



(51) International Patent Classification:

H03H 9/145 (1980.01) H03H 9/72 (1980.01)
H03H 9/64 (1980.01) H04B 1/00 (1968.09)
H03H 9/02 (1968.09)

(21) International Application Number:

PCT/EP2022/050375

(22) International Filing Date:

11 January 2022 (11.01.2022)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

17/155,829 22 January 2021 (22.01.2021) US

(71) Applicant: RF360 EUROPE GMBH [DE/DE]; Anzinger
Str. 13, 81671 München (DE).

(72) Inventors: YOON, Jiman; c/o RF360 Europe GmbH,
Anzinger Str. 13, 81671 München (DE). KIWITT, Jür-
gen; c/o RF360 Europe GmbH, Anzinger Str. 13, 81671
München (DE). KOCH, Robert; c/o RF360 Europe GmbH,
Anzinger Str. 13, 81671 München (DE). PITSCHI, Maxi-
milian; c/o RF360 Europe GmbH, Anzinger Str. 13, 81671
München (DE). KLOSKA, Gerhard; c/o RF360 Europe
GmbH, Anzinger Str. 13, 81671 München (DE).

(74) Agent: BARDEHLE PAGENBERG PART-
NERSCHAFT MBB PATENTANWÄLTE,
RECHTSANWÄLTE; BARDEHLE PAGENBERG Part-
nerschaft mbB Patentanwälte, Rechtsanwälte, Prinzregen-
tenplatz 7, 81675 München (DE).

(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ,
CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO,

(54) Title: ELECTROACOUSTIC FILTER INCLUDING SPLIT RESONATOR WITH DETUNING

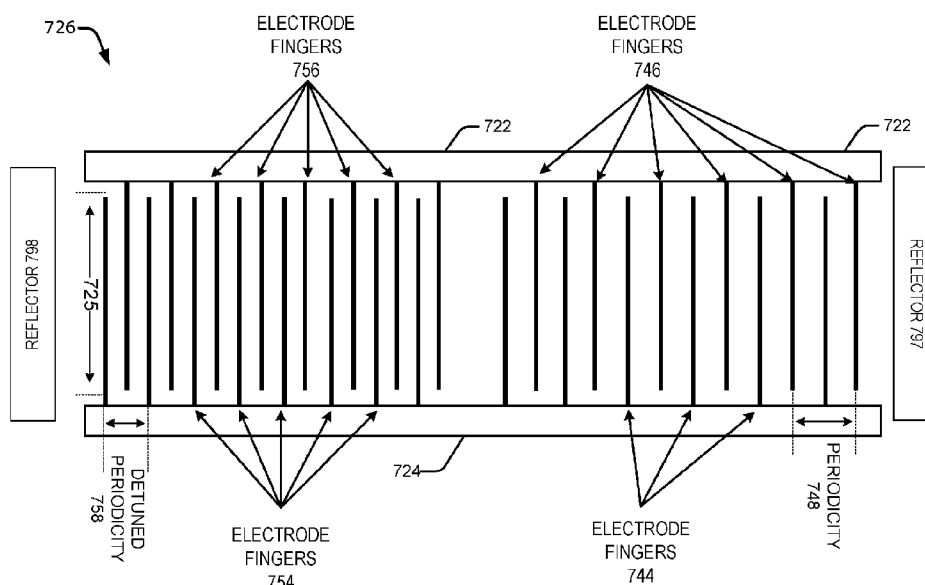


FIG. 7C

(57) Abstract: Aspects of the disclosure relate to wireless communication, and high-frequency filters with resonators. One example is a frequency band filter circuit having a split resonator. The split resonator comprises a resonator including a first section of a shared input busbar (722), a first section of a shared output busbar (724), and an electrode structure between the first section of the shared input busbar and the first section of the shared output busbar, the electrode structure configured for a resonance. The split resonator also comprises a detuned resonator. The detuned resonator includes a second section of the shared input busbar, a second section of the shared output busbar, and a detuned electrode structure between the second section of the shared input busbar and the second section of the shared output busbar, the detuned electrode structure configured for a detuned resonance different from the resonance.



DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, IT, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

- (84) Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

- *with international search report (Art. 21(3))*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(88) Date of publication of the international search report:

16 February 2023 (16.02.2023)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2022/050375

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims;; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☒ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2022/050375

A. CLASSIFICATION OF SUBJECT MATTER INV. H03H9/145 H03H9/64 ADD. H03H9/02 H03H9/72 H04B1/00		
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) H03H		
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 practicable, search terms used) EPO-Internal, COMPENDEX, INSPEC, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2016/380614 A1 (ABBOTT BENJAMIN P [US] ET AL) 29 December 2016 (2016-12-29) figures 5A, 5B, 11 -----	1, 3, 6-10, 15-19, 29, 30
X	US 2010/259341 A1 (NAKAI TSUYOSHI [JP]) 14 October 2010 (2010-10-14) figures 5A, 5B -----	1, 3, 6-10, 22, 23, 29
X	US 6 259 336 B1 (ICHIKAWA SATOSHI [JP]) 10 July 2001 (2001-07-10) column 4, line 1 - line 58; figures 1, 2, 7, 11, 12, 26, 35 ----- -/--	1, 3, 6-10, 15-19, 29, 30
☒ Further documents are listed in the continuation of Box C. ☒ See patent family 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 application or patent 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 23 December 2022		Date of mailing of the international search report 18/01/2023
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Naumann, Olaf

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2022/050375

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2020/021029 A2 (FRECNSYS [FR]) 30 January 2020 (2020-01-30) figures 12a, 12b -----	1, 2, 4, 5, 11-15, 20-28
Y	US 2020/021271 A1 (PLESSKI VIKTOR [CH]) 16 January 2020 (2020-01-16) figures 18, 19 -----	1, 2, 4, 5, 11-15, 20-28
Y	US 2019/036554 A1 (ITO MOTOKI [JP] ET AL) 31 January 2019 (2019-01-31) paragraph [0162] - paragraph [0166]; figures 9, 10A-10D -----	1, 2, 4, 5, 11-15, 20-28
Y	US 2019/123717 A1 (GAVRYLIUK OLEKSANDR [US] ET AL) 25 April 2019 (2019-04-25) paragraph [0059]; figure 1 -----	5, 25

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2022/050375

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2016380614 A1	29-12-2016	NONE	
US 2010259341 A1	14-10-2010	JP 5033876 B2 JP WO2009001651 A1 US 2010259341 A1 WO 2009001651 A1	26-09-2012 26-08-2010 14-10-2010 31-12-2008
US 6259336 B1	10-07-2001	EP 0961405 A2 US 6259336 B1	01-12-1999 10-07-2001
WO 2020021029 A2	30-01-2020	CA 3106887 A1 CN 112840561 A EP 3830956 A2 JP 2021532655 A KR 20210058824 A TW 202021269 A US 2021265980 A1 WO 2020021029 A2	30-01-2020 25-05-2021 09-06-2021 25-11-2021 24-05-2021 01-06-2020 26-08-2021 30-01-2020
US 2020021271 A1	16-01-2020	US 2020021271 A1 US 2020228091 A1 US 2020382098 A1 US 2020412330 A1 US 2021194458 A1 US 2021281240 A1	16-01-2020 16-07-2020 03-12-2020 31-12-2020 24-06-2021 09-09-2021
US 2019036554 A1	31-01-2019	CN 108496308 A CN 114039575 A JP 6445152 B2 JP WO2017131170 A1 US 2019036554 A1 WO 2017131170 A1	04-09-2018 11-02-2022 26-12-2018 08-02-2018 31-01-2019 03-08-2017
US 2019123717 A1	25-04-2019	CN 111226393 A EP 3701630 A1 JP 6900580 B2 JP 2021500838 A US 2019123717 A1 WO 2019081232 A1	02-06-2020 02-09-2020 07-07-2021 07-01-2021 25-04-2019 02-05-2019

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 3, 6-10(completely); 1, 15-19, 29, 30(partially)

Wireless communication apparatus including a split resonator comprising a first resonator and a second resonator, the resonators having differing resonance frequencies, aspects concerning the configuration of the individual resonators (see fig. 7A, 7C, 7D) of the application).

2. claims: 2, 4, 5, 11-14, 20-28(completely); 1, 15-19, 29, 30(partially)

Wireless communication apparatus including a split resonator comprising a first resonator and a second resonator, the resonators having differing resonance frequencies, configuration of the overall arrangement of the plurality of resonators (see fig. 5A, 5B, 6A, 7B of the application).
