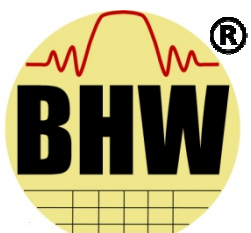# BHW Technologies (博泓微科技有限公司)

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

BHW AppNote #019

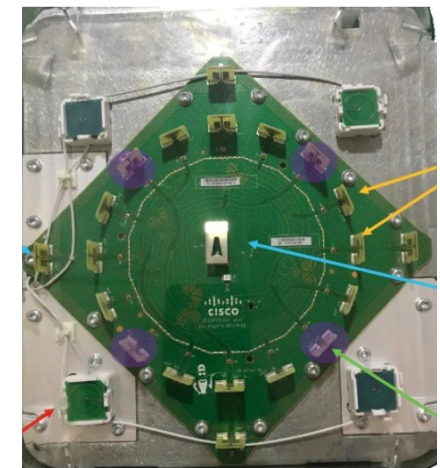**Miniature 2.4GHz RF Front-End with Integrated Chip Antenna and BHWM253 for TWS, Wireless Audio and IoT**

Rev. 1.7

www.bhw-tech.com

Active Integrated Antenna with BHWM253

Motivation: Improving 2.4GHz RF Performance under Challenging Space Constraints

Advantages & Benefits:
- 10x or More Increase in Effective Antenna Radiation Efficiency
- Virtually No Increase in PCB Size by Taking Advantage of Unused Keep-Out Space for the Chip Antenna
- Easier, Stable and Broadband Impedance Matching
- Significant Improvement in RF Performance for TWS Earphone, Wireless Audio Streaming, and IoT Solutions
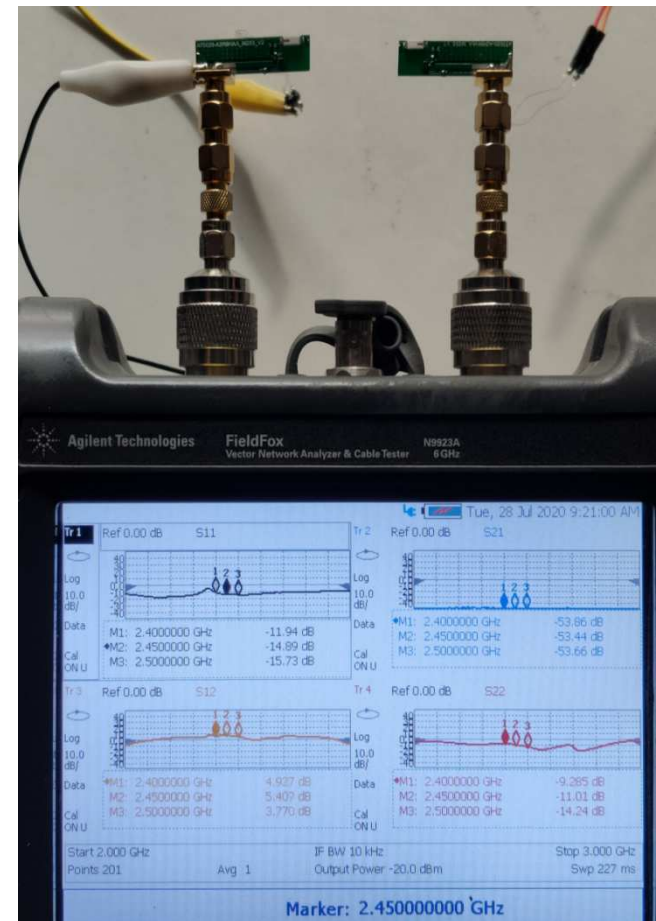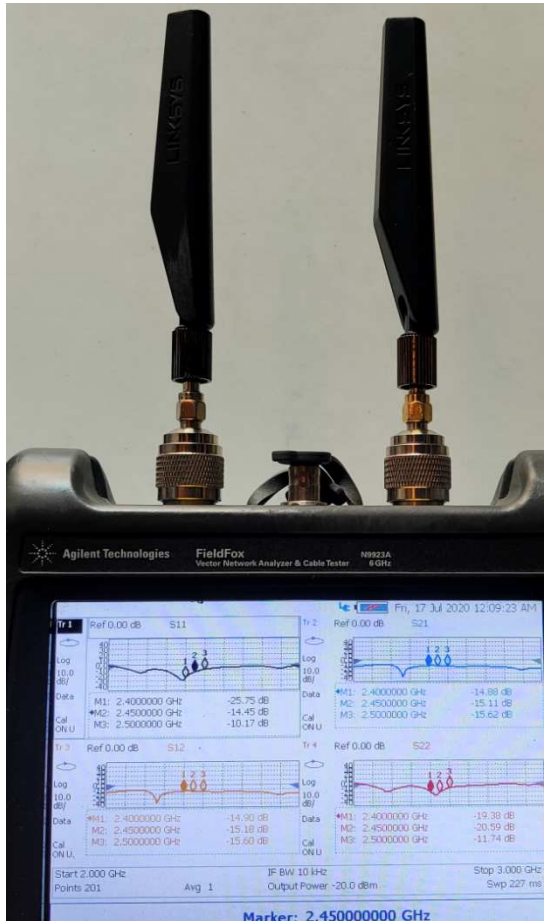
Active Integrated Antenna with BHWM253

Concept: "Embed" RF Front-End IC into Chip Antenna to Improve Wireless Link Quality

Path Loss: Two 10cm Dipoles
S21=S12~-15.1dB at 2.45GHz

Path Loss: Two Passive 5020 Monopoles
S21=S12~-19.5dB at 2.45GHz

Path Loss: Two Active 5020 Antennas
Port1: M253 as LNA; Port2: M253 as PA
S12~+5.4dB at 2.45GHz

Notes:
-Depending on Tx power and Rx sensitivity of the SoC, an improvement of 10~20dB in total link budget is possible with the AIA approach.
-The above S21 measurement is intended as an approximate estimation of the radiation performance of the antenna. Detailed evaluation of antenna pattern, gain and efficiency in anechoic chamber is in progress.

Active Integrated Antenna with BHWM253

Examples of Integrating Chip Antenna and BHWM253 RF Front-End IC
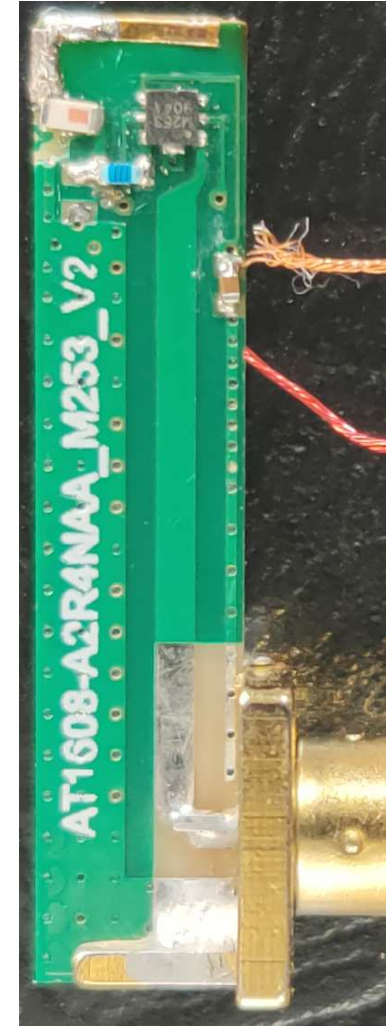
**3216 Monopole Antenna
+ BHWM253 as PA
Keep-Out: ≤6x6mm**

**3216 Loop Antenna
+ BHWM253 as PA
Keep-Out: ≤ 4x6mm**

**5020 Monopole Antenna
+ BHWM253 as LNA
Keep-Out: ≤ 8x9.6mm**

**1608 Monopole Antenna
+ BHWM253 as LNA
Keep-Out: ≤ 4x6mm**

5020 Monopole Antenna + BHWM253 as LNA

Comparison of 3D Radiation Pattern, Peak/Average Gain and Efficiency

Passive Antenna

Active Integrated Antenna
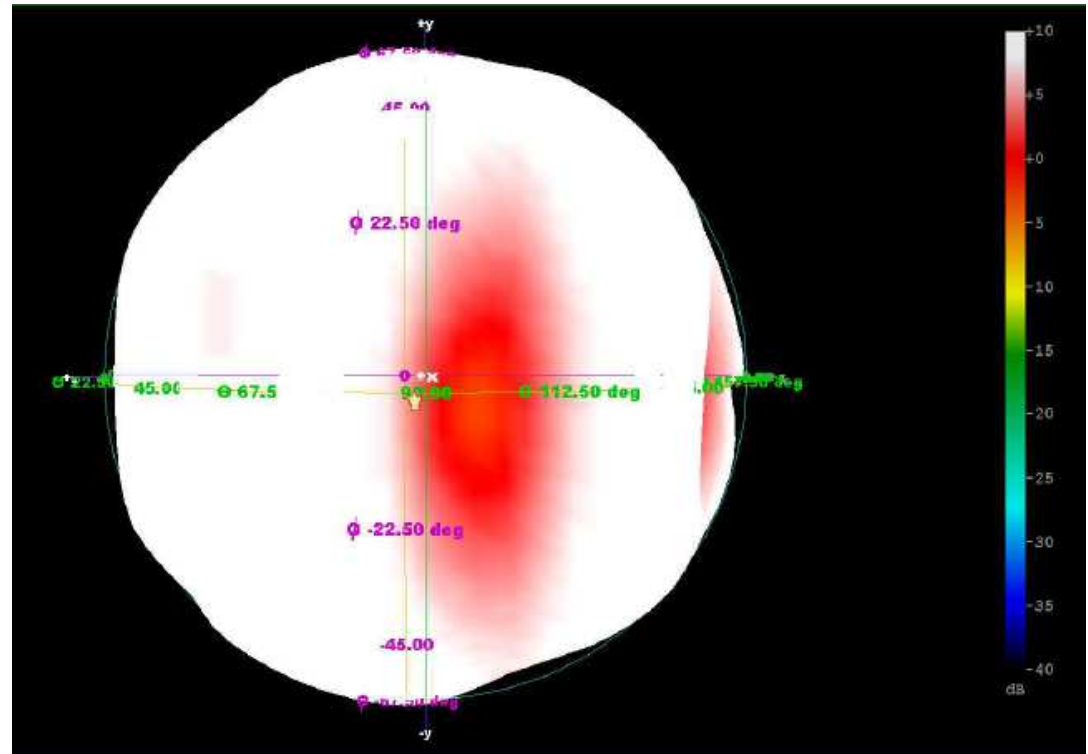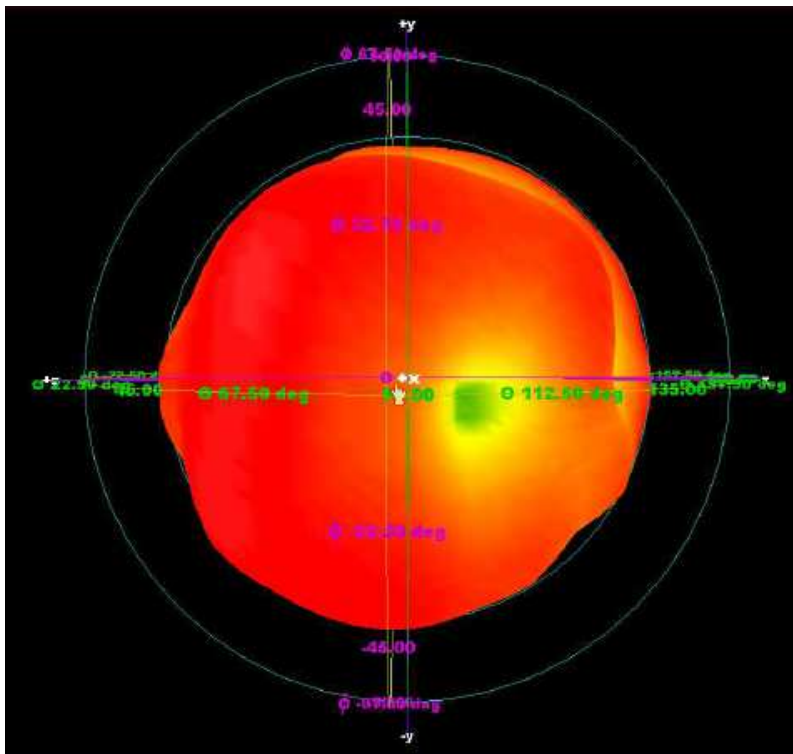
Unit in dBi@2440MHz	XY-plane		XZ-plane		YZ-plane		Efficiency
	Peak	Avg.	Peak	Avg.	Peak	Avg.	
AT5020-A2R8HAA Passive Antenna	2.4	-1.3	3.1	-2.6	-2.5	-5.2	67.0%
AT5020-A2R8HAA Active Integrated Antenna	10.3	6.1	11.5	6.4	11.0	8.4	639.0%

Courtesy: ACX Corp.

BHW RF Front-End AppNote Library

This is an abridged version of BHW AppNote #019. Please contact BHW Support or your local sales rep/distributor for a complete copy of the document and other related information.

BHW RF Front-End Solutions AppNote Library

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 2.4GHz Systems
➢ 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 RC and IoT
➢ BHW AppNote #012 - Enabling Cost-Effective High-Precision GNSS Using BHWL161 and Linear-Polarization PCB Antenna
➢ BHW AppNote #013 - GNSS Noise Floor vs Receiver Architecture
➢ 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 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 - Multiplying the Range for 2.4GHz Music Streaming with BHWR250L Active Integrated Antenna (AiA)
➢ BHW AppNote #021 - Range Extension for 2.4GHz Wireless Systems with BHWR250M Active Integrated Antenna (AiA)
➢ BHW AppNote #022 - Enabling Long-Range Angle-of-Arrival for High-Precision Indoor Positioning with BHWR250N RF AiA
➢ BHW AppNote #023 - Extend the Range for 5.8GHz Audio/Video Streaming with BHWR580M Active Integrated Antenna (AiA)
➢ BHW AppNote #024 - Improving 5.8GHz Radio Link Budget with BHWR580L Active Integrated Antenna (AiA)
➢ BHW AppNote #025 - Improving Range and Throughput of 2.4GHz Wi-Fi with BHWR250 Array Antenna
➢ BHW AppNote #026 - Improving Range and Throughput of 5GHz Wi-Fi with BHWR550 Array Antenna
➢ BHW AppNote #027 - Multi-Band High-Accuracy GNSS Solutions Using BHWP150 DFN1x1 Ultra-Compact Power Divider & Combiner
➢ BHW AppNote #028 - Use BHWM252 Cascade to Extend Range of 2.4GHz Wireless Systems with Single-Port SoCs
➢ BHW AppNote #029 - Improving Range of 2.4GHz Wireless Microphones and Audio Systems with BHWR250A Active Integrated Antenna (AiA)
➢ BHW AppNote #030 - Simultaneous Improvement in Range and Battery Life of 2.4GHz Wireless Systems with BHWR250M AiA

Contact support@bhwtechnologies.com or BHW distributors/representatives for your copy of the above and new up-coming documents.