Delivering Gigabit Tier Service With Wireless Using the 60 GHz Band or 6 GHz Band

In a recent global survey of 800 service providers conducted by Cambium Networks, the top three applications for 60 GHz technology are business connectivity, residential access and Wi-Fi backhaul. To deliver the best quality of experience in these and other applications, the Cambium solution is architected using the 802.11ay standard for higher capacity, better channel access, mesh support and more subscribers supported.

IN THE RECENT ORDER regarding the Rural Digital Opportunity Fund (RDOF) auction, the FCC said, "While an applicant will be permitted to select the Gigabit performance tier in its application if it intends to use fixed wireless or DSL technologies for meeting its Auction 904 public interest obligations, such applicants face a high burden to persuade Commission staff that they are reasonably capable of meeting the public interest obligations in rural areas and thus qualified to bid for the Gigabit performance tier."

This paper from Cambium Networks is designed to assist prospective bidders to persuade the Commission staff that the gigabit tier is most certainly capable and that many of our customers are qualified & currently delivering a gigabit service.

60 GHz Millimeter Wave

V-BAND FIXED WIRELESS TECHNOLOGY makes it easy to meet the surging demand for bandwidth in urban locations. Service providers now have access to multi-gigabit speeds in multiple configurations, including business and residential last-mile access and backhaul for wireless MicroPoP access. Certified for Facebook Terragraph mesh technology, these 60 GHz solutions make it easy to provide efficient multi-gigabit speeds in the heart of any city.

The multi-mode 802.11ay standard system can be configured for point-to-point (PTP), point-to-multipoint (PMP) or efficient mesh modes. The solution provides last-mile access to subscriber homes, enterprises and multi-dwelling buildings as well as transport for video surveillance and public Wi-Fi networks.

Performance

THE SOLUTION OPERATES in the 57 to 66 GHz bands with a channel bandwidth of 2.16 GHz and delivers up to 10 Gbps (L1) total throughput. Modules include smart beamforming for noise isolation, a GPS receiver to reduce self-interference and a design that enables easy installation.

- The V5000 Distribution Node (DN) forms the mesh network and provides coverage. Each V5000 has two sectors and can provide up to 20 Gbps.
- Client Nodes (CN) are available in two options for range and capacity:
  - V3000 – 10 Gbps throughput at a range of up to 800 m in point-to-point mode and up to 500 m in point-to-multipoint mode
  - V1000 – 10 Gbps throughput at a range of up to 200 m

V500

v3000

V1000

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Cambium Networks can achieve +1 Gbps downlink speeds utilizing the unlicensed 60 GHz band spectrum. Our solution supports CH1 to CH4 with a channel size of 2.16 GHz. With modulation from BPSK to 16-QAM, the radio supports downlink throughput up to 1.92 Gbps. With channel bonding enabled, the radio can support downlink throughput up to 3.84 Gbps.

MCS	Modulation	Coding Rate	L2 Throughput (Mbps)						
			64	128	256	512	1024	2048	4096
2	π/2-BPSK	1/2	718	729	734	737	733	740	732
3	π/2-BPSK	5/8	892	904	907	915	914	918	910
4	π/2-BPSK	3/4	1057	1072	1084	1084	1085	1093	1071
5	π/2-BPSK	4/5	1146	1155	1162	1175	1175	1174	1159
6	π/2-QPSK	1/2	1394	1415	1420	1429	1421	1435	1411
7	π/2-QPSK	5/8	1720	1734	1749	1764	1748	1767	1728
8	π/2-QPSK	3/4	2024	2041	2076	2076	2059	2089	2017
9	π/2-QPSK	4/5	2173	2192	2206	2229	2221	2224	2173
10	π/2-16-QAM	1/2	2615	2671	2682	2682	2673	2687	2609
11	π/2-16-QAM	5/8	3180	3207	3262	3262	3245	3287	3143
12	π/2-16-QAM	3/4	3694	3725	3788	3788	3737	3837	3614

TDD structure with DL/UL ratio: 50:50

6 GHz Unlicensed Band

CAMBIUM NETWORKS WILL DELIVER gigabit tier service with its ePMP4K solution based on the Wi-Fi-6E standard. Cambium Networks can achieve 1 Gbps downlink speeds utilizing the 6 GHz band spectrum and use of 160 MHz of contiguous spectrum. Initial projections assume this is achievable either by supporting a 4096-QAM deployment using 80 MHz channels or 256-QAM modulations utilizing 160 MHz of channel bandwidth. Based on the FCC's ruling on 6 GHz spectrum and the available EIRP, smaller cells with low-density access point (AP) to subscriber module (SM) ratio and relatively un-interfered environments, 1 Gbps downlink (DL) speeds are achievable.

The background data is below:

Scheduling: TDD

TDD Ratio: 75/25

DL Rates

BW, MHz	80							
Nss	2						Data Rate, Mb/s	DL TDD
MCS	Modulation	R	Nbpscs	Nsd	Ncbps	Ndbps	0.8us GI	0.7
8	256QAM	3/4	8	980	15680	11760	864.7	605.3
9		5/6				13066	960.7	672.5
10	1024QAM	3/4	10		19600	14700	1080.9	756.6
11		5/6				16333	1201.0	840.7
12	4096QAM	3/4	12		23520	17640	1297.1	907.9
13		5/6				19600	1441.2	1008.8

BW, MHz	160, 80+80							
Nss	2						Data Rate, Mb/s	DL TDD
MCS	Modulation	R	Nbpscs	Nsd	Ncbps	Ndbps	0.8us GI	0.7
8	256QAM	3/4	8	1960	31360	23520	1729.4	1210.6
9		5/6				26133	1921.5	1345.1
10	1024QAM	3/4	10		39200	29400	2161.8	1513.2
11		5/6				32666	2401.9	1681.3
12	4096QAM	3/4	12		47040	35280	2594.1	1815.9
13		5/6				39200	2882.4	2017.6

Sub-gigabit DL rates can be provided for 80 MHz channels.

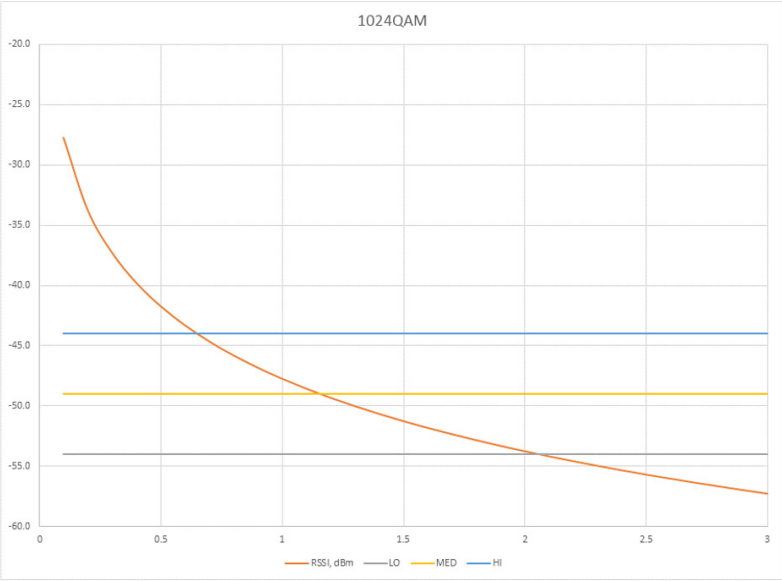
For the 160 (80+80) MHz channel, gigabit DL rates can be provided starting at 256-QAM.

Range for this throughput will vary with interference.

EIRP = 36 dBm

F = 6500 MHz

RX ant. gain = 25 dBi



For 160 MHz, 2SS, MCS11

RX sensitivity levels and corresponding distances are:

LO Interference = -54 dBm => **2.1 km**

MED Interference = -49 dBm => **1.2 km**

HI Interference = -44 dBm => **0.7 km**