

G1: CHANGING MARKET DYNAMICS

Overcoming the Limitations of Traditional Fixed Wireless Access (FWA)

Large portions of both developed and especially developing economies remain underserved in an ongoing digital divide that makes real broadband ever more urgent, as evolving modes of work, education, commerce, health care, and entertainment increase dependence on great connectivity. Copper-based fixed access networks are increasingly exhausted. Wireless alternatives continue to fail in the face of the significant technical challenges in carrier-class fixed access, including pervasive obstructions, spectrum scarcity, interference, changing conditions, and unworkable deployment models.

Tarana innovation has solved all these problems. Our Gigabit 1 platform (G1) is powered by the results of more than 10 years of focused R&D, and crafted from its custom silicon up to its cloud-based service automation with a completely fresh approach to fixed wireless. Extensively validated by tier-1 operators and well proven in carrier scale networks, our fundamental advances in multi-radio performance completely transform the economics of delivering gigabit-class access. The G1 platform features the base node (BN), remote node (RN), and Tarana Cloud Suite (TCS) for management.

- › Up to 1.6 Gbps Aggregate Capacity per Link*
- › Up to 3.2 Gbps Capacity per Sector*
- › Up to 12.8 Gbps Capacity per Cell (4 BNs)*
- › Up to 250 Clients per Sector
- › Up to 1000 Clients per Cell (4 BNs)
- › 5 or 6 GHz (unlicensed) or 3 GHz (CBRS)
- › Works in NLoS and nLoS
- › Cancels Interference
- › Fiber-Class Reliability
- › Fast to Deploy
- › More Affordable than Fiber

*In x2 (4-carrier) mode (available in future software release)

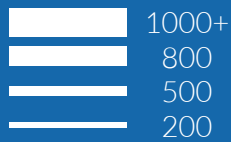


Residential Coverage

An example highlighting the Sacramento, CA metro area.

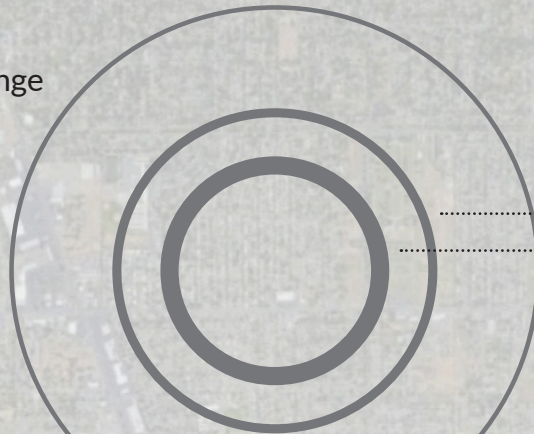
25 m tower, 1,000 HH/km² Erceg B propagation

Cell-Edge Mbps



1 km

G1 Range
3 GHz



Households Passed

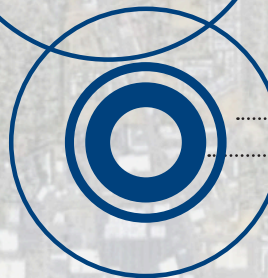
- 61,100
- 21,700
- 10,100

G1 Range
5 GHz



- 22,800
- 8,100
- 3,700

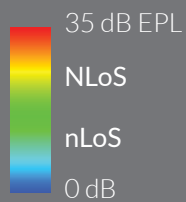
G1 Range
6 GHz
x2 (4-carrier) mode



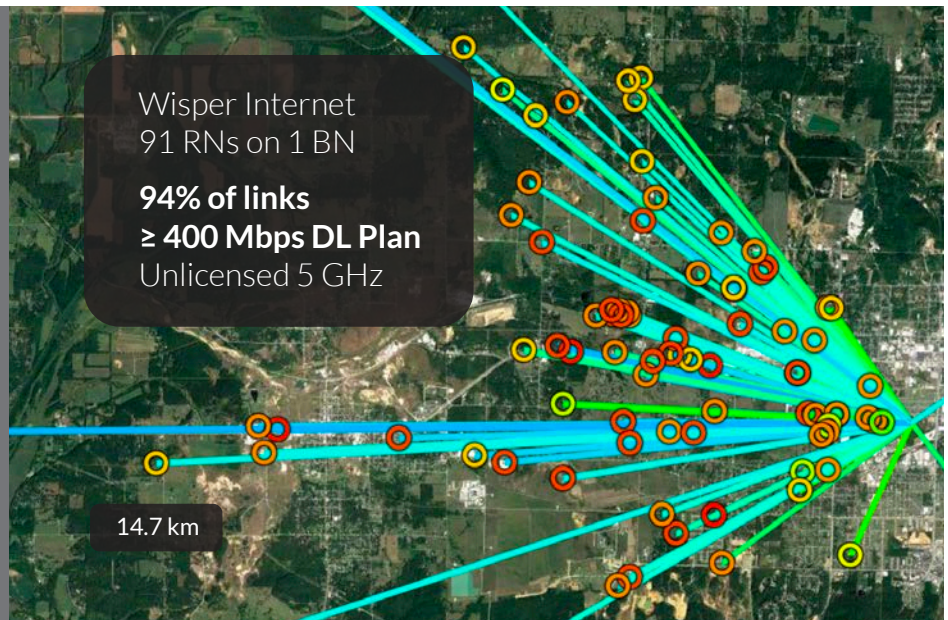
- 15,400
- 4,100
- 2,000

Degree of Link Obstruction

- RN Interference
- Link Interference

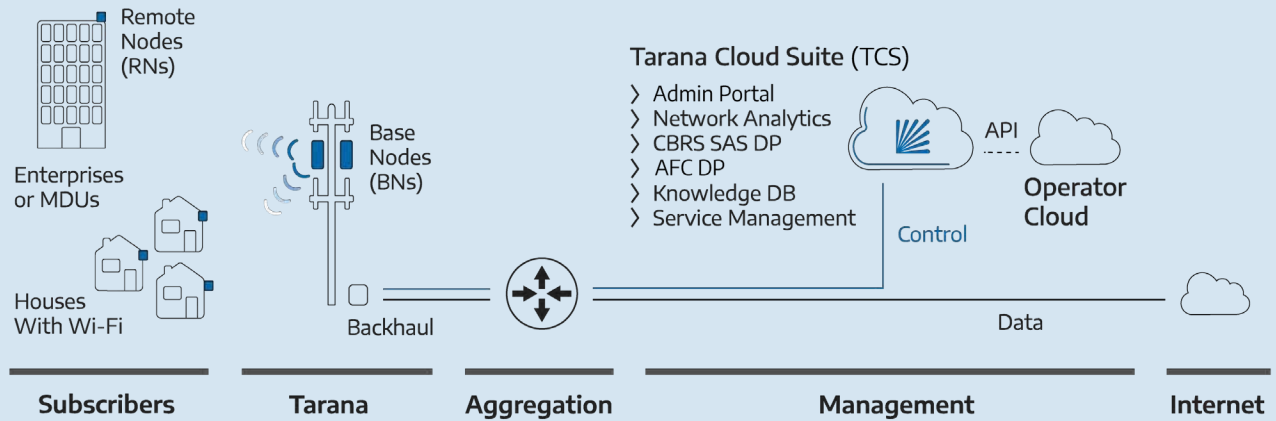


As measured by Tarana Cloud Suite (TCS).



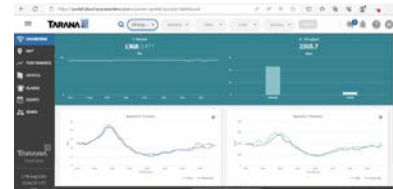
Network Architecture

Simple, Ethernet-based network architecture, supported by the Tarana Cloud Suite (TCS), enables multiple subscriber access models for highly cost-efficient residential and enterprise service.



Tarana Cloud Suite (TCS)

TCS powers efficient network planning, zero-touch provisioning, SDN management, and support automation.



Subscriber Service Activation	<ul style="list-style-type: none"> › API support for zero-touch deployment configuration › Infrastructure authentication › QoS management
Management and Maintenance	<ul style="list-style-type: none"> › 24 x 7 x 365 KPI monitoring and management, including historic data › Fault logging, correction, and reporting › Firmware & configuration management automation › End-user login and management with role-based access
Radio and Network Planning Integration (U.S. only, requires HH data)	<ul style="list-style-type: none"> › Spectrum management – CBRS, SAS, and AFC domain proxy › Coverage footprint prediction (heatmap in Google Earth) › Capacity usage for each sector › Cell densification analysis*
Fault Management and Network Analytics	<ul style="list-style-type: none"> › Alarms and historic events with e-mail alerts and webhook notifications › User-defined threshold-based alerts* › Alarm correlation, capacity expansion, anomaly detection*
REST API for Carrier System Integration	<ul style="list-style-type: none"> › Device inventory, and network topology › Subscriber provisioning and billing integration › Geo-mapping information

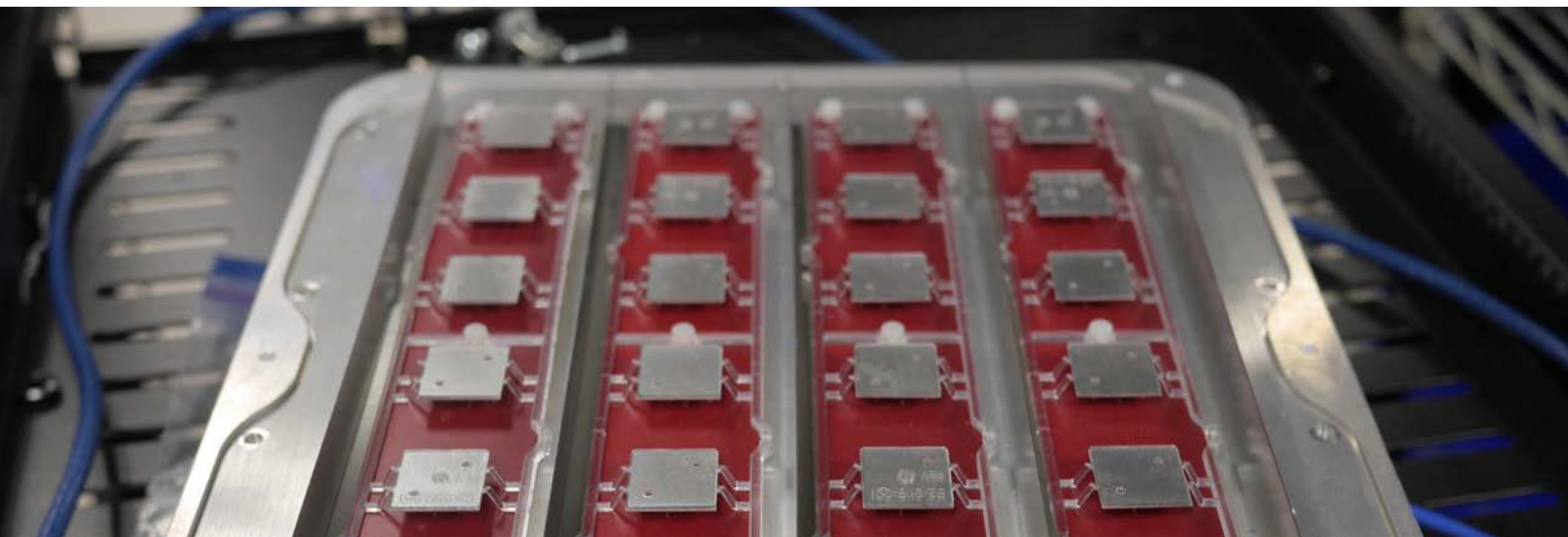
*Available in future software release

Enter Next-Generation FWA

Short for next-generation fixed wireless access, ngFWA is an entirely new technology that addresses the drawbacks of traditional fixed wireless access (FWA). Existing FWA approaches are based on technologies that fulfill their original purpose well (4G/5G for mobility and Wi-Fi for indoor networks), but are not as successful at scalable fixed access in mainstream markets. ngFWA delivers fiber-class speeds, high capacity, NLoS/nLoS capabilities, interference cancellation, quick time to market, cost efficiency, and more. To offer fast, affordable access more broadly, the industry needs this new generation of FWA to augment last-mile fiber by meeting a clear set of new requirements.

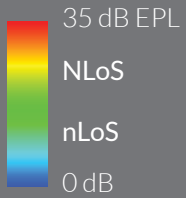
ngFWA Defined

- › Fiber-class (100 Mbps to 1.6 Gbps) per-household speeds and low latency at long range, with support for symmetric (100 Mbps down / 100 Mbps upstream) service where desired
- › High capacity per neighborhood for economically scalable deployment
- › Solid connections despite obstacles in the way (like other houses, trees, and vehicles moving on the streets) and interference from other wireless networks
- › Consistent service quality throughout the neighborhood, to support clean subscription plan marketing, sales, and fulfillment
- › High-quality service delivery in unlicensed spectrum to avoid the high cost of licensed spectrum
- › Simple installation at the home, and ideally customer self-installation

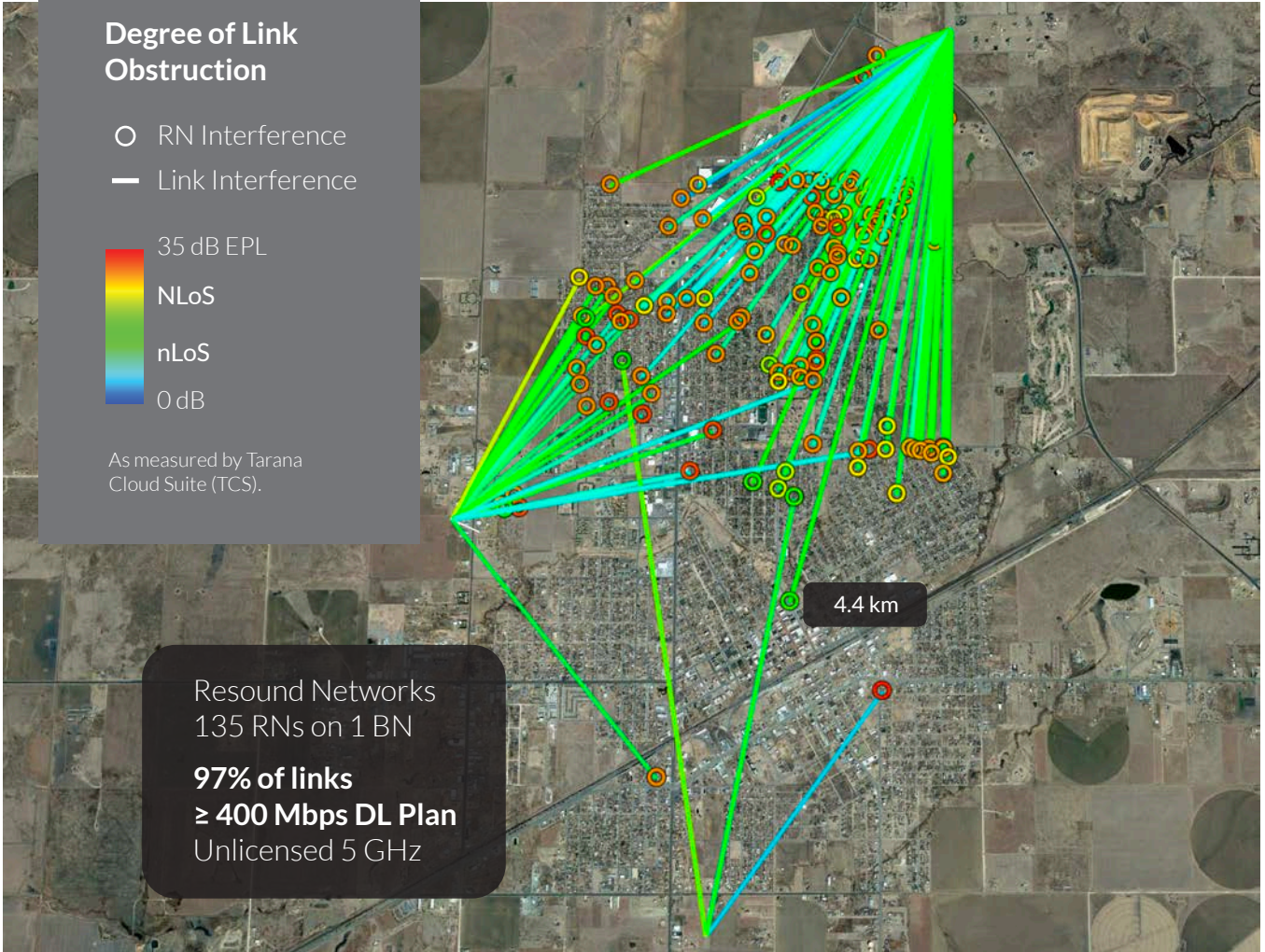


Degree of Link Obstruction

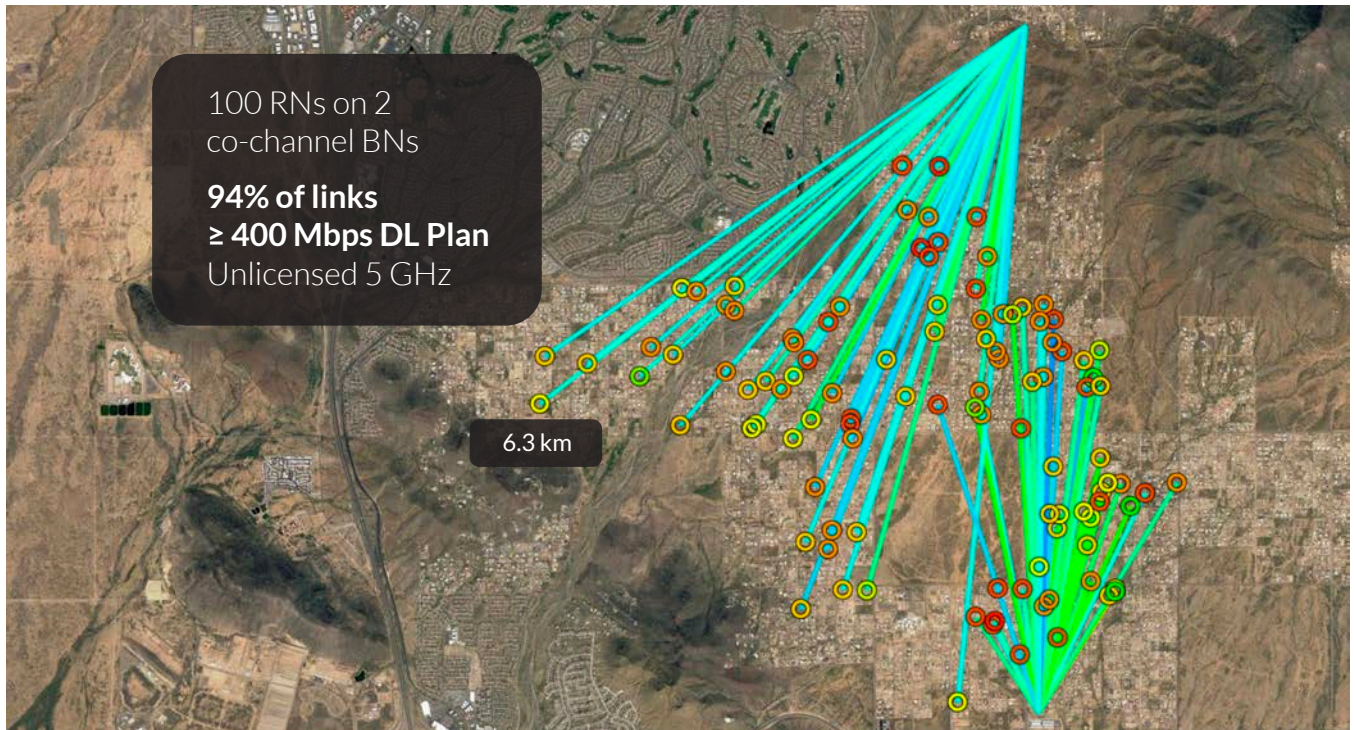
- RN Interference
- Link Interference



As measured by Tarana Cloud Suite (TCS).



Resound Networks
135 RNs on 1 BN
97% of links
≥ 400 Mbps DL Plan
Unlicensed 5 GHz



100 RNs on 2
co-channel BNs
94% of links
≥ 400 Mbps DL Plan
Unlicensed 5 GHz

Specifications

Base Nodes (BNs)

		BN 3 GHz CBRS	BN 5 GHz	BN 6 GHz
Frequency support		3.550–3.700 GHz (US CBRS, Cat B)	5.150–5.250 GHz (UNII-1 FCC/ISED) 5.725–5.850 GHz (UNII-3 FCC/ISED)	5.725–5.850 GHz (UNII-3 FCC/ISED) 5.925–6.425 GHz (UNII-5 FCC) 6.525–6.865 GHz (UNII-7 FCC)
Throughput (aggregate PHY maximum)	Per link	800 Mbps	800 Mbps	800 Mbps / 1.6 Gbps*
	Per BN	2.4 Gbps	2.4 Gbps	2.4 Gbps / 3.2 Gbps*
	Per cell (4 BNs)	9.6 Gbps	9.6 Gbps	9.6 Gbps / 12.8 Gbps*
Maximum number of RNs	Per BN	250	250	250
	Per cell (4 BNs)	1000	1000	1000
Channel bandwidth		80 MHz (2 x 40 MHz)	80 MHz (2 x 40 MHz)	80 MHz (2 x 40 MHz) / 160 MHz (4 x 40 MHz)*
MU-MIMO streams (maximum)	Per BN	6	6	6 / 4*
	Per cell (4 BNs)	24	24	24 / 16*
Model numbers		G1-BN3ASI001	G1-BN5ASI002	G1BN6ASI002
Weight		42 lbs	42 lbs	42 lbs
Dimensions (H x W x D)		16.6 x 21.2 x 5.1 inches	16.6 x 21.2 x 4.7 inches	16.6 x 21.2 x 4.7 inches
Power consumption (typical at 55°C)		275 W	275 W	275 W
Power input		-48V DC typical (-44 to -58V DC operating range)		
Mounting		Saddle clamp, band clamps for pole mount (2.375–5 inches OD); mount weighs 12 lbs		
Form factor		Outdoor micro enclosure with fully-integrated antenna, RF, and baseband; 360° coverage with 4 BNs		
Antenna		Fully integrated		
Interfaces		Dual 10 Gbps SFP+ and single 1 Gbps data interfaces, additional 1 Gbps management Ethernet interface, -48V DC power		

Remote Nodes (RNs)

		RN 3 GHz CBRS	RN 5 GHz	RN 6 GHz
Frequency support		3.550–3.700 GHz (US CBRS, Cat B)	5.150–5.250 GHz (UNII-1 FCC/ISED) 5.725–5.850 GHz (UNII-3 FCC/ISED)	5.725–5.850 GHz (UNII-3 FCC/ISED) 5.925–6.425 GHz (UNII-5 FCC) 6.525–6.865 GHz (UNII-7 FCC)
Throughput (aggregate)		800 Mbps	800 Mbps	1.6 Gbps*
Channel bandwidth		80 Mhz (2 x 40 MHz)	80 Mhz (2 x 40 MHz)	160 Mhz (4 x 40 MHz)*
MIMO streams		1x1, 2x2	1x1, 2x2	1x1, 2x2, 4x4*
Model numbers		G1-RN3ASI001 G1-RN3ASI011	G1RN5AHB012 G1-RN5ASI002 G1RN5ASI012	G1RN6AHB012

*In x2 (4-carrier) mode (available in future software release)

Remote Nodes (RNs) (cont.)

	RN 3 GHz CBRS	RN 5 GHz	RN 6 GHz
Weight	8 lbs	4.9 lbs	5 lbs
Dimensions (H x W x D)	11 x 12.5 x 3.3 inches	10.3 x 11.3 x 2.1 inches (G1RN5AHB012) 11 x 12.5 x 3 inches (G1-RN5ASI002, G1RN5ASI012)	10.3 x 11.3 x 2.1 inches
Power consumption (typical at 55°C)	49 W	40 W	40 W
Power input	48V Passive PoE Part # 44-0016-001	48V 802.3bt PoE, Type 3, Part # 44-0027-001 (G1RN5AHB012) 48V Passive PoE Part # 44-0016-001 (G1-RN5ASI002, G1RN5ASI012)	48V 802.3bt PoE, Type 3, Part # 44-0027-001 48V Passive PoE Part # 44-0016-001
Mounting	Band clamp for pole mount (1.5–2.5 inches OD); mount weights 1.2 lbs		
Form factor	Outdoor, single enclosure with fully-integrated antenna, RF, and baseband		
Antenna	Fully integrated		
Interfaces	1 Gbps Ethernet interface with PoE support, RJ45 pinout T568B		

General

G1 radio network platform		Base node (BN) Remote node (RN) Tarana Cloud Suite (TCS)
Topology		Scheduled, concentrated multi-point
Duplexing		TDD
Downlink/uplink ratios (configurable network-wide)		Network profile 1 (up to 15 km range) → 4.5:1 Network profile 2 (up to 30 km range) → 4:1 Network profile 5 (up to 15 km range) → 2.67:1 Network profile 6 (up to 15 km range) → 1.75:1
SLA profiles		Configurable per RN
Modulation		QPSK 1/2 to 256QAM 7.35/8 UL/DL
Spectral efficiency		30 bps/Hz per BN, up to 90 bps/Hz per band, configuration dependent
Range (full rate, frequency dependent)	NLoS	Up to 3 km (varies depending on vertical asset height, frequency band, morphology, and target cell-edge data rate)
	LoS	Up to 30 km (varies depending on vertical asset height, frequency band, morphology, and target cell-edge data rate)
Recommended frequency reuse factor		Universal frequency reuse (k=1), enabled by advanced self-interference cancellation
Beamforming		Auto-convergent, retro directive
Interference management		Self-interference cancellation, Advanced Burst Interference Cancellation (ABIC)
VLANs		Per BN or RN for user data, and management VLAN, Subscriber VLAN pass through

General (cont.)

QoS	DSCP, VLAN 802.1p	
Latency (one-way average)	<5 ms	
Max Ethernet MTU	2048 bytes	
Compliance	RSS-247, FCC 15E, FCC Part 96, WINNF-TS-0122	
Standards and safety	IEC 62368-1, IEC 60529, IEC 60950-1, IEC 60950-22	
Data plane security	RF Link Encryption	AES-128
Tarana Cloud Suite (TCS)	Scalable microservices based multi-tenant network management Zero-touch provisioning and control of radios with streaming telemetry Firmware and configuration management 24x7x365 KPI monitoring and management Fault management and historical events Network analytics SAS and AFC domain proxy Northbound Rest-API for customer and operator portal (B/OSS)	
Operating temperature range	-40°C to 55°C (-40°F to 131°F)	
Environmental rating	IP67	

Specifications subject to change without notice. Actual results may vary.

Tarana's mission is to accelerate the deployment of fast, affordable internet access around the world. Through a decade of R&D and more than \$400M of investment, the Tarana team has created a unique next-generation fixed wireless access (ngFWA) technology instantiated in its first commercial platform, Gigabit 1 (G1). It delivers a game-changing advance in broadband economics in both mainstream and underserved markets, using either licensed or unlicensed spectrum. G1 started production in mid-2021 and has been embraced by more than 250 operators in 19 countries and 41 states. Tarana is headquartered in Milpitas, California, with additional research and development in Pune, India.