



Antenna Reference Guide

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Introduction

This antenna reference guide provides best practices for selecting and installing antennas with Cradlepoint hardware, regulations for specific Cradlepoint products to ensure FCC compliance, and references to supporting resources.

Best Practices for Selecting & Installing Antennas on Cradlepoint Hardware

Cradlepoint endpoints are unique in their form and function and therefore not all antennas will be the best fit for each device. Cradlepoint recommends considering the following as you determine which antenna(s) will best suite your needs.

LTE, Wi-Fi, and MIMO

Multiple Input, Multiple Output (MIMO) technologies, including LTE, 5G and Wi-Fi , enable all cellular and Wi-Fi antennas to send and receive data simultaneously. The best practice for both cellular and Wi-Fi antenna usage requires:

- Antenna include the full cellular or Wi-Fi frequency range capability that matches a given Cradlepoint device's capabilities.
- All antenna ports be occupied with a compatible antenna.

In addition to assuring optimal cellular and Wi-Fi performance, having all antenna ports occupied helps protect against future network changes that could impact compatibility.

Attaching only a portion of the cellular or Wi-Fi antennas impacts the device's functionality, up to and including reduced throughput, signal drops, and instability. For example, connecting two antennas on a Cradlepoint 2x2 MIMO modem may provide 40 Mbps throughput, compared to only connecting a single antenna, which could result in 15 Mbps. Additionally, the Cradlepoint device could experience connectivity issues such as completely dropping the cellular signal, either for periods of time, or as the modem is trying to cycle through available technologies (for example- fallback to 3G), up to and including fully disconnecting.

For customers that choose an antenna configuration not compliant with best practice, Cradlepoint will continue to provide best effort support until encountering a technical challenge identified as directly related to the antenna configuration. Such challenges may include changes (implemented by the network operator) affecting the use of cellular bands, newly required MIMO cellular communication, cellular frequencies put into use by a carrier network and modem not supported by the selected antenna, excessive noise, any of which could also cause a modem to fallback to a previous generation of cellular technology. Any of the above may also inhibit Cradlepoint Support's ability to engage beyond a reasonable effort and require the customer to change the model of antenna in use.

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Cellular Reception

Without sufficient cellular reception, the router may behave as though there are no antennas attached. The following describe how reception may be impacted:

- A paddle (direct attach) antenna is attached to a router inside of a metal box (i.e. kiosk) with no cellular reception
- A paddle (direct attach) antenna is used inside a building behind metal walls and/or brick with no reception
- A long coax cable with insufficient shielding/rating is run too far from the router
- Higher frequencies are more susceptible to signal loss when using longer cables
- Each coax cable fitting will add some signal loss.
- Actual dBm loss values are provided by the fitting manufacturer.
- The antenna does not support the frequency the device is trying to connect to
- Most antennas made before 2H 2019 or 2020 do not provide adequate gain for LTE bands 71 (600Mhz), 48/CBRS (3.5GHz) and/or 46/LAA (5GHz)
- An antenna doesn't have proper separation from other radiation sources
- Example: Antennas from 2 radios that are simultaneously transmitting and receiving are positioned too close to each other and are de-sensing
- Direct attach paddle antennas aren't positioned for optimal reception
- Example: The antennas are laying on top of each other or not properly spaced
- An antenna has an insufficient ground plane to function properly
- Example: Mobile antennas are meant to be mounted on top of a metal roof with a sufficient ground plane to function properly. If mounted on a non-metallic surface or on a metal surface that is too small, they may provide insufficient gain.
- NOTE: Antenna spec sheets will call out if a ground plane is included or if needed and the minimum size.

Refer to <https://customer.cradlepoint.com/s/article/Modem-Signal-Strength-and-Signal-Quality> to determine if the signal strength is sufficient.

NOTE: Antenna types may be mixed and matched so long as they all have sufficient reception and do not exceed FCC regulations (i.e. remote/wired-out antennas for 2 LTE antenna ports on main/aux0 and GPS on the 1200M-B modem, and direct attached paddle antennas on main/aux1 of the 1200M-B modem and the Wi-Fi RP-SMA ports of an AER2200).

Refer to the FCC Regulations section of this guide for more information.

GNSS Reception

Most customers use multi-purpose antennas that incorporate Wi-Fi, GNSS, and Cellular and have acceptable performance. However, for best performance, a physically separate GNSS antenna is required.

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Cables & Ports

The following are best practices for connecting antenna cables to the Cradlepoint ports:

- Ensure cable ends are connected to the correct ports.
- LTE and GPS ports use SMA connectors and WI-FI ports use RP-SMA. Check cable ends to ensure they are the appropriate connection type for the port you're attaching them to.
- GPS/GNSS connectors can be either active or passive. An active antenna requires an active port with suitable ratings to work. A passive antenna may be used on a passive port and can often be used on an active port, as long as the antenna is not a DC short-circuit type (e.g., Loop and PIFA antennas are typically DC short circuit).
- Do not over-torque the SMA connector on the modem. Finger-tight is sufficient (maximum torque is 4 in-lbs).
- Plan cable runs to minimize signal loss. Use the fewest number of coax cable fittings to avoid unnecessary signal loss.
- Coax cable has signal loss, especially for higher frequencies. For cable runs 15 feet or longer, use low loss LMR400. They generally connect using a larger, N-type connector, which requires a convertor to connect to the smaller SMA connectors on Cradlepoint endpoints.
- Use cable clamps or other cable-holding mechanisms to secure low-loss cables against a wall or pole.
- Use at least two clamps on the cable near the Cradlepoint endpoint. This construction helps reduce stress on the cable/modem connection and increases product reliability.
- Use lightning protection.

Positioning Antennas

To avoid signal loss, ensure the appropriate cables and direct attach antennas are connected to their applicable ports on the Cradlepoint endpoint.

Antennas connected by cables

Ensure the antennas are installed according to the manufacturer's installation requirements and that the power, gain, and other applicable signal settings are configured in compliance with the specifications dictated in the Antenna selection guide.

Paddle and direct attach antennas

Stagger the angles of the paddles so that they are not in alignment with each other. Use the antenna alignment tool with applicable endpoints. For positioning examples, refer to [How to Position 1200M Antennas](#).

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FCC Regulations

The FCC requires that antennas attached to Cradlepoint products meet certain standards. Using antennas not sold by Cradlepoint places the burden of confirming that the antenna meets FCC regulations on the customer. The following specifies the acceptable frequency ranges, antenna types, and gains to assist with identifying third party antennas to use with specific Cradlepoint products.

IBR1700-1200M-B Specific Regulations

Antennas connected to the MAIN and AUX ports on products that include 1200M-B modems must have a system gain (antenna gain minus cable loss) less than the following values:

Table 1. IBR1700-1200M-B Cellular Antennas - Maximum Gain by Frequency Range.

Frequency	Maximum Gain
617-698 MHz	9 dBi
699-787 MHz	6 dBi
788-798 MHz	6.4 dBi
1710-1785 MHz	5.5 dBi
1850-1920 MHz	8.51 dBi
2000-2020 MHz	9 dBi
2300-2400 MHz*	1.08 dBi
2496-2690 MHz	5.5 dBi

*Operation in the 2300-2400 MHz band is allowed indoors only, and the antenna must be more than 50' from any roadway. If the antenna is installed outdoors, within 50' of any roadway, or if the antenna system gain is greater than 1.08 dBi in this band, the installer must disable LTE Band 30 in the Connection Manager>Modem properties>Modem tab.

Antennas connected to the Wi-Fi ports on IBR1700 series devices must have system gain (antenna gain minus cable loss) less than the following values:

Table 2. IBR1700-1200M-B Wi-Fi Antennas - Maximum Gain by Frequency Range.

Frequency	Dipole Antennas	Other Antennas
2402-2843.5 MHz	5 dBi	Not allowed
5150-5250 MHz	5 dBi	Not allowed
5250-5350 MHz	5 dBi	Not allowed
5475-5725 MHz	5 dBi	Not allowed
5725-5850 MHz	5 dBi	Not allowed

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IBR1700-600M Specific Regulations

Antennas connected to the MAIN and AUX ports on products that include 600M modems must have a system gain (antenna gain minus cable loss) less than the following values:

Table 3. IBR1700-600M Cellular Antennas - Maximum Gain by Frequency Range.

Frequency	Maximum Gain
600-800 MHz	Cannot exceed FCC EIRP Limits
800-1000 MHz	Cannot exceed FCC EIRP Limits
1700-1800 MHz	Cannot exceed FCC EIRP Limits
1800-2000 MHz	Cannot exceed FCC EIRP Limits
2300-2400 MHz*	1.0 dBi
2500-2600 MHz	Cannot exceed FCC EIRP Limits

*Operation in the 2300-2400 MHz band is allowed indoors only, and the antenna must be more than 50' from any roadway. If the antenna is installed outdoors, within 50' of any roadway, or if the antenna system gain is greater than 1.08 dBi in this band, the installer must disable LTE Band 30 in the Connection Manager>Modem properties>Modem tab.

Antennas connected to the Wi-Fi ports on IBR1700 series devices must have system gain (antenna gain minus cable loss) less than the following values:

Table 4. IBR1700-600M Wi-Fi Antennas - Maximum Gain by Frequency Range.

Frequency	Dipole Antennas	Other Antennas
2402-2843.5 MHz	5 dBi	Not allowed
5150-5250 MHz	5 dBi	Not allowed
5250-5350 MHz	5 dBi	Not allowed
5475-5725 MHz	5 dBi	Not allowed
5725-5850 MHz	5 dBi	Not allowed

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IBR900-1200M-B Specific Regulations

Antennas connected to the MAIN and AUX ports on products that include 1200M-B modems must have a system gain (antenna gain minus cable loss) less than the following values:

Table 5. IBR900-1200M-B Cellular Antennas - Maximum Gain by Frequency Range.

Frequency	Maximum Gain
617-698 MHz	9 dBi
699-787 MHz	6 dBi
788-798 MHz	6.4 dBi
1710-1785 MHz	5.5 dBi
1850-1920 MHz	8.51 dBi
2000-2020 MHz	9 dBi
2300-2400 MHz*	1.08 dBi
2496-2690 MHz	5.5 dBi

*Operation in the 2300-2400 MHz band is allowed indoors only, and the antenna must be more than 50' from any roadway. If the antenna is installed outdoors, within 50' of any roadway, or if the antenna system gain is greater than 1.08 dBi in this band, the installer must disable LTE Band 30 in the Connection Manager>Modem properties>Modem tab.

Antennas connected to the Wi-Fi ports on IBR900 series devices must have system gain (antenna gain minus cable loss) less than the following values:

Table 6. IBR900-1200M-B Wi-Fi Antennas - Maximum Gain by Frequency Range.

Frequency	Dipole Antennas	Monopole Antennas	PIFA antennas	Other Antennas
2402-2843.5 MHz	2.47 dBi	1.5 dBi	1.5 dBi	Not allowed
5150-5250 MHz	2.47 dBi	1.0 dBi	2 dBi	Not allowed
5250-5350 MHz	2.47 dBi	1.0 dBi	2 dBi	Not allowed
5475-5725 MHz	2.47 dBi	0.9 dBi	1.9 dBi	Not allowed
5725-5850 MHz	2.47 dBi	0.9 dBi	1.9 dBi	Not allowed

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IBR900-600M Specific Regulations

Antennas connected to the MAIN and AUX ports on products that include 600M modems must have a system gain (antenna gain minus cable loss) less than the following values:

Table 7. IBR900-600M Cellular Antennas - Maximum Gain by Frequency Range.

Frequency	Maximum Gain
600-800 MHz	Cannot exceed FCC EIRP Limits
800-1000 MHz	Cannot exceed FCC EIRP Limits
1700-1800 MHz	Cannot exceed FCC EIRP Limits
1800-2000 MHz	Cannot exceed FCC EIRP Limits
2300-2400 MHz*	1.0 dBi
2500-2600 MHz	Cannot exceed FCC EIRP Limits

*Operation in the 2300-2400 MHz band is allowed indoors only, and the antenna must be more than 50' from any roadway. If the antenna is installed outdoors, within 50' of any roadway, or if the antenna system gain is greater than 1.08 dBi in this band, the installer must disable LTE Band 30 in the Connection Manager>Modem properties>Modem tab.

Antennas connected to the Wi-Fi ports on IBR900 series devices must have system gain (antenna gain minus cable loss) less than the following values:

Table 8. IBR900-600M Wi-Fi Antennas - Maximum Gain by Frequency Range.

Frequency	Dipole Antennas	Monopole Antennas	PIFA antennas	Other Antennas
2402-2843.5 MHz	2.47 dBi	1.5 dBi	1.5 dBi	Not allowed
5150-5250 MHz	2.47 dBi	1.0 dBi	2 dBi	Not allowed
5250-5350 MHz	2.47 dBi	1.0 dBi	2 dBi	Not allowed
5475-5725 MHz	2.47 dBi	0.9 dBi	1.9 dBi	Not allowed
5725-5850 MHz	2.47 dBi	0.9 dBi	1.9 dBi	Not allowed

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IBR600C-150M-D Specific Regulations

Antennas connected to the MAIN and AUX ports on products that include 150M-D modems must have a system gain (antenna gain minus cable loss) less than the following values:

Table 9. IBR600C-150M-D Cellular Antennas - Maximum Gain by Frequency Range.

Frequency	Maximum Gain
617-698 MHz	8.55 dBi
699-787 MHz	8.55 dBi
788-798 MHz	8.73 dBi
1710-1785 MHz	5 dBi
1850-1920 MHz	8 dBi
2000-2020 MHz	9 dBi
2300-2400 MHz*	1.08 dBi

*Operation in the 2300-2400 MHz band is allowed indoors only, and the antenna must be more than 50' from any roadway. If the antenna is installed outdoors, within 50' of any roadway, or if the antenna system gain is greater than 1.08 dBi in this band, the installer must disable LTE Band 30 in the Connection Manager>Modem properties>Modem tab.

Antennas connected to the Wi-Fi ports on IBR900 series devices must have system gain (antenna gain minus cable loss) less than the following values:

Table 10. IBR600C-150M-D Wi-Fi Antennas - Maximum Gain by Frequency Range.

Frequency	Dipole Antennas	Monopole Antennas	PIFA antennas	Other Antennas
2402-2843.5 MHz	2.47 dBi	1.5 dBi	1.5 dBi	Not allowed

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IBR600B-LP4 Specific Regulations

Antennas connected to the MAIN and AUX ports on products that include LP4 modems must have a system gain (antenna gain minus cable loss) less than the following values:

Table 11. IBR600B-LP4 Cellular Antennas - Maximum Gain by Frequency Range.

Frequency	Maximum Gain
777-862 MHz	9.72 dBi
1710-1785 MHz	5.78 dBi
1850-1920 MHz	7.51 dBi

**Operation in the 2300-2400 MHz band is allowed indoors only, and the antenna must be more than 50' from any roadway. If the antenna is installed outdoors, within 50' of any roadway, or if the antenna system gain is greater than 1.08 dBi in this band, the installer must disable LTE Band 30 in the Connection Manager>Modem properties>Modem tab.*

Antennas connected to the Wi-Fi ports on IBR600B series devices must have system gain (antenna gain minus cable loss) less than the following values:

Table 12. IBR600B-LP4 Wi-Fi Antennas - Maximum Gain by Frequency Range.

Frequency	Dipole Antennas	Other Antennas
2402-2843.5 MHz	5.0 dBi	Not allowed

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Cradlepoint Antennas

Cradlepoint carries a limited selection of antennas for use with Cradlepoint products. Refer to the following table for more information.

Table 13. Cradlepoint Antennas.

Part Number	Description	Compatible Products
170659-001	Cellular Antenna, White, 700MHz - 2.7GHz, SMA, 210mm	Used with, CBA850-LP6, CBA850-LP4
170706-000	Cellular Antenna, Black, 700MHz - 2.7GHz, SMA, 160mm	Used with, LP6 modems, LP4 modems
170704-002	Cellular Antenna, Black mini, 600MHz - 6GHz, SMA, 140mm	Used with, 600M, 150M, 10M modems
170761-001	Cellular Antenna, White, 600MHz - 6GHz, SMA, 180mm	Used with, CBA850-1200M-B, W2000
170765-000	Cellular Antenna, White mini, 600MHz - 4.2GHz, SMA, 145mm	Used with, CBA550, L950
170801-000	Cellular Antenna, Charcoal, 600MHz - 6MHz, SMA, 180mm	Used with, E300, E3000, MC400, 1200M-B
170836-000	Wi-Fi Antenna, Charcoal, Dual-band 2.4/5GHz, RPSMA, 194mm	Used with, All Wi-Fi products

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Cradlepoint Antenna Program

The Cradlepoint Antenna Program consists of antennas partners who provide exceptional selection, support, and value for our mutual customers. Our sales, partners, VARs, and channel have many options to meet their deployment needs with the newest antennas as they are made available from the vendors.

Cradlepoint does not approve specific antennas. The antenna vendors will manage customer antenna purchases, except for specific antennas and the replacement antennas Cradlepoint provides as part of certain subscription packages.

Antenna partners in the program provide the following resources

Sales	Support	Testing & Documentation
Sell, manage, maintain antenna SKUs	Contacts provided with escalation path	Installation guides
Maintain selection guides/filters on their websites	RMAs	Spec sheets with links
Sales contacts for NA, LATAM, EMEA, APAC		All testing
SLA for recommended antennas for distribution availability		

While customers may choose to use other antenna vendors or other antennas, they are responsible for qualifying their performance, quality, and that they meet FCC regulations.

For support-related customer service, Cradlepoint Support will follow the standard best-effort procedure for troubleshooting and diagnosing endpoint connectivity issues for all antennas. If the issue appears to be related to the antenna (i.e., poor signal strength, drops, poor throughput, etc.) the customer may be asked to connect a known good antenna before further debugging.

Vendors interested in the program must be recommended by Cradlepoint sales team members, partners, or customers and have an established, consistently positive relationship with them. Recommended vendors are communicated through Cradlepoint internal requests only. External requests will not be considered.

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Appendix A: Panorama

www.panorama-antennas.com/cradlepoint

General Support: [817-539-1888](tel:817-539-1888)
[Global Support options](#)

Rep	Title	Email	Phone	Region(s)	
Bryan McAnally	Regional Account Manager	bmcanally@panorama-antennas.com	C: 817-706-8636 O: 817-225-4779	Alaska (AK) Idaho (ID) Kansas (KS) Montana (MT) Nebraska (NE)	North Dakota (ND) Oklahoma (OK) Oregon (OR) South Dakota (SD) Washington (WA)
Hans Giraud	Regional Account Manager	hgiraud@panorama-antennas.com	C: 818-512-1878 O: 817-225-4784	Arizona (AZ) Colorado (CO) New Mexico (NM)	Utah (UT) West Texas (W.TX) Wyoming (WY)
Mark Frazier	Regional Account Manager	mfrazier@panorama-antennas.com	C: 214-808-5663	Illinois (IL) Indiana (IN) Iowa (IA) Michigan (MI)	Minnesota (MN) Ohio (OH) Wisconsin (WI)
Trey Gaddy	Regional Account Manager	tgaddy@panorama-antennas.com	C: 214-415-7685 O: 817-225-4783	Alabama (AL) Arkansas (AR) Florida (FL) Georgia (GA)	Louisiana (LA) Mississippi (MS) Missouri (MO)
Rahmin Massudi	Regional Account Manager	rmassudi@panorama-antennas.com	C: 817-944-6321 O: 817-225-4781	Texas (TX), excluding West Texas	
Rick Azevedo	Regional Account Manager	razevedo@panorama-antennas.com	C: 915-799-9505 O: 817-225-4780	Connecticut (CT) Maine (ME) Massachusetts (MA) New Hampshire (NH) New Jersey (NJ)	New York (NY), excluding Upstate New York Pennsylvania (PA) Rhode Island (RI) Vermont (VT)
Leann LeHew	Regional Account Manager	llehew@panorama-antennas.com	C: 469-536-2277 O: 817-225-4778	Delaware (DE) District of Columbia (DC) Kentucky (KY) Maryland (MD)	South Carolina (SC) Tennessee (TN) Virginia (VA) West Virginia (WV)
Travis Culwell	Regional Account Manager	tculwell@panorama-antennas.com	C: 972-965-0663 O: 817-225-4787	California (CA) Hawaii (HI)	Nevada (NV)
Wil Hoyle	Head of Sales & Business - Canada	whoyle@panorama-antennas.com	C: 289-387-3126	Canada (CA)	Upstate New York (NY)
Lee Jackson	Head of Sales & Business - N.A.	ljackson@panorama-antennas.com	C: 817-312-8897 O: 817-225-4782		
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Nestor Figueroa	Area Sales Manager	nfigueroa@panorama-antennas.com	+57 304 205 8157	Central & South America	Mexico
Christian Cielinski	Area Sales Manager	ccielinski@panorama-antennas.com	+49 163 494 5925	Germany Austria	Switzerland
Ken Pattison	Area Sales Manager	kpattison@panorama-antennas.com	+44 7785 303740	United Kingdom Belgium	The Netherlands Middle East
Robert Jesman	Sales Director	rjesman@panorama-antennas.com	+44 789 9988050	Australia, New Zealand Malaysia, Singapore	South Africa South East Asia Hong Kong

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Panorama International distribution:

- Bluestar Canada
- Synnex Canada
- Exclusive
- Westbase
- Tech Data ANZ
- Go Wireless

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Appendix B: Parsec

<https://parsec-t.com/cradlepoint-approved-antennas/>

General Support: 972-804-4600
support@parsec-t.com

Rep	Title	Email	Phone	Regions
Corporate Office	All new customers	sales@parsec-t.com	972-804-4600 (Press 1 for Sales)	All
George Girvin	Senior Director - Business Development - Central U.S.	George.Girvan@parsec-t.com	469-814-8280	Canada - Central CO,IL,IN,IA,KS,KY,MI,MN,MO, NE,ND,OH,SD,WI
Cinthia Oviedo	Sales Assistant - - Central and East U.S.	Cinthia.Oviedo@parsec-t.com	972-698-4018	AL,CT,FL,GA,IL,IN,KY,ME,MD,MA,MI,MS,NH,NJ,NY,NC,OH,PA,RI,SC,TN,VT,VA,WV,WI,
Kelsey Guillory	Sales Assistant - Cental and West U.S.	Kelsey.Guillory@parsec-t.com	469-808-9030	AK,AZ,AR,CA,CO,HI,ID,IA,KS,LA,MN,MO,MT,ND,NE,NM,NV,OK,OR,SD,TX,UT,WA,WY Canada - West
Jack Neenan	Senior sales Director - North East US	jack.neenan@parsec-t.com	401-287-7737	Canada - East, CT,DE,ME,MD,MA,NH,NJ,NY,PA,RI,VT
Melissa Heckel	Partner Relations Manager	melissa.heckel@parsec-t.com	469-229-7905	All Regions
Jen Neenan	COO	jen.neenan@parsec-t.com	972-804-4808	All-- Sales for Europe and Latin America
Michael Neenan	CEO	mneenan@parsec-t.com	972-535-5501	All - Sales for Asia-Pacific and Africa

Parsec International distribution:

- Westbase
- Tech Data
- Ingram Micro

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Appendix C: Taoglas

<https://www.taoglas.com/taoglas-antenna-reference-guide/cradlepoint/>

General Support: <https://www.taoglas.com/contact/>

Rep	Title	Email	Phone	Region(s)	
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