



BHW Technologies (博泓微科技有限公司)



**Advanced RF IC, Antenna, Filter, RF Front-End
and Wireless System Solutions**

BHW Application Note #003

**Boosting Wi-Fi Tx Power and Rx Sensitivity with
BHWA251 and BHWM252**

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www.bhw-tech.com

Background: Improving Link Budget of 2.4GHz Wi-Fi Systems



Background & Challenges:

- The 2.4GHz ISM Band is the Most Widely Used Spectrum Today, including Wi-Fi, Bluetooth, ZigBee and Many Other IoT Protocols
- To Achieve Long Range and Maintain Reliable Wi-Fi Connection, RF Front-End with Sufficient Transmit Power and Best-Class Receive Sensitivity should be Considered at the Design Stage
- While Many State-of-the-Art Wi-Fi SoCs Have On-Chip Integrated PAs, the Transmit Power Are Usually Limited, Typically <math><18\text{dBm}</math> for 11g and <math><20\text{dBm}</math> for 11b, in the 2.4GHz Band
- The On-Chip Integrated LNA in Most Wi-Fi SoCs Usually Delivers Moderate Receive Sensitivity. For 11n HT40/MCS7, it is Challenging to Achieve State-of-the-Art Rx Sensitivity, in the Mid -70dBm Range, without Using External LNAs

BHW Solutions & Benefits:

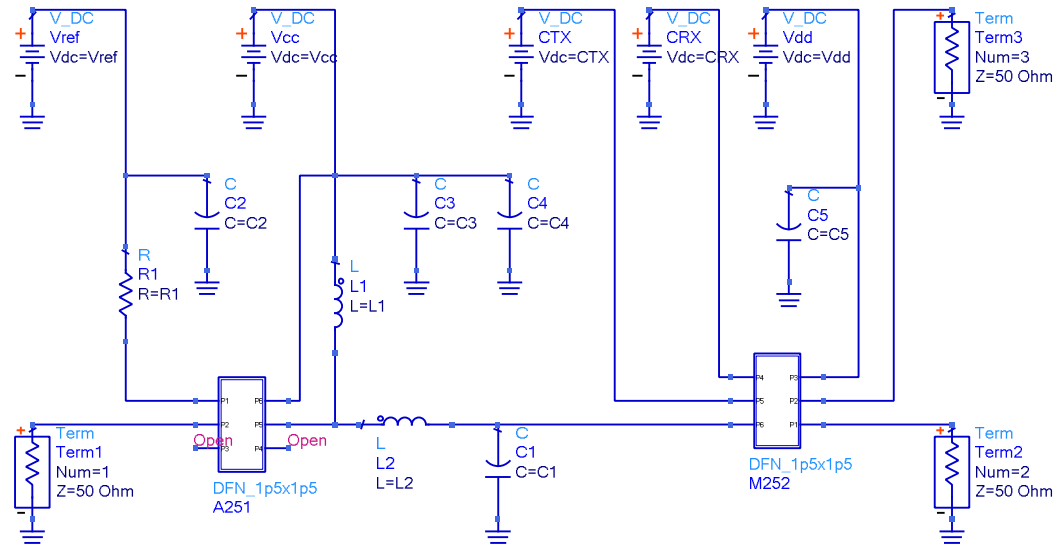
- Using Advanced GaAs HBT & ED-PHEMT Technologies, BHW has Developed a Broad Portfolio of High-Performance, Cost-Effect RF Front-End ICs for Various Wireless Applications Including the 2.4GHz Band
- BHWA251 is a GaAs HBT PA with up to +25.5dBm Output P1dB and Industry-Leading PAE in a 1.5x1.5mm DFN
- BHWM252 is a GaAs PHEMT LNA/SPDT Front-End IC with Low 1.6dB NF and 0.7dB Switch IL in 1.5x1.5mm DFN
- Combination of BHWA251/M252, Especially if 5V Power Supply is Available, Can Help Increase both Tx Power and Rx Sensitivity of 2.4GHz Wi-Fi Products Significantly, as Described in this AppNote
- The rugged design of BHWM252 allows potential elimination of LNA bypass in conventional Wi-Fi receiver chain architecture, reducing PCB foot-print, simplifying circuit design, and lowering cost of both RF ICs and eBOM



BHWA251/M252 Combo Schematic and EVB

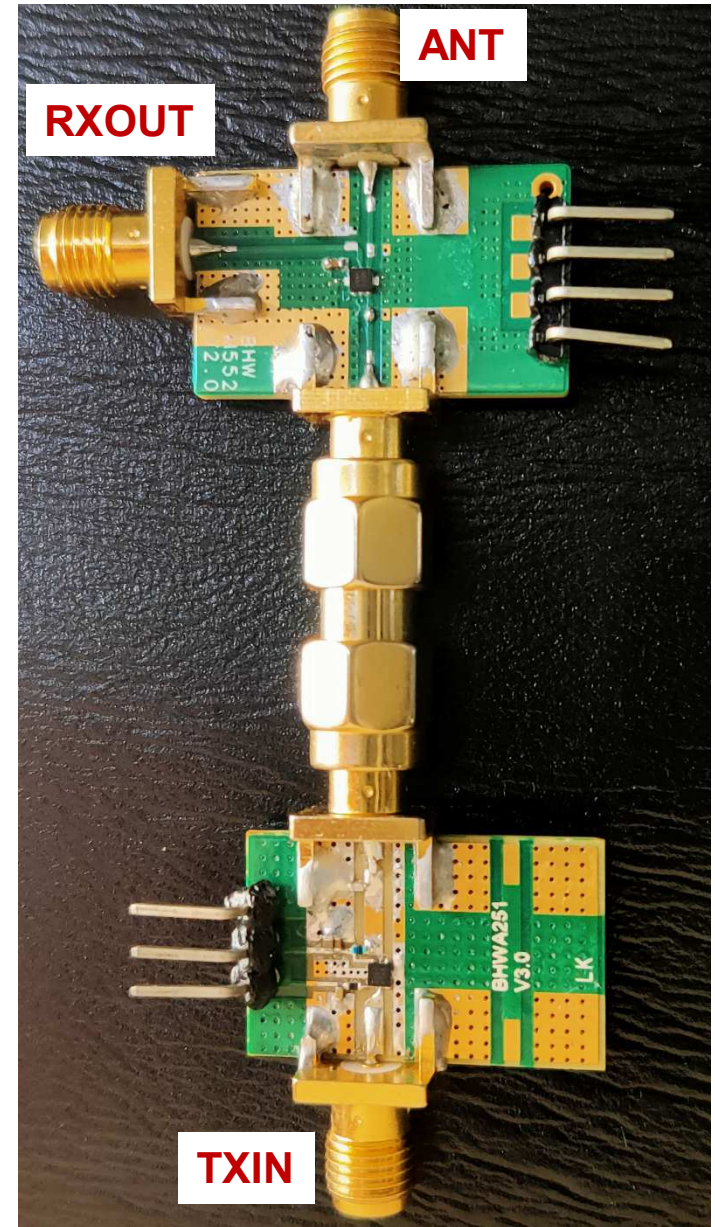


Application Schematic

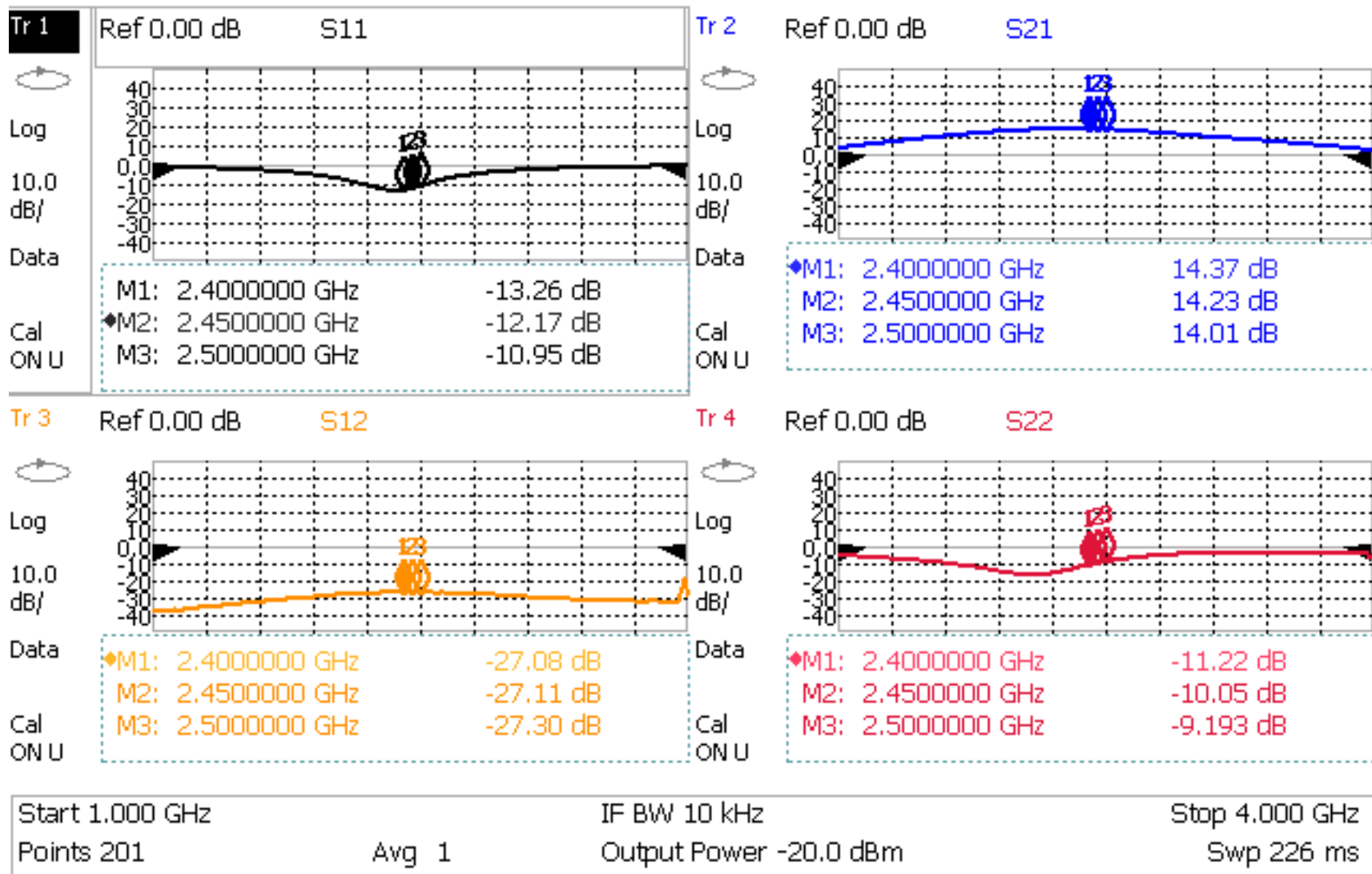


Nominal BOM for 2.4GHz 5V/3.3V Operation:

- Capacitors: C1=1.2pF, C2=470pF, C3=330pF, C4=10uF, C5=1uF
- Inductors: L1=10nH, L2=1.5nH (or ~5mm Transmission Line from Pin5)
- Resistor: R1=200 Ohm for $I_{cq} \sim 75/95\text{mA}$ at $V_{cc}=3.3\text{V}/5\text{V}$, $V_{ref}=3.3\text{V}$.
- Other bias settings available upon request



BHWA251/M252 Combo S-Parameters: Tx



Notes:

- Bias Setting: Vcc=3.3V, Vref=Vdd=CTX=3.3V, Icq~75mA; CRX=0
- Measured data include feedline and SMA connector losses of ~0.2dB

BHW RF Front-End AppNote Library



For further information, please email to support@bhwtechnologies.com, or contact your local BHW Sales Rep or Distributor. We will send you the complete AppNote as well as additional related information.

In addition to standard datasheets and EVB/BOM info, BHW publishes an AppNote series that address various topics on RF front-end design and performance over a wide frequency range from 300MHz to 6GHz, as an effort to assist customers in developing cutting-edge, cost-competitive products:

- BHW AppNote #001 - Cross-Over Cascade of BHWM253 to Boost Tx Power and Rx Sensitivity of BLE and 2.4GHz IoT
- BHW AppNote #002 - Accurate Benchmark of GNSS CN0 Using the Power-Splitter Method
- BHW AppNote #003 - Boosting Wi-Fi Tx Power and Rx Sensitivity with BHWA251 and BHWM252
- BHW AppNote #004 - UHF 900MHz RF Front-End Solution Using BHWA251 Half-Watt PA and BHWL160 Sub-1dB-NF LNA
- BHW AppNote #005 - Sub-1GHz Applications of BHWA350 2-in-1 Wideband Fully Matched Amplifier
- BHW AppNote #006 - Low-Noise High-IIP3 LNB Architecture for Dual-Band High-Precision GNSS Using Cascade of BHWL160
- BHW AppNote #007 - UWB RF Front-End Solution Using BHWA350 and BHWM552
- BHW AppNote #008 - High-Power 5.8GHz RF Front-End Solution Using BHWA555 and BHWM552 for ETC, V2X and Wireless Video
- BHW AppNote #009 - 5.8GHz RF Front-End Using BHWA350 and BHWM552 for Wireless Audio
- BHW AppNote #010 - Multi-Constellation GNSS Active Antenna Using BHWL161 Cascade and Single-Fed Dual-Band Antenna
- BHW AppNote #011 - BHWL161 Super-Compact Low-Power Low Noise Amplifier for Range Extension of 2.4GHz BLE, RC and IoT
- BHW AppNote #012 - Enabling Cost-Effective High-Precision GNSS Using BHWL160 and Linear-Polarization PCB Antenna
- BHW AppNote #013 - Enabling Long-Range BLE AoA&AoD for High-Precision Indoor Positioning with BHW GaAs RF Front-End ICs
- BHW AppNote #014 - Designing Ultra Low-Power High-Performance GNSS Products Using BHWL160 GaAs PHEMT LNA
- BHW AppNote #015 - BHWL161 GNSS Full-Band High-Performance LNA in Super-Compact 1x1mm DFN with Relaxed Pin Pitch
- BHW AppNote #016 - Improving GNSS NF Measurement Accuracy Using Broadband LNA BHWL161 as Pre-Amp
- BHW AppNote #017 - High-Efficiency, Low-NF 2.4GHz Front-End Solution for BLE & IoT Using BHWA251 and BHWM252
- BHW AppNote #018 - Optimizing BHWA555 Wideband One-Watt PA for Long-Range 5.8GHz Transmitter Applications
- BHW AppNote #019 - Miniature 2.4GHz RF Front-End with Integrated Chip Antenna and BHWM253 for TWS and IoT
- BHW AppNote #020 - Doubling the Range for BLE Music Streaming with BHW250L Active Integrated Antenna (AIA)