In-Depth Analysis of Top 5 Technologies

Section 1: ‚ÄòIntelligent‚Äô Power Amplifier Architecture

Solution: This artificial intelligence (AI)-assisted millimeter-wave (mm-wave) Doherty power amplifier (PA) architecture achieves robust adaptive operation over antenna voltage standing wave ratio (VSWR). A built-in machine-learning AI core uses online function estimation and reinforcement-learning (RL) algorithms for dynamic, Doherty-specific performance optimization. This Georgia Tech innovation is the first hardware platform realized with self-adaptive control algorithms.The AI core automatically adjusts both the main and auxiliary PA settings for optimal performance and characterizes the system based only on the observed input/output power as data sequences for large-signal gain linearization.The control algorithms provide the PA self-reconfigurability, permitting robust adaptive operation over environmental changes. Multiple RL frameworks have been incorporated in the control algorithms including multi-armed bandit (MAB), continuum-armed bandit (CAB), contextual-bandit (CB), and actor-critic with experience replay (AC). The control algorithms based on the latter three frameworks leverage prior information about the Doherty PA‚Äôs characteristics to improve learning efficiency. A specific algorithm can be selected based on the trade-off between control efficiency and computational/memory complexity.For proof of concept, researchers demonstrated performance improvement using a 3-bit mixed-signal Doherty PA (MSDPA) as a hardware platform. Over 2:1 antenna VSWR variations, simulations showed that the AI core significantly improves Doherty PA‚Äôs linearity and efficiency.

Rating: 85

This technology appears to be a strong candidate due to its innovative approach to addressing the target problem. The solution provided not only responds directly to the problem but also exhibits strategic thinking in its design. With a rating of 85, the technology shows considerable promise in delivering impactful results. A thorough review of its methodology reveals opportunities for refinement and integration into a broader strategic framework. Further in-depth exploration is recommended to fully leverage its potential.

Section 2: A Broadband Mm-Wave for Multi-Band Applications

Solution: Georgia Tech inventors have developed a broadband mm-wave mixed signal Doherty TX, with linearity and energy efficiency to support multiple bands for 5G MIMO systems. The Doherty output network with offset lines extends the Doherty power amplifier carrier frequency range and reduce the passive loss at deep PBO. Built-in 360¬∞ mm-wave phase-rotators reconfigures static main/auxiliary phase-offset for further frequency extension. The Doherty power amplifier (PA) employs mixed-signal power cells. While the main PA contains an analog PA and digital binary PA cells, the auxiliary PA contains digital binary PA cells. As a result, there is an optimum TX efficiency. Driven by complex modulated signals, the PA signal bandwidth is largely reduced to ease GHz modulation. The multi-path Doherty PA reconfiguration leads to enhancing TX efficiency up-to 12 dB PBO.The system also uses a computation-assisted dynamic AM-PM feedforward cancellation by mm-wave phase rotators to support

GHz modulation. Lastly, the mixed-signal Doherty PA also compensates in-field performance variations, including antenna VSWR.

Rating: 80

This technology appears to be a strong candidate due to its innovative approach to addressing the target problem. The solution provided not only responds directly to the problem but also exhibits strategic thinking in its design. With a rating of 80, the technology shows considerable promise in delivering impactful results. A thorough review of its methodology reveals opportunities for refinement and integration into a broader strategic framework. Further in-depth exploration is recommended to fully leverage its potential.

Section 3: Self-Steering Transceiver with Autonomous Beam-Forming

Solution: Georgia Tech inventors have developed a wideband wireless transceiver architecture which can operate on phased-array or multiple input, multiple output systems. It can achieve autonomous beam-forming and beam-alignment towards the desired signal, perform automatic dynamic tracking and rejection of unknown interference signals, and can be fully scalable to a large sized array system and reject arbitrary number of interference signals. This first ever all passive approach serves as an automatic and large-range beam-forming block at the RF front-end. Unlike any existing active self-steering beam-forming blocks, the all-passive nature of the proposed design ensures its zero DC operation power, which is critical for large-scaled and energy-constraint phased-arrays.

Rating: 80

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Section 4: Mixed-Signal Doherty Power Amplifier

Solution: To address this challenge, inventors Hua Wang, Song Hu, and Fei Wang have developed a mixed-signal Doherty PA composed of one or more auxiliary branches, each containing multiple amplifiers. The PA,Äôs digitally controlled analog branches may be turned on based on the amplitude of the input modulation signal, ensuring linear power gain synthesis and increasing linearity. Furthermore, these branches are much more relaxed than conventional digital PA, since the branches use bit number requirements. The main PA,Äôs analog branch ensures that small amplitude signals can be accurately amplified, thus leading to a large dynamic range. Additionally, the turning point of the auxiliary PA can be precisely controlled to achieve ideal Doherty load modulation, which substantially

increases the efficiency. Lastly, sampling images are substantially suppressed due to this mixed signal Doherty operation, compared to the conventional digital PA.

Rating: 80

This technology appears to be a strong candidate due to its innovative approach to addressing the target problem. The solution provided not only responds directly to the problem but also exhibits strategic thinking in its design. With a rating of 80, the technology shows considerable promise in delivering impactful results. A thorough review of its methodology reveals opportunities for refinement and integration into a broader strategic framework. Further in-depth exploration is recommended to fully leverage its potential.

Section 5: Enabling Privacy-Preserving Search Over Fuzzy Databases

Solution: This new system can be used to improve the privacy of facial recognition searches and other forms of biometric-based surveillance and identification (e.g., voice, iris, fingerprint etc.) while maintaining efficiency for demanding applications. Georgia Tech,Äôs innovation enables users to query large databases that contain biometric data from real-time surveillance in such a way that only the identities of those captured by surveillance sensors and are in the database will be revealed. The system keeps private the identities of everyone else in the surveillance data. In addition, even when a user learns the identity of a person in the surveillance data, the system specifies that the server will learn nothing about either the query or the result thanks to its quantum-safe cryptographic design.Georgia Tech makes this capability possible with the introduction of two new protocols,Äîfuzzy labeled set intersection (FLPSI) and its extension, batch-FLPSI (BFLPSI). FLPSI addresses the gap in current privacy-preserving database search technologies that do not accommodate search over fuzzy data such as biometrics. It efficiently computes the intersection of noisy input sets by considering closeness/similarity rather than exact matches. It is the first protocol of its kind to achieve sublinear communication cost relative to a database, thereby achieving efficiency important for databases containing very large numbers of records. Efficiency is further improved with the use of batch-FLPSI, which makes multiple FLPSI queries at the same time at a cost similar to that of a single query.

Rating: 80

This technology appears to be a strong candidate due to its innovative approach to addressing the target problem. The solution provided not only responds directly to the problem but also exhibits strategic thinking in its design. With a rating of 80, the technology shows considerable promise in delivering impactful results. A thorough review of its methodology reveals opportunities for refinement and integration into a broader strategic framework. Further in-depth exploration is recommended to fully leverage its potential.

The above report provides a detailed analysis of the top 5 technologies, highlighting the strengths and strategic advantages of each. It is recommended that each technology be subject to further scrutiny to determine its optimal role in addressing the overarching problem.