME COVERAGE		

This collection of information is required by 37 CFR 1.76. 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 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet 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.**

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 the Freedom of Information Act requires disclosure of these records.
- 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.

DEDICATED BACKHAUL FOR WHOLE HOME COVERAGE

FIELD

Various of the disclosed embodiments concern a dedicated backhaul for whole home coverage.

BACKGROUND

In a hierarchical telecommunications network the backhaul portion of the network comprises the intermediate links between the core network, or backbone network and the small subnetworks at the "edge" of the entire hierarchical network. In the home, such network can comprise an access point (AP) with links to various repeaters. A mesh network is often used to establish a wireless backhaul between the AP and the various repeaters. With mesh networking, access points are connected wirelessly and exchange data frames with each other to forward to/from a gateway point, such as the AP. However, a mesh network is difficult to set up and maintain, especially where intermediate links between the edge and the access point are added, such as when intermediate repeaters relay traffic between the AP and a remote repeater that is out of range of the AP.

BRIEF DESCRIPTION OF THE DRAWINGS

One or more embodiments of the present disclosure are illustrated by way of example and not limitation in the figures of the accompanying drawings, in which like references indicate similar elements.

FIG. 1 is a schematic diagram showing a dedicated backhaul for whole home coverage according to the invention;

FIGS. 2A-2B are schematic diagrams showing a 5G backhaul (FIG. 2A) 2G and 5G

backhaul (FIG. 2B) according to the invention;

FIGS. 3A-3H are flow diagrams showing operational phases of a dedicated backhaul for whole home coverage according to the invention;

FIGS. 4A-4D are schematic representations of a dedicated backhaul apparatus according to the invention;

FIG. 5 and FIGS 5A-5M are an overall view (FIG. 5) and partial views (FIGS. 5A-5S) of an app for a dedicated backhaul according to the invention;

FIGS. 6A-6 are flow diagrams showing LED indicator operation in a dedicated backhaul apparatus according to the invention;

FIGS. 7A-7K are assembly drawings of a dedicated backhaul apparatus according to the invention; and

FIG. 8 shows a diagrammatic representation of a machine in the example form of a computer system within which a set of instructions for causing the machine to perform one or more of the methodologies discussed herein may be executed.

Those skilled in the art will appreciate that the logic and process steps illustrated in the various flow diagrams discussed below may be altered in a variety of ways. For example, the order of the logic may be rearranged, sub-steps may be performed in parallel, illustrated logic may be omitted, other logic may be included, etc. One will recognize that certain steps may be consolidated into a single step and that actions represented by a single step may be alternatively represented as a collection of sub-steps. The figures are designed to make the disclosed concepts more comprehensible to a human reader. Those skilled in the art will appreciate that actual data structures used to store this information may differ from the figures and/or tables shown, in that they, for example, may be organized in a different manner; may contain more or less

information than shown; may be compressed, scrambled and/or encrypted; etc.

DETAILED DESCRIPTION

Various example embodiments will now be described. The following description provides certain specific details for a thorough understanding and enabling description of these examples. One skilled in the relevant technology will understand, however, that some of the disclosed embodiments may be practiced without many of these details.

Likewise, one skilled in the relevant technology will also understand that some of the embodiments may include many other obvious features not described in detail herein. Additionally, some well-known structures or functions may not be shown or described in detail below, to avoid unnecessarily obscuring the relevant descriptions of the various examples.

The terminology used below is to be interpreted in its broadest reasonable manner, even though it is being used in conjunction with a detailed description of certain specific examples of the embodiments. Indeed, certain terms may even be emphasized below; however, any terminology intended to be interpreted in any restricted manner will be overtly and specifically defined as such in this Detailed Description section.

Dedicated Backhaul For Whole Home Coverage

FIG. 1 is a schematic diagram showing a dedicated backhaul for whole home coverage according to the invention. Embodiments of the invention concern:

- Using the 5GHz high band or low band as a dedicated backhaul;
- Using the 2.4GHz band as backup if the 5GHz band fails to reach;

- Using Ethernet when it is better than the 5GHz and 2.4GHz bands and it is available; and
- Using a spanning tree protocol or a variant to avoid loops.

Daisy Chain

In embodiments of the invention:

- Use probe request contents to communicate hop count and link quality;
- Try to go directly to route if link quality is better than a defined threshold;
- For each extra hop, there needs to be some percentage gain over smaller hops;
- If the link is below some threshold, it shall not be used; and
- Extend WPS across several nodes so the node can join on anyone.

Backhaul used to push configuration

In embodiments of the invention:

- The nodes that are in network and are talking over backhaul channels can configure a new node; and
- Configuration can be pushed by pressing buttons or by an app on the phone.

DFS details

In embodiments of the invention:

- Backhaul channel in ETSI is on the radar band; Or In FCC locale, radar band may be used when the non-radar backhaul channel may have interference
- If Radar shows up, we need to change backhaul, *e.g.* moving of the channel in coordinated way; and
- Communication of DFS detection between different nodes in mesh network, *e.g.* using 2.4GHz, the other 5G, and/or 802.11h.
- Action frames and/or beacon frame from 802.11h may be extended for use-case of mesh.

Channel planning for client facing radios

In embodiments of the invention:

- Use different 2.4GHz channels when 2.4G is not used as backhaul;
- Change the channel of the 5GHz band; and/or
- Change the channel to avoid congestion.
- Channel coordination is done to use the cleanest channels among multiple nodes depending on available traffic.

Changing basic rate set per topology

In embodiments of the invention:

- Change beacon rate to force clients to roam; and/or
- Change the management frame rate.

Changing TX power per distance

In embodiments of the invention:

Max transmit power may be dropped on mesh nodes if the mesh node coverage is smaller than what its peak power allows.

Transmit power of some management or control frames may be dropped

Transmit power of some certain modulation and or coding may be dropped.

Transmit power to some certain client may be dropped.

Mobility control over dedicated backhaul

In embodiments of the invention:

- Send data between different modules and decide how to roam, when to roam, and send packets to client to roam; and
- Roaming is done based on best effective rate.

Bluetooth mesh/Bluetooth over WiFi

- Extend Bluetooth across home over WiFi or over Bluetooth mesh.

- Bluetooth signal may be decoded the bits may be sent over wifi backhaul to a node which is close to destination and blueooth packet may be transmitted at that node.

Star Topology

Topology: Topology defines the arrangement in which nodes are connected in the network including which nodes are directly connected and which communication channel and technology is used for different nodes to talk.

Star Topology: Star topology is an arrangement in which all the nodes are directly connected to the base node. Base node is the node that is connected to home gateway.

In star topology, the software running on the satellite and base nodes makes a decision as which wireless band works the best for connection between the satellite and the base. A dedicated wireless band is the preferred method of wireless communication if the dedicated band is available for communication and the quality of the dedicated link is better than a defined threshold.

The 5GHz high band is defined as a dedicated backhaul in embodiments of the invention. The high band is defined in US as Channel 100 to 140 + 149 to 165 and in Europe as DFS band channel 100 to 140. If the dedicated wireless link falls below the quality threshold, the 2.4GHz band may be used as a backup option. The decision as which band is used for backhaul may differ from satellite to satellite.

FIGS. 2A and 2B are schematic diagrams showing a 5G backhaul (FIG. 2A) 2G and 5G backhaul (FIG. 2B) according to the invention. FIG. 2A is an example in which the dedicated 5G band is used as a method of communication between two devices; and FIG. 2B is an example in where the dedicated 5G band is used for one satellite and the 2.4GHz is used for another satellite.

In embodiments of the invention, the dedicated backhaul is used if the RSSI of the dedicated channel is above a threshold. The threshold is a parameter that can be defined and modified after hardware qualification is done on the hardware.

Wireless features in embodiments of the invention include Star Topology at launch, daisy chain topology after launch, client steering after launch, unit on-boarding at launch using VIE and WPS, ACS and 2.4G bandwidth at launch, BLE after launch, and channel planning after launch.

For star only at launch, the 5GHz dedicated channel is the primary backhaul channel. If 5GHz does not work, try to use 2.4G. The unit associates on both bands and uses 5G if RSSI is above a predefined threshold, e.g. -80dBm. If RSSI is below a the threshold, the satellite unit uses 2.4G as backhaul and the 5G backhaul is not used. If RSSI of 2.4G and 5G is below a threshold (-80dBm), an LED indicates that unit needs to be moved closer (see the LED discussion elsewhere herein).

In embodiments of the invention, a daisy chain after launch is Initially based on RSSI and 5G is preferred. The systems tries to use 5G dedicated and star, if possible. If 5G star cannot be used, the system tries using a 5G daisy chain. If 5G does not work in start or daisy chain, the system tries using 2.4G as a last resort. A 5G dedicated daisy chain is preferred over 2.4G if the RSSI is good enough.

In embodiments of the invention, for client steering using BTM, the system relies on 802.11v and 802.11k when available and when the client behaves. This is the safest steering. The system uses WiFi SON as a base and asks for some modifications. For on band steering, the system uses RSSI and loads to move clients from 2.4GHz to 5GHz. The system does not use load to move clients from 5G to 2.4G. On moving clients from a unit to unit, if RSSI drops below some threshold, the system checks the RSSI of other APs. If the RSSI of other APs are above a threshold on 5GHz, the system moves to 5GHz; if RSSI of other APs is above some other threshold in 2.4G, the

system moves clients to 2.4G of the other AP.

In embodiments of the invention, wireless features for legacy client steering include:

For clients that do not support 802.11v/k or clients that do not have the correct implementation, this method is used. This happens during an idle period if the client has no uplink packets for X seconds. The RSSI threshold is below that which disconnects the client. The RSSI may be different for 2.4GHz and 5GHz. When the client connects back, the system tries to steer the client to the right AP by having it associate to an AP which has an RSSI above a threshold and hop count above a threshold. The system rejects a probe response and measures RSSI for X tries. The then lets the client associate to any band of any radio it desires.

In embodiments of the invention, for on-boarding (WPS) is used for new units on backhaul and for addition of a unit with different backhaul credential to the network. WPS works with hidden a SSID on backhaul. Only units with a Vendor IE can go through WPS procedure on a dedicated channel. The Vendor IE content includes: capability, dedicated band, hop count, steering capabilities, transmit power, 2.4G channel planning, and 5g channel planning.

On the satellite unit, if a backhaul connection not in place, WPS is used to find a backhaul connection. Once a credential is acquired on one backhaul channel, it is copied to the other one. If the backhaul credential is already in place and the unit is connected, a WPS button is used to initiate WPS with clients or other satellite units on a dedicated channel.

In embodiments of the invention, 2.4 GHZ channel selection is used if there is no APs in the vicinity. If there is an AP in the vicinity, the channel where the AP with highest RSSI resides is picked. The system only considers APs with an RSSI that is higher than -80dBm for 20/40MHz coexistence (enable by default) and ignores a 20/40 coexistence bit reported by clients (enable by default).

In embodiments of the invention, BLE sets up the SSID and Password. BLE is also used for WiFi diagnosis purposes. BLE may be used to allow guest access and BLE Mesh.

In embodiments of the invention, the 5GHz backhaul includes MU-MIMO support. A different 2.4G channel may be used for different units and different 5G client facing channels may be used on different units.

FIGS. 3A-3H are flow diagrams showing operational phases of a dedicated backhaul for whole home coverage according to the invention, where FIG. 3A shows a star topology boot up, FIG. 3B shows a daisy chain flow chart, FIG. 3C shows 802.11k/v client roaming, FIG. 3D shows legacy client steering, FIG. 3E shows 2.4 GHz channel selection, FIG. 3F shows system ACS, FIG. 3G shows router or bridge determination, and FIG. 3H shows a detailed star topology bootup.

FIGS. 4A-4D are schematic representations of a dedicated backhaul apparatus according to the invention, showing a system block diagram for a base (FIG. 4A), a system block diagram for a satellite (FIG. 4B), an RF block diagram for a backhaul cascade (4x4 RF) (Fig. 4C), and an RF block diagram for an AP (22x2 RF) (FIG. 4D).

Test cases for US country code

1) Test case: Clean chamber environment, no interference, and very low level of noise (<-95dBm)

Dedicated band RSSI at satellite unit –ThresholdDbase dBm+15dBm

Pass criteria: The AP shall select 5GHz as backhaul. Backhaul selection by command line.

2) Test case: Clean chamber environment, no interference, and very low level of

noise (<-95dBm)

Dedicated band RSSI at satellite unit –ThesholdDbase dBm +5dBm

Pass criteria: The AP shall select 5GHz as backhaul. Backhaul selection by command line.

3) Test case: Clean chamber environment, no interference, and very low level of noise (<-95dBm)

Dedicated band RSSI at satellite unit –ThesholdDbase dBm - 5dBm

Pass criteria: The AP shall select 2.4GHzGHz as backhaul. Backhaul selection by command line.

4) Test case: Clean chamber environment, no interference, and very low level of noise (<-95dBm)

Dedicated band RSSI at satellite unit –ThesholdDbase dBm - 20dBm. Dedicated channel cannot reach.

Pass criteria: The AP shall select 2.4GHzGHz as backhaul. Backhaul selection by command line.

Automatic Channel Selection

Embodiments of the invention provide Auto Channel Selection (ACS) during initial boot-up. The algorithm for this feature scans all of the channels, then collects appropriate statistics, such as interferences (both WLAN and non-WLAN) and assigns weights to each channel.

The following discussion describes the statistics that are collected during scan and the general guideline as how the statistics may be used.

Statistic Collection and Algorithm Guidelines

The following is a list of items that need to be taken into account

- 1) The number of APs on each channel is counted accurately during the scan. The buffer size is limited for the scan and as a result, when there are many APs, the APs on higher channels do not fit into the limited buffer size. As a result, scanning in 2.4G is broken into at least three separate scans in three subsets of the channel to make sure all APs are seen on all channels.
- 2) Scan time is increased on each channel such that all the APs are seen.
- 3) If one or more APs with an RSSI of -45dBm or higher are within vicinity, the channel of the AP which has highest RSSI is picked. If the AP is 40MHz, the same primary channel is picked.
- 4) Interference from neighboring channels is taken into account.

The channel with smallest grade is the best.

E = constant which depends on AP RSSI

- If 20MHz AP is on Z= channel CH, CH-1, CH+1, $\text{Grade_on_channel_Z} = \text{Grade_on_channel_Z} + 2 * E$
- If 20MHz AP is on Z= CH-2, CH+2, $\text{Grade_on_channel_Z} = \text{Grade_on_channel_Z} + E$

- If 40MHz AP, for both 20MHz subchannels of the 20MHz, apply grade calculation as described above.

5) The RSSI of APs is taken into account. Grade in the following is the grade on the AP channel and all affected neighboring channels.

The following may be used to start for 4x4:

AP RSSI < -70dBm $\Rightarrow$ E=1

-70dB < AP RSSI < -40dB $\Rightarrow$ E=1.5

RSSI > -40dB $\Rightarrow$ E=2

6) Noise floor on each channel is measured during scan

tmpnoise = (noise_db < -95) ? -95 : noise_db;

tmpnoise = (noise_db >= -65) ? -65 : noise_db;

noise_grade = (tmpnoise+95)/5*4;

7) For 40MHz channel selection, the 20/40 coexistence (wl obss_coex) is taken into account. If there is no 40MHz channel available because of coexistence requirement, the best 20MHz channel is selected.

8) Transmit power on each channel is taken into account. Channel 1 and channel 11 shall be avoided in the US and Australia.

9) Channel utilization on each channel is measured during scan. Channel utilization includes CCA stats and percentage of the time that the channel is clean.

10) Interference statistics on each channel are measured during the scan and may be used.

Test Cases

The channel is recorded at boot up time. Each test case is run ten times. The result and corresponding console logs are recorded and reported.

20MHz Channel

1) FCC and Australia

Channel 1 and channel 11 shall never be picked. Even when ACS fails to run. The default driver shall be changed from channel 1 to a channel 3.

- Test case: Clean chamber environment, no interference, and very low level of noise (<-95dBm)

Pass criteria: The AP shall select a channel between 2 and 10. The AP shall not select same channels for all ten runs. Randomness should be used.

- Test case: Include APs. One 20MHz 11n AP on channel 1. APs with RSSI of -39dBm or higher.

Pass criteria: The AP shall select a channel from channel 1.

- Test case: Include APs. One 20MHz 11n AP on channel 11. AP with RSSI of -39dBm or higher.

Pass criteria: The AP shall select a channel from channel 11.

- Test case: Include three other APs. One 20MHz 11n AP on channel 1. One 20MHz 11n AP on channel 6. One AP on channel 11. All APs with RSSI of -60dBm or lower.

Pass criteria: The AP shall select a channel from channel 3,4,8, or 9.

- Test case: Add 4 APs. One 20MHz 11n AP on channel 1. One 20MHz 11n AP on channel 2. One 20MHz 11n AP on channel 4. One 20MHz 11n AP on channel 6. All APs with RSSI of -60dBm or lower.

Pass criteria: The AP shall select channel 8,9, or channel 10.

- Test case: Add 4 APs. One on channel 3 20MHz with RSSI of -39dBm or higher. One AP on channel 6 20MHz with RSSI of 70dBm or lower. One AP on channel 11 20MHz with RSSI of -70dB or lower.

Pass criteria: AP shall pick channel 3.

- Test case: Add 3 APs. One on channel 1 20MHz with RSSI of -39dBm or higher. One AP on channel 6 20MHz with RSSI of -60dBm or lower. One AP on channel 11 20MHz with RSSI of -60dBm or lower.

Pass criteria: AP shall pick channel 1.

2) ETSI, China, Japan, and Russia

- Test case: Clean chamber environment no interference and very low level of noise (<-95dBm)

Pass criteria: The AP shall select a channel between 1 and 13. The AP shall not select same channels for all 10 runs

- Test case: Include three other APs. One 20MHz 11n AP on channel 1. One 20MHz 11n AP on channel 6. One 20MHz 11n AP on channel 11. All APs with RSSI of

-60dBm or lower.

Pass criteria: The AP shall select a channel from channel 3,4,8, 9, or 13

- Test case: Add 6 APs. One 20MHz 11n AP on channel 1. One 20MHz 11n AP on channel 2. One 20MHz 11n AP on channel 4. One 20MHz 11n AP on channel 6. One 20MHz 11n AP on channel 11. One 20MHz 11n AP on channel 13. All APs with RSSI of -60dBm or lower.

Pass criteria: The AP shall select channel 8 or 9.

- Test case: Add 4 APs. One on channel 1 20MHz with RSSI of -60dBm or lower. One AP on channel 6 20MHz with RSSI of -39dBm or higher. One AP on channel 11 20MHz with RSSI of -60dBm or lower. One AP on channel 13 20MHz with RSSI of -60dBm or lower.

Pass criteria: AP shall pick channel 6.

40MHz Channel

1) FCC and Australia

Remove 40MHz channels that are centered on channel 3 and channel 9

- a. Test case: Clean chamber environment, no interference, and very low level of noise (<-95dBm)

Pass criteria: The AP shall pick that has the highest power 40MHz channel among all 2.4G 40MHz channels which are channel 4,5,6,7,8 where the number is the center of the channel (not primary channel). If there is more than one 40MHz channel with the highest power, the AP shall not pick the same 40MHz channel on all ten test runs.

- b. Test case: Put one 20MHz AP on channel 1. APs with RSSI of -60dBm or lower

Pass criteria: AP shall pick a 40MHz channel that does not overlap with interference.

- c. Test case: Include three other APs. One 20MHz 11n AP on channel 1. One 20MHz 11n AP on channel 6. One AP on channel 11. APs with RSSI of -60dBm or lower. APs with RSSI of -60dBm or lower.

Pass criteria: The AP shall drop from 40MHz to 20MHz and it shall pick channel 3,4, 8 or 9. The AP shall not pick the same channel on all 10 test cases.

2) ETSI, China, Japan, and Russia

- a. Test case: Clean chamber environment no interference and very low level of noise (<-95dBm)

Pass criteria: The AP shall pick a 40MHz channel. The AP shall not pick the same 40MHz channel on all 10 test runs.

- b. Test case: Put one 20MHz AP on channel 13 and channel 11.

Pass criteria: AP shall pick a 40MHz channel that does not overlap with interference.

Test case: Include 4 other APs. One 20MHz 11n AP on channel 1. One 20MHz 11n AP on channel 6. One AP on channel 11. One AP on channel 13. APs with RSSI of -60dBm or lower.

Pass criteria: The AP shall drop from 40MHz to 20MHz and it shall pick channel 3,4, 8 or 9. The AP shall not pick the same channel on all 10 test cases.

FIG. 5 and FIGS 5A-5M are an overall view (FIG. 5) and partial views (FIGS. 5A-5S) of

an app for a dedicated backhaul according to the invention.

FIGS. 6A-6 are flow diagrams showing LED indicator operation in a dedicated backhaul apparatus according to the invention.

RF

RF isolation through air

RF isolation through conducted methods

Flowchart for joining

Chimney pattern for heat

Design patent (ID)

LED Status

Power LED

Power LED	What it means	Criteria
Solid Green	Power on	Base & Satellite: Enter boot-code
Solid Amber	Rework in progress	Base & Satellite: - Boot-code had detected NMRP server and entering NMRP operation - Hardware reset button pushed (< 5s) for device reboot

Pulse Amber	Rework is done	Base & Satellite: - NMRP reworking is complete - Hardware reset button pushed ($\geq 5s$) for device reset to default
Pulse Red	Firmware corruption	Base & Satellite: Firmware is corrupted and can't be executed

System Status

Ring LED	What it means	Criteria
Pulse White	Power up	Base & Satellite: Enter Linux firmware
Pulse Amber	Factory default	Base: - Factory default Satellite: - No such state (used for uplink status indication)
OFF	Most of the time, LED will be off	Working normally
Pulse Magenta	Generic Error	Base: - WAN port link down - Failed to lease IP address - Failed to reach Internet - Traffic Meter upper limit (router mode) Satellite: - Lost uplink connection

		Failed to lease IP address
Pulse Green	Changing ongoing	Base & Satellite: - Apply configuration - Firmware upgrading

WPS

Ring LED	What it means	Criteria
Pulse Blue	WPS ongoing	Base & Satellite - Button pushed - Discovery - Paring
Solid Magenta 3 sec	WPS failure	Base & Satellite - Timeout - Any other error
Solid Blue	WPS Success	Base & Satellite: WPS complete and success

Satellite Uplink Connectivity

Ring LED	What it means	Criteria
Pulse Magenta	No connection	Satellite: - Lost uplink connection - Trying to connect to uplink AP - Connect to uplink AP, but failed to lease IP address
Solid Magenta 10 sec	Failed to lease IP address	
Solid Green 10 sec	Connectivity is good	IP address leased and 5G 4x4 backhaul RSSI ≥ -75dB (TBD) 2G 2x2 backhaul RSSI ≥ -75dB (TBD)

Solid Amber 10 sec	Connectivity is weak	IP address leased and 5G 4x4 backhaul RSSI < -75dB (TBD) 2G 2x2 backhaul RSSI < -75dB (TBD)
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Internet Status – Base Only

When the Base leased an IP address on WAN port interface, the Internet is reachable. If only the physical link is up, but there is no IP address leased, the Internet is unreachable.

How to determine if Internet connection is reachable.

- Static IP: Internet connection is up as long as physical link is up
-
- DHCP: When physical link is back, be able to automatically start IP address acquisition again. Internet connection is up when IP address is successfully leased
-
- PPP (PPPoE or PPTP): Except physical link, LCP echo request/reply message is used to detect link connection. Follow section of PPPoE/PPTP in Router Spec for detail.

Uplink Connection Status – Satellite Only

Uplink is considered dropped when backhaul interface is not associated.

When uplink is associated and IP address is acquired, implementation needs to periodical sending ping to its uplink AP. Uplink AP is Base for initial launch, uplink parent for daisy-chain in future. Every 180 seconds, send out ping traffic to test if uplink still connected. Send out three Ping-Request concurrently, consider uplink is connected if able to receive any Ping-Response in five seconds. Retry a total of two times if there is no response received. After 15 seconds and no ping response received, uplink is considered dropped. If the uplink connection is considered dropped, implementation

needs to trigger wireless re-connection. Note, required to have guard interval handling for Ring LED operation.

When Satellite loss uplink connection or not able to lease IP address, the default IP address is 192.168.1.250/24. (if there is previously leased IP, use the leased IP instead). Because there is no DHCP server running on Satellite, there is NO need to trigger IP re-leasing via disconnect Wi-Fi client or reset switch PHY for Ethernet PC.

When there are multiple backhauls (2G and 5G) being used, as long as there is one backhaul connection being connected, the disconnecting of other backhaul didn't require for LED status indication.

Lost connection: only when all backhauls interfaces failed to associated to uplink AP. There is 5s (TBD: to be tuned) guard interval to prevent Satellite's LED status changing too frequently, the interval LED is kept in last state. When WPS process just complete successfully. When uplink connection change from CONNECT to DISCONNECT. Backhaul color – only when both backhaul are not good. Note: Might lead to keep connecting at 2G. Exception for guard interval handling, should cancel guard interval. When WPS PBC pushed.

FIGS. 7A-7K are assembly drawings of a dedicated backhaul apparatus according to the invention.

Computer System

FIG. 8 is a block diagram of a computer system as may be used to implement certain features of some of the embodiments. The computer system may be a server computer, a client computer, a personal computer (PC), a user device, a tablet PC, a laptop computer, a personal digital assistant (PDA), a cellular telephone, an iPhone, an iPad, a Blackberry, a processor, a telephone, a web appliance, a network router, switch or bridge, a console, a hand-held console, a (hand-held) gaming device, a

music player, any portable, mobile, hand-held device, wearable device, or any machine capable of executing a set of instructions (sequential or otherwise) that specify actions to be taken by that machine.

The computing system 300 may include one or more central processing units ("processors") 305, memory 310, input/output devices 325 (e.g., keyboard and pointing devices, touch devices, display devices), storage devices 320 (e.g., disk drives), and network adapters 330 (e.g., network interfaces) that are connected to an interconnect 315. The interconnect 315 is illustrated as an abstraction that represents any one or more separate physical buses, point to point connections, or both connected by appropriate bridges, adapters, or controllers. The interconnect 315, therefore, may include, for example, a system bus, a Peripheral Component Interconnect (PCI) bus or PCI-Express bus, a HyperTransport or industry standard architecture (ISA) bus, a small computer system interface (SCSI) bus, a universal serial bus (USB), IIC (12C) bus, or an Institute of Electrical and Electronics Engineers (IEEE) standard 1394 bus, also called "Firewire".

The memory 310 and storage devices 320 are computer-readable storage media that may store instructions that implement at least portions of the various embodiments. In addition, the data structures and message structures may be stored or transmitted via a data transmission medium, e.g., a signal on a communications link. Various communications links may be used, e.g., the Internet, a local area network, a wide area network, or a point-to-point dial-up connection. Thus, computer readable media can include computer-readable storage media (e.g., "non-transitory" media) and computer-readable transmission media.

The instructions stored in memory 310 can be implemented as software and/or firmware to program the processor(s) 305 to carry out actions described above. In some embodiments, such software or firmware may be initially provided to the processing system 300 by downloading it from a remote system through the computing system 300 (e.g., via network adapter 330).

The various embodiments introduced herein can be implemented by, for example, programmable circuitry (e.g., one or more microprocessors) programmed with software and/or firmware, or entirely in special-purpose hardwired (non-programmable) circuitry, or in a combination of such forms. Special-purpose hardwired circuitry may be in the form of, for example, one or more ASICs, PLDs, FPGAs, etc.

Remarks

The above description and drawings are illustrative and are not to be construed as limiting. Numerous specific details are described to provide a thorough understanding of the disclosure. However, in certain instances, well-known details are not described in order to avoid obscuring the description. Further, various modifications may be made without deviating from the scope of the embodiments.

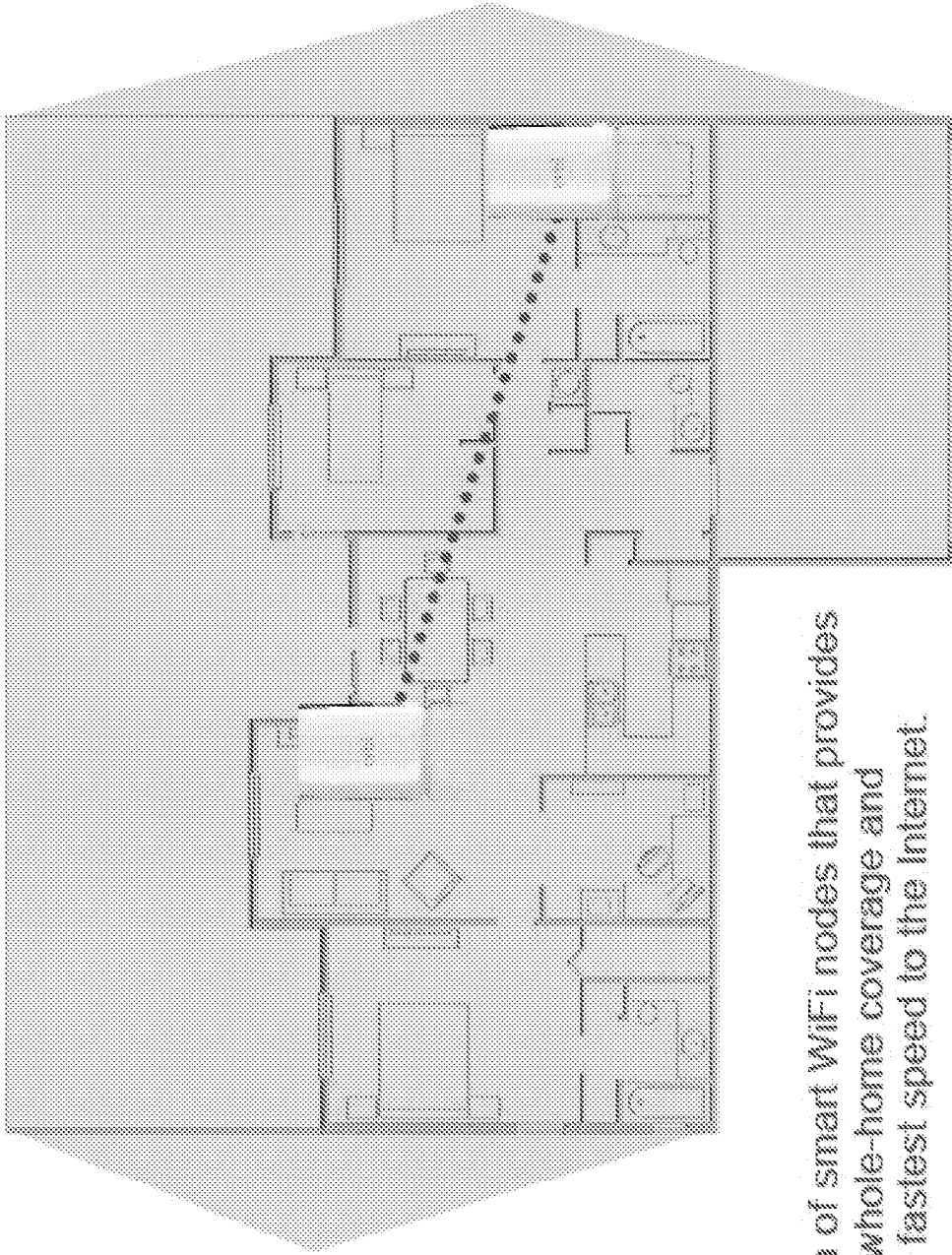
Reference in this specification to "one embodiment" or "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the disclosure. The appearances of the phrase "in one embodiment" in various places in the specification are not necessarily all referring to the same embodiment, nor are separate or alternative embodiments mutually exclusive of other embodiments. Moreover, various features are described which may be exhibited by some embodiments and not by others. Similarly, various requirements are described which may be requirements for some embodiments but not for other embodiments.

The terms used in this specification generally have their ordinary meanings in the art, within the context of the disclosure, and in the specific context where each term is used. Certain terms that are used to describe the disclosure are discussed above, or elsewhere in the specification, to provide additional guidance to the practitioner regarding the description of the disclosure. For convenience, certain terms may be highlighted, for example using italics and/or quotation marks. The use of highlighting

has no influence on the scope and meaning of a term; the scope and meaning of a term is the same, in the same context, whether or not it is highlighted. It will be appreciated that the same thing can be said in more than one way. One will recognize that "memory" is one form of a "storage" and that the terms may on occasion be used interchangeably.

Consequently, alternative language and synonyms may be used for any one or more of the terms discussed herein, nor is any special significance to be placed upon whether or not a term is elaborated or discussed herein. Synonyms for certain terms are provided. A recital of one or more synonyms does not exclude the use of other synonyms. The use of examples anywhere in this specification including examples of any term discussed herein is illustrative only, and is not intended to further limit the scope and meaning of the disclosure or of any exemplified term. Likewise, the disclosure is not limited to various embodiments given in this specification.

Without intent to further limit the scope of the disclosure, examples of instruments, apparatus, methods and their related results according to the embodiments of the present disclosure are given above. Note that titles or subtitles may be used in the examples for convenience of a reader, which in no way should limit the scope of the disclosure. Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this disclosure pertains. In the case of conflict, the present document, including definitions will control.



A system of smart WiFi nodes that provides whole-home coverage and the fastest speed to the Internet.

FIGURE 1

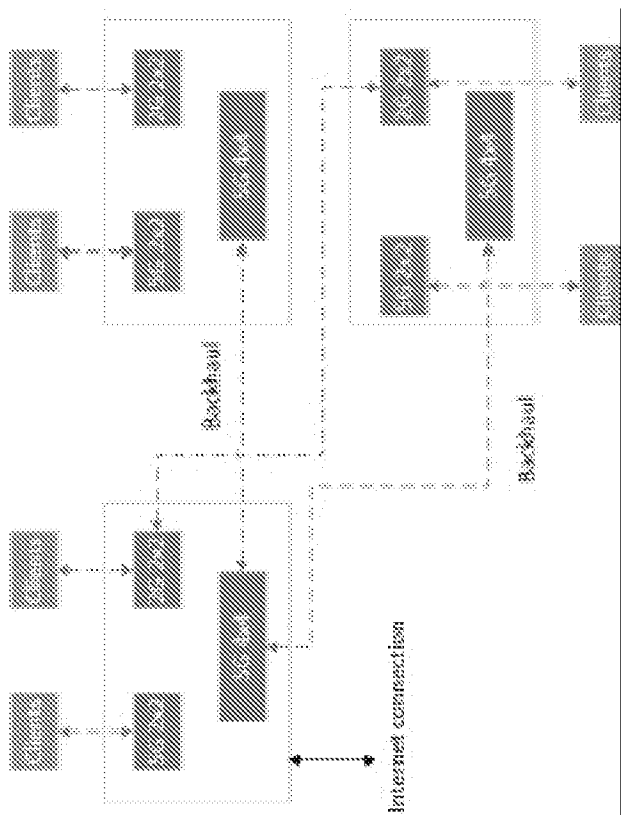


FIGURE 2A

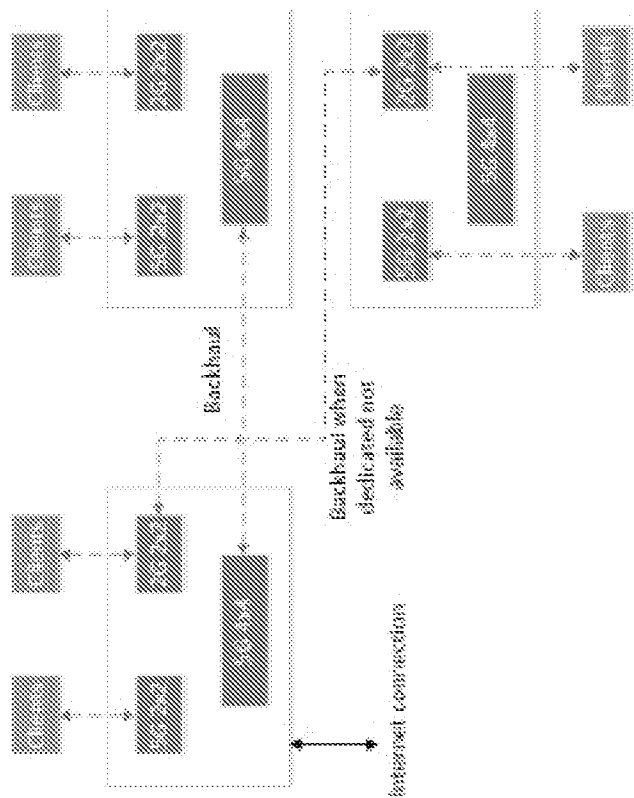


FIGURE 2B

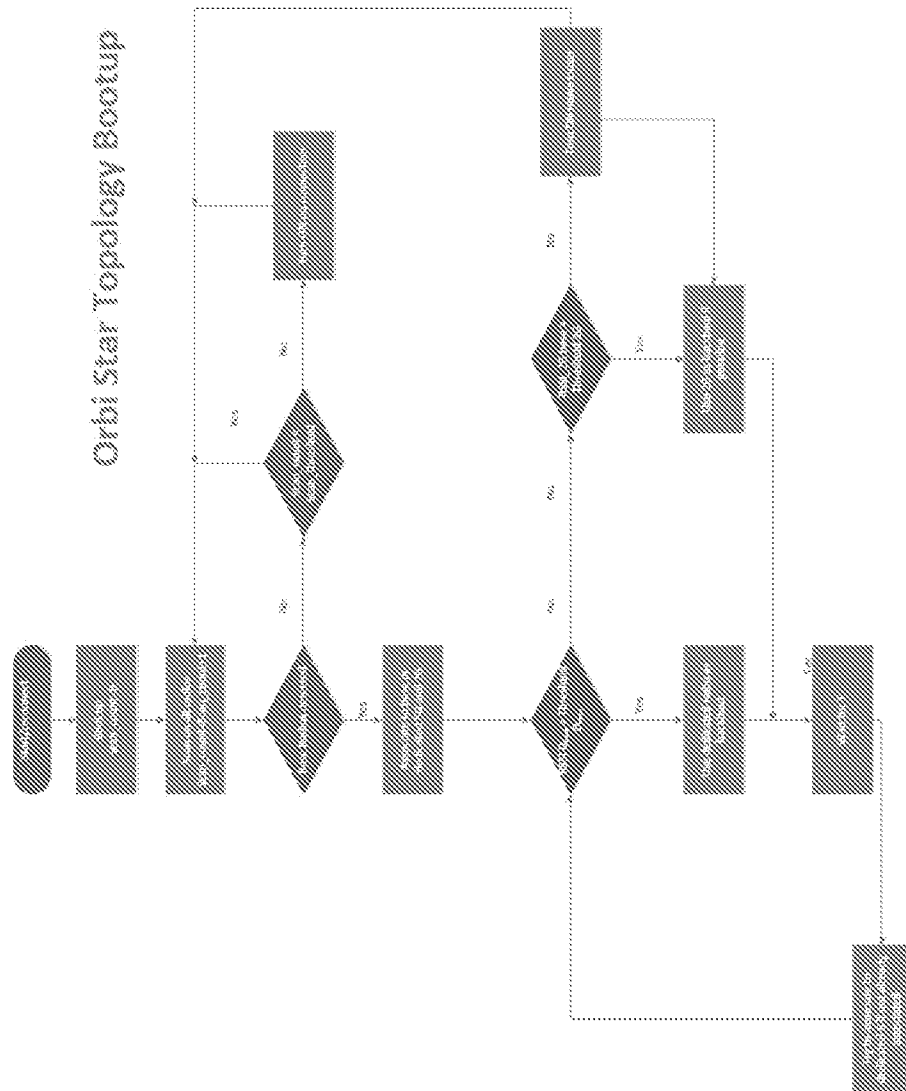


FIGURE 3A

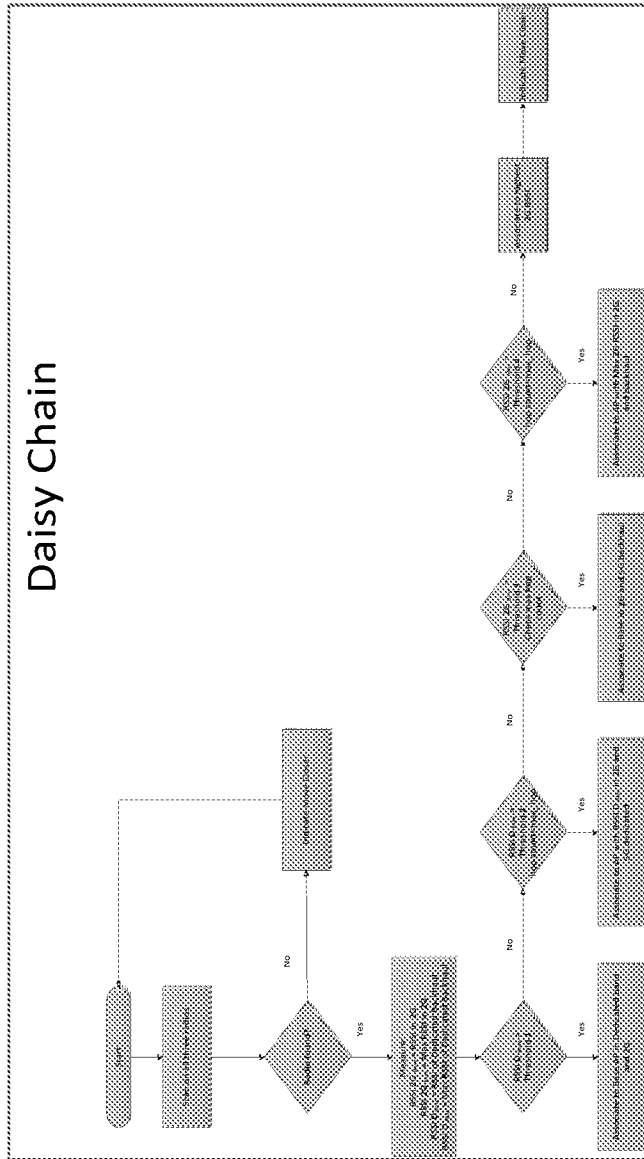


FIGURE 3B

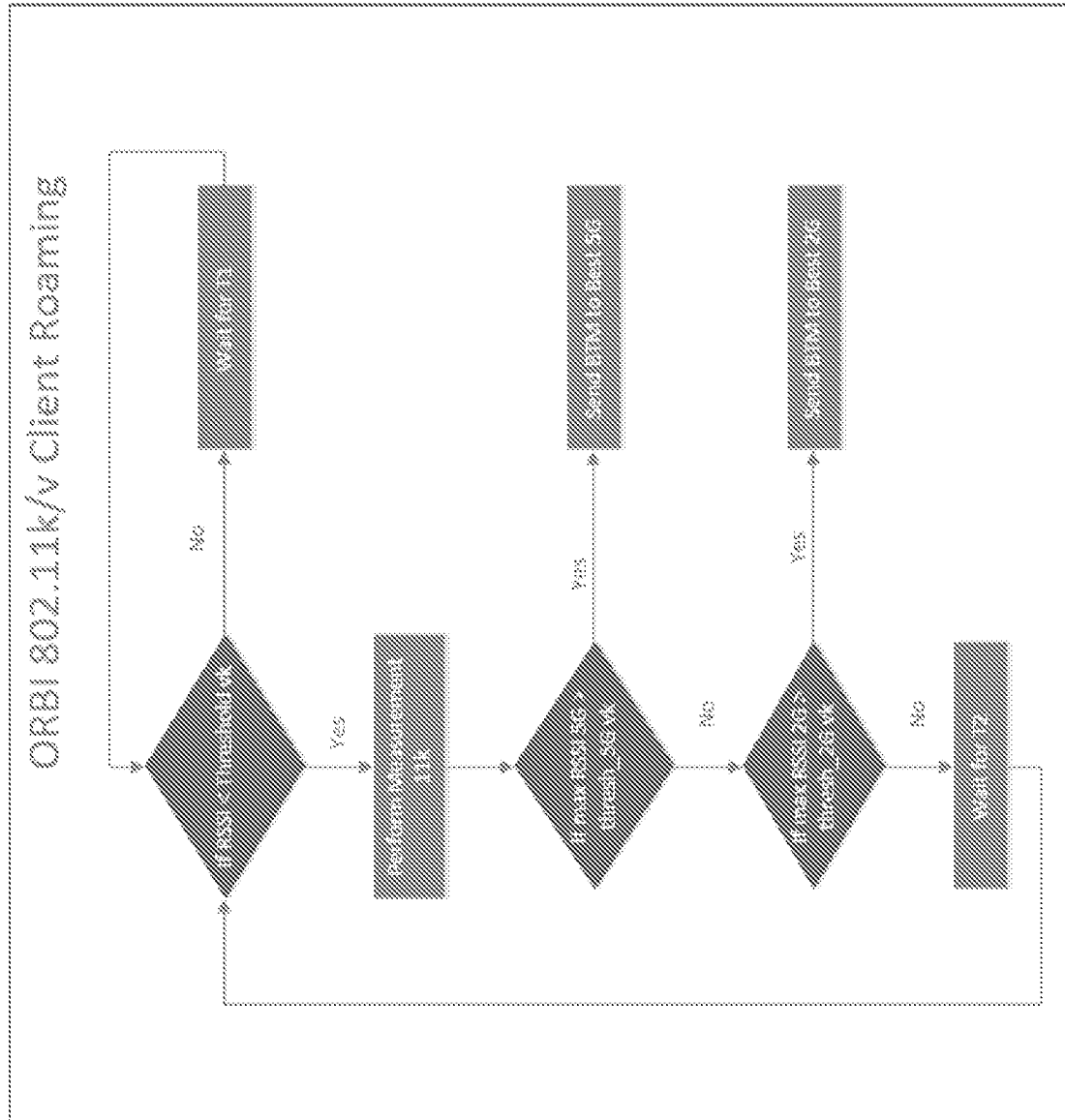


FIGURE 3C

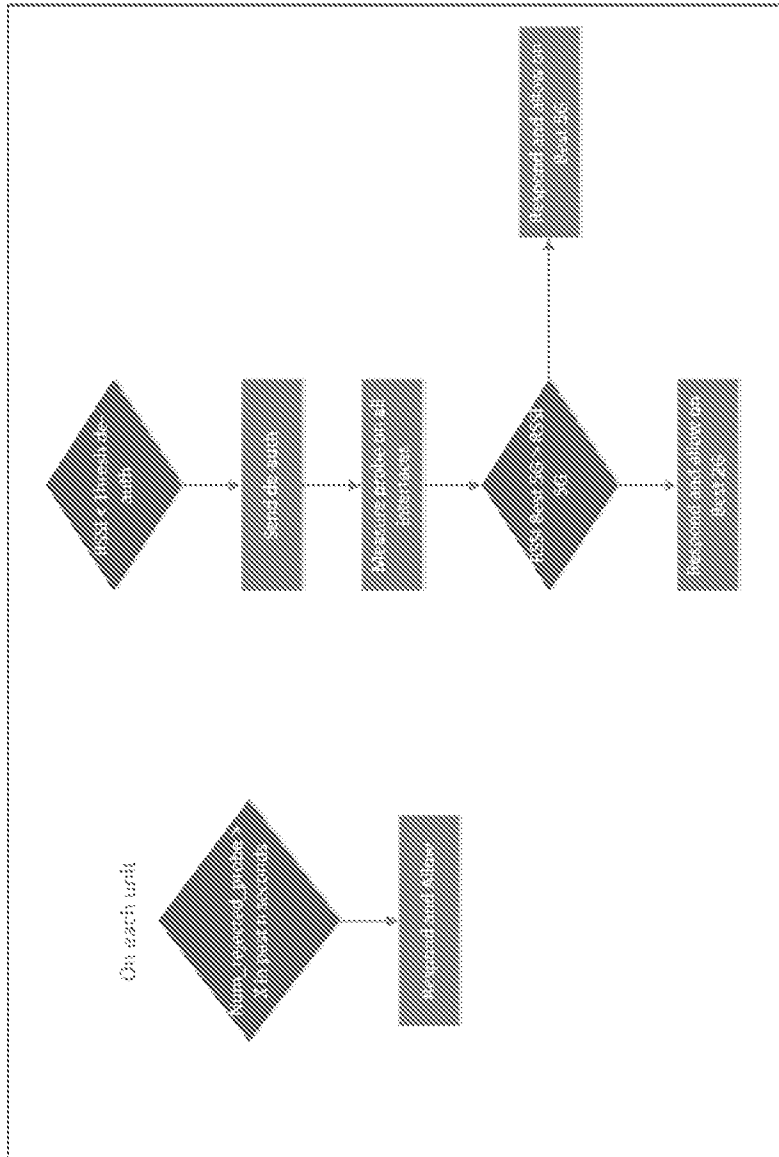


FIGURE 3D

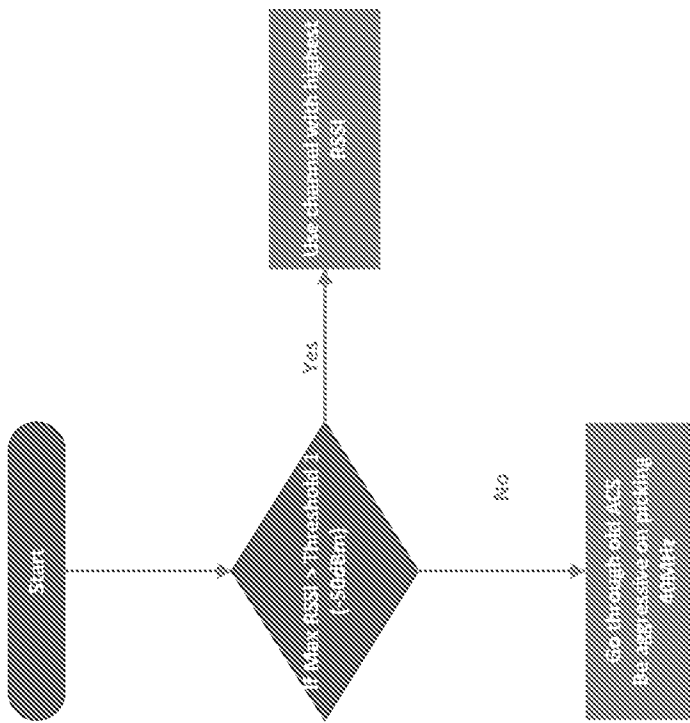


FIGURE 3E

Orbi ACS

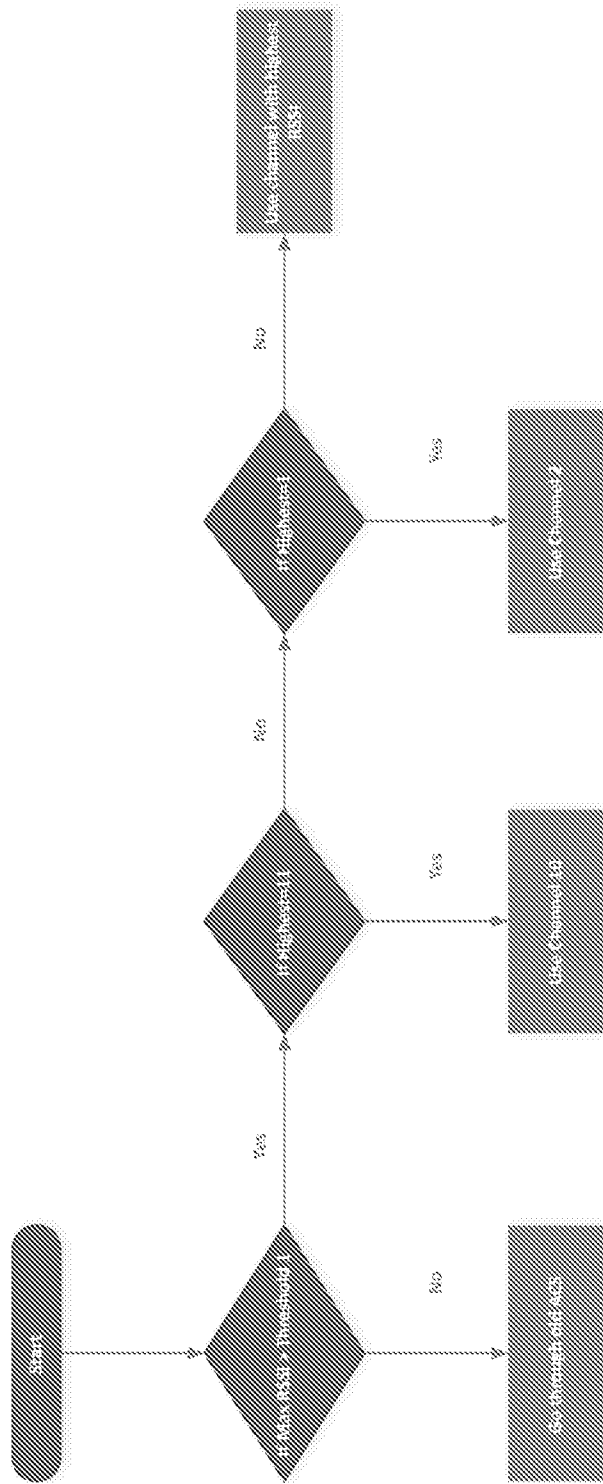


FIGURE 3F

Orbi Router or Bridge ?

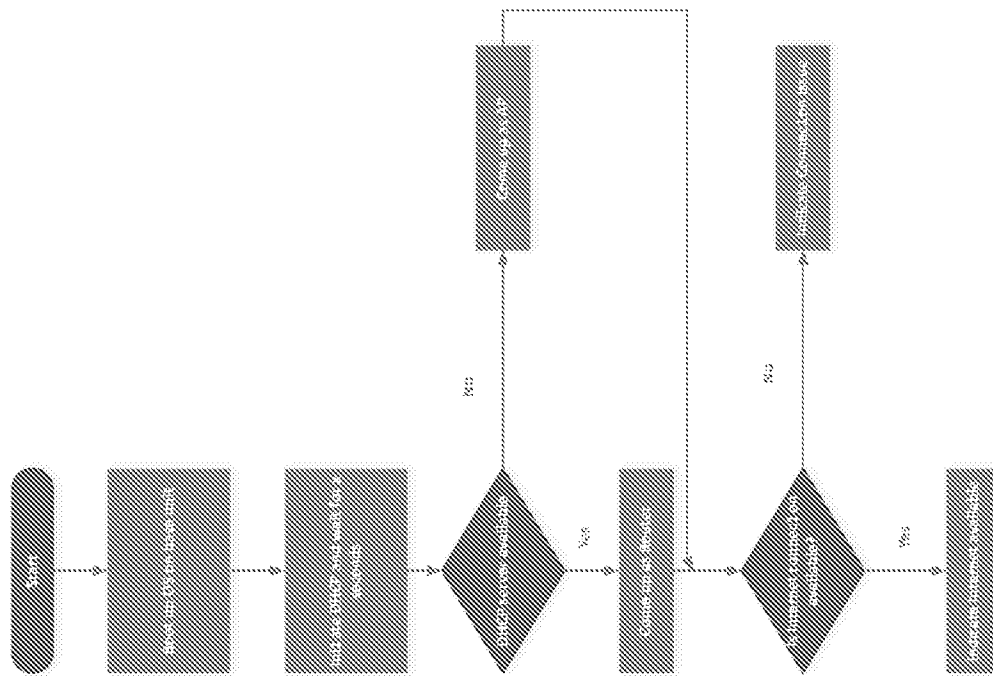


FIGURE 3G

Orbi Star Topology Bootstrap

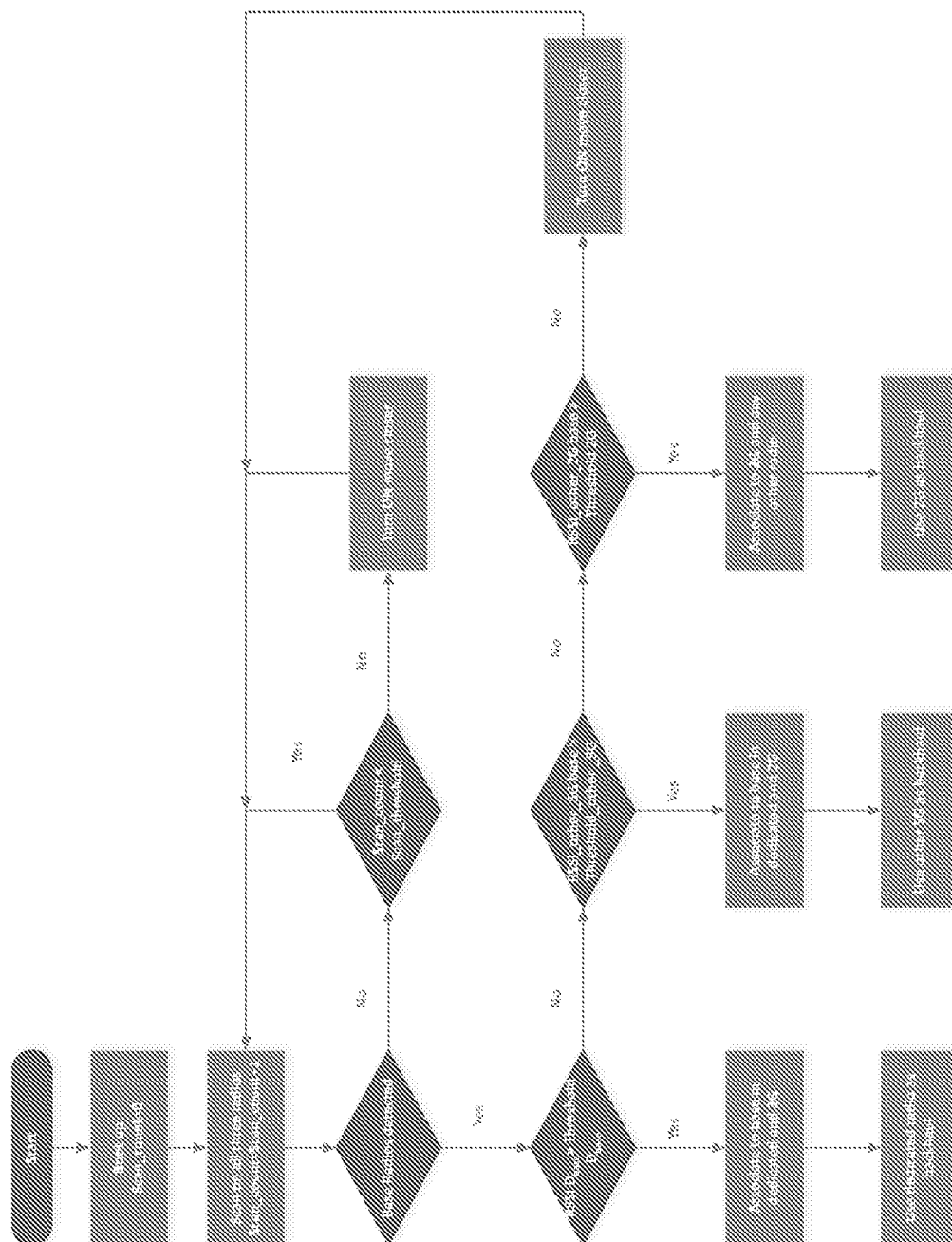


FIGURE 3H

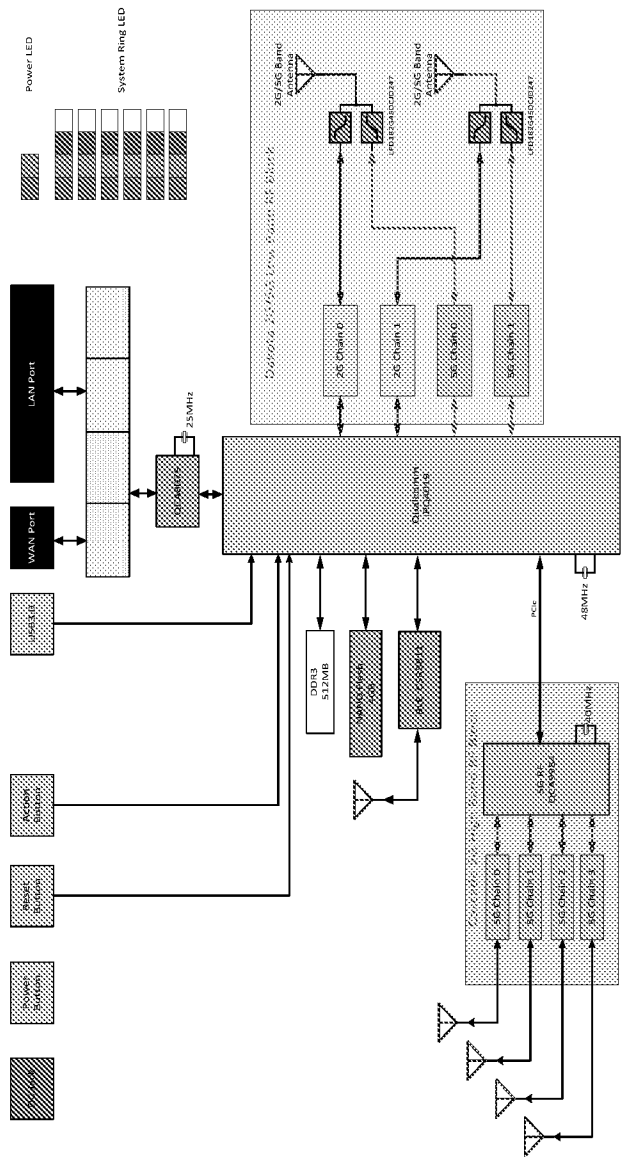
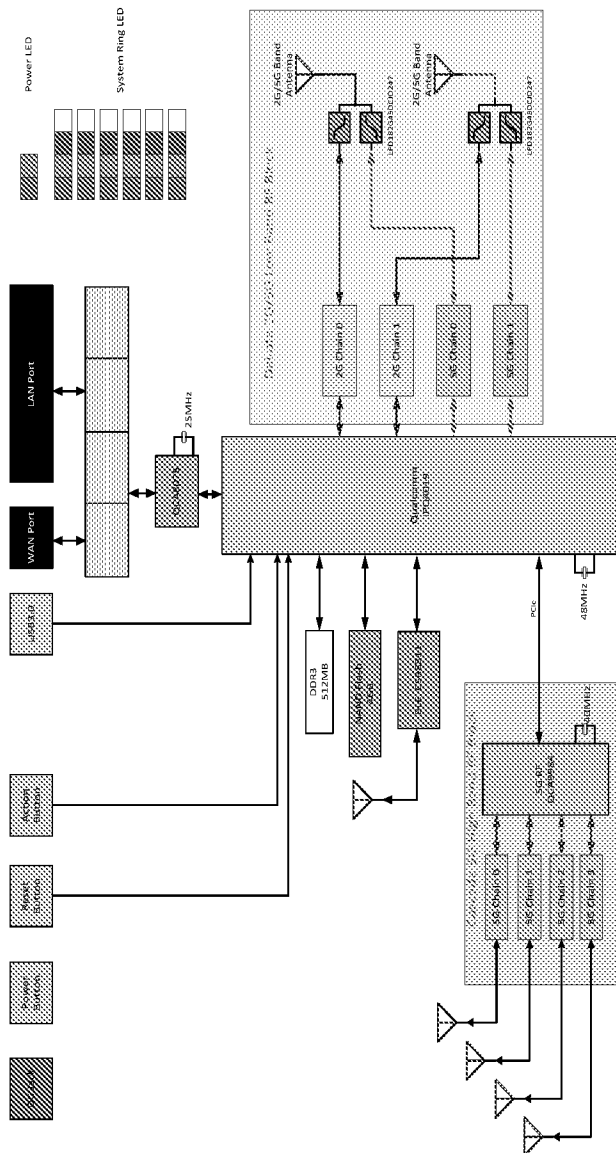


FIGURE 4A



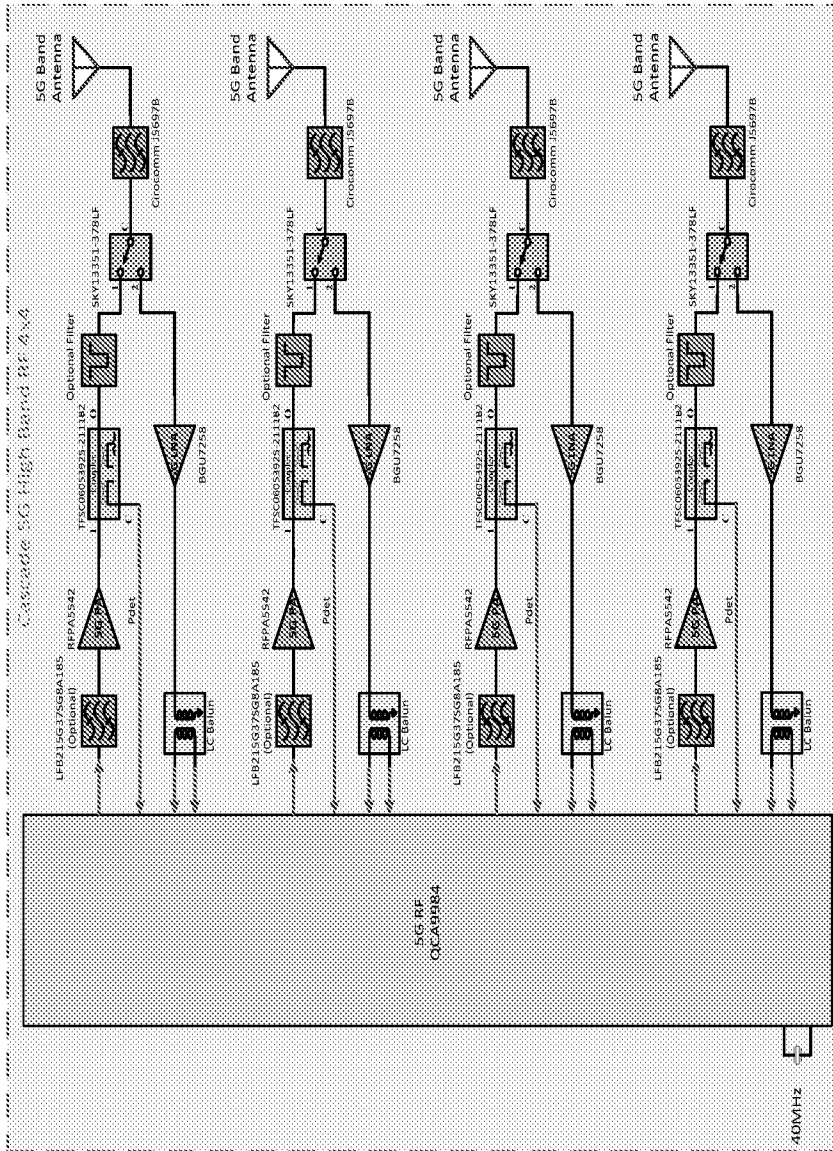


FIGURE 4C

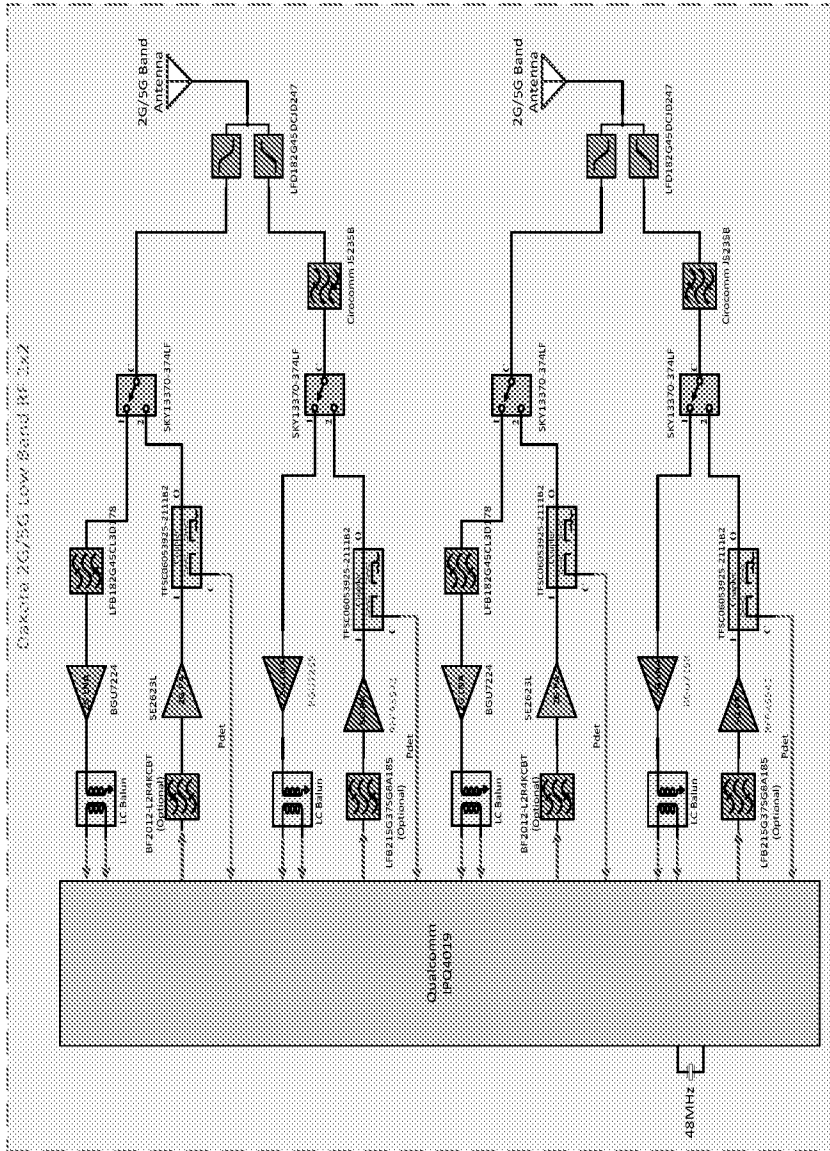


FIGURE 4D

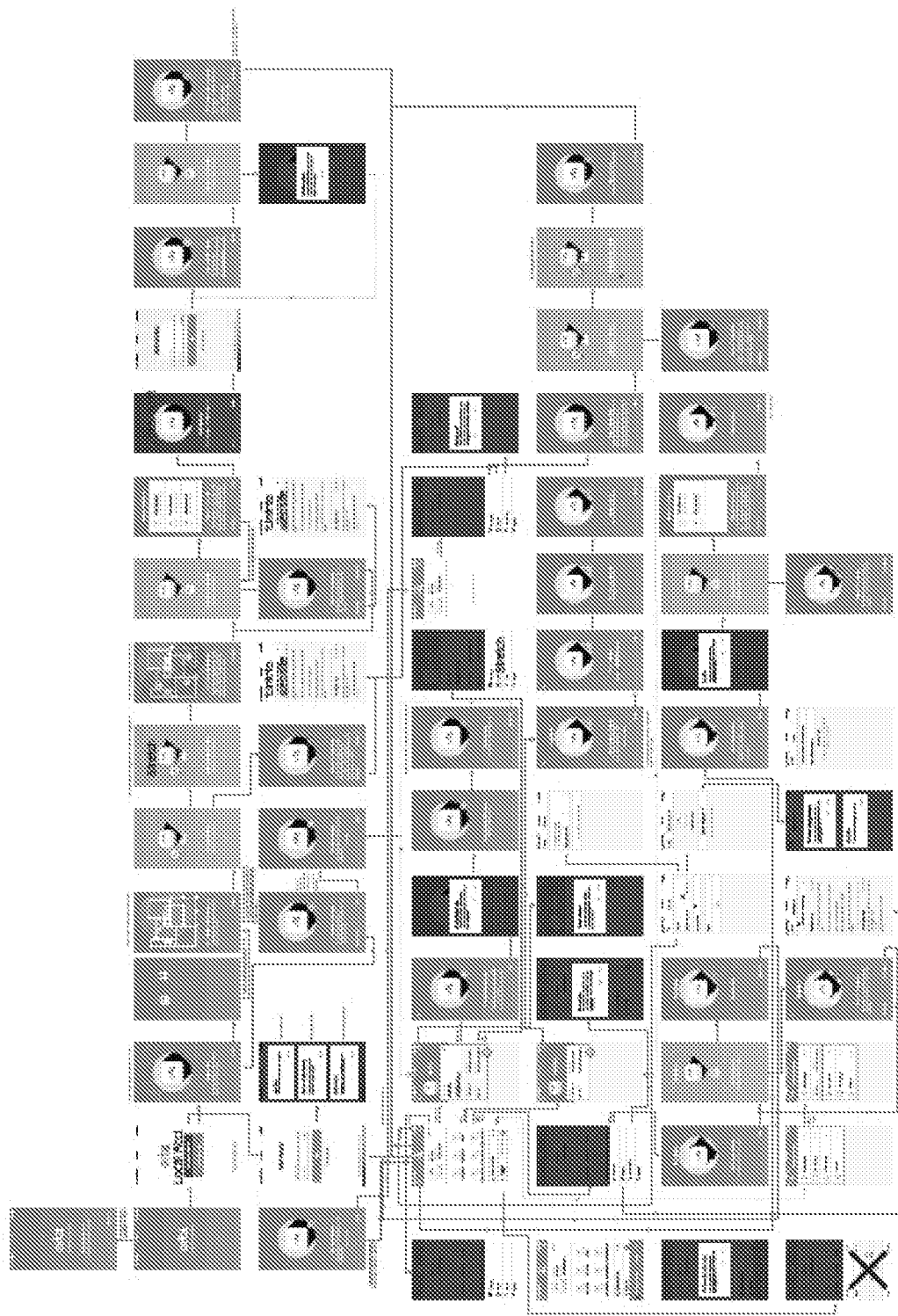


FIGURE 5

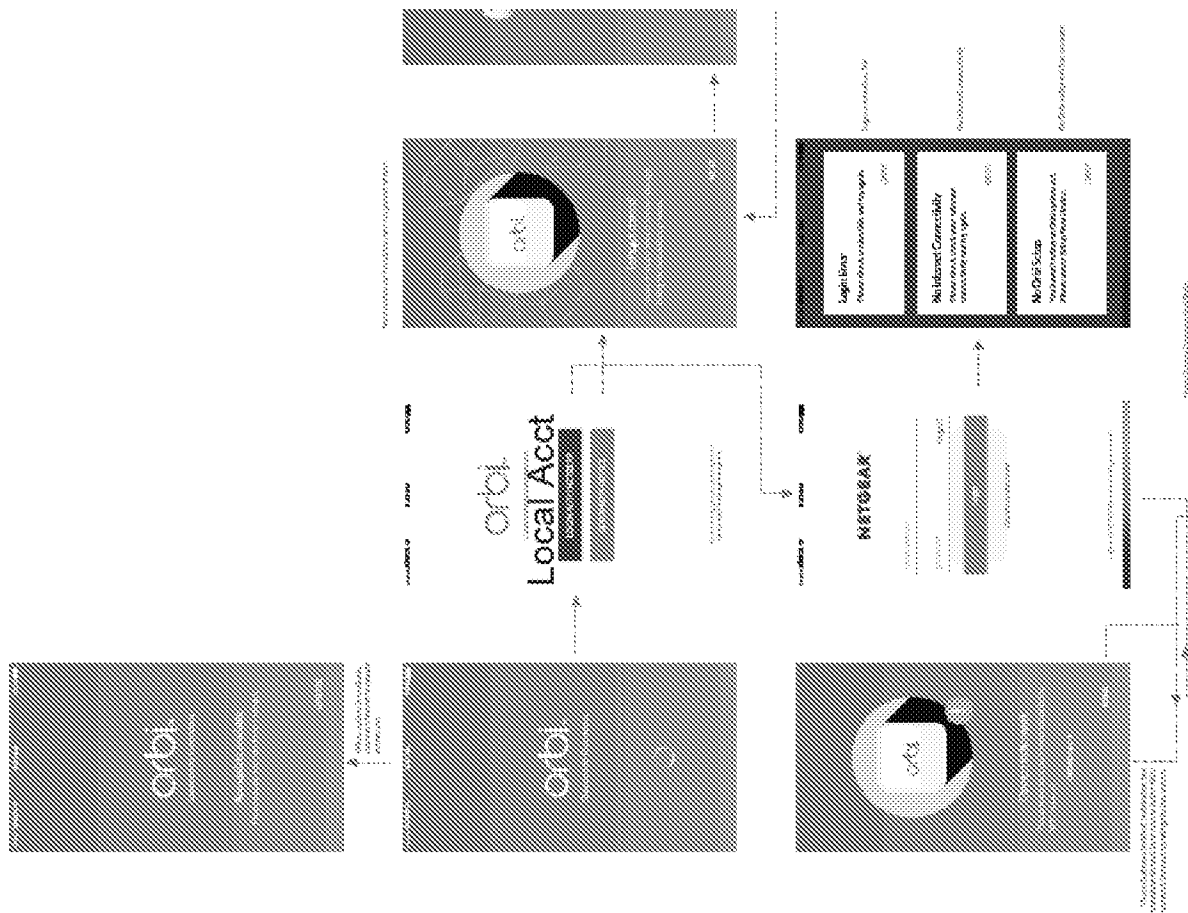


FIGURE 5A

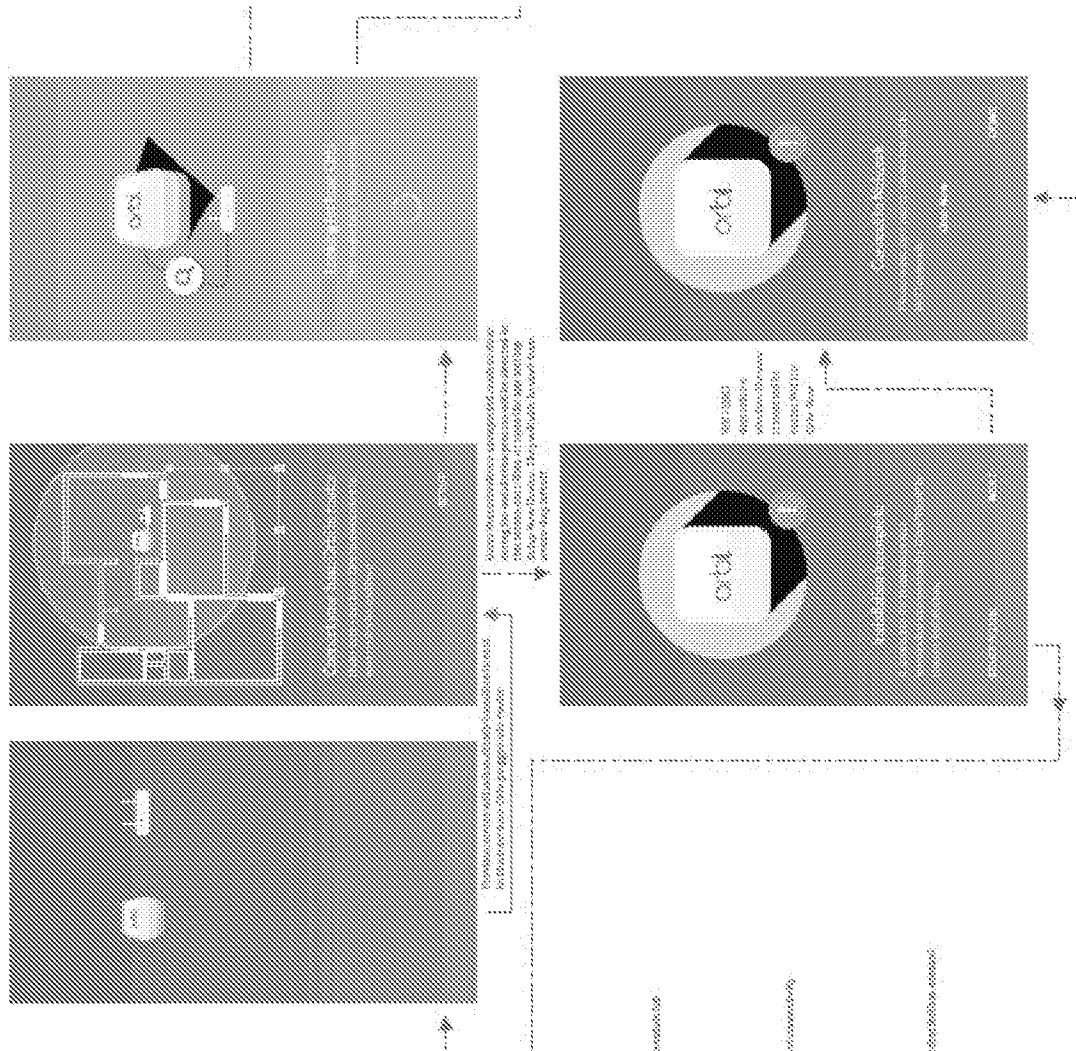
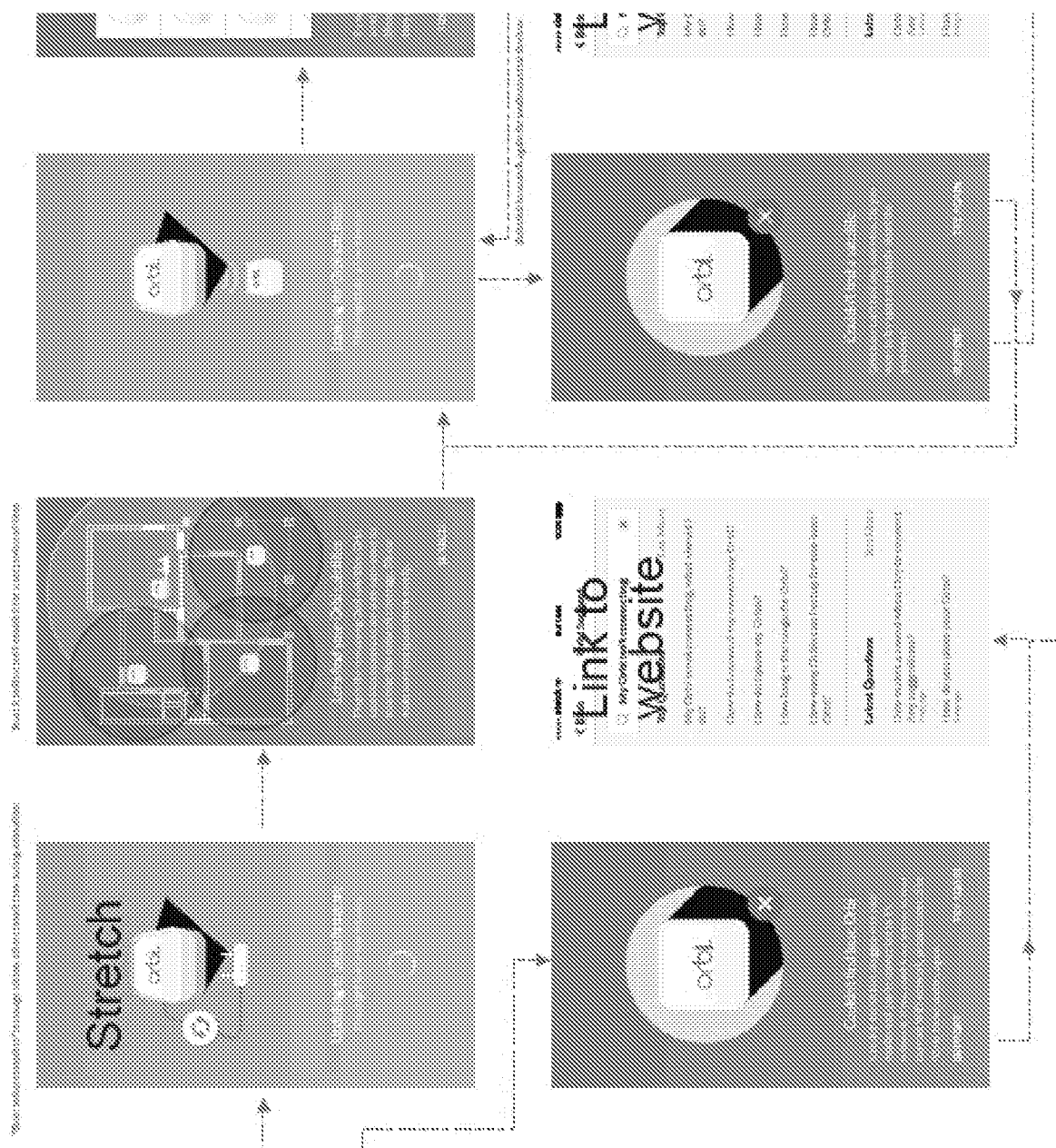


FIGURE 5B



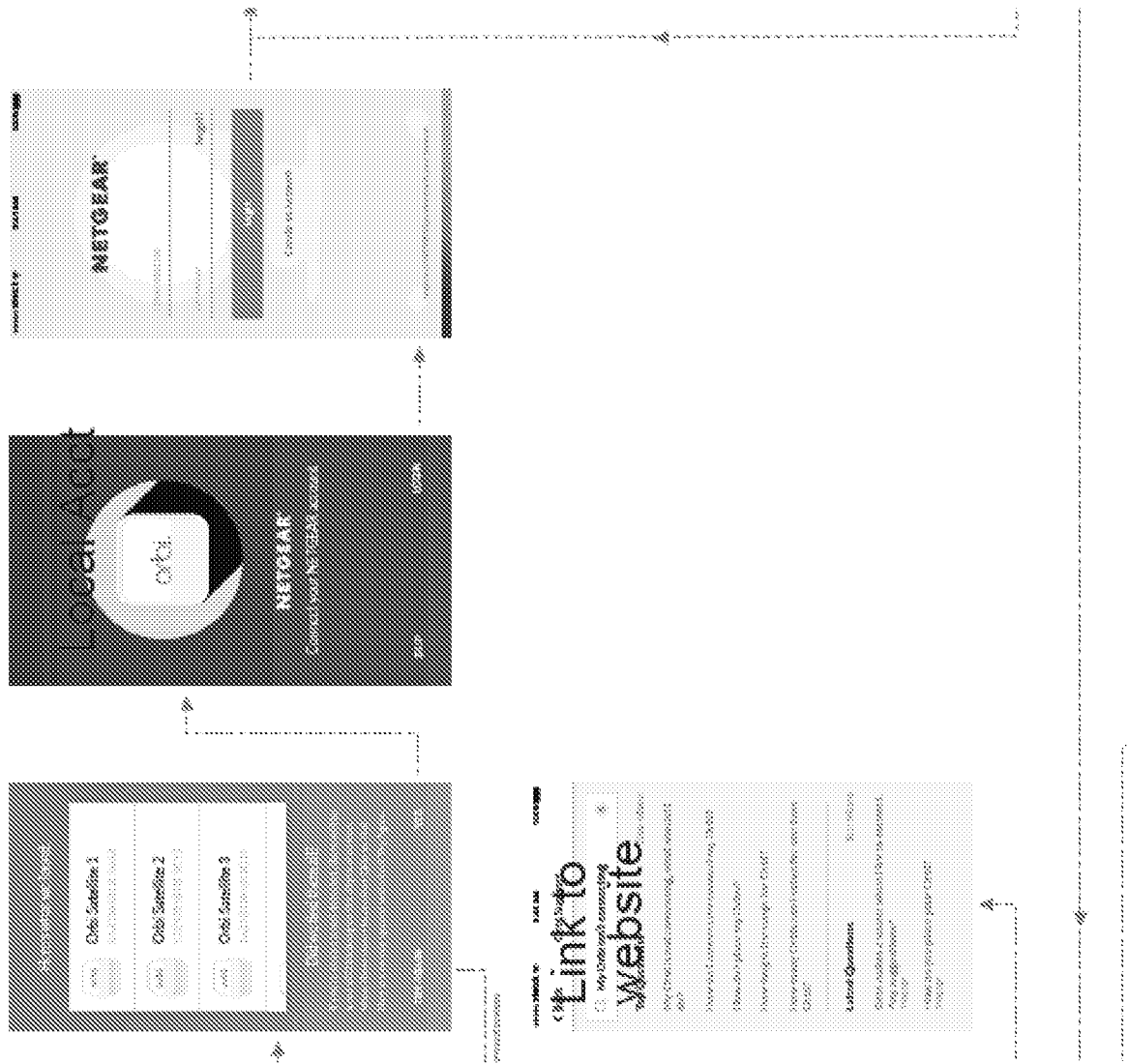


FIGURE 5D

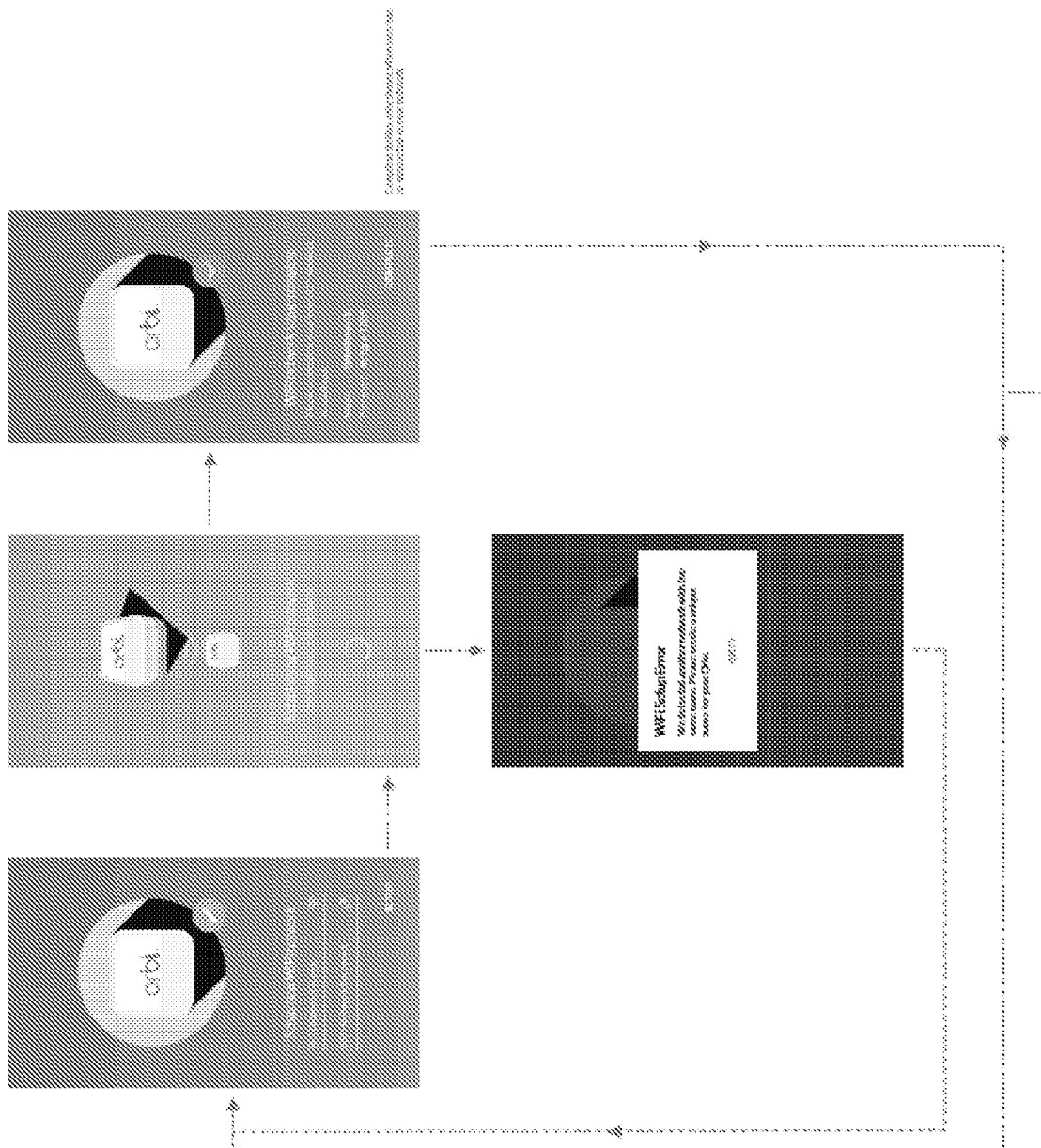


FIGURE 5E

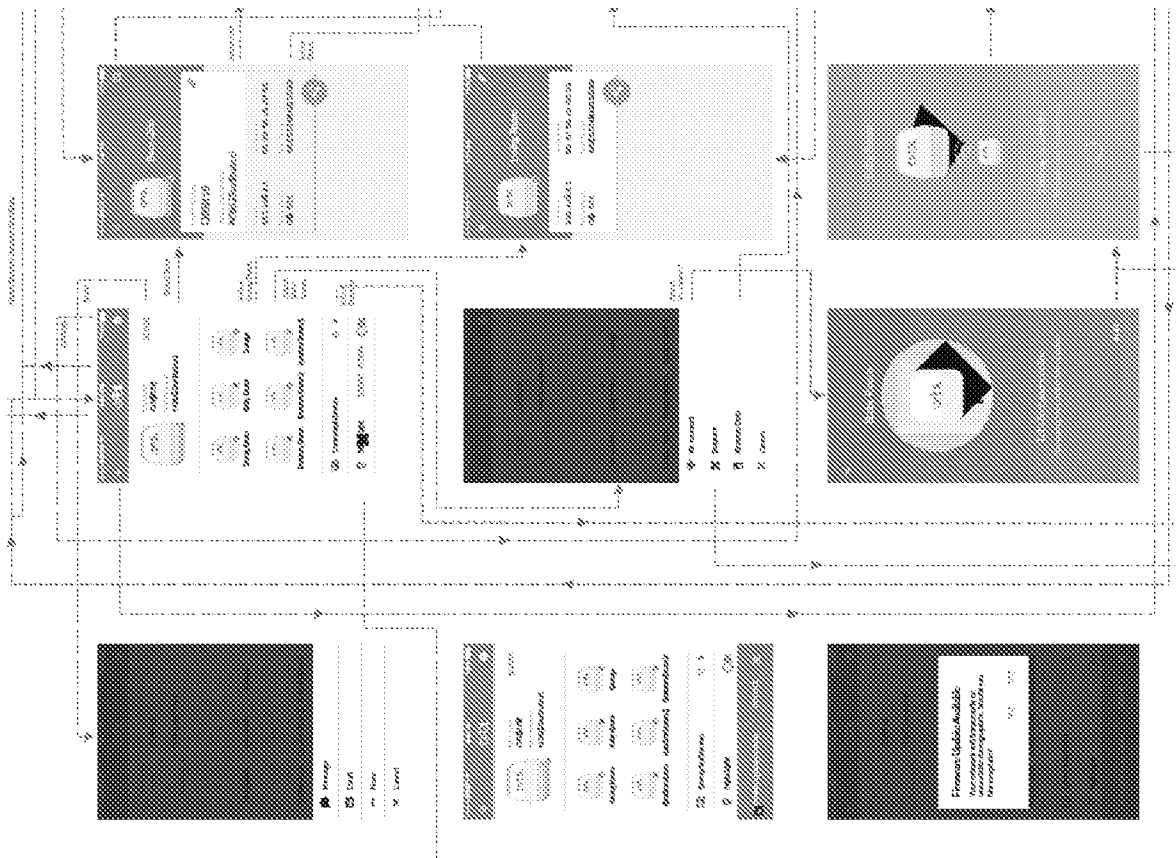


FIGURE 5F

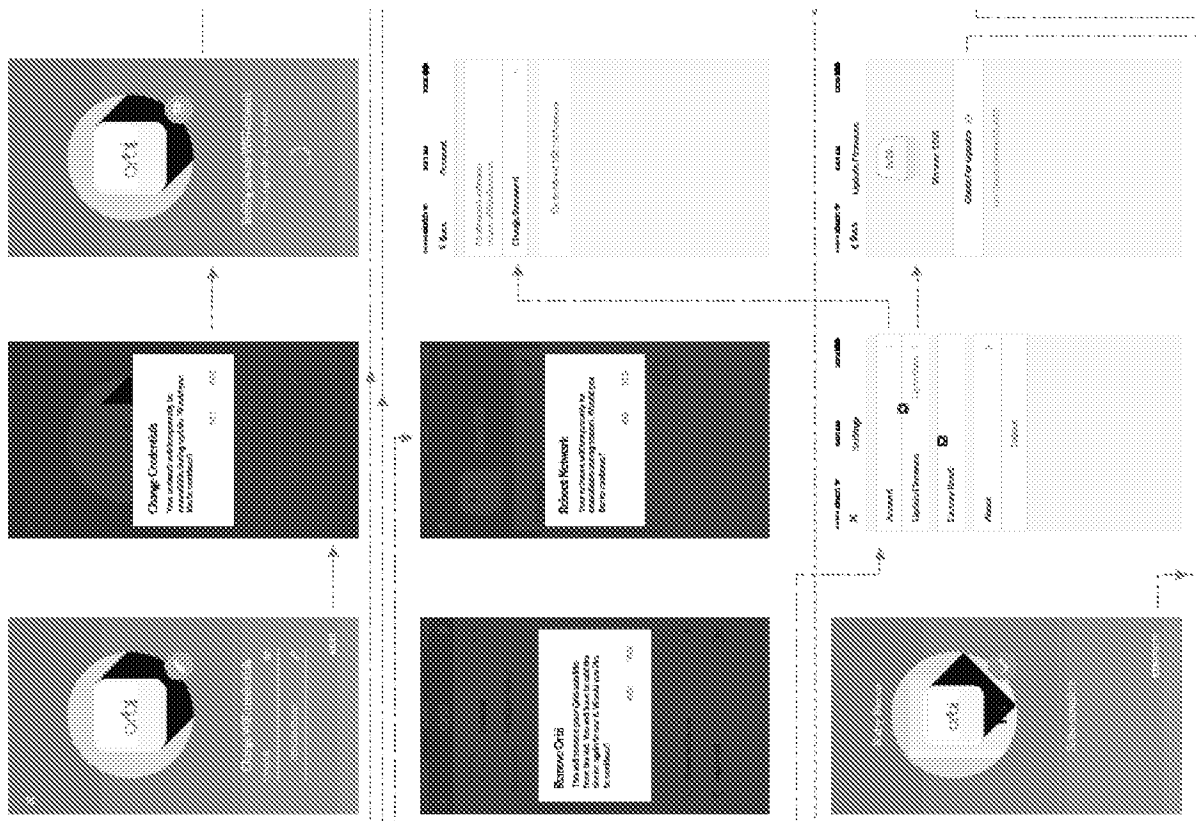


FIGURE 5G

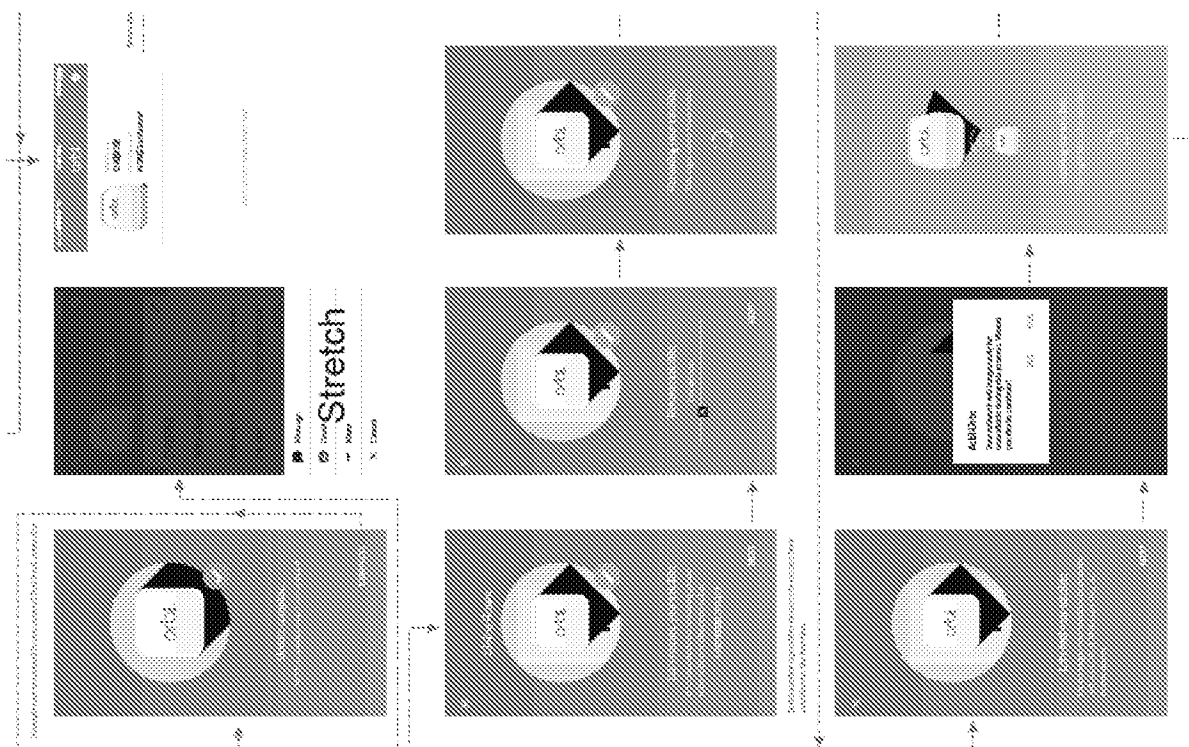
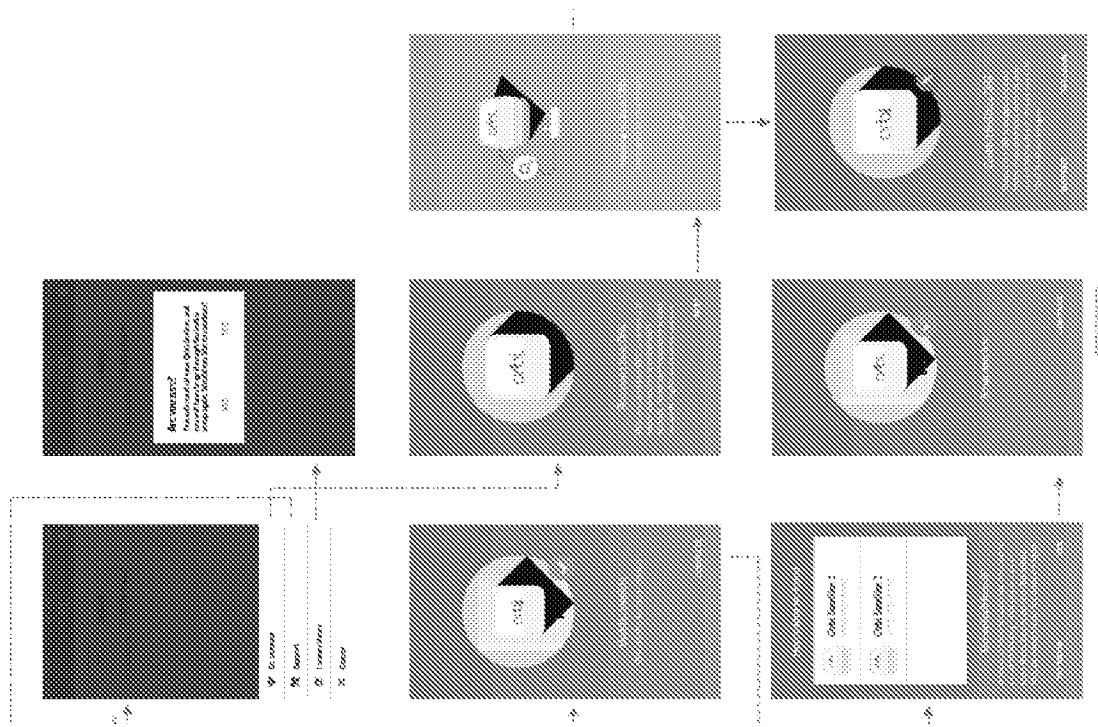


FIGURE 5H



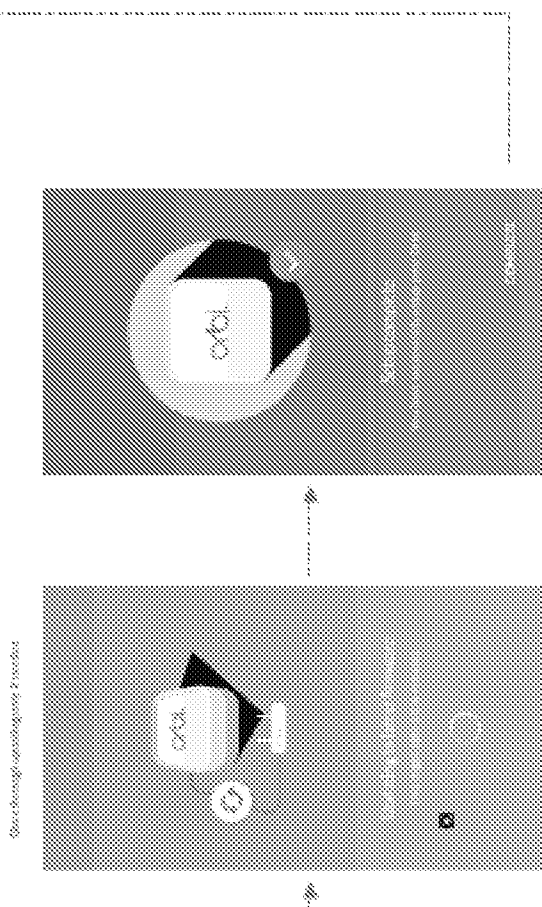


FIGURE 5J

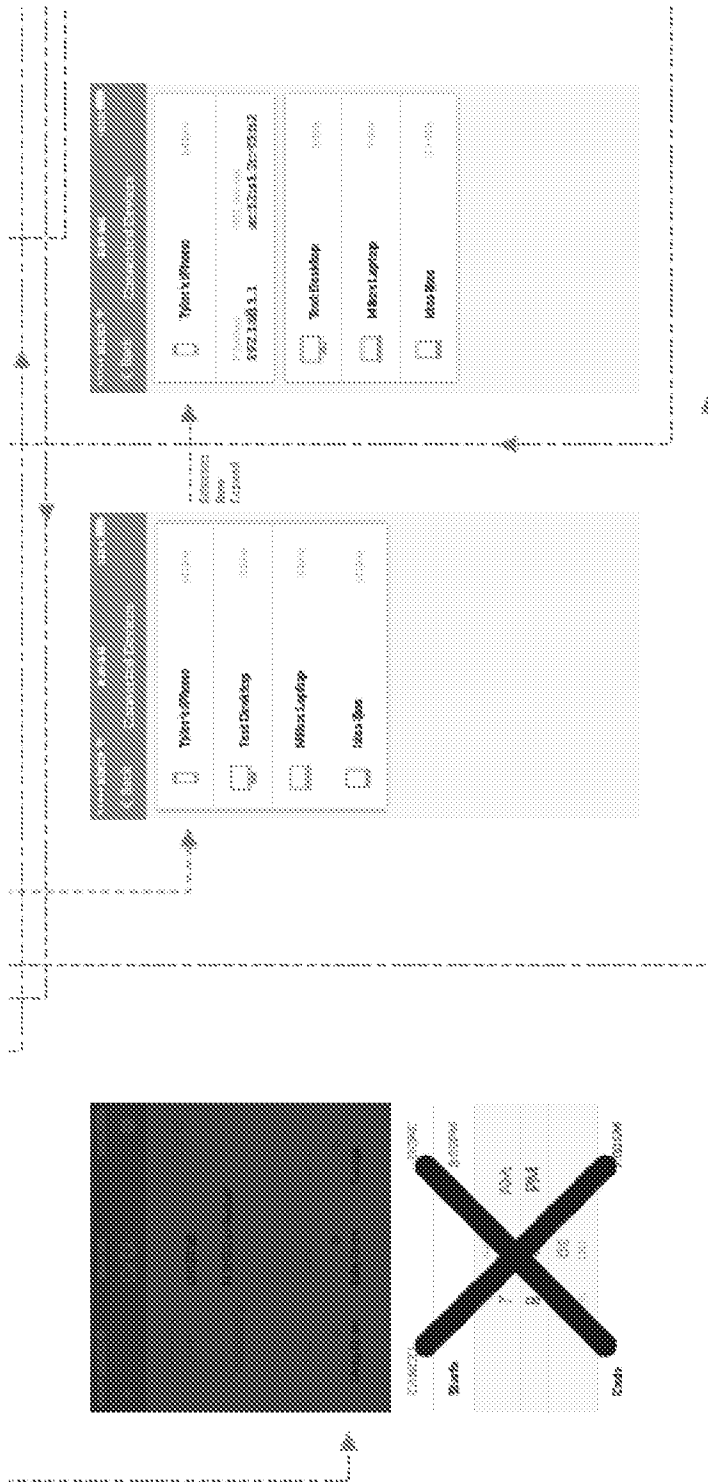


FIGURE 5K

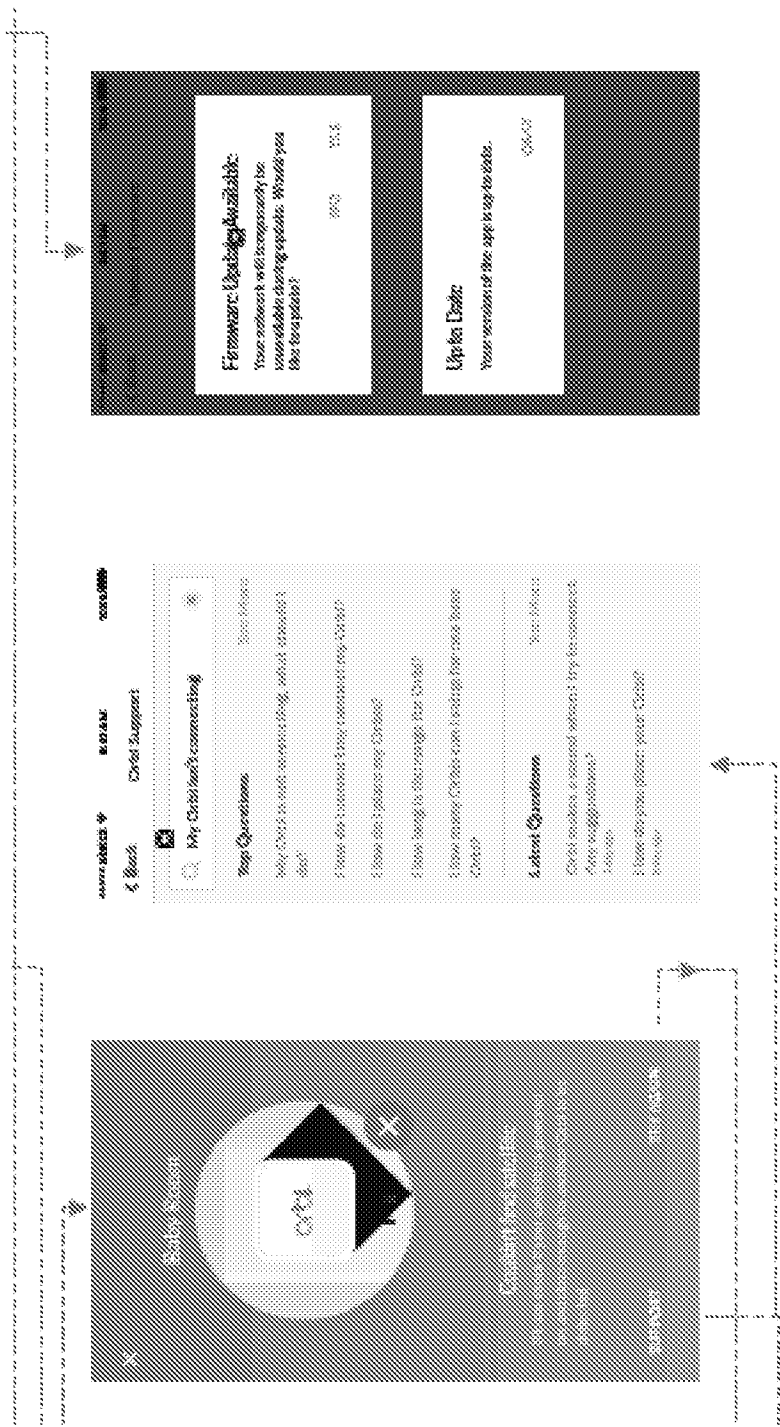


FIGURE 5L

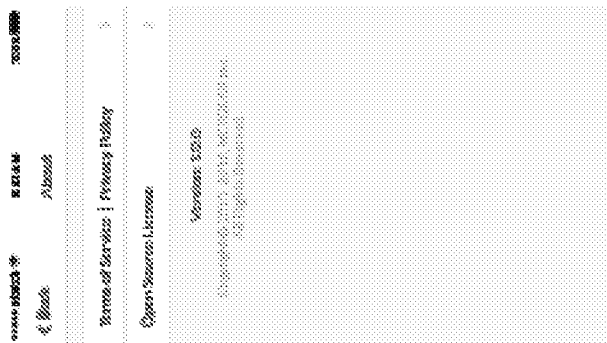
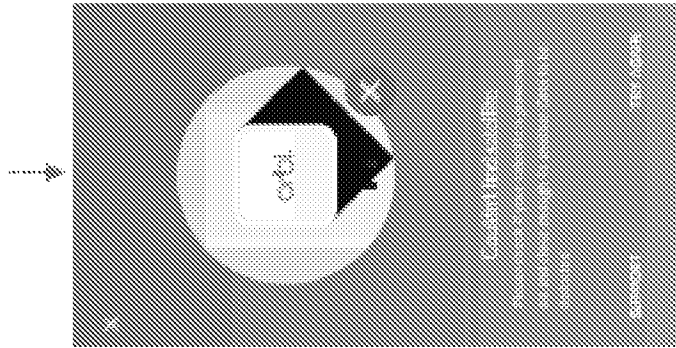


FIGURE 5M

Power LED (R/G)

+ Possible LED behaviors

• OFF, Red, Green, Amber

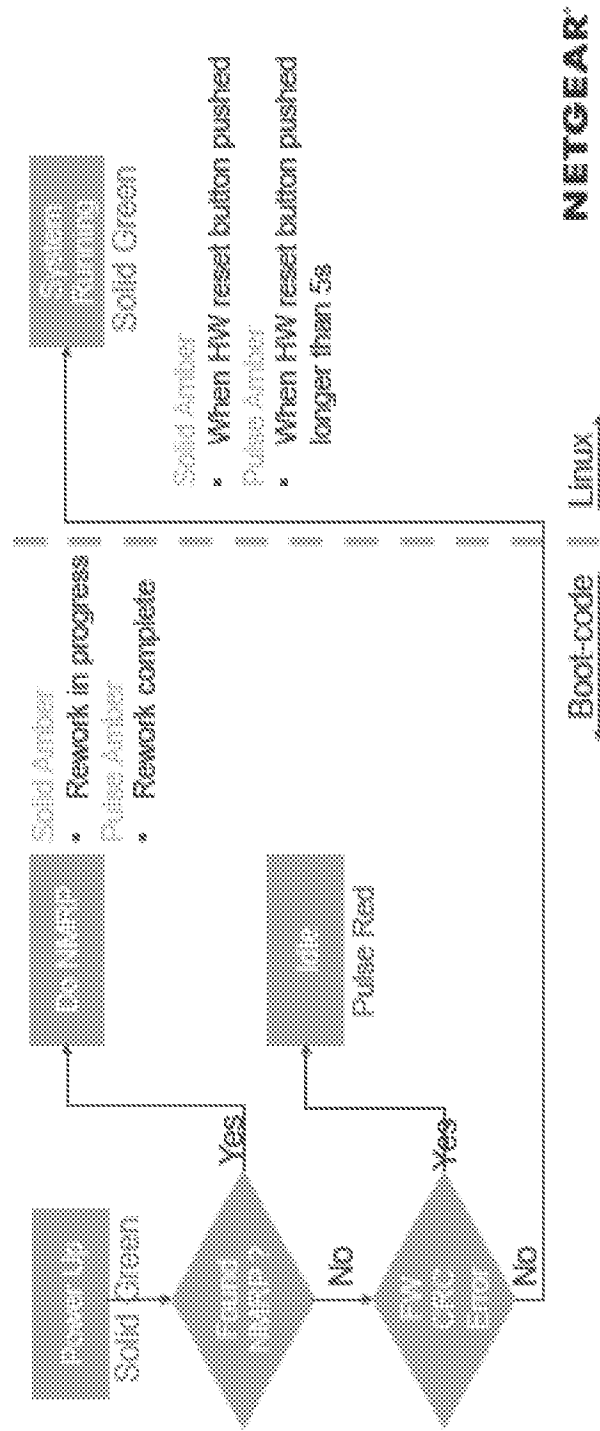
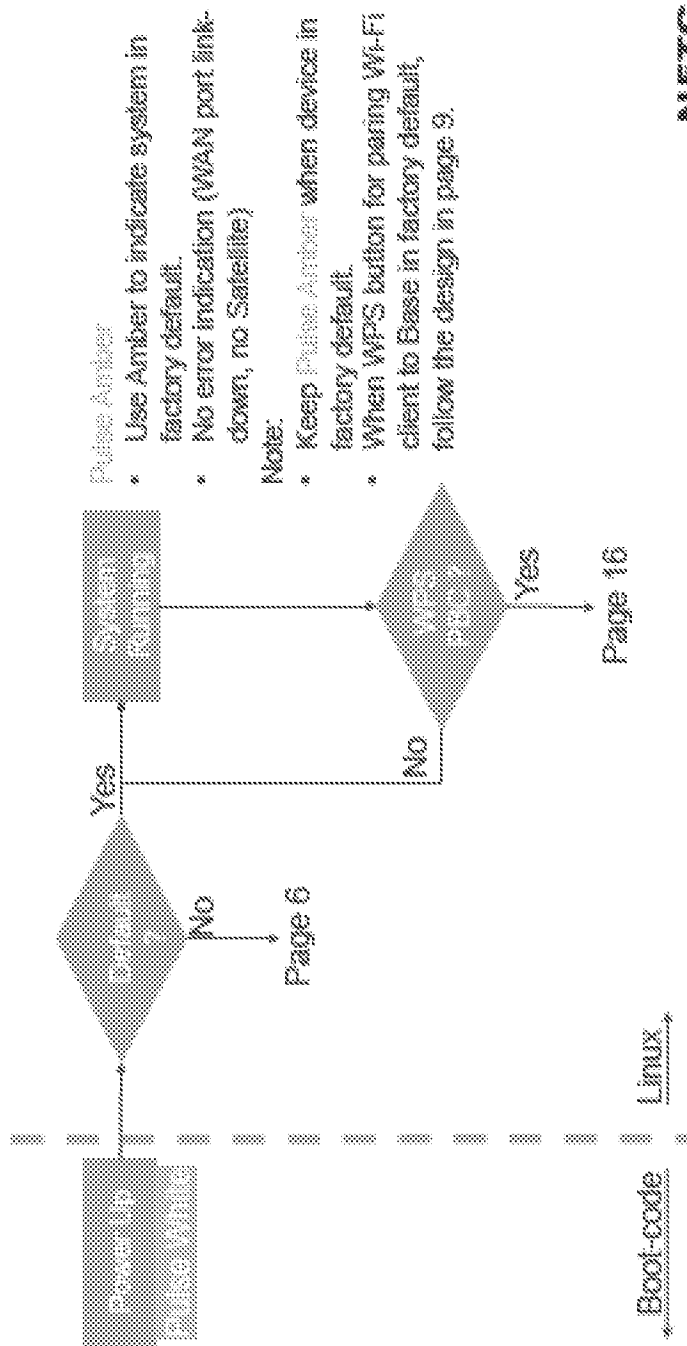


FIGURE 6A

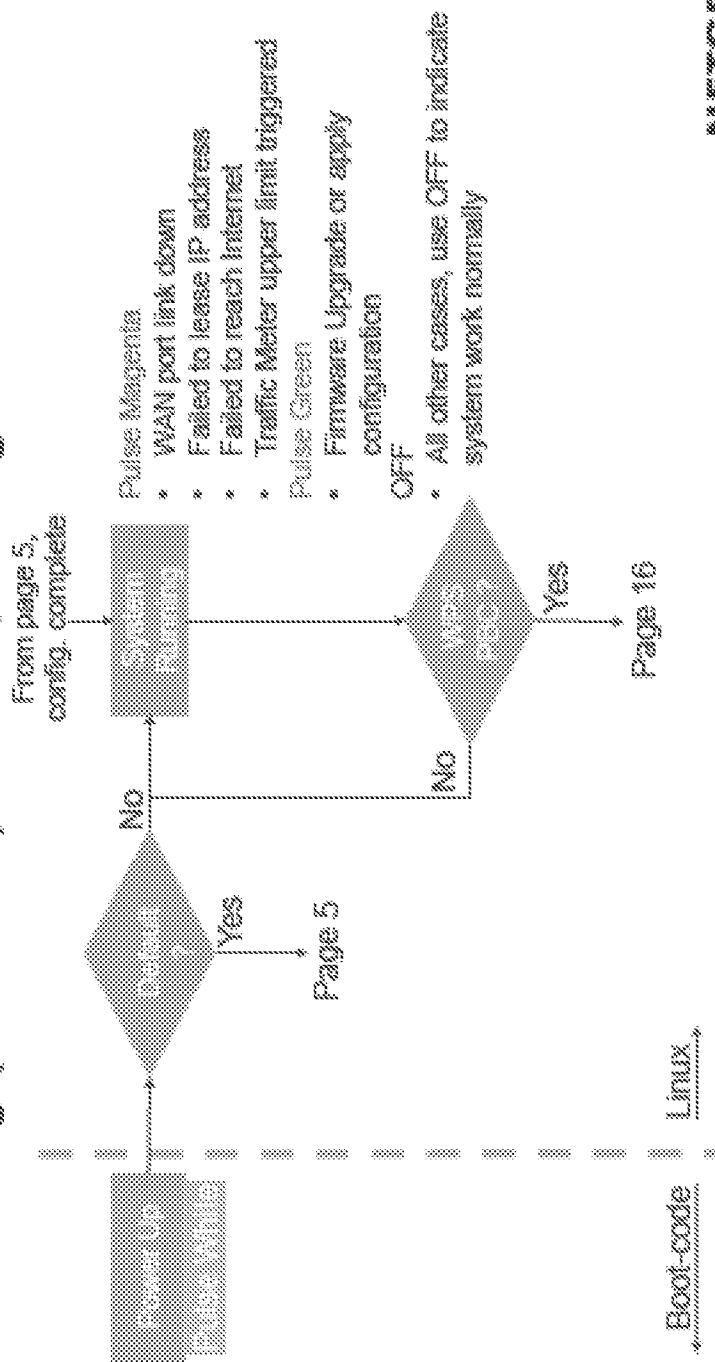
LED Ring (R/G/B/W) – Base, Factory Default



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FIGURE 6B

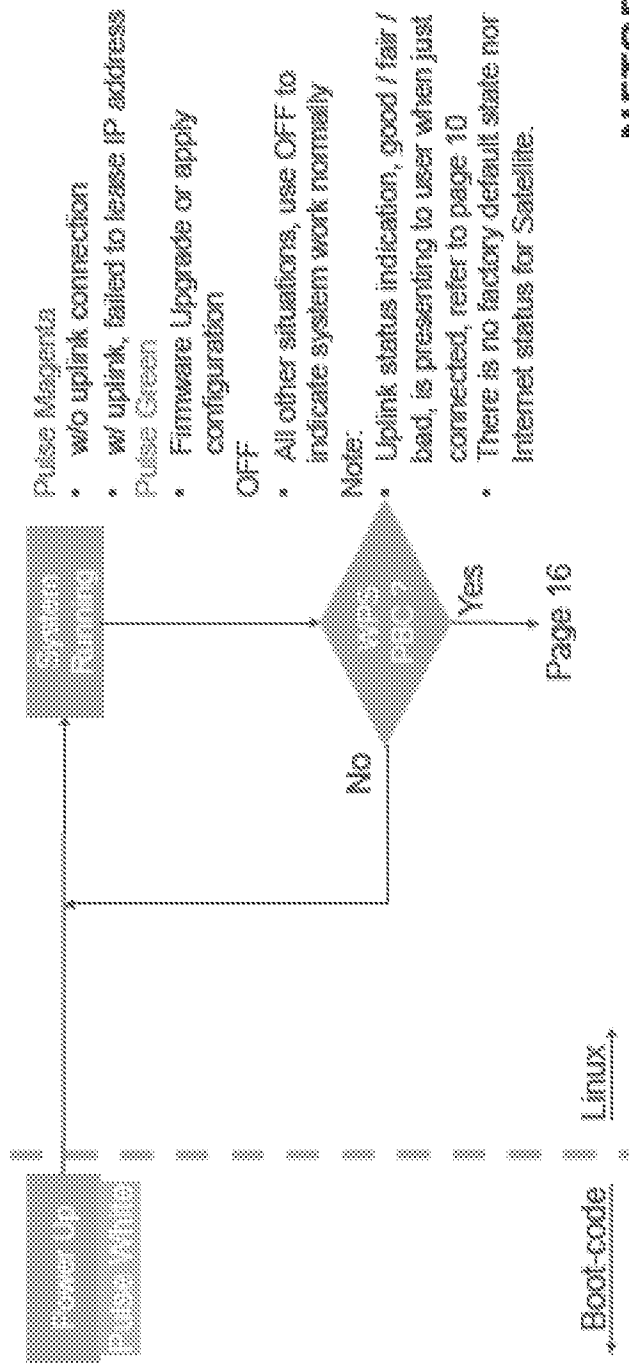
LED Ring (R/G/B/W) – Base, Configured



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FIGURE 6C

LED Ring (R/G/B/W) – Satellite Factory Default & Configured



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FIGURE 6D

LED Ring (R/G/B/W) – Base/Satellite – WPS

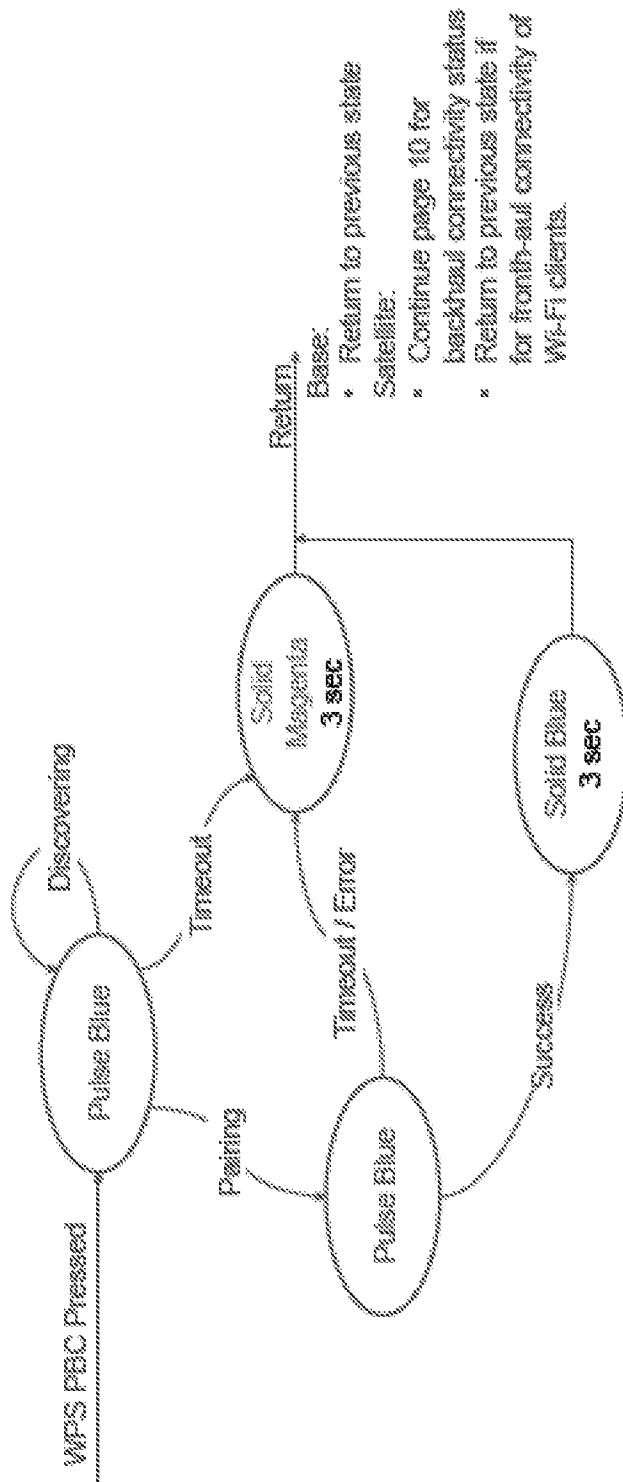


FIGURE 6E

LED Ring (R/G/B/W) – Connection Status

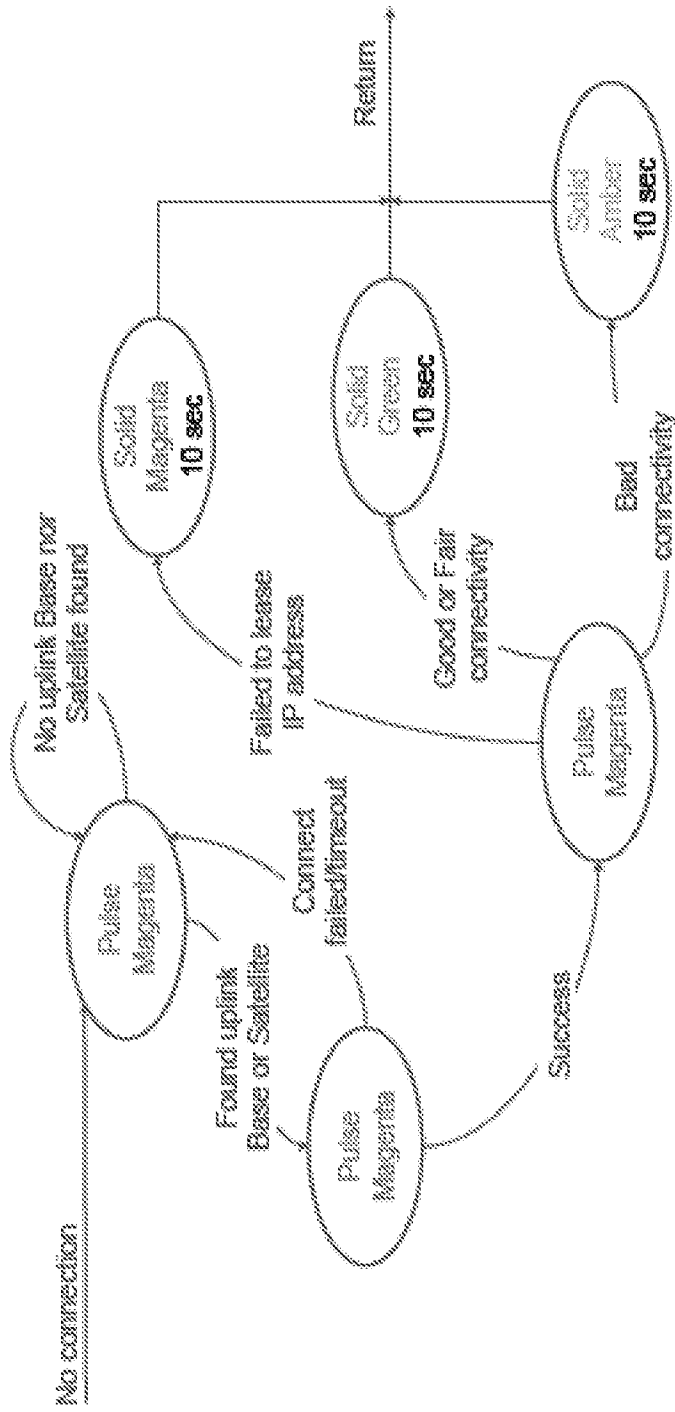
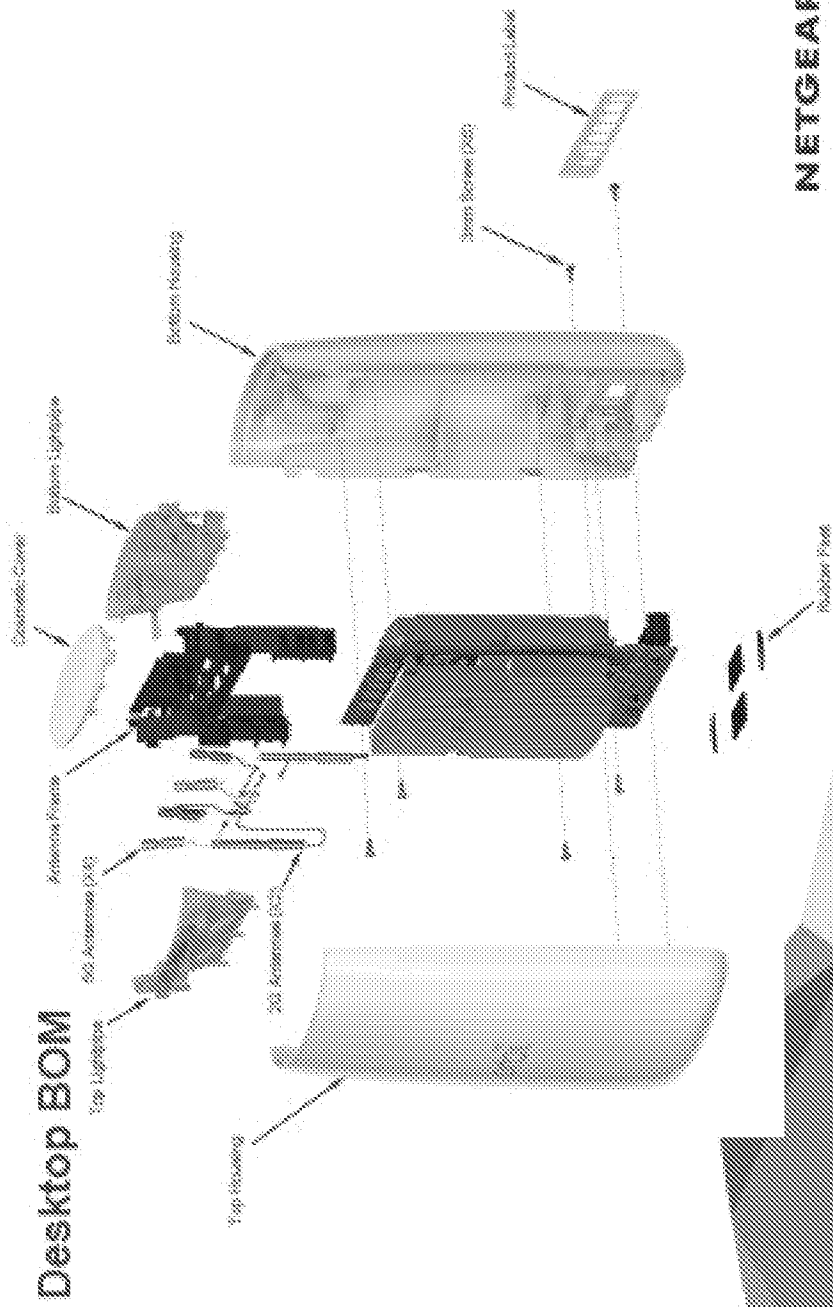


FIGURE 6F

Desktop BOM



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FIGURE 7A

Assembly Steps

Step 1 (Antenna Frame Assembly):

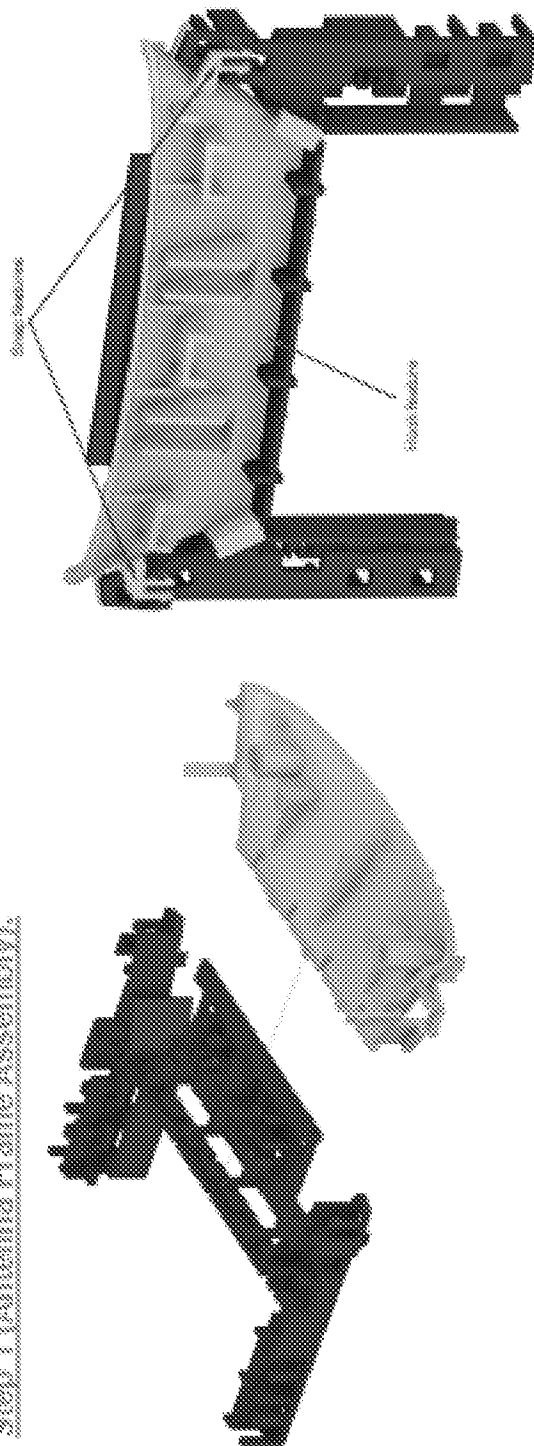


FIGURE 7B

Abstract

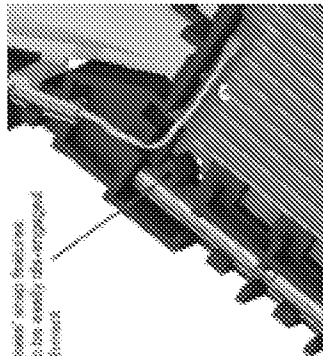


FIGURE 7C

Assembly Steps

Step 1 (Buffer Level Assembly):

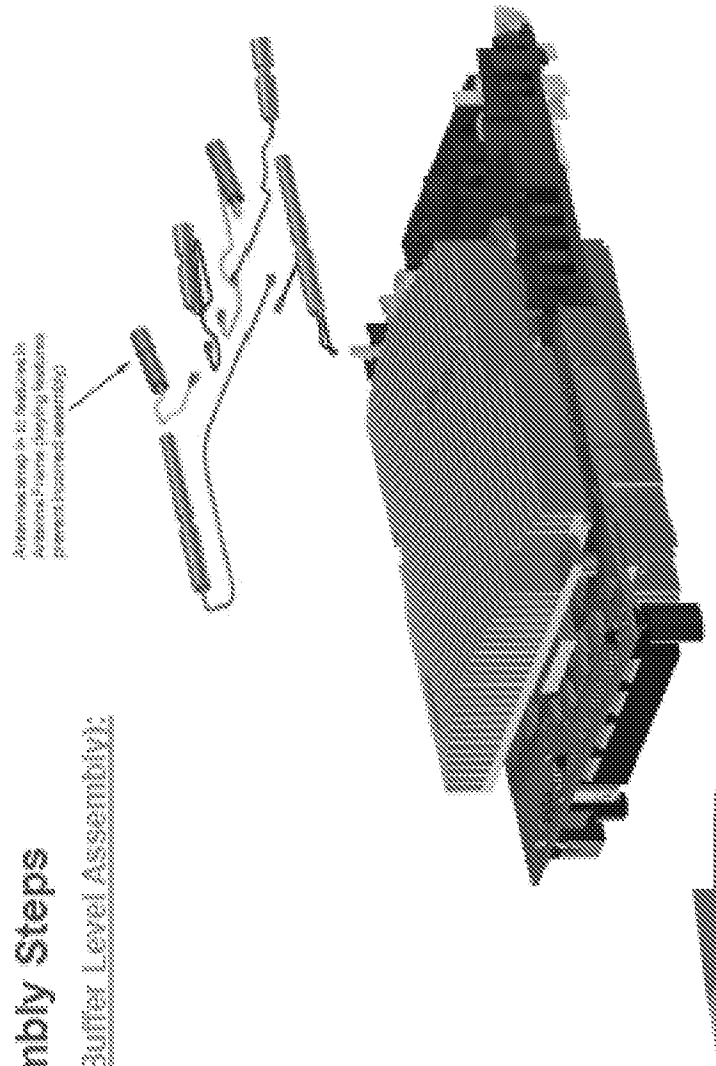


FIGURE 7D

Assembly Steps

Step 1 (Buffer Level Assembly):

Route Antenna Cables Through Holes in Antenna Frame (See Drawing 100)

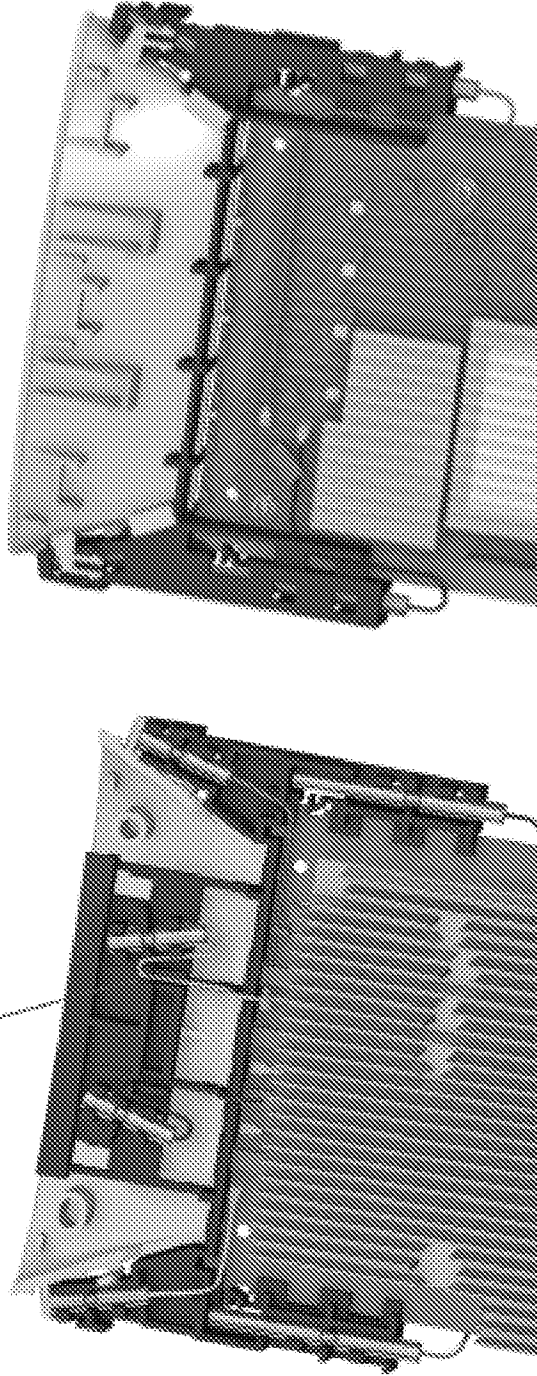


FIGURE 7E

Assembly Steps

Step 1 (Buffer Level Assembly):

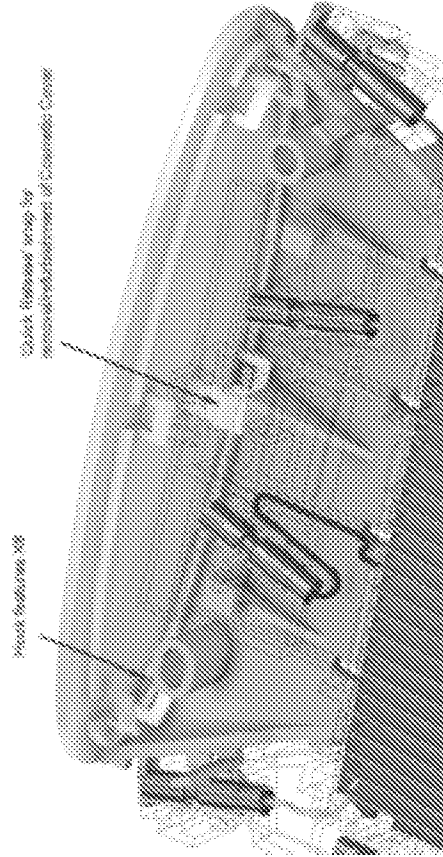
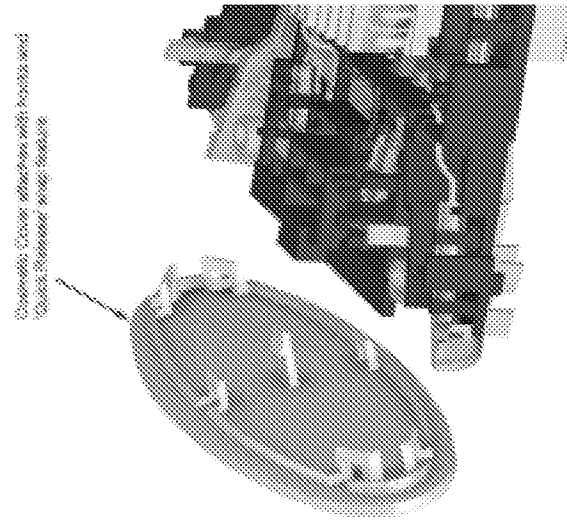


FIGURE 7F

Assembly Steps

Step 1 (Buffer Level Assembly):

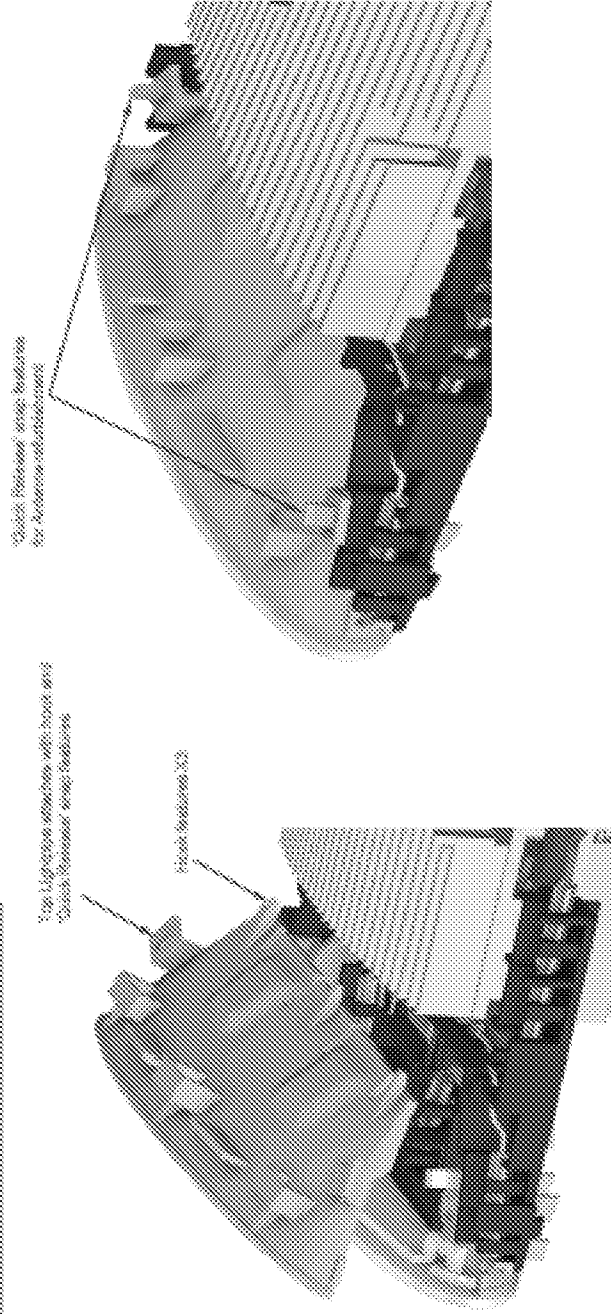


FIGURE 7G

Assembly Steps

Step 2:

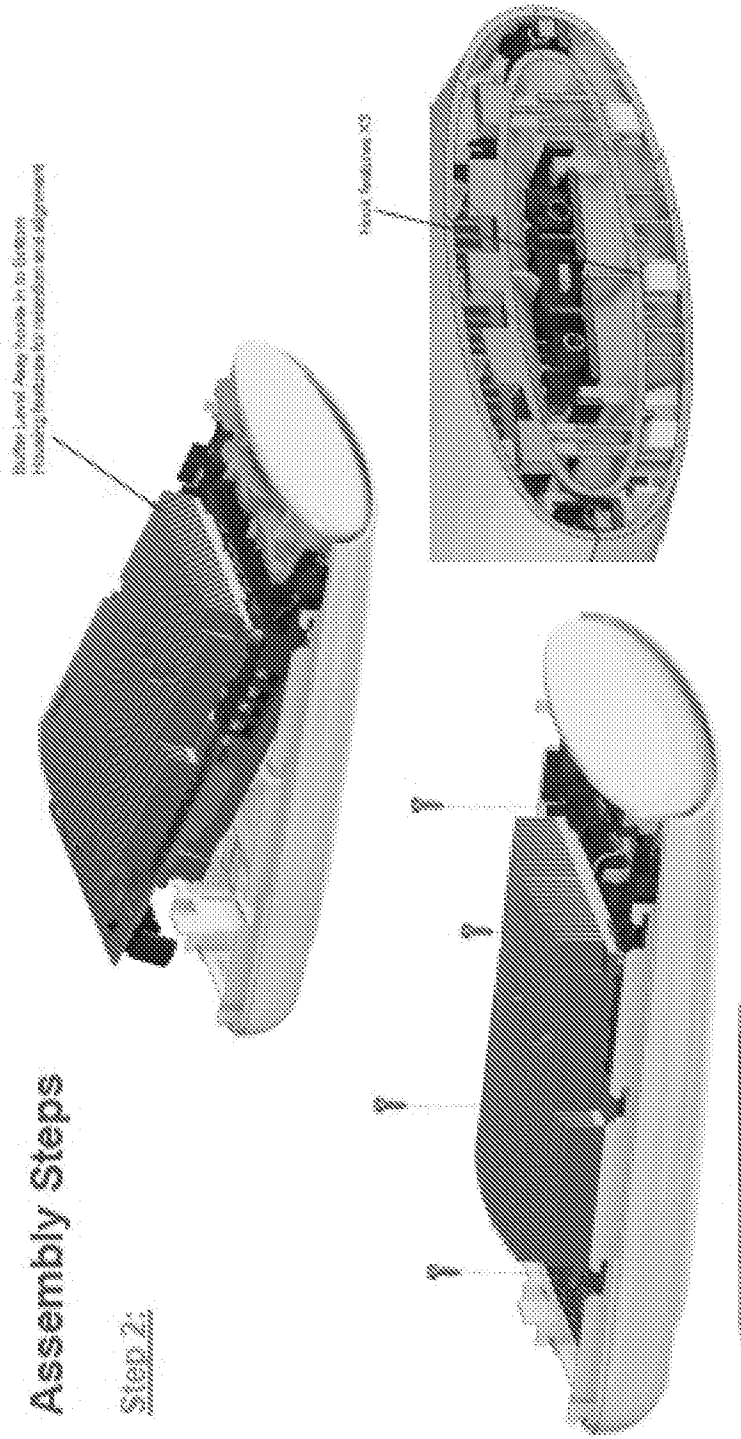


FIGURE 7H

Assembly Steps

Step 3:

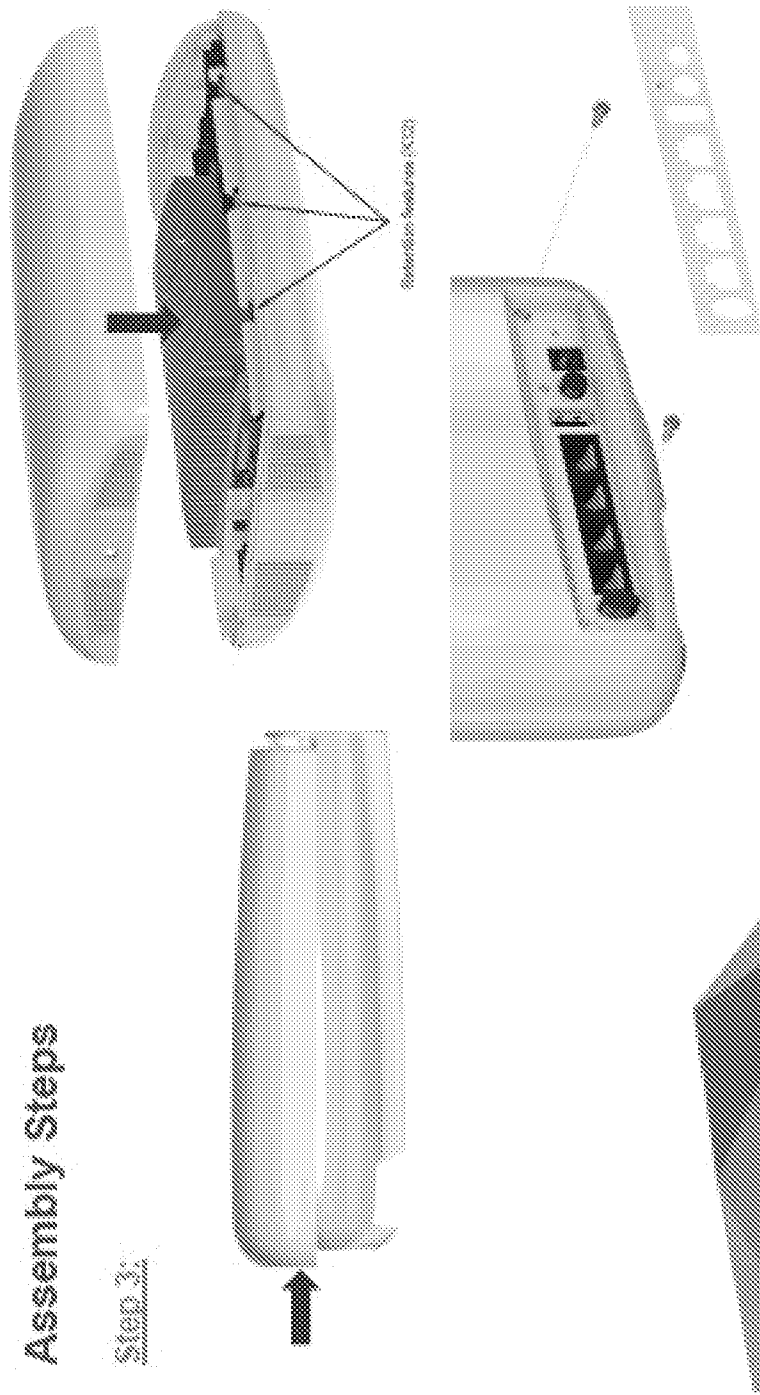


FIGURE 71

Assembly Steps

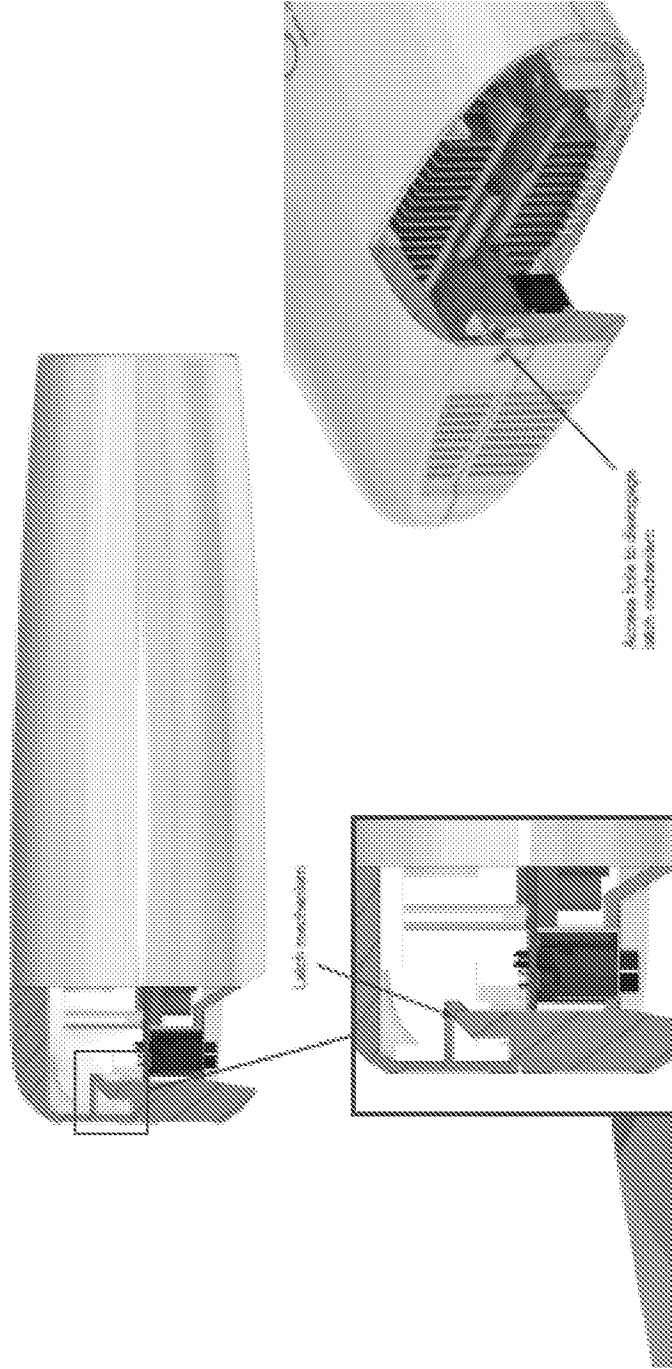
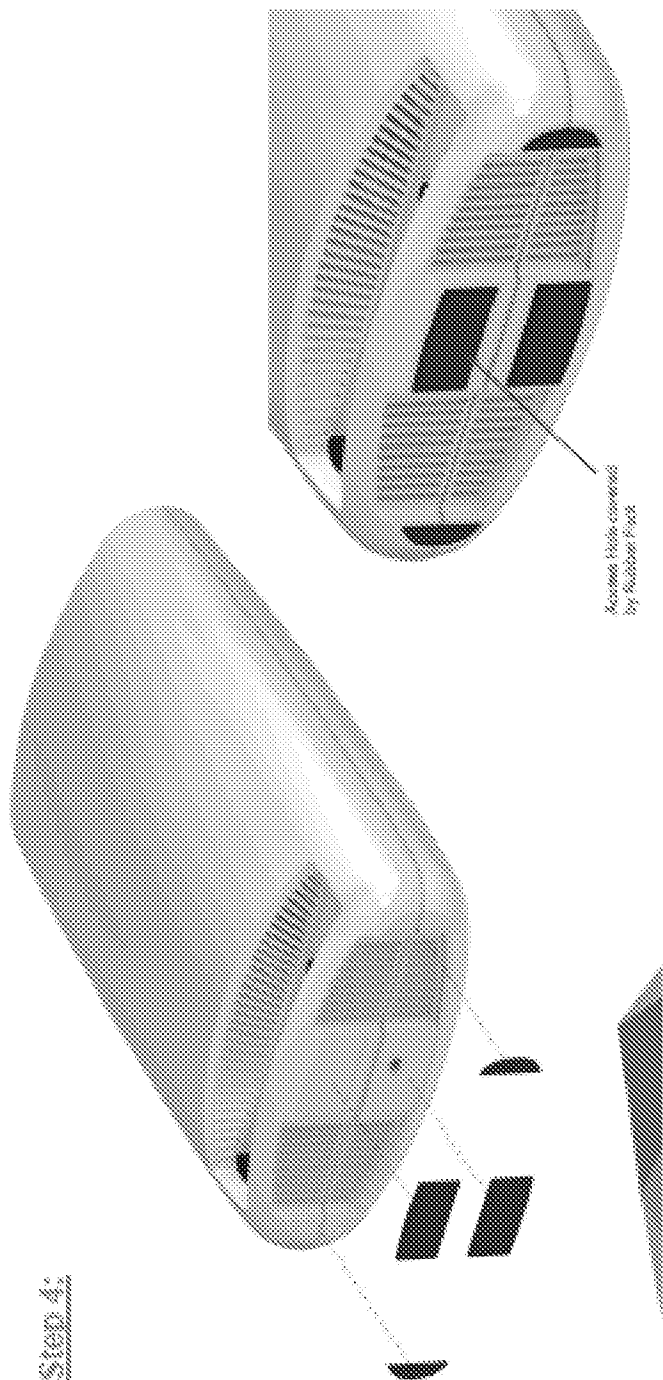


FIGURE 7J

Assembly

15 JULY 2004



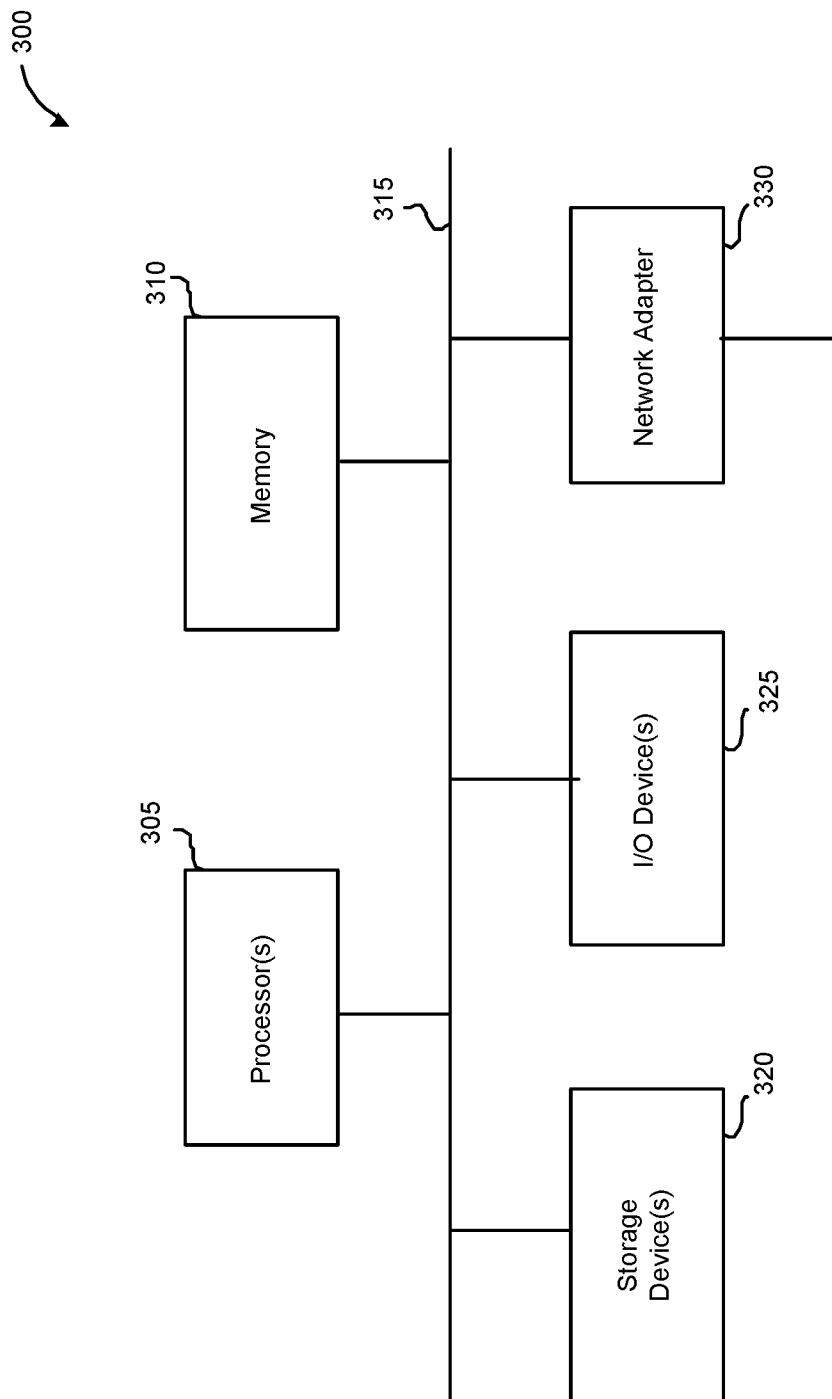


FIGURE 8



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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
62/336,503	05/13/2016		260	110729-8058.US00		

CONFIRMATION NO. 1077

FILING RECEIPT

22918
PERKINS COIE LLP - PAO General
P.O. BOX 1247
SEATTLE, WA 98111-1247



Date Mailed: 05/31/2016

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Projected Publication Date: None, application is not eligible for pre-grant publication

Non-Publication Request: No

Early Publication Request: No

Title

DEDICATED BACKHAUL FOR WHOLE HOME COVERAGE

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

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