

Comparison of Low-Power WAN Alternatives

Name of Standard	Weightless			SigFox	LoRaWAN	LTE-Cat M	IEEE P802.11ah (low power WiFi)	Dash7 Alliance Protocol 1.0	Ingenu RPMA	nWave
	-W	-N	-P							
Frequency Band	TV whitespace (400-800 MHz)	Sub-GHz ISM	Sub-GHz ISM	868 MHz/902 MHz ISM	433/868/780/915 MHz ISM	Cellular	License-exempt bands below 1 GHz, excluding the TV White Spaces	433, 868, 915 MHz ISM/SRD	2.4 GHz ISM	Sub-GHz ISM
Channel Width	5MHz	Ultra narrow band (200Hz)	12.5 kHz	Ultra narrow band	EU: 8x125kHz, US 64x125kHz/8x125kHz, Modulation: Chirp Spread Spectrum	1.4MHz	1/2/4/8/16 MHz	25 KHz or 200 KHz	1 MHz (40 channels available)	Ultra narrow band
Range	5km (urban)	3km (urban)	2km (urban)	30-50km (rural), 3-10km (urban), 1000km LoS	2-5k (urban), 15k (rural)	2.5- 5km	Up to 1Km (outdoor)	0 – 5 km	>500 km LoS	10km (urban), 20-30km (rural)
End Node Transmit Power	17 dBm	17 dBm	17 dBm	10µW to 100 mW	EU:<+14dBm, US:<+27dBm	100 mW	Dependent on Regional Regulations (from 1 mW to 1 W)	Depending on FCC/ETSI regulations	to 20 dBm	25-100 mW
Packet Size	10 byte min.	Up to 20 bytes	10 byte min.	12 bytes	Defined by User	~100 ~1000 bytes typical	Up to 7,991 Bytes (w/o Aggregation), up to 65,535 Bytes (with Aggregation)	256 bytes max / packet	Flexible (6 bytes to 10 kbytes)	12 byte header, 2-20 byte payload
Uplink Data Rate	1 kbps to 10 Mbps	100bps	200 bps to 100 kbps	100 bps to 140 messages/day	EU: 300 bps to 50 kbps, US:900-100kbps	~200kbps	150 Kbps ~ 346.666 Mbps	9.6 kb/s, 55.55 kbps or 166.667 kb/s	AP aggregates to 624 kbps per Sector (Assumes 8 channel Access Point)	100 bps
Downlink Data Rate	1 kbps to 10 Mbps	No downlink	200 bps to 100 kbps	Max 4 messages of 8 bytes/day	EU: 300 bps to 50 kbps, US:900-100kbps	~200kbps	150 Kbps ~ 346.666 Mbps	9.6 kb/s, 55.55 kbps or 166.667 kb/s	AP aggregates to 156 kbps per Sector (Assumes 8 channel Access Point)	--
Devices per Access Point	Unlimited	Unlimited	Unlimited	1M	Uplink:>1M, Downlink:<100k	20k+	8191	NA (connectionless communication)	Up to 384,000 per sector	1M
Topology	Star	Star	Star	Star	Star on Star	Star	Star, Tree	Node-to-node, Star, Tree	Typically Star. Tree supported with an RPMA extender	Star
End node roaming allowed	Yes	Yes	Yes	Yes	Yes	Yes	Allowed by other IEEE 802.11 amendments (e.g., IEEE 802.11r)	Yes	Yes	Yes
Governing Body	Weightless SIG			Sigfox	LoRa Alliance	3GPP	IEEE 802.11 working group	Dash7 Alliance	Ingenu (formerly OnRamp)	Weightless SIG
Status	Limited deployment awaiting spectrum availability	Deployment beginning	Standard in development. Scheduled release 4Q 2015	In deployment	Spec released June 2015, in deployment	Release 13 expected 2016	Targeting 2016 release	Released May 2015	In Deployment	In Deployment