Claims

1. A filter bank module comprising:
    - a substrate;
    - an antenna port terminal; and
    - a filter bank die fixed to the substrate, the filter bank die comprising:
        - a first acoustic wave (AW) filter having a first antenna terminal coupled to the antenna port terminal and a first filter terminal; and
        - a second AW filter having a second filter terminal, and a second antenna terminal coupled to the first antenna terminal to effectively diplex signals that pass through the first AW filter and the second AW filter; and
        - a double-throw switch having a first throw terminal coupled to the first filter terminal and a second throw terminal coupled to the second filter terminal, a transmit pole terminal, and a receive pole terminal, wherein an insertion loss between either of the transmit pole terminal or the receive pole terminal and the antenna port terminal minus an insertion loss of either the first AW filter or the second AW filter is no greater than 1.2 decibels, and wherein a real estate area of the filter bank module is no greater than 4 square millimeters.

2. The filter bank module of claim 1 wherein the first antenna terminal and the second antenna terminal are directly coupled together.

3. The filter bank module of claim 1 or 2, wherein the double-throw switch comprises a single-pole double-throw switch having a first throw terminal coupled to the first filter terminal and a second throw terminal coupled to the second filter terminal and a single pole terminal.

4. The filter bank module of claim 1 or 2, wherein the double-throw switch comprises a double-pole double-throw switch having a first throw terminal coupled to the first filter terminal and a second throw terminal coupled to the second filter terminal, a transmit pole terminal, and a receive pole terminal.

5. The filter bank module of claim 4 wherein the double-pole double-throw switch is configured to selectively couple the receive pole terminal between the first throw terminal and the second throw terminal.

6. The filter bank module of claim 4 wherein the double-pole double-throw switch is configured to selectively couple the transmit pole terminal between the first throw terminal and the second throw terminal.

7. The filter bank module of claim 4 further comprising a low-noise amplifier (LNA) having an LNA input terminal coupled to the receive pole terminal and an LNA output terminal.

8. The filter bank module of claim 7 further comprising a power amplifier (PA) having a PA output coupled to the transmit pole terminal and a PA input.

9. The filter bank module of claim 1 or 2 further comprising a passive filter having a third antenna terminal coupled to the antenna port terminal and a third filter terminal.

10. The filter bank module of claim 9 wherein the passive filter comprises at least one inductor and at least one capacitor.

11. The filter bank module of claim 9 wherein the third antenna terminal is coupled directly to both the first antenna terminal and the second antenna terminal.

12. The filter bank module of claim 9, wherein the double-throw switch comprises a single-pole double-throw switch having a first throw terminal coupled to the first filter terminal and a second throw terminal coupled to the second filter terminal and a single pole terminal.

13. The filter bank module of claim 4 wherein the double-pole double-throw switch is configured to selectively couple the receive pole terminal between the first throw terminal and the second throw terminal.

14. The filter bank module of claim 4 wherein the double-pole double-throw switch is configured to selectively couple the transmit pole terminal between the first throw terminal and the second throw terminal.

15. The filter bank module of claim 4 further comprising a low-noise amplifier (LNA) having an LNA input terminal coupled to the receive pole terminal and an LNA output terminal.

16. The filter bank module of claim 15 further comprising a power amplifier (PA) having a PA output coupled to the transmit pole terminal and a PA input.

17. The filter bank module of claim 1 wherein a real estate area of the filter bank module is no greater than 2.56 square millimeters.

18. The filter bank module of any one of claims 1 to 17 wherein the first AW filter and the second AW filter are configured for different passbands.

19. The filter bank module of any one of claims 1 to 18 wherein the first AW filter is configured to have a filter skirt with a slope that spans over at least a 100 MHz gap between adjacent passbands.

20. The filter bank module of any one of claims 1 to 19 wherein the second AW filter is configured to have a filter skirt with a slope that spans over at least a 100 MHz gap between adjacent passbands.

21. The filter bank module of claim 18 wherein the first AW filter is configured as a bandpass filter to pass a Unlicensed National Information Infrastructure bands 1 to 2a (UNII-1 to UNII-2a) passband with a filter skirt having a falling slope that spans up to a 160 MHz gap between adjacent passbands.

22. The filter bank module of claim 18 wherein the second AW filter is configured as a bandpass filter to pass an Unlicensed National Information Infrastructure bands 2c to 3 (UNII-2c to UNII-3) passband with a filter skirt having a rising slope that spans up to a 160 MHz gap between adjacent passbands.

23. The filter bank module of claim 18 wherein the second AW filter is configured as a bandpass filter to pass an Unlicensed National Information Infrastructure bands 2c to 4 (UNII-2c to UNII-4) passband with a filter skirt having a rising slope that spans up to a 160 MHz gap between adjacent passbands.

24. The filter bank module of claim 18 wherein the first AW filter is configured as a bandpass filter to pass an Unlicensed National Information Infrastructure bands 2c to 4 (UNII-2c to UNII-4) passband with a filter skirt having a rising slope that spans up to a 160 MHz gap between adjacent passbands.

25. The filter bank module of claim 18 wherein the second AW filter is configured to pass an Unlicensed National Information Infrastructure bands 5 to 8 (UNII-5 to UNII-8) passband while rejecting the UNII-2c to UNII-4 passband.

26. The filter bank module of claim 18 wherein the first AW filter is configured as a bandpass filter to pass an Unlicensed National Information Infrastructure bands 1 to 2a (UNII-1 to UNII-2a) passband with a filter skirt having a falling slope that

spans up to a 160 MHz gap between adjacent passbands and the second AW filter is configured as a bandpass filter to pass an Unlicensed National Information Infrastructure bands 2c to 3 (UNII-2c to UNII-3) passband with a filter skirt having a rising slope that spans up to a 160 MHz gap between adjacent passbands.