

The WOO Way

A whitepaper on accurate jump height measurement

V1.3

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LIST OF ACRONYMS AND UNITS

ACRONYMS

2D	Two Dimensional
3D	Three Dimensional
AMR	Absolute Maximum Ratings
BLE	Bluetooth Low Energy
C	Celsius (measure of Temperature)
CPU	Central Processing Unit
IMU	Inertial Measurement Unit
MCU	Microcontroller Unit
MEMS	Microelectromechanical System
PCB	Printed Circuit Board
PPM	Parts Per Million
QFN	Quad-Flat No Leads
SMT	Surface-Mount Technology

UNITS

deg	degrees (measure of Angle)
dps	Degrees per Second (measure of Angular Velocity)
g	Measure of acceleration ($1g = 9.81m/s^2$)
Hz	Hertz (measure of Frequency)
mdeg	millidegrees (1/1000 degree)
mdps	millidegrees per second
mg	milli-g ($1mg = 9.81 \cdot 10^{-3} m/s^2$)
ug	mikro-g ($1ug = 9.81 \cdot 10^{-6} m/s^2$)

1 INTRODUCTION

When WOO was founded in 2013, our vision was to build a meaningful game in the sport of kiteboarding. Back then, we had other sports in mind as well, but as of 2024, WOO is a business focused exclusively on kiteboarding. To this day, our vision has remained firm. WOO is first and foremost a game that is to deliver its participants lots of moments of joy, and is to bring them together in a welcoming community.

Before developing the WOO, we took a deep dive into what makes games work, and what can break them. The main point in all areas was clear – a game needs to have a fair set of rules, and those rules need to be the same for everyone. After all, a throwing contest is meaningless if one participant throws a baseball, the next one a ping pong ball, and the last one a basketball. With this understanding, we went out and explored different options. Whichever way we spun it, we realized that there is no way in avoiding the costly undertaking in building a dedicated piece of hardware. Over the years, as new technologies came available, we constantly revised our assumptions, but always ended in the same conclusion. If the goal is merely to get an estimate on how high you can jump, phones and watches suffice. As soon as any element of competition is involved, be it against yourself, your peers, or as part of a team, phones and watches won't suffice, no matter how perfect the algorithm may be. Think about how much time and money you invest into the games you care about – it has to be meaningful. This Whitepaper is to shed light on the theory behind what it takes to have a comparable jump height measurement platform. In writing this, and in looking back at the past years, we realized that there is a theme going through all of this. We've stuck to our guns and resisted the temptation to develop phone and watch based solutions, even though they may give us a short-term commercial success. We understand that this would be a short-sighted success at best, for it would deflate and destroy the foundation of what makes WOO, WOO. Hence, we coined this "The WOO way". Our way of going about jump height measurement in kiteboarding. Our way of staying true to our values, and not veering from our path for a few short-term gains. Our way of delivering a product to our community that has the best shot at delivering them long term, sustainable value, in the form of fun, joy, and a sense of community.

The following pages offer a deep look at what drives our decision to build the WOO. And what it takes to deliver the results you can see in the chart below.

1.1 SAMPLE TEST RESULTS

The essence of this document is well represented in the test results below. While three WOO 4.0 devices deliver very precise and comparable jump height results, independent of conditions, other solutions offer results that are simply not suitable for a fair and fun game. The pinpoint precision on airtime with WOO 4.0, and significant lack thereof on watch and phone based solutions, clearly shows that jumps aren't detected well with a phone or watch. Even though phones and watches use highly complex and sophisticated algorithms, you can observe height

differences of 2.19m (76.8%) on a 3m jump, Airtime differences of 3.54sec (80.9%) on a 4sec jump, and jump distance measurements of 6m, 11m, and 26m on the very same jump. The whole remainder of the document is a theoretical explanation as to why this is, and why we subsequently decide to build a dedicated, on-board sensor.

1.1.1 3X WOO 4.0, TARIFA

This test was performed in the early stages of the development of WOO 4.0. One of our test riders, Maarten Haeger, did all his Big Air repertoire had in store to confuse the WOO device. From here on, we let the results speak for themselves.

WOO 4.0 PRECISION

Rider: Maarten Haeger
 Spot: Balneario, Tarifa
 Riding: Big Air
 Boogie loops, late backs, inverted front rolls etc.

Average Jump Height: 15.7m
 # of Jumps: 17
 Average Difference (m): **+/- 0.08m**
 Average Difference (%): **+/- 0.5%**

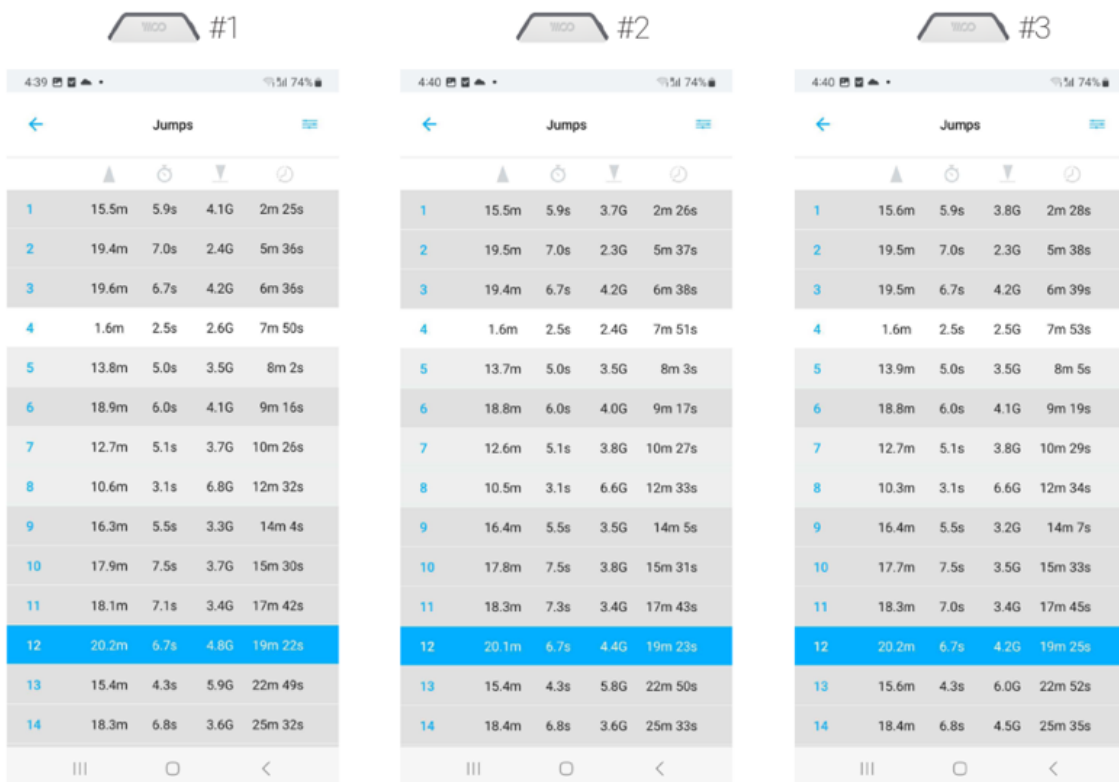


Figure 1 - Precision of WOO 4.0

	#1 Height (m)	#2 Height (m)	#3 Height (m)	DIFF (+/-) Height (m)	% (+/-)
1	15.5	15.5	15.6	0.05	0.32%
2	19.4	19.5	19.5	0.05	0.26%
3	19.6	19.4	19.5	0.10	0.51%
4	1.6	1.6	1.6	0.00	0.00%
5	13.8	13.7	13.9	0.10	0.72%
6	18.9	18.8	18.8	0.05	0.27%
7	12.7	12.6	12.7	0.05	0.39%
8	10.6	10.5	10.3	0.15	1.43%
9	16.3	16.4	16.4	0.05	0.31%
10	17.9	17.8	17.7	0.10	0.56%
11	18.1	18.3	18.3	0.10	0.55%
12	20.2	20.1	20.2	0.05	0.25%
13	15.4	15.4	15.6	0.10	0.65%
14	18.3	18.4	18.4	0.05	0.27%
15	16.0	16.0	15.8	0.10	0.63%
16	15.6	15.4	15.5	0.10	0.65%
17	12.8	12.6	12.9	0.15	1.17%
AVG	15.5	15.4	15.5	0.08	0.53%

Figure 2 – WOO 4.0 Test Data from Tarifa

1.1.2 PHONE, WATCH TEST

This small section is to highlight the differences in measurement between different measuring devices and phones. This is data from tests run by a rider in the Netherlands. Results are similar for different types of sessions, e.g. stronger winds. However, this example very strongly highlights the inconsistencies between devices, even though state-of-the-art hardware was used for this test.

Board Height (m)	Wetsuit Height (m)	Watch Height (m)	DIFF Height (m)	%
2.89	3.76	1.57	2.19	139%
2.75	4.39	3.88	1.64	60%

Figure 3 – Competitor Test Data (Height)

The main point is to be observed in the airtime comparison. It highlights the inability of different devices in different locations to accurately detect takeoff and landing, which are paramount and the foundation of accurate jump measurement, and subsequently a fair and fun game.

Board Airtime (sec)	Wetsuit Airtime (sec)	Watch Airtime (sec)	DIFF Airtime (sec)	%
2.70	4.18	6.24	3.54	131%
2.65	4.20	4.11	1.55	58%

Figure 4 – Competitor Test Data (Airtime)

Board Jump Distance (m)	Wetsuit Jump Distance (m)	Watch Jump Distance (m)	DIFF Jump Distance (m)	%
5	10	20	15	300%
6	11	26	20	333%

Figure 5 – Competitor Test Data (Jump Distance)

Board				Wetsuit				Garmin					Difference Height		Difference Airtime		Difference Distance		
H	A	D	TS	H	A	D	TS	H	A	D	TS	TS_C	[cm]	[%]	[sec]	[%]	[m]	[%]	
[m]	[sec]	[m]	[m.s]	[m]	[sec]	[m]	[m.s]	[m]	[sec]	[m]	[m.s]								
2,18	2,32	5	4,1	2,32	3,91	10	4,18	2,08	3,52	17	13,48	4,18	24	10,9%	1,59	48,9%	12	113%	
3,10	3,02	5	5,1	3,87	4,25	10	5,12	3,89	4,18	20	14,42	5,12	79	21,8%	1,23	32,2%	15	129%	
2,71	2,41	10	6,3	3,13	3,87	14	6,33	2,69	3,30	8	16,03	6,73	44	15,5%	1,46	45,7%	6	56%	
3,68	2,65	6	7,4	4,24	4,20	11	7,49	4,23	4,11	26	17,19	7,89	56	13,8%	1,55	42,4%	20	140%	
2,95	4,15	25	8,6	3,82	5,23	25	9,06	3,12	4,54	11	18,37	9,07	87	26,4%	1,08	23,3%	14	69%	
5,20	4,81	25	12,1	5,22	5,11	30	12,13	5,38	5,01	25	21,43	12,13	18	3,4%	0,30	6,0%	5	19%	
5,54	4,30	24	13,3	5,46	5,51	23	13,37	5,59	5,46	41	23,07	13,77	13	2,4%	1,21	23,8%	18	61%	
6,07	4,36	30	14,6	6,03	5,47	32	15,06	5,89	5,17	45	24,36	15,06	18	3,0%	1,11	22,2%	15	42%	
5,06	4,49	28	17,6	5,64	5,88	37	18,02	5,91	6,02	60	27,33	18,03	85	15,4%	1,53	28,0%	32	77%	
4,24	4,82	25	19,2	4,75	5,05	26	19,28	4,69	4,90	26	28,58	19,28	51	11,2%	0,23	4,7%	1	4%	
5,06	4,24	23	20,6	5,04	5,34	31	21,04	4,91	5,28	37	30,34	21,04	15	3,0%	1,10	22,2%	14	46%	
4,87	3,98	32	22,3	5,03	5,08	27	22,41	4,46	5,21	49	32,12	22,82	57	11,9%	1,23	25,9%	22	61%	
3,69	4,12	20	24,0	3,93	5,69	21	24,09	2,91	4,50	33	33,4	24,1	102	29,1%	1,57	32,9%	13	53%	
3,23	2,89	22	27,6	3,76	4,18	26	28,02	1,57	2,36	11	37,33	28,03	219	76,8%	1,82	57,9%	15	76%	
2,75	3,08	21	30,3	4,39	4,50	32	30,38	3,88	3,78	20	40,09	30,79	164	44,6%	1,42	37,5%	12	49%	
2,88	2,70	20	31,4	3,64	4,21	24	31,5	3,51	3,80	22	41,2	31,9	76	22,7%	1,51	42,3%	4	18%	
3,09	2,49	18	32,5	3,43	4,27	23	32,55	3,59	3,40	10	42,26	32,96	50	14,8%	1,78	52,6%	13	76%	
3,75	2,70	19	38,4	4,18	4,18	18	38,47	4,64	6,24	30	48,19	38,89	89	21,2%	3,54	80,9%	12	54%	
5,43	5,27	27	40,3	5,93	5,24	26	40,42	5,71	5,42	29	50,13	40,83	50	8,8%	0,18	3,4%	3	11%	
2,63	2,54	1	42,5	2,93	4,20	11	42,56	2,08	3,74	13	52,28	42,98	85	33,4%	1,66	47,5%	12	144%	
													AVG	69	19,5%	1,36	34,0%	13	65%
													MAX	219	76,8%	3,54	80,9%	32	144%

Figure 6 – Competitor Test Data, Overview

Note that these results were recorded with state-of-the-art hardware (Garmin Fenix 7 & 2023 Xiaomi phones). To get a full, comprehensive test on accuracy of phone / watch solutions, likely more than 1,000 devices would have to be tested.

As mentioned, similar results can be observed in sessions with higher jumps. More examples are in Appendix B - List of Measurement Devices.

1.2 SCOPE

The scope of this whitepaper is for measuring jumps in kitesurfing. It is focused on riding a twintip as a board type, even though many of the principles also apply for foil boards, directionals, and wing foiling. It is focused on the usage of data coming from IMU's (inertial measurement units).

2 WHY ACCURACY MATTERS

In short, it is all about the game. The premise and foundation on which WOO was built was to create an exciting game. The analogy often used is soccer. Kicking the ball around an open field of grass is a mundane activity. Soccer would have never gained its global popularity if all that were to be done was to kick a ball around an empty field. What was done instead was to build a beautiful, exciting and fun game around it. There are teams, goals, winners and losers, leagues, championships, fans, referees, and the ensuing drama in pre- and post-game coverage. Soccer (or all professional sports, for what it is worth) are built on being a game. Said game hinges on a truly clear set of rules, and a fair competition. Imagine a World Cup final, it is the 90th minute, and the score between Germany and Italy is 1-1. Players and fans alike are captivated by the events unfolding in the arena, and the tension of the moment is seemingly about to burst. Then, unexpectedly, the referee awards a penalty shot to Germany. Nothing had happened, the ball was out of play. The whole tension and excitement is deflated, Germany wins 2-1, fans on both sides leave the stadium, and the players vow to never play this stupid game again. Let this happen a few times, and soccer will be an irrelevant sport in a matter of months.

Project this situation onto kiteboarding. You have been in a fierce battle with your friend. It's led you to change your lifestyle habit to gain a competitive advantage. May I at this stage quote one of our users (full document is in the appendix):

I started taking regular exercise to build the strength and stamina needed to improve technique, kiting weekly when possible, substituted by trips to the gym to swim. • I looked at my weight for the first time and changed my diet completely, out was fast food, cake and biscuits and in was salad, fresh fruit and fish. My BMI went from 25.3 (overweight) to 20.3 (healthy weight).

All this hard work is paying off for you, and you are starting to gain an advantage over your friend. Then, suddenly, out of the blue, and completely out of left field, your friend busts out a new personal record. He had been using a Samsung Spherix S8 phone, which happens to have a range of only +/- 4g on the accelerometer, and an ST microchip motion sensor that is known to produce bad results in high temperatures. Meanwhile, you know him to be clumsy and do not trust that he properly calibrated his phone. Finally, his record was set in Egypt, where folks do not wear wetsuits and his phone may be dangling on his body under a rash guard quite loosely. You are deflated. You have put all this work into this, and now, "the referee awarded a penalty to your friend in the 90th minute". Game over. For a second there, you consider buying an Apple Watch 3 - rumors have it that with it - if you go out on wavy conditions, put it slightly at an angle when calibrating, and wave your arm midair - you can get higher results. Of course, you can also gain a 1m advantage by lowering your arm just prior to takeoff. But no, this is silly, this is pointless. You wish there were a unified system. A device, with a standardized sensor, perfect calibration, and high precision, that is mounted in one single place, so you could play a fair game with your friends. With a referee team behind it to step in if

things do not seem fair or calculated correctly. That would be amazing, but this, as it is, is pointless. Game Over.

Accuracy (or more precisely, precision) is the foundation of the game. The game is meaningless without an accurate sensor. Without an accurate sensor, “the beautiful game of soccer gets demoted to kicking the ball around randomly on an open field”. It is boring, pointless, mundane.

As we will learn, in the domain of measuring the height of kiteboarding jumps, many factors contribute to a fair and accurate game. None of them are replaceable, as in, they are all a link in a long chain of things that uphold the fairness, and hence the fun of the game for those participating. Not just on a day-to-day basis, but over decades.

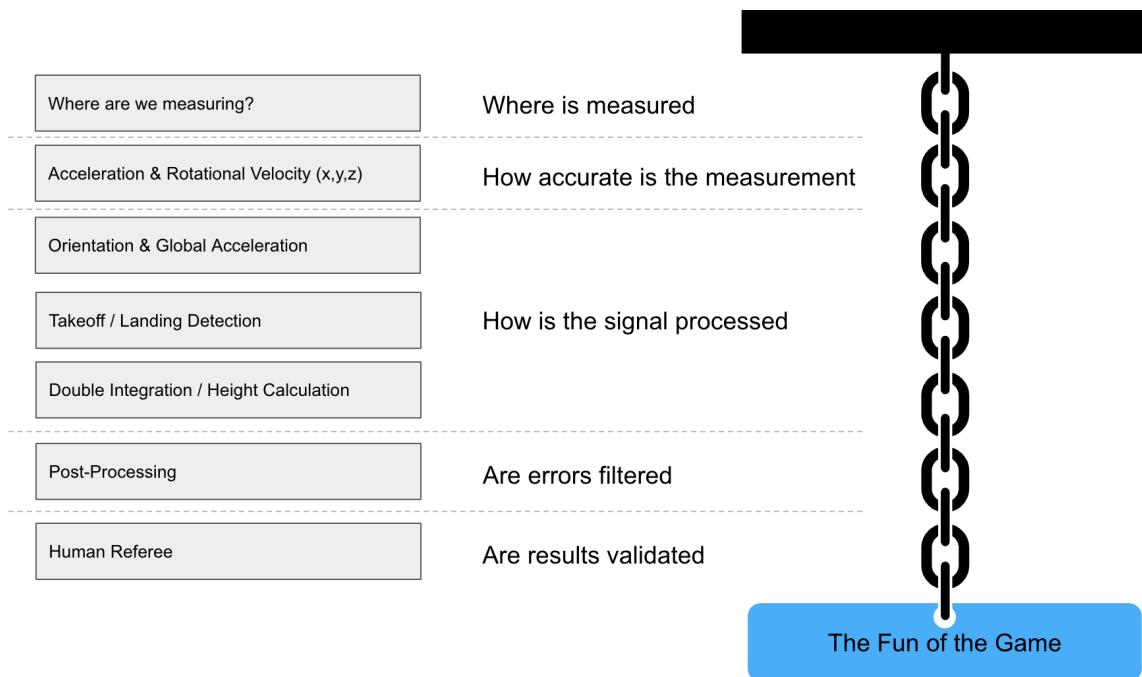


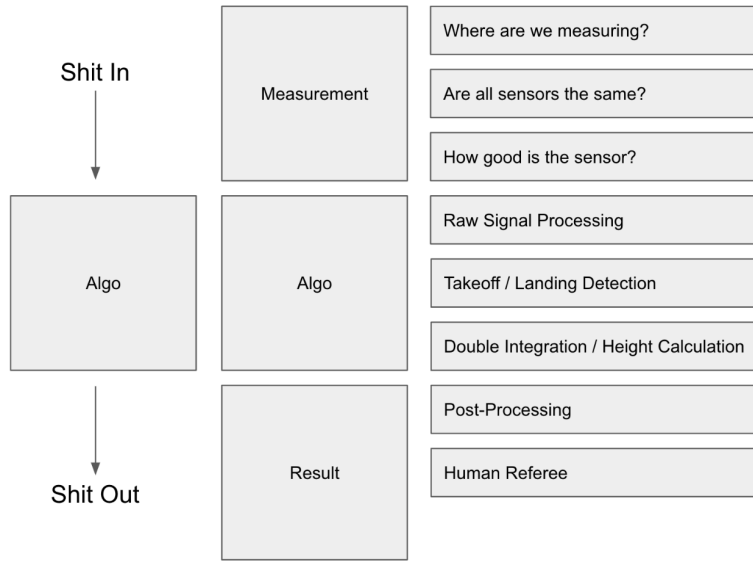
Figure 7 – The links of the chain that make up a meaningful game

This whitepaper is to emphasize the importance of “the first links in the chain”, which build the foundation of a precise solution. Namely

- Where are we measuring?
- Are all the sensors the same?
- How good is the sensor?

The algorithm itself is downstream, meaning that this all follows the “shit in shit out” principle. So, if the data coming from the sensor and into the algorithm is not good and/or consistent between devices, it is impossible to achieve a precise solution.

The WOO Way



Why accuracy matters

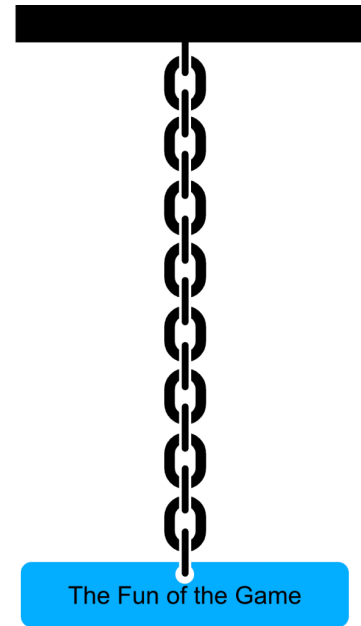


Figure 8 – The Shit in Shit out principle

3 A DEFINITION OF ACCURACY

The term accuracy is widely used to describe how “accurate” a system is. However, taking a closer look, people tend to bulk three different terms into one. What they really mean by accuracy is precision, reliability, and absolute accuracy.

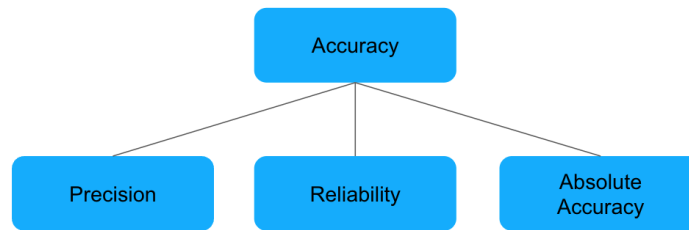


Figure 9 – A definition of accuracy

3.1 PRECISION

The term precision describes the following - if you put multiple WOO devices on a board next to each other, how close together will the results be? Precision is the most important of all aspects under the umbrella of accuracy, because it influences the competitive nature the most. You don't care as much about how high you went, what matters to your competition is whether or not you jumped higher than your friend. Imagine a throwing contest out in the field. Even without measuring, if you throw the ball further than your friend, you win. You do not need an absolute reading to have a fun and fair competition. Even many sports use arbitrary metrics (think of Tennis, where you can get 15, 30 and 40 points), and computer games invented the notion of a “point score”.

For WOO, precision is the holy grail. This is why we go through hoops, with a unified sensor, mounted on the board, highly calibrated, and developed using data from over 100 million jumps. Precision is the foundation of a fair competition. You jump higher than your friend, your WOO shows that. Game on.

3.2 RELIABILITY

Reliability is the second most important aspect under the umbrella of accuracy. It describes the following - if you do 10 jumps, will all of those be measured as jumps, or will some of those be missed? After all, if you score a goal in soccer and the referee happens to look the other way, leading to the goal not being counted, what fun is the game?

This also goes the other way. Are perhaps 11 jumps measured, even though only 10 were performed?

3.3 ABSOLUTE ACCURACY

Absolute Accuracy denotes that if you do a jump of 10m, will the WOO show 9m, 10m or 11m? This is irrelevant for the competitive nature of things, but regardless, is an area we put a lot of work into, and take a lot of pride in.



Figure 10 – Hierarchy of Accuracy

Validating absolute accuracy is easier for smaller jumps, particularly when done on flat water. It gets incrementally more difficult as the waters get rougher and choppier, for there is not an even water level to measure off of, and using reference objects for visual measurement becomes difficult. Hence, we use a complex and expensive technology that provides centimeter-level accuracy as a reference. In general, since 95% of our users complain that the WOO measures too low vs. too high, when there is any doubt, we are always vying on the side of the rider, i.e. trying to find the maximum measurement. As an example, when riding in waves, we count the jump from the bottom of the wave.

3.4 THE INFLUENCE OF METRICS

The games we play at WOO can be varied. For sure, the main metric is Max Height - how high can you jump? However, many of our users compete on different playing fields, such as airtime, total height, total airtime, total distance, and so forth. Different aspects of accuracy matter for different types of games. For example, precision is the key for the “max height” game, whereas reliability and precision are equally important for the total metrics.

For any metric related to jumps, detecting the takeoff and landing properly is paramount. If you measure the length of a car, but do not measure from the beginning to the end of it, your measurement will be wrong. Airtime, height, distance etc. can simply not be calculated correctly without the proper detection of takeoff and landing.

4 HOW HEIGHT IS MEASURED

This section is not to go into depth of how height is measured in kiteboarding, but is to provide a simple overview to create a basic understanding. At the core of height measurement in kiteboarding are so-called MEMS (Microelectromechanical Systems) Sensors. A subgroup of those are so-called IMU's (Inertial Measurement Units). Those usually consist of an accelerometer and gyroscope. The meaningful end-product those sensors deliver is a reading of the vertical acceleration. Said vertical acceleration can be integrated twice, and as a result, delivers a jump trajectory.

To get the correct vertical acceleration (along the axis of gravity), the local acceleration measurements from the sensor must be transposed. The sensor measures in local x, y, z coordinates. Using the orientation of the device and complex but standard math, those x, y, z acceleration values can be used to calculate the global vertical acceleration.

The next critical element for jump height measurement is the accurate detection of takeoff and landing.

4.1 THE EXPONENTIAL ISSUE OF INERTIAL MEASUREMENT

In the world of inertial measurement, the acceleration must be integrated twice to get any form of distance. For the calculation of height, this means that the vertical acceleration is integrated twice.

$$\iint_{t_1}^{t_2} (a_v + c_0) dt dt$$

If you integrate twice, any signal error (depicted as c_0) will grow exponentially over time. As an example, if the error after 10sec is 20cm, it is 20m after 100sec and 2km after 1,000sec.

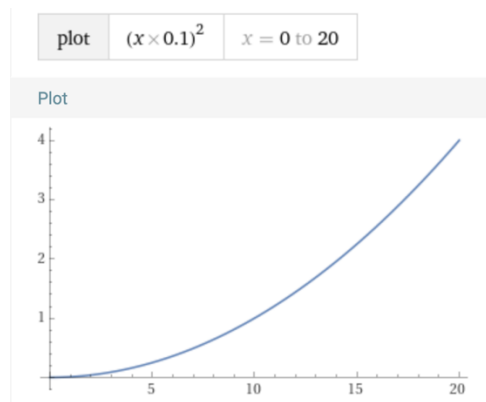


Figure 11 - Exponential growth of error

That is why inertial sensors are not suitable for e.g. navigation of a car, though they can be used in short spurts of time. Kiteboarding offers a unique help. Since the jump always leaves and eventually comes back to sea level, said error can be corrected for to some degree. Either way, the exponential nature of the error emphasizes the strong impact sensor imperfections have on the measurement results, and the need for the best possible calibration (more on that soon).

5 FACTORS FOR A FAIR GAME

Next, we take a closer look at the different elements of a product that determine its precision, reliability, and absolute accuracy. Our goal is to build a direct correlation between these attributes of a product and the effect it has on the competitions.

5.1 POINT OF MEASUREMENT

Point of measurement refers to the position of the inertial motion sensor. In the context of this document, we will distinguish between three different points:

- The board
- The rider's chest (via a phone pouch)
- The wrist (as a Watch device)

The point of measurement poses four questions -

- A. How is height measured correctly
- B. How well can landing and takeoff be detected in each of the locations?
- C. Are results between different measurement locations comparable?
- D. What other factors exist

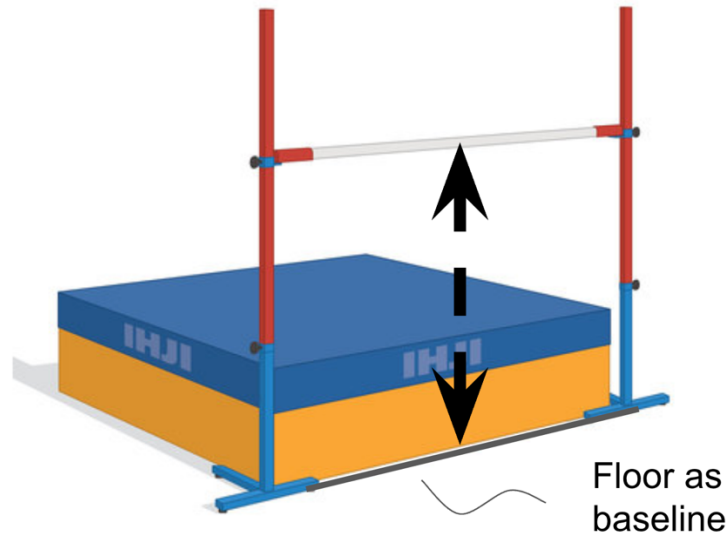
5.1.1 ESTABLISHING THE BASELINE

When the question is posed on how kiteboarding jump height should be measured, the first and most pressing question is, where do we measure from? Before we get into the measurement of jump height, let's first look at the definition of height. The Oxford Language definition of height is defined as:

*The measurement of someone or something from head to foot or from **base to top**.*

Height is measured from base to top. Clear. If you measure the height of a house, you measure base to top. If you measure your very own height, you don't start at the ankles or at the waist, you measure base to top.

Moving on to the measure of jump height in general, we can see the same paradigm in competitive sports. The first High Jump competition was already had in the 19th century. Here, the height is also measured "base to top", starting at the floor.



High Jump height measurement

Translating this paradigm into kiteboarding, it is easy and clear to say, jumps need to be measured from sea level. And the only mounting location that supports measuring jump height from base (sea level) is a board mounted solution.

Aside from scientific and historic considerations, measuring from sea level is also the only “common sense” solution. Assume we’re in magic land, and you have the magic capability to freeze time. Moreso, you can move around in said frozen time. And you’ve been asked and tasked by one of your friends to measure a kiteboarding jump. He gives you a tape measure, and puts you to the task. Would it even occur to you to ask where to measure from? Would you ever even consider measuring jump height from the wrist of the rider on the water? Wouldn’t you naturally measure from sea level (aka the surface of the water, where the board left the water) upwards? As in, in this frozen dimension of space and time, wouldn’t you put the end of the tape measure at the sea level, and measure from there? Isn’t that the “duh” type place to measure from? Of course it is.

5.1.2 LANDING AND TAKEOFF DETECTION

The first question to ask is, what signal can we get from each of the different points? How suitable is a given point to accurately detect a jump, and determine the point of takeoff and point of landing? Can riding over a big wave be distinguished from a jump? Is there an accurate way to determine if the rider is on the water or in the air?

As we will see, two types of signals make the board mounted solution the only reliable way to consistently detect takeoff and landing accurately. For all other options, it is the good old “shit in shit out” problem - no matter how great the algorithm is, the received data is by far not good enough to calculate accurate height and airtime metrics.

5.1.2.1 ACCELERATION

When measuring on the board, the acceleration profile gives a very clear and accurate signal on whether or not the rider is on the water or in the air. The board, even when riding through flat water, produces a constant noise (rapid up and down) in the acceleration signal. Below is an example of this signal. It is even visible to the naked eye where the board is touching the water, and where it is in the air. When contemplating this in the context of being able to notice the difference between riding over a wave or an actual jump, based on the acceleration signal, only a board mounted device can measure such differences. The same goes for the difference between a rider floating over the water during a downloop, and him landing on the water.



Figure 12 – Sample Acceleration signal of a jump (board measurement)

5.1.2.2 ORIENTATION

The orientation, if measured on the board, is another surefire clue for an accurate takeoff detection. Riders of all levels perform a pronounced, and always characteristic pop motion. This results in a combination of a change of Yaw angle and a pronounced change of Roll angle. Said pop motion is a clear indication of “takeoff”, and as such the second clear advantage a board mounted solution has over a wrist- or chest mounted solution.

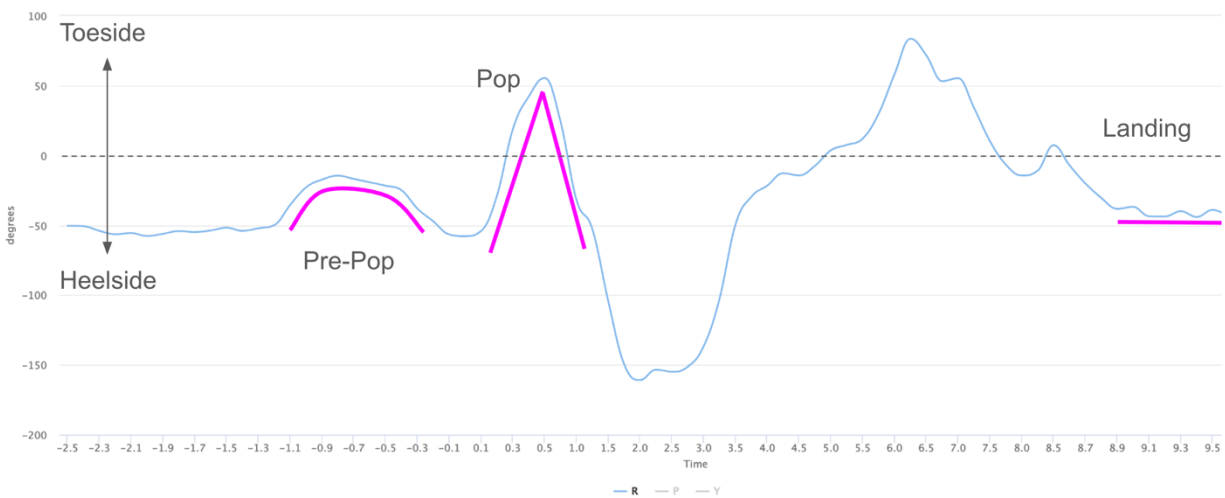


Figure 13 – Roll angle data of a jump

Concluding, the point of measurement is a factor that makes accurate measurements possible only if the device is mounted on the board.

5.1.3 GEOMETRY

Another issue arises, particularly as it relates to the comparable precision of height measurements. Assume two devices are mounted on a rider performing an inverted front roll. A device mounted on the chest will, by definition, measure much lower than the solution mounted on the board. What is correct from an absolute height standpoint is up for debate in this case, however, two equally high inverted front rolls cannot be compared. In the example below, the board mounted solution delivers a staggering 60% more height than the chest mounted device (8m vs. 5m).

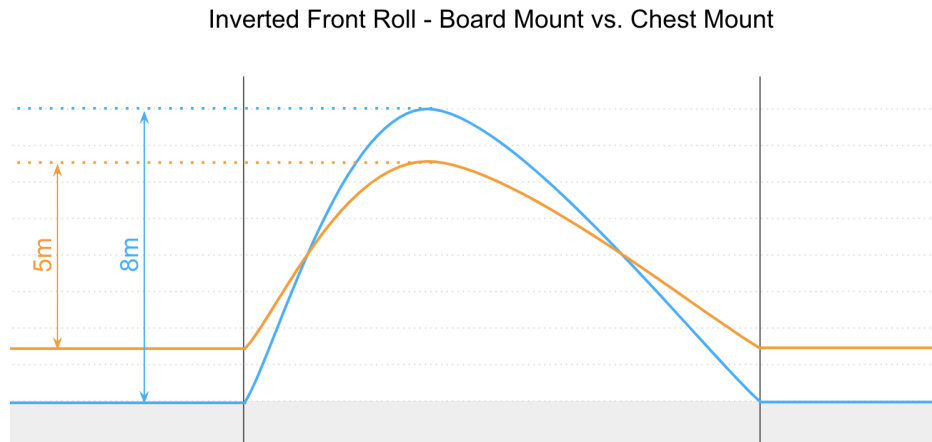


Figure 14 – Comparison Board vs. Chest Mount

We can conclude that, for the sake of comparability and a fair game, it is of the utmost importance to have a consistent mounting point.

5.1.4 OTHER FACTORS

5.1.4.1 MOUNTING SOLIDITY

This refers to how “solid” the sensor is mounted to an object. To get this point across, imagine a WOO sensor dangling from a 1m long leash off the board. Even though it is “board mounted”, there is lots of movement the WOO could do relative to the board. As inertial measurement is extremely sensitive and prone to error signal, such movement would make it ridiculously hard to get an accurate solution. Moreso, many WOO’s dangling off many cords could not produce consistent and comparable results, no matter good the algorithm is. Having the sensor rigidly mounted on an object is critical for a fair game. Any wiggle room here will lead to inaccurate results.

5.1.4.2 CHEATABILITY

A critical component to the game is that signal cannot be easily manipulated. A board mounted sensor requires the rider to manipulate the motion of the board, and with that, initiate what we call a kiteboarding move (i.e. a tabletop, or a board off) that require skill and technique.

A wrist mounted solution, on the other hand, can be manipulated in many ways. A rider could lower the arm prior to takeoff and raise it midair. The rider could rotate or shake the arm violently to manipulate results. The rider could also try to “fake” a longer jump by suspending the arm at the point of landing and shake it a few seconds later to trick the device into detecting the landing point there. Other options include mounting the device on a pole to extract extra height.

A chest mounted solutions does not offer as many degrees of freedom. However, plausible scenarios are the user tapping the chest, or similarly, mounting and extending a phone on a pole.

5.1.4.3 REFEREEING

A separate section (see 5.7 Human Referee) deals with this topic in depth.

5.1.5 SUMMARY

	Board Mount Only	Wrist/Chest Mount
Jump Detection	++	-
Correct Baseline	++	-
Same Geometry	++	-
Mounting Solidity	++	-
Cheatability	++	-
Refereeing	++	-
Fair Game	YES	NO

Figure 15 – Comparison of Mounting Locations

5.2 SENSOR PERFORMANCE

5.2.1 RANGE

The range of a sensor has a huge effect on the ability to accurately measure jumps. Particularly because both signals require to be integrated (the gyroscope once, the acceleration twice), any little error accumulates over time, in case of acceleration exponentially. If the range of the sensor is not big enough to measure all amplitudes of the signal, it simply cannot measure jumps. Furthermore, sensors are known to be losing accuracy as they near their saturation point, just like most speakers sound horrible with the volume fully turned up, or an engine runs inefficiently when running at full power.

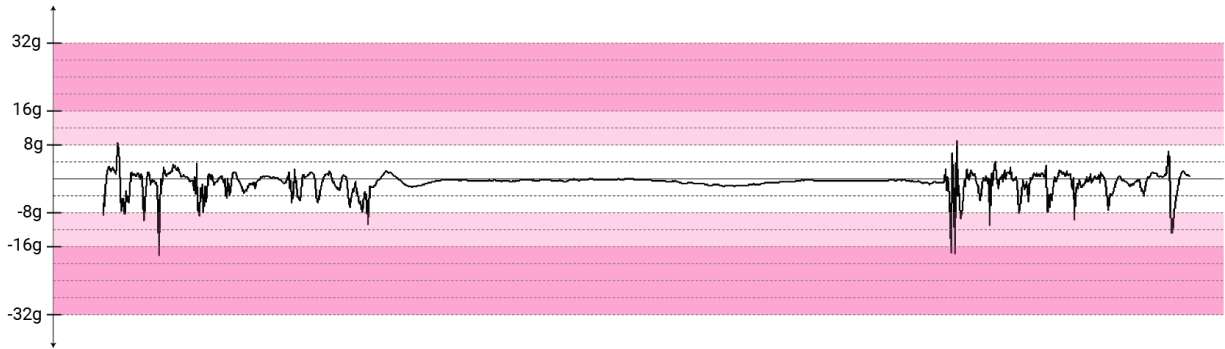


Figure 16 – Accelerometer Range Limitations

Looking at our sample acceleration signal from above, a too small range can simply cut off the signal. Many phones are in the +/-8g range, while most Apple phones are in the +/-16g range. A WOO 3.0 and WOO 4.0 device uses a sensor purpose built for high dynamic environments, with a range of +/-30g and +/-32g respectively. With WOO 1.0 and WOO 2.0, we realized that the sensor would be saturated too often, so even +/- 16g would not suffice.

The same problem accounts for the gyroscope, where the range can vary from 1,000dps (degrees per second) up to 4,000dps. Again, the WOO device is at the top end of the range, measuring up to 4,000dps. A failure to capture all rotation data correctly and completely has an even more devastating effect on the accuracy of the measurement, since the device orientation can no longer be calculated correctly. With both acceleration and gyroscope signals incomplete, the Kalman filter (more on that later) will have a ridiculously hard time maintaining an accurate solution, leading to results becoming unreliable and erroneous.

The main issue of oversaturated signal, however, is that the Kalman filter (more on that later) receives a very bad input, and loses its orientation. It takes a while of saturated signal to correct this erroneous input. We noticed with WOO 1.0 and WOO 2.0 that even a +/-16g range would occasionally lead to a dramatic loss of orientation signal. The figure below exemplifies this issue with a simplified 2D example. If the sensor is saturated on one axis (in this example the y axis), the orientation angle receives a very large error.

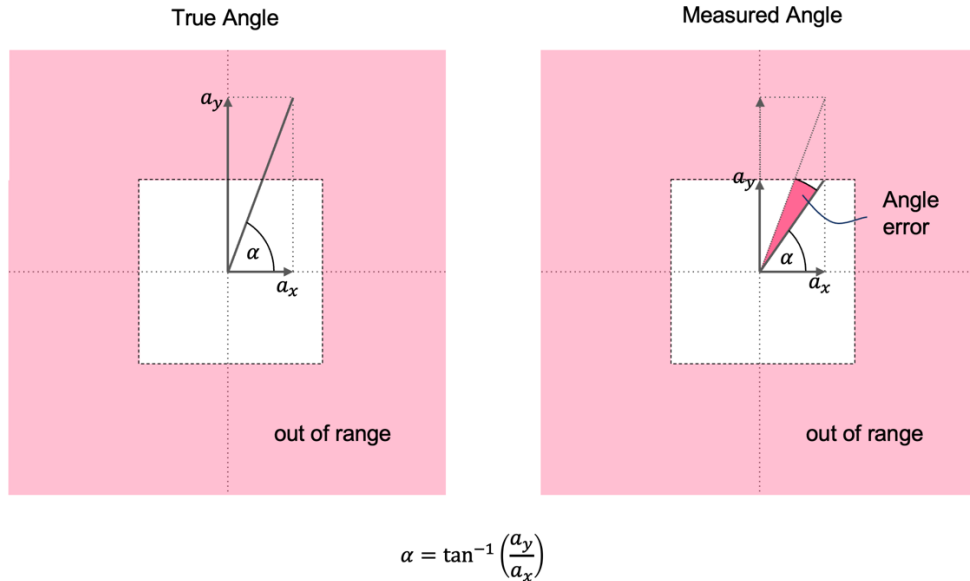


Figure 17 – Orientation error due to oversaturated sensor signal

Worst case, this leads to massive outliers, or a missed jump. A wrong orientation can lead to highly inflated results, because horizontal and vertical acceleration measurements (in themselves incomplete) can no longer be distinguished.

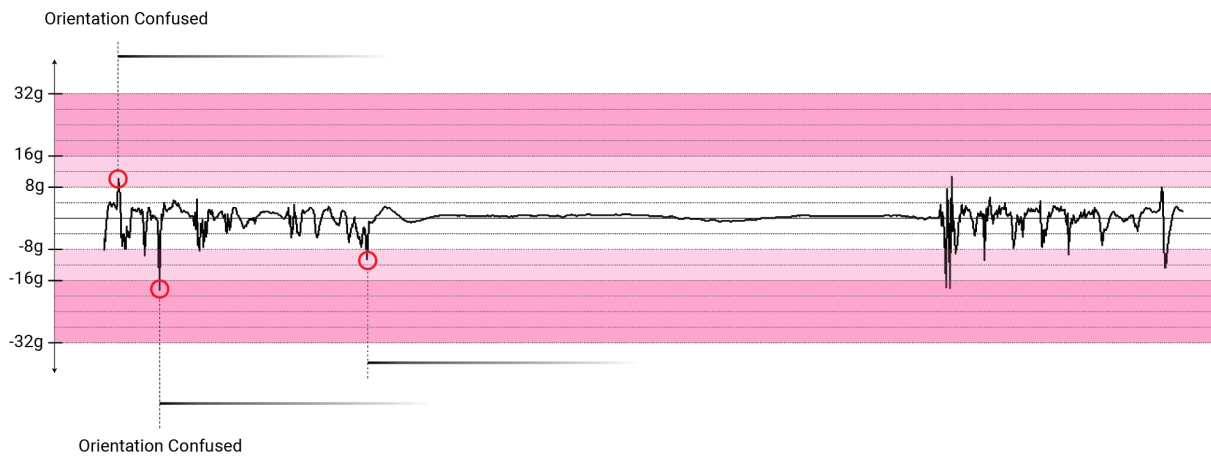


Figure 18 – Loss of orientation due to oversaturated signal

5.2.2 RESOLUTION

Since all analog sensor signal must be transferred into a digital environment, some of the fidelity is lost. A continuous signal (analog) is broken down into small steps. Depending on the resolution, this can give an exceptionally good/close approximation of the signal, or a bad and grainy one.

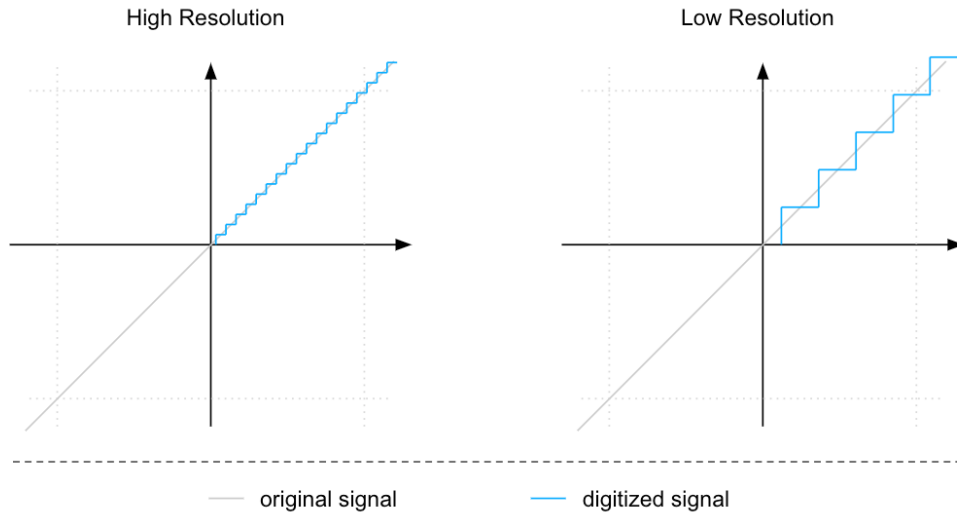


Figure 19 – Sensor Resolution

5.2.3 SAMPLE RATE

The sample rate indicates how often a signal is measured. Particularly in the high dynamic environment of kiteboarding, a high sample rate is critical to consistently find good solutions. With too low of a sample rate, important parts of the signal may be missed. The graphic below shows this dilemma. The first line represents the original signal. The second line maps this signal with a low sample rate. The third line maps the signal with a sufficiently high sample rate. As can be seen,

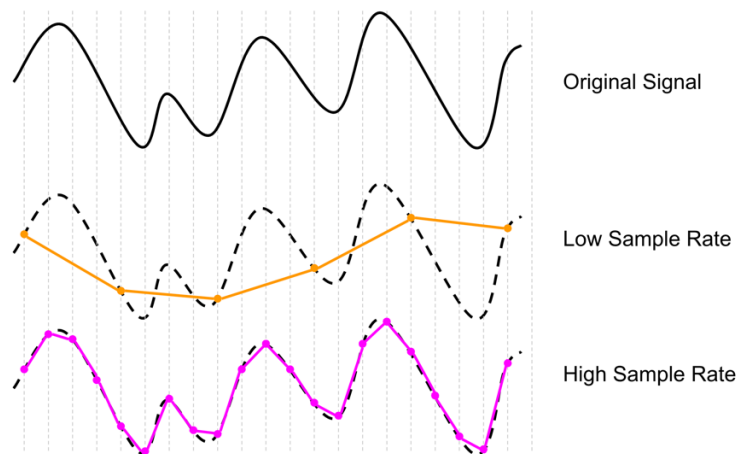


Figure 20 – Sensor Sample Rate

5.2.4 CLOCK

Since we are integrating twice over time, an accurate clock is just as important as an accurate sensor. Or, in other words, an error in the time signal has an equally significant effect on the accuracy of the measured signal than the signal itself. That alone would be issue enough, but as it turns out, the clock (or lack thereof) is an even bigger issue.

By default, accelerometer and gyroscope oscillate at a frequency. Their oscillation is within a specified bandwidth, and hence, is used as a signal. Let us say both the accelerometer and gyroscope have a frequency of 1kHz. The problem, once again, is the imperfection - the accelerometer may oscillate at 998Hz, and the gyroscope at 1002Hz (a 0.4% error). Further, these errors can vary at different temperatures. Now, as we will learn later, these two signals are combined to determine the device's exact orientation. If they do not run in synch (which with any common MEMS sensor, they do not), the orientation may be calculated wrong. Meaning, what the device may interpret as a horizontal acceleration, may in truth be vertical, or vice versa. Orientation is one of the basic, key elements of height calculation, and any error in it will carry through and cause more, amplified imperfections downstream.

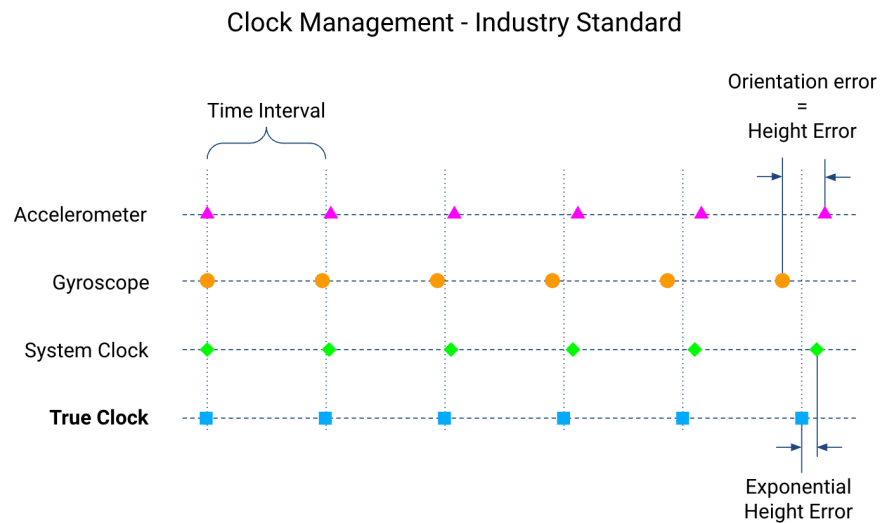


Figure 21 – Disjointed Clock management in Consumer Devices

To mitigate the issue, the accelerometer and gyroscope in the WOO 4.0 device are synchronized by a dedicated, external high precision oscillating crystal. This not only guarantees that accelerometer and gyroscope run in synch with each other, but also gives a highly accurate time signal to perform the double integration.

Clock Management - WOO 4.0

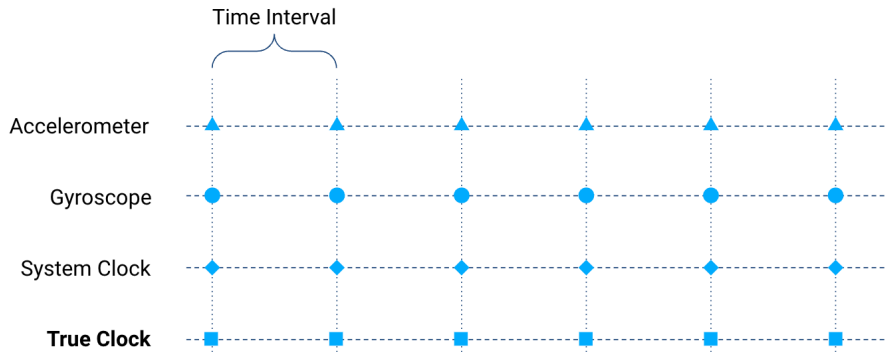


Figure 22 – Synchronized Clock management in WOO 4.0 Device

5.2.5 SENSOR IMPERFECTIONS

Every sensor can only measure reality with a degree of imperfection. In an ideal world, every sensor would measure the exact same thing, but it is due to these imperfections that they don't. As with any sensor related topic, comparability is important to guarantee a fair game. Having two bad sensors is better than having a good one and a bad one. Of course, the best solution is to have two good sensors, and WOO achieves this by using state of the art motion sensors in each WOO 3.0 device.

5.2.5.1 NOISE

One of those imperfections is noise. It is comparable to the background noise of your radio, even though the station is not transmitting anything. This noise leads to false signals.

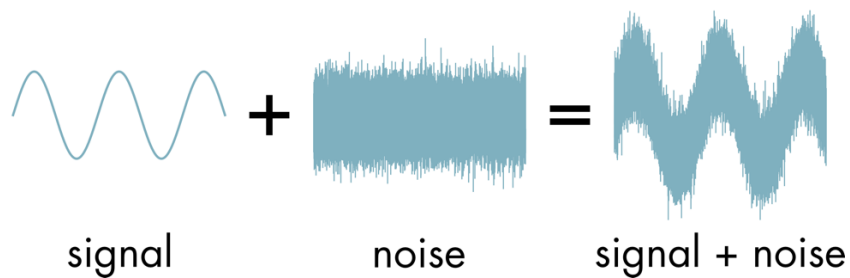


Figure 23 – Example of Sensor Noise

5.2.5.2 ZERO OFFSET

The Zero Offset describes the factory calibration of a device. While a proper six axis calibration (more on that below) will be able to correct for any zero offset, simpler calibration procedures are not.

5.2.5.3 NONLINEARITY

Nonlinearity describes the nonlinear imperfections a sensor can have.

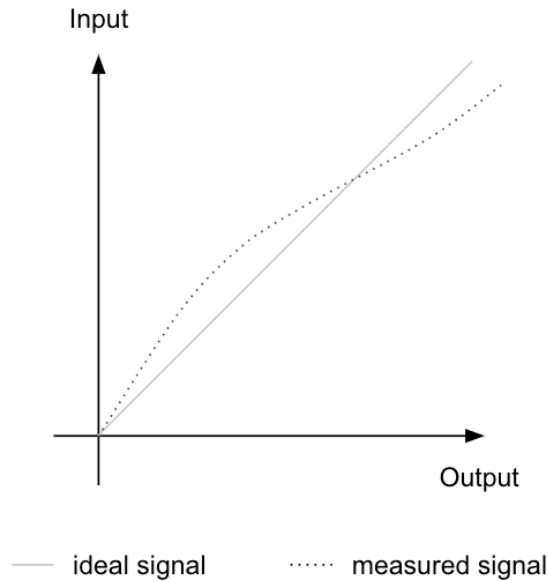


Figure 24 – Example of Sensor Nonlinearity

5.2.5.4 TEMPERATURE STABILITY

Every piece of electrical equipment behaves slightly differently as temperature changes. Hence, it is important to choose equipment with specs that are stable and suitable over a wide range of temperatures, and to correct for any remaining variability over temperature in the firmware of the device.

5.2.5.5 TECHNICAL SPECIFICATIONS

Below are technical specifications of the Motion Sensor itself, as well as the Timing Crystal (see 5.2.4).

For the accelerometer, you can see that values increased dramatically from WOO 3.0 to WOO 4.0, which is a piece in the puzzle of achieving pin-point precision in WOO 4.0.

ACCELEROMETER	Unit	WOO 3.0	WOO 4.0	better
Sample Rate	Hz	4,500	32,000	higher
Resolution	Increments	65,536	262,144	higher
Range	g	30	32	higher
Nonlinearity	%	0.5	0.1	lower
Noise	ug/rt-Hz	285	70	lower
Initial Tolerance	mg	65	20	lower
Zero G Level Change vs Temp	mg/C	0.8	0.15	lower
Cross Axis Sensitivity	%	2	1	lower

Figure 25 – Acceleometer Specifications

A similar picture emerges for the Gyroscope, values Improved 5x on average between WOO 3.0 and WOO 4.0.

GYROSCOPE	Unit	WOO 3.0	WOO 4.0	better
Sample Rate	Hz	9,000	32,000	higher
Resolution	Increments	65,536	524,288	higher
Range	dps	4,000	4,000	higher
Initial Zero Tolerance	dps	5	0.5	lower
Noise	mdps/rt-Hz	17.5	5.3	lower
Zero Offset	increments	50	10	lower
Cross Axis Sensitivity	%	2	1	lower
Zero Variation over Temp	dps/c	0.05	0.01	lower
Sensitivity Scale Factor / Temp	%/C	0.05	0.005	lower

Figure 26 – Gyroscope Specifications

Not to be forgotten is the Timing Crystal, a new feature in WOO 4.0. It synchronizes Accelerometer and Gyroscope, and creates an overall stable and precise system timing. The maximum error is 7ppm, which equates to a 0.0007% error. More importantly, this error remains constant as the device ages.

TIMING CRYSTAL	Unit	WOO 3.0	WOO 4.0	better
Nominal Frequency	Hz	-	32,768	higher
Frequency Tolerance at 25C	ppm	-	7	lower
Aging (10yr MAX)	ppm	-	10	lower

Figure 27 – Timing Crystal Specifications

5.2.5.6 SUMMARY

	WOO 4.0	Phone / Watch
Range	++	?
Resolution	++	?
Sample Rate	++	?
Clock	++	?
Imperfections	++	?
Fair Game	YES	NO

Figure 28 – Comparison of Sensor Characteristics

5.3 SENSOR CALIBRATION

Any sensor is only as good as its calibration. At WOO, every device is calibrated

- for Offset and Gain
- on all three axes (x, y and z)
- In an automated, factory-controlled setting

A purpose-built robot calibrates the WOO's in the factory. It is a closed-loop controlled system, meaning that the six positions held during calibration are observed by an expensive, high precision instrument. Any vibration or the slightest movement of the robot itself leads to an abortion of the process, and the calibration of each WOO device is validated at the end of the process.

This assures accurate results, but moreover, comparable results between different sensors. To calibrate all three sensor axes for offset and gain, six measurements must be taken.

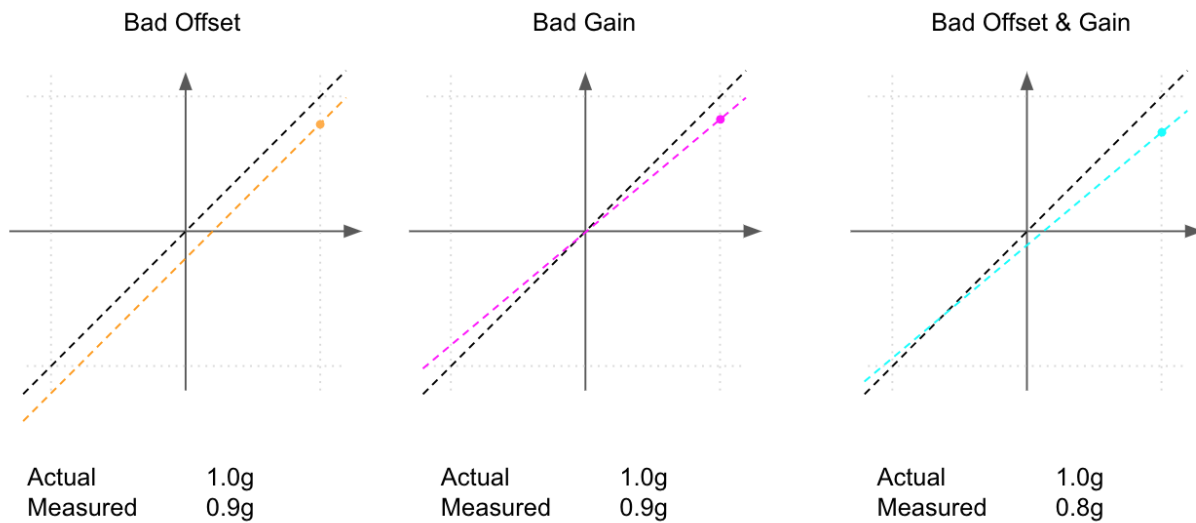


Figure 29 – Offset and Gain

WOO takes the six measurements needed to calibrate offset and gain on all three axes. Our calibration is done in an automated, controlled factory setting, and validated / tested afterwards. If calibration is not done in a controlled environment, results can be wrong. E.g., if a phone is not perfectly flat on the ground (one degree makes an enormous difference!), or there is any kind of movement or unnoticeable vibration, results will be bad.

	WOO 4.0	Phone / Watch
6-Axis Offset & Gain	YES	NO
Automated Calibration	YES	NO (manual)
Fair Game	YES	NO

Figure 30 – Comparison of Calibration

5.4 DEVICE MANUFACTURING

Inertial Motion sensors (IMU's) are extremely sensitive Integrated Circuits (IC's), or more commonly called, microchips. If they are not handled and manufactured correctly, stresses can occur on those IC's that create a bad signal. Has the sensor been placed in a stress-free area on the Printed Circuit Board (PCB)? Is the PCB decoupled from the housing, such that it is assured that external stresses on a device (i.e. a bending force on the phone) do not translate onto the IMU, and hence create a false signal? Is the PCB mounted such that it cannot rattle even the slightest bit in the housing, creating a false signal? During the so called SMT process, where all components (including microchips) are placed on the PCB and connected via a heated-up soldering mass, is there enough time given at hot temperature for the soldering mass to flow and de-stress, so that any induced stresses are removed? Every product has its own solder reflow profile, which can be optimized towards throughput (as often done in high-volume manufacturing), or towards quality (i.e. complete removal of any stress induced by the soldering mass).

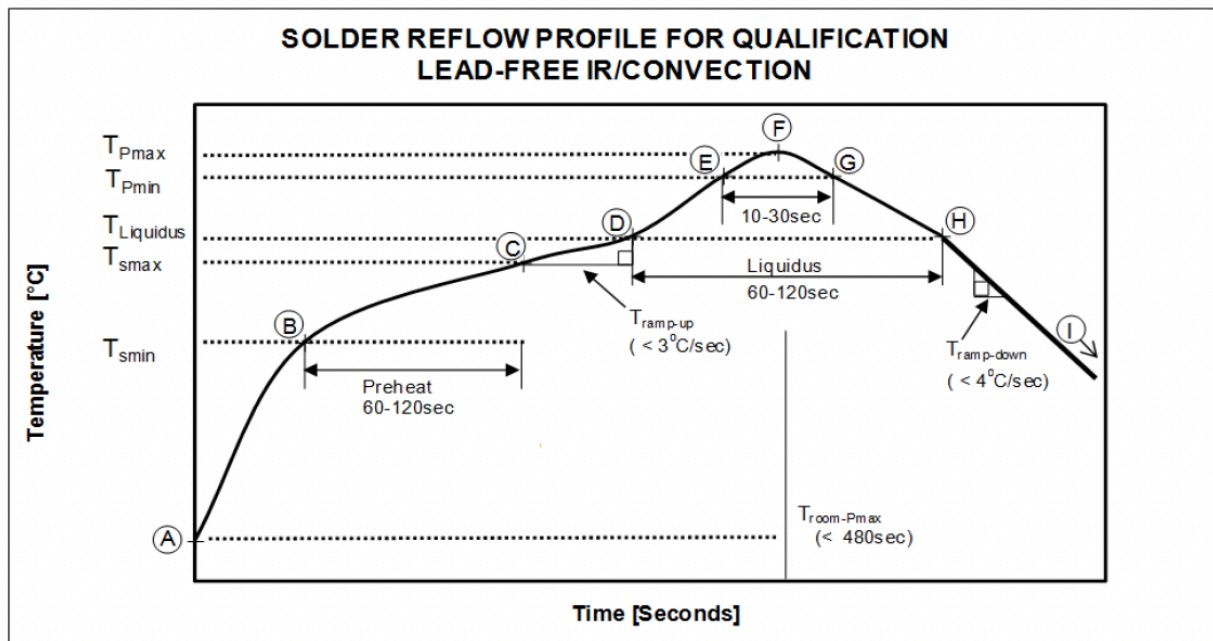


Figure 31 – Temperature Profile of SMT Process

For further understanding of the complexities of manufacturing, below is another excerpt from a 23-page document that defines and describes how a IMU needs to be handled and manufactured.

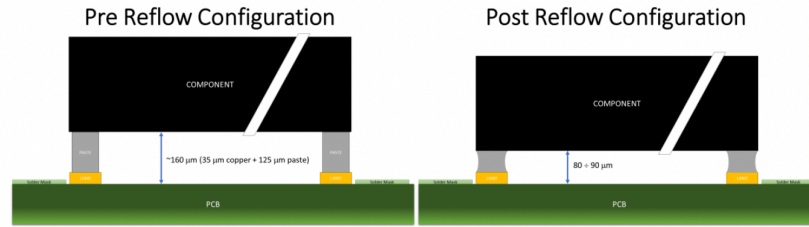


Figure 4: Pre and post reflow configuration

Solder paste thickness calculation example for 4.5 x 4.5 mm² QFN Package:

- Stencil nominal land width: $W = 0.25 \text{ mm}$ (pad size)
- Stencil nominal land length: $L = 0.53 \text{ mm} + 0.32 \text{ mm} = 0.85 \text{ mm}$ (pad size + extension for tip wettability)
- To respect Aspect Ratio: $T < 0.166 \text{ mm}$
- To respect Area Ratio: $T < 0.146 \text{ mm}$
- Stencil optimal $T = 0.13 \text{ mm}$

Component Placement Pressure and Pick-and-Place Velocity

Use a typical pick-and-place machine with reflow equipment like an oven. Avoid any manual soldering process. Machines should be set up to slow down both the pick and the place operations, as much possible, to help minimize any shock impact to the device.

Sensor has been designed and tested to survive at shock up to the Absolute Maximum Rating (AMR) reported into the datasheet, shock above the AMR could damage the MEMS structure. Parts subjected to shock greater than AMR have to be discarded.

PCB Mounting and Cross-Axis Sensitivity

Even if the package tends to center itself and correct for slight placement errors during the reflow process due to surface tension of the solder joint, orientation errors of the gyroscope and accelerometer mounted on the PCB can cause cross-axis sensitivity in which one gyro or accel responds to rotation or acceleration about another axis, respectively. The orientation mounting error concept is illustrated in Figure 5:

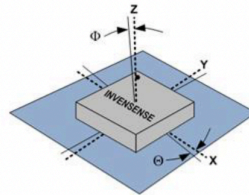


Figure 5. Package Gyro & Accel Axes (---) Relative to PCB Axes (—) with Orientation Errors (Θ and Φ)

Figure 32 – IMU manufacturing guidelines

5.4.1 SUMMARY

	WOO 4.0	Phone / Watch
Manufacturing tuned for IMU	YES	NO
Consistent Mfg Process	YES	NO
Fair Game	YES	NO

Figure 33 – Comparison of Manufacturing Process

5.5 SENSOR SIGNAL PROCESSING

5.5.1 SENSOR FUSION ALGORITHMS

To determine its orientation in space using accelerometer and gyroscope, the sensor needs to run complex and well tweaked math. The only absolute means to know its orientation is the gravity vector - that one is always pointing down. Fortunately, gravity never changes its mind. It is not sufficient, though, because as the object starts moving, more forces are occurring that may suggest a different direction of gravity. Hence, the Gyroscope is used to correct for these errors. Gyroscopes measure rotational velocity and can provide changes in angle. During a kiteboarding session, these two signals are constantly being run through what is called Sensor Fusion Algorithms. These Algorithms use different techniques (e.g. a Kalman, Madgwick or Mahony Filter) to constantly output the most accurate orientation signal. Further, each of these algorithms can be tweaked to rely more on the Accelerometer signal, or more on the Gyroscope signal - or, to manage this distribution dynamically and depending on the riding condition.

Here, it becomes evident why the High Precision Oscillating Crystal is so important - if Accelerometer and Gyroscope rely on their own frequency, which has a tolerance and varies over time, bad signal is fed into the Sensor Fusion Algorithm, and the orientation calculation has an error.

Determining the exact orientation of the device as best as possible is critical for accurate and precise height measurements, since the local X, Y, Z acceleration signals of the sensor must be translated into global coordinates (two horizontal and one vertical vector). The vertical vector is integrated twice for the height calculation.

	WOO 4.0	Phone / Watch
Fusion tuned for kiteboarding	YES	NO
Equal Fusion across devices	YES	NO
Fair Game	YES	NO

Figure 34 – Comparison of Sensor Fusion Solutions

5.6 OTHER FACTORS

5.6.1 OUTLIERS

Technology is amazing and creates a repeatability and precision that humans cannot themselves. Though, even technology is not perfect. Just like engines fail, apps have bugs, and computers crash, any height measurement device can fail. The art of engineering and manufacturing is always to reduce the risk of failure to a minimal amount. Having one standardized, high precision sensor in the best location helps minimize the risk. However, the chance of failure is never zero, and hence cannot be ignored. That is why in aviation, all critical systems (i.e. instruments to measure speed) have at least single redundancy, so that if one component fails, another one can take over the job. And there is even a plan for the unlikely event that both systems fail.

Translated to the world of measuring jump height, this means that in rare cases, outliers do occur. Our estimated rate of outliers is less than one in ten thousand jumps. The most important thing is that these outliers are being detected and being brought to our attention. First off, WOO users can flag/report jumps in the app. Second, there are a plethora of filters on our servers, flagging suspicious results and jumps. It is important to know that for every jump, many more metrics and much more data is sent from the WOO to the app and to our servers than what is visible to our users. There are ten more metrics, all of which are meaningless to our users, but help us detect outliers. There is also granular rotation data sent to our servers, so we know the movement and orientation of the kiteboard over time. Here, it is critical to have this data right from the kiteboard, not from the wrist or chest. Once a jump is flagged by a user or caught by one of our filters, our developers are alerted of the issue and can look at what happened. Here, we look to do two things - correct the issue at hand and learn from what went wrong in the first place, so that we can take measures (i.e. adjustments to the algorithm) so that this issue will not re-occur.

In summary, outliers do occur and cannot be ignored. Hence, the task we set for ourselves is to minimize the number of outliers as best we can, and do everything we can to detect and correct outliers when they do occur.

5.6.2 CHEATABILITY

Cheatability was a major concern early in the development of WOO. We knew that if our system could be cheated, we would never be able to gain credibility, and the game would eventually be rendered meaningless. This is one of the main reasons why we decided to build a purpose-made sensor (instead of using 3rd party hardware) that would be mounted on the board - nowhere else.

Unfortunately, cheating is part of any sport. Of course, we encourage users to always act in the faith of fair play. However, users will try to cheat our system, if even for the sake of curiosity. As with anything, preventing cheating is not a simple task, but a complex and multidimensional undertaking. First off, it is important to assure that the device itself, and software running on it, cannot be manipulated. Software encryption and a sealed enclosure come to mind, both which assure that the WOO cannot be "hacked". The second option for manipulation would be to change or alter the calibration of the WOO device. This cannot be done, and calibration

information is sent to our servers to assure everything is within range frequently. If the calibration process is user-driven, there are obvious loopholes that allow for manipulation. Lastly, a well calibrated and unmanipulated device could still be attached to e.g. a drone. This is where and why the board mounting is so critical. As described in the chapters before, a kiteboarding jump has a very distinct “signature”. The most obvious ones are the noise signal (“chatter” or “rattling”) if the board is in the water, and the smoothness of the signal when it is in the air.



Figure 35 – Acceleration data of a jump (board measurement)

The second obvious one is the characteristic rotation pattern (yaw, pitch and roll angles) the board undergoes at takeoff, the so called “pop” motion.

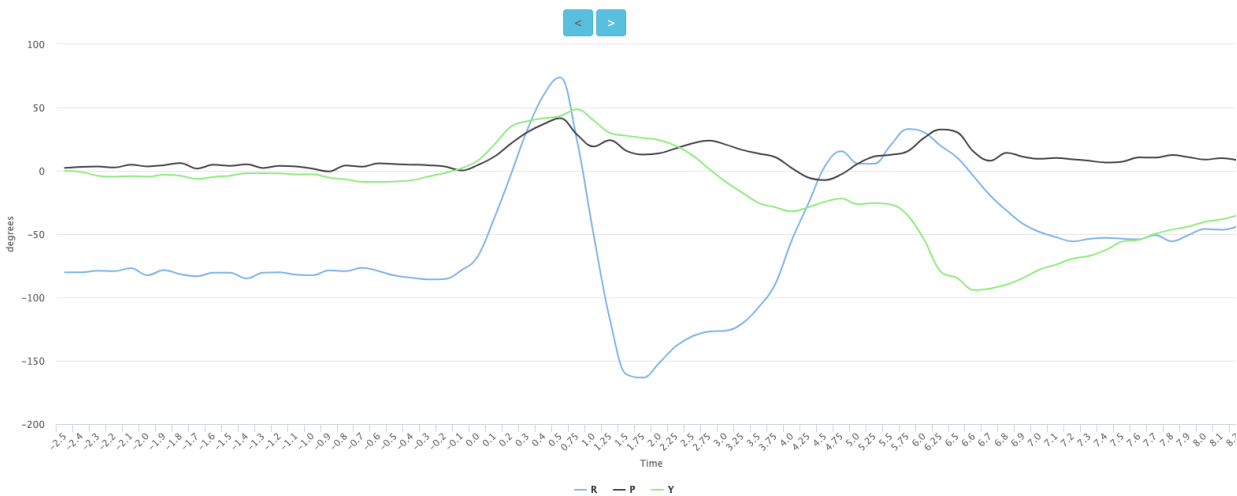


Figure 36 – Rotation data of a jump (board measurement)

These two make it impossible to fake a jump with e.g. a drone, without being detected and flagged as fake. This critical signal is missing when measuring at the chest or on the wrist. Finally, there are further filters (like those that detect outliers) that flag suspicious results and jumps. Those are then investigated by our referee.

5.6.3 TIME AND CONTINUITY

This is an underrated factor in the fun of the game. WOO has been around for over ten years now, and continuity has emerged as one of our main pillars in our strategy as a business. It had

a strong influence in our decision to integrate WOO Sports as a business into the Boards and More universe. Having the most successful kite brand as a backbone gives us the power for future growth, and the backbone and war chest to weather the ever-changing business landscape. A business model geared for sustainable success vs. rapid growth is another cornerstone of a model that guarantees continuity, hopefully for years and decades to come.

5.6.4 SUMMARY

	WOO 4.0	Phone / Watch
Outliers	++	-
Cheatability	++	-
Time and Continuity	++	-
Fair Game	YES	NO

Figure 37 – Comparison of Other Factors

5.7 HUMAN REFEREE

As a final instance, every competitive sport needs an impartial and independent human referee to make the final verdict in case of a conflict or disagreement. At WOO, we have a dedicated resource that monitors the community frequently. In case a doubtful jump or session is brought to our attention by a user, the referee can draw all the relevant information to judge the result. The data available through on-board measurement (specifically the board's motion) gives the referee an unambiguous understanding of whether the jump in doubt is valid. Only in exceedingly rare cases does our referee deem a jump invalid. If it is due to the user cheating, disciplinary action may or may not be taken. If it is due to a technical issue, our FRACAS system (Failure Reporting and Corrective Action System) will go into effect - or, in simpler words, our developers will try to solve the problem, so that it will not reoccur.

WOOLY, a WOO internal database management website, is our main tool of choice for refereeing. In it, we can review a jump graph (incl. Velocity and acceleration data), orientation data plot over time (roll, pitch, yaw) and a 3D visualization of the movement of the WOO device. This first image shows the 3D visualization. Camera angle can be rotated, to get the best view on the device. The slider on the bottom allows us to move through time and analyze the motion of the device. Since the device is mounted on the board, we can very well see the jump motion.

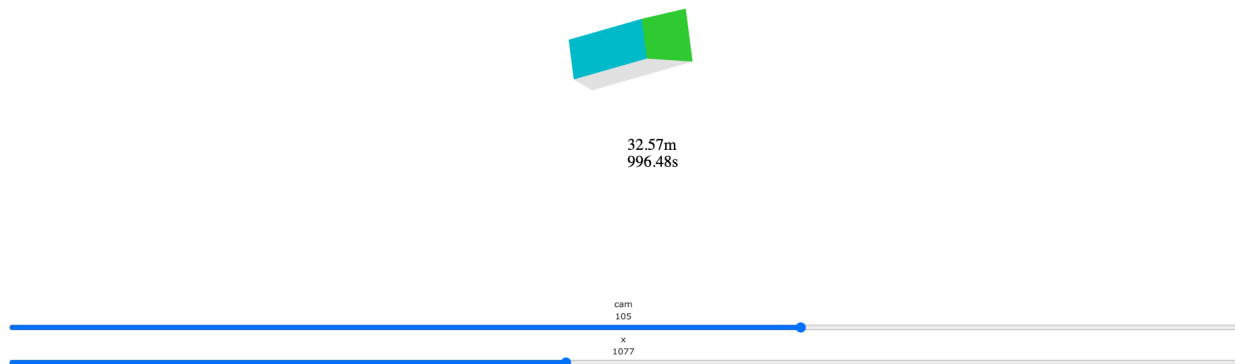


Figure 38 - 3D Visualization of WOO Device in WOOLY

Below is an example from a jump sequence, which was part in a German magazine.

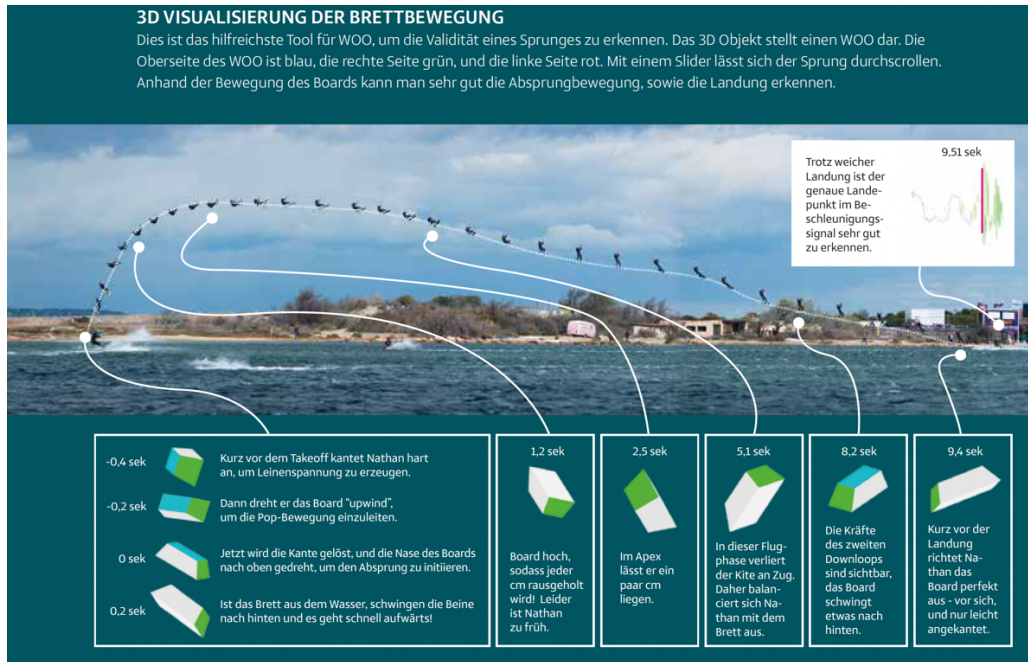


Figure 39 – Example of 3D visualization throughout a jump

The graph below shows the rotation data of the WOO throughout the jump. Without any prior knowledge, it is easy to spot the takeoff point, particularly when considering that the blue line represents the “edge” angle of the board. During the pop motion, the edge angle crosses the “flat” point (0deg). In the air, most riders swing the board back, and then bring it back through 0 to the front for the WOOsting motion. Yaw (green) and Roll (black) give other good indicators on the jump dynamics.



Figure 40 - Rotation Data of a Jump in WOOLY

This graph is a simplified/down sampled jump graph (blue line). You can see in the black line (representing vertical velocity) that the rider performed a few downloops on the way down, decelerating his descent every time, before coming down for a particularly soft landing.

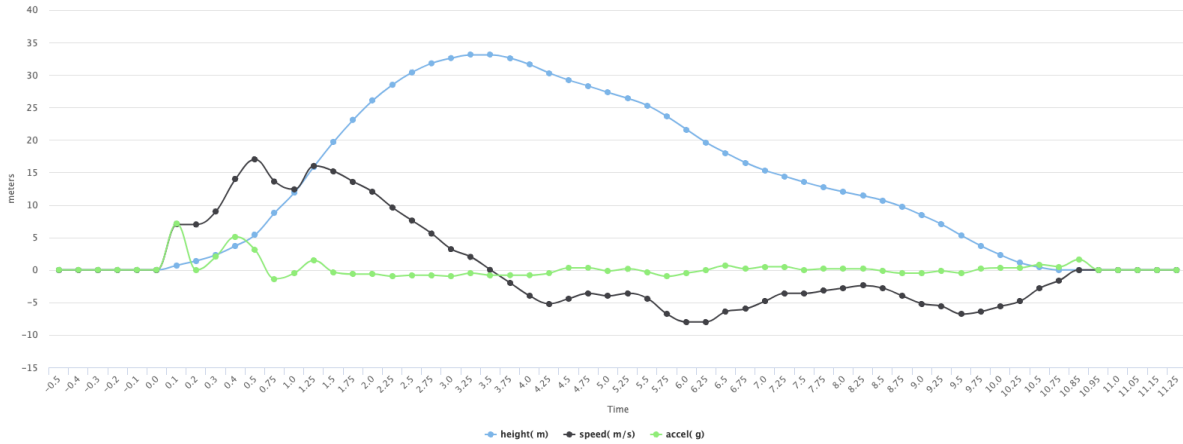


Figure 41 – Jump Graph of a Jump in WOOLY

The graph below represents the same data as seen above, albeit “pre-processed”, so not fully run through the jump detection algorithm – it is raw data. You can see that the jump height is slightly different, and the jump seems to not come down to sea level.

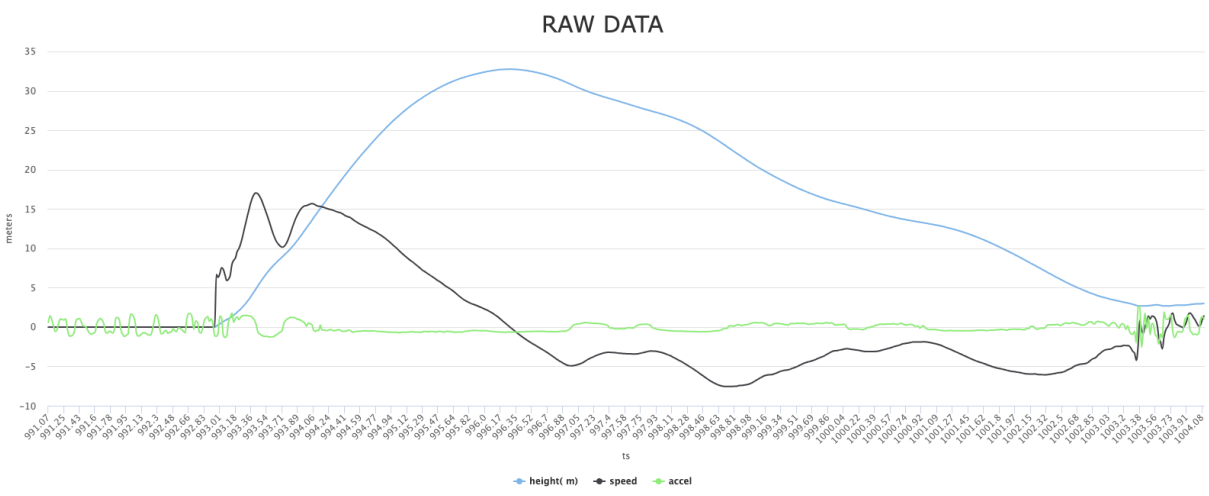


Figure 42 – Raw Data of a Jump in WOOLY

A key element here is that albeit the rider managed an exceptionally soft landing, the acceleration signal (green line) at the point of landing is very visible.

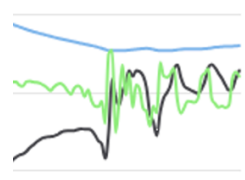


Figure 43 – Clear acceleration spike at landing (green line)

5.7.1 SUMMARY

As a conclusion, we can summarize that only board mounted solutions deliver data that is relevant and necessary for a human referee to judge results.

	WOO 4.0	Phone / Watch
Suitable data for referee	YES	NO
Fair Game	YES	NO

Figure 44 – Comparison of Human Referee

5.8 SUMMARY – FACTORS OF A FAIR GAME

	Board Mount / WOO	Wrist/Chest / Phone/Watch
Location of Measurement		
Jump Detection	++	-
Correct Baseline	++	-
Same Geometry	++	-
Mounting Solidity	++	-
Cheatability	++	-
Refereeing	++	-
Motion Sensor		
Range	++	?
Resolution	++	?
Sample Rate	++	?
Clock	++	?
Imperfections	++	?
Sensor Signal Fusion		
Fusion tuned for kiteboarding	YES	NO
Equal Fusion across devices	YES	NO
Other Factors		
Outliers	++	-
Cheatability	++	-
Time and Continuity	++	-
Human Referee		
Suitable data for referee	YES	NO
Fair Game	YES	NO

Figure 45 – Summary of the factors for a fair game

6 SUMMARY

6.1 A MATHEMATICAL VIEW

In the end, the fun of the game hinges on a variety of factors. The links in the chain. No game is fun without people in it, the community. And no game is fun without continuity. Then, all the measurement factors come in.

- (A) Mounting location: Different locations, different results, no trustworthy competition
- (B) Sensor performance: Bad sensors, bad results, no trustworthy competition
- (C) Sensor uniformness: Different sensors, different results, no trustworthy competition
- (D) Sensor calibration: Bad/different calibration, bad/different results, no trustworthy competition
- (E) Device manufacturing: Bad/different manufacturing, bad/different results, no trustworthy competition
- (F) Sensor Signal Processing: Different calibration, different results, no trustworthy competition
- (G) Cheatable platform: No trustworthy competition
- (H) No human referee (having the data he needs to judge): No trustworthy competition

$$Fun = Community \times Continuity \times (A \times B \times C \times D \times E \times F \times G \times H)$$

where

$$\begin{aligned} A &= \textit{mounting location} \\ B &= \textit{sensor performance} \\ C &= \textit{sensor uniformness} \\ D &= \textit{sensor calibration} \\ E &= \textit{device manufacturing} \\ F &= \textit{sensor signal processing} \\ G &= \textit{cheatability} \\ H &= \textit{human referee} \end{aligned}$$

Ultimately, if any of the factors above are 0, there is 0 fun. Perhaps this is the best way to summarize just why it is so important to have one purpose-built powerhouse sensor in one (the best) measuring location. That's the WOO way of doing things, and that's why we put so much effort into building the WOO sensor. We have the greatest community in all of kiteboarding, we are set up for continuity, and our tech team will take care that anything and everything from A-Z is optimized to provide as much fun as possible for our customers.

7 APPENDIX A – TEST DATA

7.1 SESSION 1

Surfr Garmin Height [m]	Surfr Phone Height [m]	Height DIFF [m]	Height DIFF %			4.0 #1 Height [m]	4.0 #2 Height [m]	Height DIFF [m]	Height DIFF %
2.49	2.66	0.17	6.60%			3.15	2.99	0.16	5.21%
8.60	9.25	0.65	7.28%			10.24	9.92	0.32	3.17%
5.00	5.83	0.83	15.33%			5.55	5.53	0.02	0.36%
7.65	7.82	0.17	2.20%			9.15	9.07	0.08	0.88%
9.32	11.01	1.69	16.63%			12.43	12.44	0.01	0.08%
8.73	9.33	0.6	6.64%			11.00	11.00	0.00	0.00%
8.71	10.14	1.43	15.17%			11.48	11.35	0.13	1.14%
8.03	8.71	0.68	8.12%			10.43	10.43	0.00	0.00%
5.19	5.57	0.38	7.06%			5.44	5.46	0.02	0.37%
10.41	11.03	0.62	5.78%			12.39	12.52	0.13	1.04%
9.35	10.5	1.15	11.59%			12.55	12.50	0.05	0.40%
12.86	13.91	1.05	7.84%			13.23	13.18	0.05	0.38%
7.67	8.1	0.43	5.45%			6.37	6.46	0.09	1.40%
6.99	7.85	0.86	11.59%			6.21	6.15	0.06	0.97%
	8.83					7.54	7.34	0.20	2.69%
6.20	6.63	0.43	6.70%			6.38	6.42	0.04	0.63%
8.53	10.07	1.54	16.56%			11.71	11.70	0.01	0.09%
5.71	7.08	1.37	21.42%			5.83	5.94	0.11	1.87%
9.72	10.99	1.27	12.26%			12.38	12.36	0.02	0.16%
7.23	8.17	0.94	12.21%			6.27	6.41	0.14	2.21%
11.45	12.5	1.05	8.77%			13.10	13.03	0.07	0.54%
AVERAGE		0.87	10.26%			AVERAGE	0.08	1.12%	
					10.6				

Figure 46 – Competitor Test Data (Sample Session I)

7.2 SESSION 2

Garmin	Board	Wetsuit	AVG	%		WOO 4.0	WOO 4.0	DIFF	%	
10.76	10.64	11.17	0.53	5.0%		13.14	13.06	0.08	0.6%	
11.32	11.43	12.17	0.85	7.5%		13.42	13.23	0.19	1.4%	
10.22	10.15	11.46	1.31	12.9%		13.06	13.42	0.36	2.7%	
12.42	11.65	12.98	1.33	11.4%		14.97	14.65	0.32	2.2%	
10.14	10.86	11.69	1.55	15.3%		12.28	12.33	0.05	0.4%	
8.91	8.77	9.72	0.95	10.8%		11.95	12.23	0.28	2.3%	
11.25	10.83	11.64	0.81	7.5%		14.57	14.13	0.44	3.1%	
12.24	12.72	13.12	0.88	7.2%		16.26	16.23	0.03	0.2%	
13.13	12.78	13.59	0.81	6.3%		15.50	15.35	0.15	1.0%	
12.96	12.56	14.00	1.44	11.5%		15.87	15.76	0.11	0.7%	
13.12	12.48	14.21	1.73	13.9%		15.50	15.32	0.18	1.2%	
8.56	8.07	10.03	1.96	24.3%		9.55	9.77	0.22	2.3%	
10.86	11.94	13.26	2.40	22.1%		14.73	14.30	0.43	3.0%	
13.87	15.41	14.96	1.54	11.1%		16.75	16.76	0.01	0.1%	
11.52	12.45	12.16	0.93	8.1%		15.00	15.19	0.19	1.3%	
11.61	10.07	12.25	2.18	21.6%		12.73	12.03	0.70	5.8%	
11.07	10.85	12.19	1.34	12.4%		12.02	11.76	0.26	2.2%	
5.65	5.32	6.49	1.17	22.0%		13.53	13.15	0.38	2.9%	
9.90	8.21	10.37	2.16	26.3%		5.02	4.77	0.25	5.2%	
13.10	11.82	13.56	1.74	14.7%		8.46	7.89	0.57	7.2%	
13.31	14.58	14.87	1.56	11.7%		17.63	17.72	0.09	0.5%	
14.90	13.75	15.48	1.73	12.6%		16.88	16.33	0.55	3.4%	
14.13	15.27	15.13	1.14	8.1%		16.93	16.92	0.01	0.1%	
15.47	16.83	16.14	1.36	8.8%		19.11	18.85	0.26	1.4%	
17.52	16.07	18.01	1.94	12.1%		19.84	19.29	0.55	2.9%	
10.40	10.51	11.38	0.98	9.4%		12.95	12.76	0.19	1.5%	
			AVG	1.40	12.9%			AVG	0.26	2.1%

Figure 47 – Competitor Test Data (Sample Session II)

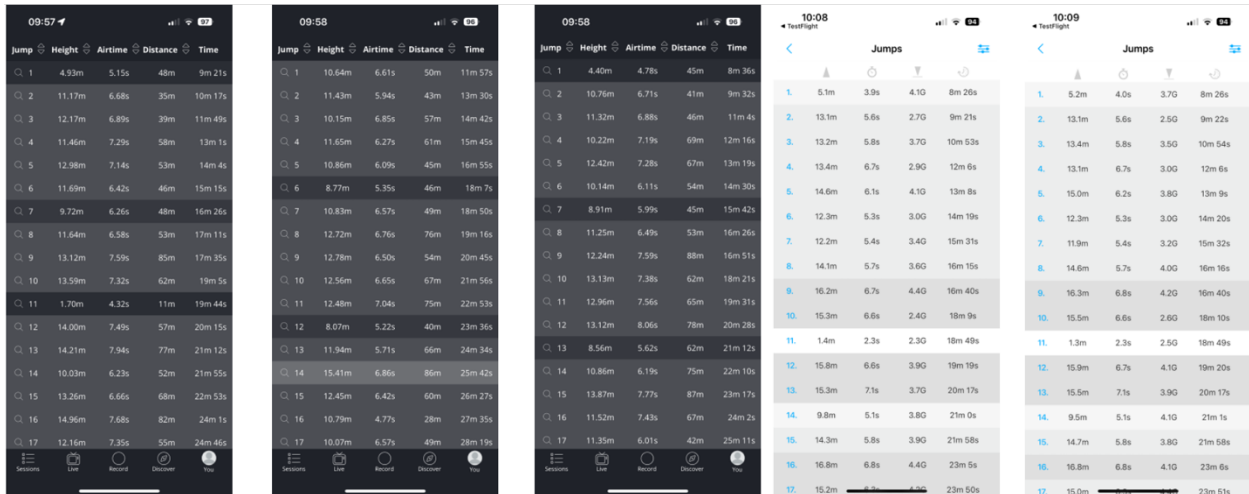


Figure 48 – Screenshots of Sample Session II

8 APPENDIX B - LIST OF MEASUREMENT DEVICES

8.1 LIST OF WOO DEVICES

Model	Developer	Release date
WOO 1.0	WOO Sports	2015/01
WOO 2.0	WOO Sports	2016/06
WOO 3.0	WOO Sports	2018/04
WOO 4.0	WOO Sports	2023/08

8.2 LIST OF DEVICES FOR PHONE / WATCH SOLUTIONS

8.2.1 ANDROID SMARTPHONES

Model	Developer	Release date	Android version at release
Amazon Fire Phone	Amazon	2014/07	Android 4.2.2 Jelly Bean
Arirang (original)	Arirang (smartphone)	2013/08	Android 4.0.4 Ice Cream Sandwich
Arirang 171	Arirang (smartphone)	2018/04	Android 7.1.1 Nougat
Asus PadFone	Asus	2012/06	Android 4.0 Ice Cream Sandwich
Asus PadFone 2	Asus	2012/10	Android 4.0 Ice Cream Sandwich
Asus PadFone Infinity	Asus	2013/04	Android 4.1 "Jelly Bean"
Asus PadFone Infinity 2	Asus	2013/10	Android 4.1 Jelly Bean
Asus PadFone mini	Asus	2013/12	Android 4.1 Jelly Bean
Asus PadFone E	Asus	2014/01	Android 4.1 Jelly Bean
Asus PadFone Infinity Lite	Asus	2014/02	Android 4.1 Jelly Bean
Asus ZenFone 5 (2014)	Asus	2014/04	Android 4.1 Jelly Bean
Asus ZenFone 4 (2014)	Asus	2014/05	Android 4.1 Jelly Bean
Asus ZenFone 6 (2014)	Asus	2014/05	Android 4.1 Jelly Bean
Asus PadFone S/X	Asus	2014/06	Android 4.4 "KitKat"

Asus ZenFone 4.5 (2014)	Asus	2014/07	Android 4.4 KitKat
Asus ZenFone 5 (2014)	Asus	2014/07	Android 4.4 KitKat
Asus PadFone X mini	Asus	2014/10	Android 4.4 KitKat
Asus Pegasus (X002)	Asus	2014/12	Android 4.4 KitKat
Asus ZenFone 5 (2015)	Asus	2015/01	Android 4.1 Jelly Bean
Asus ZenFone 2	Asus	2015/03	Android 5.0 "Lollipop"
Asus ZenFone 3	Asus	2016/08	Android 6.0 "Marshmallow"
Asus ZenFone 4	Asus	2017/10	Android 7.0 "Nougat"
Asus ZenFone Max Plus M1	Asus	2017/11	Android 7.0 Nougat
Asus ZenFone Max M1	Asus	2018/05	Android 8.0 "Oreo"
Asus ZenFone Max Pro M1	Asus	2018/05	Android 8.0 Oreo
Asus ZenFone 5	Asus	2018/05	Android 8.0 Oreo
Asus ZenFone Live L1	Asus	2018/05	Android 8.0 Oreo
Asus ROG Phone	Asus	2018/10	Android 8.0 Oreo
Asus ZenFone Lite L1	Asus	2018/10	Android 8.0 Oreo
Asus ZenFone Max M2	Asus	2018/12	Android 9 "Pie"
Asus ZenFone Max Pro M2	Asus	2018/12	Android Pie
Asus ZenFone Max Shot	Asus	2019/03	Android 8.0 Oreo
Asus ZenFone Max Plus M2	Asus	2019/03	Android 8.0 Oreo
Asus ZenFone Live L2	Asus	2019/05	Android 8.0 Oreo
Asus ZenFone 6	Asus	2019/05	Android Pie
Asus ROG Phone II	Asus	2019/09	Android Pie
Asus ROG Phone 3/Strix	Asus	2020/08	Android 10
Asus ZenFone 7	Asus	2020/09	Android 10
Asus ROG Phone 5/Pro/Ultimate	Asus	2021/03	Android 11
Asus ZenFone 8/Flip	Asus	2021/05	Android 11
Asus Smartphone for Snapdragon Insiders	Asus	2021/08	Android 11
Asus ROG Phone 5s/Pro	Asus	2021/08	Android 11

Asus ROG Phone 6/Pro	Asus	2022/07	Android 12
Asus ZenFone 9	Asus	2022/09	Android 12
Asus ROG Phone 6D/Ultimate	Asus	2022/10	Android 12
Asus ROG Phone 7/Ultimate	Asus	2023/04	Android 13
Asus ZenFone 10	Asus	2023/07	Android 13
Asus ROG Phone 8 Pro/Pro Edition	Asus	2024/01	Android 14
B[edit]			
Model	Developer	Release date	Android version at release
Balmuda Phone	Balmuda	2021/11	Android 11 Red Velvet Cake
BlackBerry Priv	BlackBerry Limited	2015/11	Android 5.0 Lollipop
BlackBerry DTEK50	BlackBerry Limited	2016/08	Android 6.0 Marshmallow
BlackBerry DTEK60	BlackBerry Limited	2016/10	Android 6.0 Marshmallow
BlackBerry Aurora	BlackBerry Mobile	2017/03	Android 7.0 Nougat
BlackBerry KeyOne	BlackBerry Mobile	2017/04	Android 7.0 Nougat
BlackBerry Motion	BlackBerry Mobile	2017/12	Android 7.0 Nougat
BlackBerry Key2	BlackBerry Mobile	2018/06	Android 8.0 Oreo
BlackBerry Evolve/X	BlackBerry Mobile	2018/08	Android 8.0 Oreo
BlackBerry Key2 LE	BlackBerry Mobile	2018/10	Android 8.0 Oreo
BoringPhone	BoringPhone	2019	Android 9.0 Pie
C[edit]			
Model	Developer	Release date	Android version at release
CAT S22 Flip	CAT	2021/11	Android Red Velvet Cake Go
CAT S62 Pro	CAT	2020/09	Android Queen Cake
Cherry Mobile Flare S8 Deluxe	Cherry Mobile	2019/07	Android Pie
Cherry Mobile Flare S8 Pro	Cherry Mobile	2019/07	Android Pie
Cherry Mobile Flare S8 Plus	Cherry Mobile	2019/07	Android Pie
Cherry Mobile Flare S8 Lite	Cherry Mobile	2019/07	Android Pie

Casio G'zOne Commando	NEC, Casio and Hitachi	2011/04	Android 2.2.1 "Froyo"
D[edit]			
Model	Developer	Release date	Android version at release
Dior Phone Touch/Dior Revires	Dior	2011	Unknown Android Version
E[edit]			
Model	Developer	Release date	Android version at release
Essential PH-1	Essential Products	2017/08	Android 7.0 Nougat
Eye	ESTI	Unreleased	Android 7.1 Nougat
F[edit]			
Model	Developer	Release date	Android version at release
Fairphone 1	FairPhone	2013/04	Android 4.2 Jelly Bean
Fairphone 2	FairPhone	2015/12	Android 5 Lollipop
Fairphone 3	FairPhone	2019/09	Android 9 Pie
Fairphone 3+	FairPhone	2020/08	Android 10
Fairphone 4	FairPhone	2021/10	Android 11
Fairphone 5	FairPhone	2023/08	Android 13
Freedom Phone	Freedom Phone	2021/07	Android 10
G[edit]			
Model	Developer	Release date	Android version at release
Geeksphone One	Geeksphone	2010	Android 1.6 Donut
Blackphone	Geeksphone & Silent Circle	2014/06	Android 4.4.2 KitKat
Garmin Nüvifone A10	Garmin	2010/07	Android 1.6 Donut
Garmin Nüvifone A50/Garminfone	Garmin	2010/06	Android 1.6 Donut
Geeksphone Revolution	Geeksphone	2014/01	Android 4.2.2 Jelly Bean
Goophone X	Goophone	2017/09	Android 5.0 Lollipop
Goophone i5C	Goophone	2013/08	Android 4.2 Jelly Bean
Goophone i5S	Goophone	2013/03	Android 4.2 Jelly Bean
Goophone i6	Goophone	2014/07	Android 4.2.2 Jelly Bean
Goophone i5	Goophone	2012/08	Android 4.0 Ice Cream Sandwich (w/ iOS 6 skin)

Goophone 12 Pro	Goophone	2020/09	Android 10
H[edit]			
Model	Developer	Release date	Android version at release
HTC Dream	HTC	2008/09	Android 1.0
HTC Magic	HTC	2009/05	Android 1.6 Donut
HTC Hero	HTC	2009/07	Android 1.5 Cupcake
HTC Tattoo	HTC	2009/09	Android 1.6 Donut
HTC Desire	HTC	2010/02	Android 2.0 Eclair
HTC Legend	HTC	2010/03	Android 2.0 Eclair
HTC Droid Incredible	HTC	2010/04	Android 2.0 Eclair
HTC Wildfire	HTC	2010/05	Android 2.0 Eclair
HTC Aria	HTC	2010/06	Android 2.0 Eclair
HTC Evo 4G	HTC	2010/06	Android 2.0 Eclair
HTC Evo 4G+	HTC	2010/06	Android 2.0 Eclair
HTC Desire HD	HTC	2010/10	Android 2.2 "Froyo"
HTC Desire Z	HTC	2010/11	Android 2.2 Froyo
HTC Gratia	HTC	2010/11	Android 2.2 Froyo
HTC Evo Shift 4G	HTC	2011/01	Android 2.2 Froyo
HTC Inspire 4G	HTC	2011/02	Android 2.2 Froyo
HTC Incredible S	HTC	2011/02	Android 2.2 Froyo
HTC ThunderBolt	HTC	2011/03	Android 2.2 Froyo
HTC Desire S	HTC	2011/03	Android 2.3 "Gingerbread"
HTC Merge	HTC	2011/04	Android 2.2 Froyo
HTC Sensation	HTC	2011/05	Android 2.3 Gingerbread
HTC Wildfire S	HTC	2011/05	Android 2.3 Gingerbread
HTC ChaCha	HTC	2011/06	Android 2.3 Gingerbread
HTC Salsa	HTC	2011/06	Android 2.3 Gingerbread
HTC Evo 3D	HTC	2011/07	Android 2.3 Gingerbread
HTC Amaze 4G	HTC	2011/10	Android 2.3 Gingerbread
HTC Explorer	HTC	2011/10	Android 2.3 Gingerbread
HTC Sensation XE	HTC	2011/10	Android 2.3 Gingerbread

HTC Rhyme	HTC	2011/10	Android 2.3 Gingerbread
HTC Raider 4G	HTC	2011/10	Android 2.3 Gingerbread
HTC Evo Design 4G	HTC	2011/10	Android 2.3 Gingerbread
HTC Sensation XL	HTC	2011/11	Android 2.3 Gingerbread
HTC Rezound	HTC	2011/11	Android 2.3 Gingerbread
HTC One S	HTC	2012/04	Android 4.0 Ice Cream Sandwich
HTC One V	HTC	2012/04	Android 4.0 Ice Cream Sandwich
HTC One X/XL	HTC	2012/05	Android 4.0 Ice Cream Sandwich
HTC Evo 4G LTE	HTC	2012/05	Android 4.0 Ice Cream Sandwich
HTC One S C2	HTC	2012/06	Android 4.0 Ice Cream Sandwich
HTC Desire C	HTC	2012/06	Android 4.0 Ice Cream Sandwich
HTC Desire V	HTC	2012/06	Android 4.0 Ice Cream Sandwich
HTC Droid Incredible 4G LTE	HTC	2012/07	Android 4.0 Ice Cream Sandwich
HTC Desire VC	HTC	2012/07	Android 4.0 Ice Cream Sandwich
HTC Desire XC	HTC	2012/07	Android 4.0 Ice Cream Sandwich
HTC One XC	HTC	2012/08	Android 4.0 Ice Cream Sandwich
HTC J	HTC	2012/08	Android 4.0 Ice Cream Sandwich
HTC Desire VT	HTC	2012/08	Android 4.0 Ice Cream Sandwich
HTC Desire X	HTC	2012/10	Android 4.0 Ice Cream Sandwich
HTC One VX	HTC	2012/10	Android 4.0 Ice Cream Sandwich
HTC One X+	HTC	2012/11	Android 4.1 Jelly Bean
HTC Desire SV	HTC	2012/11	Android 4.0 Ice Cream Sandwich
HTC Desire 400	HTC	2012/12	Android 4.1 Jelly Bean
HTC One SV	HTC	2013/01	Android 4.0 Ice Cream Sandwich
HTC Butterfly	HTC	2013/01	Android 4.1 Jelly Bean
HTC One (M7)	HTC	2013/03	Android 4.1 Jelly Bean
HTC First	HTC	2013/04	Android 4.1 Jelly Bean
HTC Desire L/P/Q	HTC	2013/04	Android 4.1 Jelly Bean
HTC Desire U	HTC	2013/06	Android 4.0 Ice Cream Sandwich
HTC Desire 600	HTC	2013/06	Android 4.1 Jelly Bean
HTC Desire 200	HTC	2013/07	Android 4.0 Ice Cream Sandwich

HTC Butterfly S	HTC	2013/07	Android 4.1 Jelly Bean
HTC One Mini	HTC	2013/08	Android 4.1 Jelly Bean
HTC Desire 500	HTC	2013/09	Android 4.1 Jelly Bean
HTC One Max	HTC	2013/10	Android 4.1 Jelly Bean
HTC Desire 601	HTC	2013/10	Android 4.1 Jelly Bean
HTC Desire 300	HTC	2013/12	Android 4.1 Jelly Bean
HTC Desire 601 dual sim	HTC	2013/12	Android 4.1 Jelly Bean
HTC Desire 700	HTC	2014/01	Android 4.1 Jelly Bean
HTC Desire 501	HTC	2014/02	Android 4.1 Jelly Bean
HTC Desire 816	HTC	2014/03	Android 4.4 KitKat
HTC One (M8)	HTC	2014/03	Android 4.4 KitKat
HTC Desire 310	HTC	2014/04	Android 4.1 Jelly Bean
HTC Desire 610	HTC	2014/03	Android 4.4 KitKat
HTC Desire 816 dual sim	HTC	2014/05	Android 4.4 KitKat
HTC One Mini 2	HTC	2014/05	Android 4.4 KitKat
HTC Desire 210	HTC	2014/06	Android 4.1 Jelly Bean
HTC Desire 616	HTC	2014/06	Android 4.1 Jelly Bean
HTC One (E8)	HTC	2014/06	Android 4.4 KitKat
HTC Desire 516	HTC	2014/06	Android 4.1 Jelly Bean
HTC One Remix	HTC	2014/07	Android 4.4 KitKat
HTC Butterfly 2	HTC	2014/09	Android 4.4 KitKat
HTC Desire 510	HTC	2014/09	Android 4.4 KitKat
HTC Desire 820q	HTC	2014/10	Android 4.4 KitKat
HTC Desire 612	HTC	2014/10	Android 4.4 KitKat
HTC One (M8 Eye)	HTC	2014/10	Android 4.4 KitKat
HTC Desire 816G	HTC	2014/10	Android 4.4 KitKat
HTC Desire 820	HTC	2014/11	Android 4.4 KitKat
HTC Desire Eye	HTC	2014/11	Android 4.4 KitKat
HTC Desire 620/G	HTC	2014/12	Android 4.4 KitKat
HTC Desire 320	HTC	2015/01	Android 4.4 KitKat
HTC Desire 526G+	HTC	2015/01	Android 4.4 KitKat

HTC Desire 826	HTC	2015/03	Android 5.0 Lollipop
HTC Desire 626	HTC	2015/03	Android 4.4 KitKat
HTC Desire 820s	HTC	2015/03	Android 4.4 KitKat
HTC Desire 626G+	HTC	2015/04	Android 4.4 KitKat
HTC One M9	HTC	2015/03	Android 5.0 Lollipop
HTC One E9/+	HTC	2015/05	Android 5.0 Lollipop
HTC One M8s	HTC	2015/05	Android 5.0 Lollipop
HTC One M9+	HTC	2015/05	Android 5.0 Lollipop
HTC Desire 326G	HTC	2015/06	Android 4.4 KitKat
HTC Desire 820G+	HTC	2015/06	Android 4.4 KitKat
HTC One ME	HTC	2015/07	Android 5.0 Lollipop
HTC Desire 626s	HTC	2015/07	Android 5.0 Lollipop
HTC Desire 526	HTC	2015/08	Android 5.0 Lollipop
HTC Desire 626 (USA)	HTC	2015/08	Android 5.0 Lollipop
HTC One M9+ Supreme Camera Edition	HTC	2015/10	Android 5.0 Lollipop
HTC Butterfly 3	HTC	2015/10	Android 5.0 Lollipop
HTC One E9s	HTC	2015/10	Android 5.0 Lollipop
HTC One A9	HTC	2015/10	Android 6.0 Marshmallow
HTC Desire 520	HTC	2015/11	Android 5.0 Lollipop
HTC Desire 728	HTC	2015/11	Android 5.0 Lollipop
HTC Desire 828	HTC	2015/11	Android 5.0 Lollipop
HTC One M9s	HTC	2015/11	Android 5.0 Lollipop
HTC One X9	HTC	2016/01	Android 6.0 Marshmallow
HTC Desire 530	HTC	2016/03	Android 6.0 Marshmallow
HTC Desire 825	HTC	2016/04	Android 6.0 Marshmallow
HTC 10	HTC	2016/04	Android 6.0 Marshmallow
HTC Desire 830	HTC	2016/05	Android 6.0 Marshmallow
HTC One M9 Prime Camera	HTC	2016/05	Android 5.0 Lollipop
HTC Desire 630	HTC	2016/06	Android 6.0 Marshmallow
HTC 10 Lifestyle	HTC	2016/06	Android 6.0 Marshmallow

HTC One S9	HTC	2016/06	Android 6.0 Marshmallow
HTC Desire 628	HTC	2016/06	Android 5.0 Lollipop
HTC Desire 625	HTC	2016/08	Android 5.0 Lollipop
HTC Desire 10 Lifestyle	HTC	2016/09	Android 6.0 Marshmallow
HTC Desire 728 Ultra	HTC	2016/12	Android 6.0 Marshmallow
HTC One A9s	HTC	2016/11	Android 6.0 Marshmallow
HTC 10 evo	HTC	2016/11	Android 6.0 Marshmallow
HTC Desire 10 Pro	HTC	2016/12	Android 6.0 Marshmallow
HTC Desire 650	HTC	2016/12	Android 6.0 Marshmallow
HTC U Play	HTC	2017/02	Android 6.0 Marshmallow
HTC U Ultra	HTC	2017/02	Android 7.0 Nougat
HTC U11	HTC	2017/06	Android 7.0 Nougat
HTC One X10	HTC	2017/07	Android 6.0 Marshmallow
HTC U11+/Life	HTC	2017/11	Android 8.0 Oreo
HTC U11 EYEs	HTC	2018/01	Android 8.0 Oreo
HTC U12+	HTC	2018/06	Android 8.0 Oreo
HTC U12 life	HTC	2018/08	Android 8.0 Oreo
HTC Desire 12/12+	HTC	2018/09	Android 8.0 Oreo
HTC Exodus 1	HTC	2018/12	Android 8.0 Oreo
HTC Desire 12s	HTC	2018/12	Android 8.0 Oreo
HTC Desire 19+	HTC	2019/06	Android Pie
HTC U19e	HTC	2019/06	Android Pie
HTC Wildfire X	HTC	2019/08	Android Pie
HTC Exodus 1s	HTC	2019/10	Android 8.0 Oreo
HTC Desire 19s	HTC	2019/11	Android Pie
HTC Wildfire R70	HTC	2020/02	Android Pie
HTC Desire 20 Pro	HTC	2020/06	Android 10
HTC Wildfire E2	HTC	2020/08	Android 10
HTC U20 5G	HTC	2020/10	Android 10
HTC Desire 20+	HTC	2020/10	Android 10
HTC Desire 21 Pro 5G	HTC	2021/01	Android 10

HTC Wildfire E3	HTC	2021/05	Android 10
HTC Wildfire E2 Plus	HTC	2021/12	Android 11
HTC Desire 22 Pro	HTC	2022/07	Android 12
HTC Wildfire E Plus	HTC	2022/10	Android 12
HTC/Google Sooner	HTC/Google	Unreleased (2007 prototypes)	Android htc-2065.0.8.0.0 build (oldest known build seen on the device)
Honor U8860	Huawei	2011/09	Android 2.3 Gingerbread
Honor 2	Huawei	2012/10	Android 4.0 Ice Cream Sandwich
Honor 3	Huawei	2013/08	Android 4.1 Jelly Bean
Honor 3C	Huawei	2013/12	Android 4.1 Jelly Bean
Honor 3X	Huawei	2013/12	Android 4.4 KitKat
Honor 3X Pro	Huawei	2014/05	Android 4.1 Jelly Bean
Honor 3C 4G	Huawei	2014/06	Android 4.4 KitKat
Honor 6	Huawei	2014/08	Android 4.4 KitKat
Honor 3C Play	Huawei	2014/09	Android 4.1 Jelly Bean
Honor 4 Play	Huawei	2014/09	Android 4.4 KitKat
Honor Holly	Huawei	2014/10	Android 4.4 KitKat
Honor 4X	Huawei	2014/10	Android 4.4 KitKat
Honor 6 Plus	Huawei	2014/12	Android 4.4 KitKat
Honor 4C	Huawei	2015/04	Android 4.4 KitKat
Honor Bee	Huawei	2015/05	Android 4.4 KitKat
Honor 7	Huawei	2015/07	Android 5.0 Lollipop
Honor 7i	Huawei	2015/08	Android 5.0 Lollipop
Honor 5X	Huawei	2015/11	Android 5.0 Lollipop
Honor Holly 2 Plus	Huawei	2016/01	Android 5.0 Lollipop
Honor 5c	Huawei	2016/04	Android 6.0 Marshmallow
Honor V8	Huawei	2016/05	Android 6.0 Marshmallow
Honor 5A	Huawei	2016/06	Android 5.0 Lollipop
Honor 8	Huawei	2016/07	Android 6.0 Marshmallow
Honor Note 8	Huawei	2016/08	Android 6.0 Marshmallow
Honor Holly 3	Huawei	2016/07	Android 6.0 Marshmallow

Honor 6X	Huawei	2016/10	Android 6.0 Marshmallow
Honor Magic	Huawei	2016/12	Android 6.0 Marshmallow
Honor 8 Pro	Huawei	2017/04	Android 7.0 Nougat
Honor 6A	Huawei	2017/05	Android 7.0 Nougat
Honor 9	Huawei	2017/07	Android 7.0 Nougat
Honor 6C Pro	Huawei	2017/10	Android 7.0 Nougat
Honor 7X	Huawei	2017/12	Android 7.0 Nougat
Honor V10	Huawei	2017/12	Android 8.0 Oreo
Honor 9 Lite	Huawei	2017/12	Android 8.0 Oreo
Honor 7A	Huawei	2018/04	Android 8.0 Oreo
Honor 7C	Huawei	2018/05	Android 8.0 Oreo
Honor 10	Huawei	2018/05	Android 8.0 Oreo
Honor 7S	Huawei	2018/05	Android 8.0 Oreo
Honor 9N	Huawei	2018/07	Android 8.0 Oreo
Honor Play	Huawei	2018/08	Android 8.0 Oreo
Honor Note 10	Huawei	2018/08	Android 8.0 Oreo
Honor 8X/Max	Huawei	2018/09	Android 8.0 Oreo
Honor 8C	Huawei	2018/10	Android 8.0 Oreo
Honor Magic 2/3D	Huawei	2018/08	Android 9 Pie
Honor 10 Lite	Huawei	2018/11	Android 9 Pie
Honor V20	Huawei	2018/12	Android 9 Pie
Honor Play 8A	Huawei	2019/01	Android 9 Pie
Honor 8A Pro	Huawei	2019/04	Android 9 Pie
Honor 20 lite	Huawei	2019/05	Android 9 Pie
Honor 20i	Huawei	2019/05	Android 9 Pie
Honor 20	Huawei	2019/06	Android 9 Pie
Honor 20 Pro	Huawei	2019/07	Android 9 Pie
Honor 9X (China)	Huawei	2019/07	Android 9 Pie
Honor 9X Pro	Huawei	2019/07	Android 9 Pie
Honor Play 3/3e	Huawei	2019/09	Android 9 Pie
Honor 20S	Huawei	2019/09	Android 9 Pie

Honor 20 lite (China)	Huawei	2019/10	Android 9 Pie
Honor 9X	Huawei	2019/10	Android 9 Pie
Honor V30/30 Pro	Huawei	2019/11	Android 10
Honor 8A Prime	Huawei	2020/03	Android 10
Honor Play 9A	Huawei	2020/03	Android 10
Honor 30S	Huawei	2020/03	Android 10
Honor Play 4T/Pro	Huawei	2020/04	Android 10
Honor 8A 2020	Huawei	2020/04	Android 10
Honor 20e	Huawei	2020/04	Android 10
Honor 30/Pro/Pro+	Huawei	2020/04	Android 10
Honor 9X Lite	Huawei	2020/04	Android 10
Honor 9C/9S/9A	Huawei	2020/04	Android 10
Honor X10	Huawei	2020/05	Android 10
Honor 8S 2020	Huawei	2020/05	Android 10
Honor Play4/Pro	Huawei	2020/06	Android 10
Honor 30 Lite	Huawei	2020/07	Android 10
Honor X10 Max	Huawei	2020/07	Android 10
Honor 30i	Huawei	2020/09	Android 10
Honor 10X Lite	Huawei	2020/10	Android 10
Honor V40	Honor	2021/01	Android 10
Honor V40 Lite	Honor	2021/03	Android 10
Honor Play 5T Youth	Honor	2021/04	Android 10
Honor Play 20	Honor	2021/05	Android 10
Honor Play 5	Honor	2021/05	Android 10
Honor 50/Pro	Honor	2021/06	Android 11
Honor 50 SE	Honor	2021/07	Android 11
Honor X20 SE	Honor	2021/07	Android 11
Honor Play 5T Pro	Honor	2021/08	Android 11
Honor Magic3/Pro/Pro+	Honor	2021/08	Android 11
Honor X20	Honor	2021/08	Android 11
Honor Play 5 Youth	Honor	2021/11	Android 11

Honor 50 Lite	Honor	2021/11	Android 11
Honor X30 Max/X30i	Honor	2021/08	Android 11
Honor 60/Pro	Honor	2021/12	Android 11
Honor X30	Honor	2021/12	Android 11
Honor Play 30 Plus	Honor	2022/01	Android 11
Huawei U8230	Huawei	2010/03	Android 2.0 Eclair
Huawei U8100	Huawei	2010/07	Android 2.0 Eclair
Huawei IDEOS	Huawei	2010/09	Android 2.2 Froyo
Huawei IDEOS X5	Huawei	2011/04	Android 2.2 Froyo
Huawei Sonic	Huawei	2011/07	Android 2.3 Gingerbread
Huawei Ascend P1	Huawei	2012/07	Android 4.0 Ice Cream Sandwich
Huawei STREAM X GL07S	Huawei	2013/02	Android 4.1 Jelly Bean
Huawei Ascend Mate	Huawei	2013/03	Android 4.1 Jelly Bean
Huawei Ascend P2	Huawei	2013/04	Android 4.1 Jelly Bean
Huawei Ascend P6	Huawei	2013/06	Android 4.1 Jelly Bean
Huawei Ascend Mate 2 4G	Huawei	2014/01	Android 4.1 Jelly Bean
Huawei Ascend P7	Huawei	2014/06	Android 4.4 KitKat
Huawei Enjoy 7 Plus	Huawei	2011/09	Android 7.0 Nougat
Huawei Ascend Mate 7	Huawei	2014/10	Android 4.4 KitKat
Huawei P8	Huawei	2015/04	Android 4.4 KitKat
Huawei Mate S	Huawei	2015/10	Android 5.0 Lollipop
Huawei Mate 8	Huawei	2015/11	Android 6.0 Marshmallow
Huawei P9	Huawei	2016/04	Android 6.0 Marshmallow
Huawei Nova/Plus	Huawei	2016/10	Android 6.0 Marshmallow
Huawei Mate 9	Huawei	2016/12	Android 7.0 Nougat
Huawei P10	Huawei	2017/02	Android 7.0 Nougat
Huawei Nova 2/Plus	Huawei	2017/06	Android 7.0 Nougat
Huawei Mate 10 Lite	Huawei	2017/11	Android 7.0 Nougat
Huawei Mate 10	Huawei	2017/11	Android 8.0 Oreo
Huawei P20	Huawei	2018/03	Android 8.0 Oreo

Huawei Nova 3i/P Smart+	Huawei	2018/07	Android 8.0 Oreo
Huawei Nova 3	Huawei	2018/08	Android 8.0 Oreo
Huawei Mate 20	Huawei	2018/11	Android 9 Pie
Huawei Nova 4	Huawei	2018/12	Android 9 Pie
Huawei Nova 4e	Huawei	2019/03	Android 9 Pie
Huawei P30	Huawei	2019/03	Android 9 Pie
Huawei P30 lite	Huawei	2019/04	Android 9 Pie
Huawei Nova 5/5i/Pro	Huawei	2019/06	Android 9 Pie
Huawei Nova 5i Pro	Huawei	2019/07	Android 9 Pie
Huawei Nova 5T	Huawei	2019/09	Android 9 Pie
Huawei Mate 30	Huawei	2019/09	Android 10
Huawei Nova 5z	Huawei	2019/11	Android 9 Pie
Huawei Nova 6/5G/SE	Huawei	2019/12	Android 10
Huawei Y7p	Huawei	2020/02	Android 9 Pie
Huawei Nova 7i	Huawei	2020/02	Android 9 Pie
Huawei P40 lite	Huawei	2020/03	Android 10
Huawei P40 lite E	Huawei	2020/03	Android 9 Pie
Huawei P40	Huawei	2020/04	Android 10
Huawei Nova 7/Pro/SE	Huawei	2020/04	Android 10
Huawei P40 lite 5G	Huawei	2020/05	Android 10
Huawei Nova 7 SE 5G Youth	Huawei	2020/10	Android 10
Huawei Mate 40	Huawei	2020/11	Android 10
Huawei Nova 8 SE	Huawei	2020/11	Android 10
Huawei Nova 8 5G/Pro	Huawei	2020/12	Android 10
Huawei Mate X2	Huawei	2021/02	Android 10
Huawei Nova 8 Pro 4G	Huawei	2021/05	Android 10
Huawei Nova 8i	Huawei	2021/07	Android 10
Huawei Nova 8 SE Youth	Huawei	2021/08	Android 10
Huawei P50/Pro	Huawei	2021/08	Android 11
Huawei Enjoy 20e	Huawei	2021/08	Android 10
Huawei Nova 9	Huawei	2021/09	Android 11

Huawei Nova Y60	Huawei	2021/09	Android 10
Huawei P50 Pocket	Huawei	2021/12	Android 11
Huawei Nova 9 SE	Huawei	2022/03	Android 11
Huawei Nova 9 SE 5G	Huawei	2022/04	Android 11
Huawei Nova Y70/Plus	Huawei	2022/05	Android 11
Huawei Nova Y90	Huawei	2022/07	Android 11
Huawei Mate Xs 2	Huawei	2022/07	Android 11
Huawei Nova 10	Huawei	2022/07	Android 11
Huawei Mate 50/Pro/RS	Huawei	2022/09	Android 12
Huawei Nova 10 SE	Huawei	2022/10	Android 11
Huawei Nova Y61	Huawei	2022/11	Android 11
I[edit]			
Model	Developer	Release date	Android version at release
Intel AZ210	Intel	2012/04	Android 2.3 "Gingerbread"
iQoo Z6 Lite 5G	iQoo	2022/10	Android 12
J[edit]			
Model	Developer	Release date	Android version at release
Jupiter IO 3	Vaporcade	2016/01	Android 4.4 "KitKat"
K[edit]			
Model	Developer	Release date	Android version at release
Kodak Ektra (phone)	Kodak	2017/07	Android 6.0 "Marshmallow"
Karbonn a15	Karbonn	2012/12	Android 4.0 Ice Cream Sandwich
L[edit]			
Model	Developer	Release date	Android version at release
Leitz Phone 1	Leica	2021/07	Android 11
Leitz Phone 2	Leica	2022/11	Android 12
Lenovo P780	Lenovo	2013/06	Android 4.1 Jelly Bean
Lenovo Vibe Z	Lenovo	2013/11	Android 4.1 Jelly Bean
Lenovo A526	Lenovo	2014/06	Android 4.1 Jelly Bean
Lenovo Vibe Z2 Pro	Lenovo	2014/08	Android 4.4 KitKat
Lenovo Vibe Z2	Lenovo	2014/09	Android 4.4 KitKat

ZUK Z1	Lenovo	2015/08	Android 5.0 Lollipop
Lenovo Vibe P1	Lenovo	2015/09	Android 5.0 Lollipop
Lenovo Vibe K4 Note	Lenovo	2016/01	Android 5.0 Lollipop
Lenovo K5 Note	Lenovo	2016/01	Android 5.0 Lollipop
Lenovo Vibe P1 Turbo	Lenovo	2016/02	Android 5.0 Lollipop
Lenovo Vibe K5/Plus	Lenovo	2016/02	Android 5.0 Lollipop
ZUK Z2	Lenovo	2016/05	Android 6.0 Marshmallow
Lenovo Phab 2/Plus/Pro	Lenovo	2016/06	Android 6.0 Marshmallow
Lenovo K6/Power/Note	Lenovo	2016/09	Android 6.0 Marshmallow
Lenovo P2	Lenovo	2016/09	Android 6.0 Marshmallow
Lenovo Z2 Plus	Lenovo	2017/01	Android 6.0 Marshmallow
Lenovo Legion Pro	Lenovo	2020/07	Android 10
Lenovo Legion Duel	Lenovo	2020/10	Android 10
Lenovo Legion 2 Pro	Lenovo	2021/04	Android 11
Lenovo Legion Duel 2	Lenovo	2021/05	Android 11
Lenovo Legion Y90	Lenovo	2022/03	Android 12
Lenovo Legion Y70	Lenovo	2022/08	Android 12
LG GW620	LG Electronics	2009/11	Android 1.5 "Cupcake"
LG Optimus Q	LG Electronics	2010/05	Android 2.0 Eclair
LG Optimus	LG Electronics	2010/06	Android 1.6 "Donut"
LG Optimus One	LG Electronics	2010/10	Android 2.2 Froyo
LG Optimus Chic	LG Electronics	2010/11	Android 2.2 Froyo
LG Optimus 2X	LG Electronics	2011/02	Android 2.2 Froyo
LG Optimus Black	LG Electronics	2011/05	Android 2.2 Froyo
LG Optimus 3D	LG Electronics	2011/07	Android 2.2 Froyo
LG Optimus Slider	LG Electronics	2011/10	Android 2.3 Gingerbread
LG Optimus LTE (LU6200)	LG Electronics	2012/01	Android 2.3 Gingerbread
LG Optimus 4X HD	LG Electronics	2012/06	Android 4.0 Ice Cream Sandwich
LG Optimus LTE (SU640)	LG Electronics	2012/08	Android 2.3 Gingerbread
LG Optimus L9	LG Electronics	2012/11	Android 4.0 Ice Cream Sandwich
LG Optimus Vu	LG Electronics	2012/11	Android 4.0 Ice Cream Sandwich

LG Optimus G	LG Electronics	2013/01	Android 4.0 Ice Cream Sandwich
LG G2	LG Electronics	2013/09	Android 4.2.2 Jelly Bean
LG G Flex	LG Electronics	2013/11	Android 4.2.2 Jelly Bean
LG G Pro Lite	LG Electronics	2013/11	Android 4.1.2 Jelly Bean
LG Gx	LG Electronics	2014/01	Android 4.3 Jelly Bean
LG G2 Mini	LG Electronics	2014/04	Android 4.4 KitKat
LG G Pro 2	LG Electronics	2014/04	Android 4.4 KitKat
LG G3	LG Electronics	2014/05	Android 4.4 KitKat
LG G3 Stylus	LG Electronics	2014/10	Android 4.4 KitKat
LG G Flex 2	LG Electronics	2015/02	Android 5.0 Lollipop
LG G4	LG Electronics	2015/04	Android 5.1 Lollipop
LG V10	LG Electronics	2015/10	Android 5.1 Lollipop
LG K10	LG Electronics	2016/01	Android 5.1 Lollipop
LG G5	LG Electronics	2016/04	Android 6.0 Marshmallow
LG V20	LG Electronics	2016/10	Android 7.0 Nougat
LG K10 (2017)	LG Electronics	2017/02	Android 7.0 Nougat
LG G6	LG Electronics	2017/05	Android 7.0 Nougat
LG V30	LG Electronics	2017/10	Android 7.1 Nougat
LG G7 ThinQ	LG Electronics	2018/05	Android 8.0 Oreo
LG V35 ThinQ	LG Electronics	2018/06	Android 8.0 Oreo
LG K10 (2018)	LG Electronics	2018/06	Android 7.1.2 Nougat
LG V40 ThinQ	LG Electronics	2018/10	Android 8.1 Oreo
LG G8 ThinQ	LG Electronics	2019/04	Android Pie
LG V50 ThinQ	LG Electronics	2019/05	Android Pie
LG Stylo 5	LG Electronics	2019/06	Android Pie
LG W10/W30	LG Electronics	2019/07	Android Pie
LG W30 Pro	LG Electronics	2019/10	Android Pie
LG W10 Alpha	LG Electronics	2020/02	Android Pie
LG Q51	LG Electronics	2020/02	Android 10
LG V60 ThinQ	LG Electronics	2020/03	Android 10
LG Velvet	LG Electronics	2020/05	Android 10

LG Stylo 6	LG Electronics	2020/05	Android 10
LG Q61	LG Electronics	2020/05	Android 10
LG K31	LG Electronics	2020/08	Android 10
LG Q92 5G	LG Electronics	2020/08	Android 10
LG K22	LG Electronics	2020/09	Android 10
LG K42/K71	LG Electronics	2020/09	Android 10
LG Q31	LG Electronics	2020/09	Android 10
LG Wing	LG Electronics	2020/10	Android 10
LG Q52	LG Electronics	2020/10	Android 10
LG K52/K62	LG Electronics	2020/11	Android 10
LG K92 5G	LG Electronics	2020/11	Android 10
LG W31/+	LG Electronics	2020/12	Android 10
LG W41/+Pro	LG Electronics	2021/03	Android 10
M[edit]			
Model	Developer	Release date	Android version at release
Marshall London	Marshall Amplification	2015	Android 5.02 "Lollipop"
Meizu M9	Meizu	2011/01	Android 2.2 Froyo
Meizu MX	Meizu	2011/12	Android 2.3 Gingerbread
Meizu MX 4-core	Meizu	2012/06	Android 4.0 Ice Cream Sandwich
Meizu MX2	Meizu	2012/11	Android 4.1 Jelly Bean
Meizu MX3	Meizu	2013/09	Android 4.1 Jelly Bean
Meizu MX4	Meizu	2014/09	Android 4.4 KitKat
Meizu MX4 Pro	Meizu	2014/10	Android 4.4 KitKat
Meizu M1/1 Note	Meizu	2015/01	Android 4.4 KitKat
Meizu M2 Note	Meizu	2015/06	Android 5.0 Lollipop
Meizu MX5	Meizu	2015/06	Android 5.0 Lollipop
Meizu M2	Meizu	2015/07	Android 5.0 Lollipop
Meizu PRO 5	Meizu	2015/09	Android 5.0 Lollipop
Meizu M1 Metal	Meizu	2015/10	Android 5.0 Lollipop
Meizu MX5e	Meizu	2016/04	Android 6.0 Marshmallow
Meizu M3 Note	Meizu	2016/04	Android 5.0 Lollipop

Meizu PRO 6	Meizu	2016/04	Android 6.0 Marshmallow
Meizu M3	Meizu	2016/04	Android 5.0 Lollipop
Meizu M3s	Meizu	2016/06	Android 5.0 Lollipop
Meizu MX6	Meizu	2016/07	Android 6.0 Marshmallow
Meizu M3E	Meizu	2016/08	Android 5.0 Lollipop
Meizu U10/20	Meizu	2016/08	Android 6.0 Marshmallow
Meizu M3 Max	Meizu	2016/09	Android 6.0 Marshmallow
Meizu M5	Meizu	2016/10	Android 6.0 Marshmallow
Meizu PRO 6s	Meizu	2016/11	Android 6.0 Marshmallow
Meizu M3x	Meizu	2016/11	Android 6.0 Marshmallow
Meizu PRO 6 Plus	Meizu	2016/11	Android 6.0 Marshmallow
Meizu M5 Note	Meizu	2016/12	Android 6.0 Marshmallow
Meizu M5s	Meizu	2017/02	Android 6.0 Marshmallow
Meizu E2	Meizu	2017/04	Android 7.0 Nougat
Meizu M5c	Meizu	2017/05	Android 6.0 Marshmallow
Meizu PRO 7/Plus	Meizu	2017/07	Android 7.0 Nougat
Meizu M6 Note	Meizu	2017/08	Android 7.0 Nougat
Meizu M6	Meizu	2017/09	Android 7.0 Nougat
Meizu M6s	Meizu	2018/01	Android 7.0 Nougat
Meizu E3	Meizu	2018/03	Android 7.0 Nougat
Meizu 15/Pro/Lite	Meizu	2018/04	Android 7.0 Nougat
Meizu M8c	Meizu	2018/05	Android 7.0 Nougat
Meizu M6T	Meizu	2018/05	Android 7.0 Nougat
Meizu 16th/Plus	Meizu	2018/08	Android 8.0 Oreo
Meizu 16X	Meizu	2018/09	Android 8.0 Oreo
Meizu V8/Pro	Meizu	2018/09	Android 8.0 Oreo
Meizu X8	Meizu	2018/09	Android 8.0 Oreo
Meizu Note 8	Meizu	2018/10	Android 8.0 Oreo
Meizu C9/Pro	Meizu	2018/12	Android 8.0 Oreo
Meizu Note 9	Meizu	2019/03	Android 9 Pie
Meizu M10	Meizu	2019/09	Android 9 Pie

Meizu 16s	Meizu	2019/04	Android 9 Pie
Meizu 16Xs	Meizu	2019/05	Android 9 Pie
Meizu 16s Pro	Meizu	2019/08	Android 9 Pie
Meizu 16T	Meizu	2019/10	Android 9 Pie
Meizu 17/Pro	Meizu	2020/05	Android 10
Meizu 18/Pro	Meizu	2021/03	Android 11
Meizu 18s/Pro	Meizu	2021/09	Android 11
Meizu 18X	Meizu	2021/09	Android 11
Mode Phone MP1	Mode	2021	Android 10 Queen Cake
Motorola Cliq	Motorola	2009/10	Android 1.5 "Cupcake"
Motorola Droid	Motorola	2009/11	Android 2.0 Eclair
Motorola Backflip	Motorola	2010/03	Android 1.5 "Cupcake"
Motorola Flipout	Motorola	2010/06	Android 2.0 Eclair
Motorola Droid X	Motorola	2010/07	Android 2.0 Eclair
Motorola Charm	Motorola	2010/08	Android 2.0 Eclair
Motorola Droid 2	Motorola	2010/08	Android 2.2 Froyo
Motorola Defy	Motorola	2010/10	Android 2.0 Eclair
Motorola Droid Pro	Motorola	2010/11	Android 2.2 Froyo
Motorola Atrix 4G	Motorola Mobility	2011/02	Android 2.3 Gingerbread
Motorola Droid 3	Motorola Mobility	2011/07	Android 2.3 Gingerbread
Motorola Droid Bionic	Motorola Mobility	2011/09	Android 2.3 Gingerbread
Motorola Atrix 2	Motorola Mobility	2011/10	Android 2.3 Gingerbread
Motorola Droid Razr	Motorola Mobility	2011/11	Android 2.3 Gingerbread
Motorola Droid 4	Motorola Mobility	2012/02	Android 2.3 Gingerbread
Motorola Atrix HD	Motorola Mobility	2012/07	Android 4.0 Ice Cream Sandwich
Motorola Photon Q	Motorola Mobility	2012/08	Android 4.0 Ice Cream Sandwich
Motorola Droid Razr M	Motorola Mobility	2012/09	Android 4.0 Ice Cream Sandwich
Motorola Droid Razr HD	Motorola Mobility	2012/10	Android 4.0 Ice Cream Sandwich
Motorola Droid Maxx	Motorola Mobility	2013/08	Android 4.1 Jelly Bean
Motorola Droid Mini	Motorola Mobility	2013/08	Android 4.1 Jelly Bean
Moto X (1st generation)	Motorola Mobility	2013/08	Android 4.1 Jelly Bean

Moto G (1st generation)	Motorola Mobility	2013/11	Android 4.1 Jelly Bean
Moto E (1st generation)	Motorola Mobility	2014/05	Android 4.4 KitKat
Moto G (2nd generation)	Motorola Mobility	2014/09	Android 4.4 KitKat
Moto X (2nd generation)	Motorola Mobility	2014/09	Android 4.4 KitKat
Motorola Droid Turbo	Motorola Mobility	2014/10	Android 4.4 KitKat
Moto E (2nd generation)	Motorola Mobility	2015/02	Android 5.0 Lollipop
Moto G (3rd generation)	Motorola Mobility	2015/07	Android 5.0 Lollipop
Moto X Play	Motorola Mobility	2015/07	Android 5.0 Lollipop
Moto X Style	Motorola Mobility	2015/09	Android 5.1.1 Lollipop
Moto G4	Motorola Mobility	2016/05	Android 6.0 Marshmallow
Moto E3	Motorola Mobility	2016/07	Android 6.0 Marshmallow
Moto Z	Motorola Mobility	2016/09	Android 6.0 Marshmallow
Moto Z Play	Motorola Mobility	2016/09	Android 6.0 Marshmallow
Moto G5	Motorola Mobility	2017/03	Android 7.0 Nougat
Moto C	Motorola Mobility	2017/05	Android 7.0 Nougat
Moto E4	Motorola Mobility	2017/06	Android 7.0 Nougat
Moto Z2 Play	Motorola Mobility	2017/06	Android 7.0 Nougat
Moto Z2 Force	Motorola Mobility	2017/08	Android 7.0 Nougat
Moto X4	Motorola Mobility	2017/09	Android 7.0 Nougat
Moto E5	Motorola Mobility	2018/05	Android 8.0 Oreo
Moto G6	Motorola Mobility	2018/05	Android 8.0 Oreo
Moto Z3 Play	Motorola Mobility	2018/06	Android 8.0 Oreo
Moto Z3	Motorola Mobility	2018/08	Android 8.0 Oreo
Motorola One/One Power	Motorola Mobility	2018/10	Android 8.0 Oreo
Moto G7	Motorola Mobility	2019/03	Android 9 Pie
Motorola One Vision	Motorola Mobility	2019/06	Android 9 Pie
Moto Z4	Motorola Mobility	2019/06	Android 9 Pie
Motorola One Zoom	Motorola Mobility	2019/09	Android 9 Pie
Moto G8 Plus	Motorola Mobility	2019/10	Android 9 Pie
Motorola One Macro	Motorola Mobility	2019/10	Android 9 Pie
Motorola One Action	Motorola Mobility	2019/10	Android 9 Pie

Motorola Razr (4G)	Motorola Mobility	2019/11	Android 9 Pie
Motorola One Hyper	Motorola Mobility	2020/01	Android 10
Moto G8 Power	Motorola Mobility	2020/02	Android 10
Moto G Power/Stylus	Motorola Mobility	2020/02	Android 10
Moto G8	Motorola Mobility	2020/03	Android 10
Moto E6s (2020)	Motorola Mobility	2020/03	Android Pie
Moto G8 Power Lite	Motorola Mobility	2020/04	Android Pie
Motorola Edge/Edge+	Motorola Mobility	2020/05	Android 10
Moto G Pro	Motorola Mobility	2020/05	Android 10
Moto E (2020)	Motorola Mobility	2020/06	Android 10
Moto G Fast	Motorola Mobility	2020/06	Android 10
Motorola One Fusion+	Motorola Mobility	2020/06	Android 10
Motorola One Fusion	Motorola Mobility	2020/07	Android 10
Moto G 5G Plus	Motorola Mobility	2020/07	Android 10
Moto G9 Play	Motorola Mobility	2020/08	Android 10
Moto G9 Plus	Motorola Mobility	2020/09	Android 10
Moto E7 Plus	Motorola Mobility	2020/09	Android 10
Motorola Razr (5G)	Motorola Mobility	2020/09	Android 10
Moto G9 Power	Motorola Mobility	2020/12	Android 10
Moto G 5G	Motorola Mobility	2020/12	Android 10
Moto E7	Motorola Mobility	2020/12	Android 10
Moto G Play (2021)	Motorola Mobility	2021/01	Android 10
Moto G Power (2021)	Motorola Mobility	2021/01	Android 10
Moto G Stylus (2021)	Motorola Mobility	2021/01	Android 10
Moto E6i	Motorola Mobility	2021/02	Android 10
Moto E7 Power	Motorola Mobility	2021/02	Android 10
Moto G10	Motorola Mobility	2021/03	Android 11
Moto G30	Motorola Mobility	2021/03	Android 11
Moto G10 Power	Motorola Mobility	2021/03	Android 11
Moto G50	Motorola Mobility	2021/04	Android 11
Moto G100	Motorola Mobility	2021/04	Android 11

Moto G60	Motorola Mobility	2021/04	Android 11
Moto G40 Fusion	Motorola Mobility	2021/05	Android 11
Moto G20	Motorola Mobility	2021/06	Android 11
Moto G Stylus 5G	Motorola Mobility	2021/06	Android 11
Motorola Defy (2021)	Motorola Mobility	2021/07	Android 10
Moto G50 5G	Motorola Mobility	2021/08	Android 11
Moto G60S	Motorola Mobility	2021/08	Android 11
Motorola Edge 20	Motorola Mobility	2021/08	Android 11
Motorola Edge (2021)	Motorola Mobility	2021/09	Android 11
MyPhone myA1 Plus	MyPhone	2020/09	Android 9.0 "Pie" (Go Edition)
MyPhone myA17	MyPhone	2020/09	Android 9.0 "Pie" (Go Edition)
MyPhone myA18	MyPhone	N/A	Android 9.0 "Pie" (Go Edition)
MyPhone myP1	MyPhone	2020/08	Android 9.0 "Pie"
MyPhone myG1	MyPhone	N/A	Android 9.0 "Pie" (Go Edition)
MyPhone myX11	MyPhone	N/A	Android 8.1 "Oreo" (Go Edition)
MyPhone myX11 Pro	MyPhone	N/A	Android 9.0 "Pie"
MyPhone myX11 Plus	MyPhone	N/A	Android 9.0 "Pie"
MyPhone myX12	MyPhone	N/A	Android 9.0 "Pie"
MyPhone myX13	MyPhone	N/A	Android 9.0 "Pie"
N[edit]			
Model	Developer	Release date	Android version at release
Nextbit Robin	Nextbit	2016/02	Android 5.0 Lollipop
Nexus One	HTC/Google	2010/01	Android 2.0 Eclair
Nexus S	Samsung Electronics/Google	2010/12	Android 2.3 Gingerbread
Galaxy Nexus	Samsung Electronics/Google	2011/11	Android 4.0 Ice Cream Sandwich
Nexus 4	LG Electronics/Google	2012/11	Android 4.1 Jelly Bean
Nexus 5	LG Electronics/Google	2013/10	Android 4.4 KitKat
Nexus 6	Motorola Mobility/Google	2014/11	Android 5.0 Lollipop
Nexus 5X	LG Electronics/Google	2015/09	Android 6.0 Marshmallow
Nexus 6P	Huawei/Google	2015/09	Android 6.0 Marshmallow

Nokia X	Nokia	2014/02	Android 4.1 Jelly Bean
Nokia XL	Microsoft Mobile	2014/05	Android 4.1 Jelly Bean
Nokia X2	Microsoft Mobile	2014/06	Android 4.1 Jelly Bean
Nokia 6	HMD Global	2017/01	Android 7.1 Nougat
Nokia 3	HMD Global	2017/06	Android 7.0 Nougat
Nokia 5	HMD Global	2017/07	Android 7.1 Nougat
Nokia 7	HMD Global	2017/10	Android 7.1 Nougat
Nokia 8	HMD Global	2017/10	Android 7.1 Nougat
Nokia 2	HMD Global	2017/11	Android 7.1 Nougat
Nokia 7 Plus	HMD Global	2018/03	Android 8.1 Oreo
Nokia 1	HMD Global	2018/04	Android 8.1 Oreo
Nokia 6.1	HMD Global	2018/04	Android 8.1 Oreo
Nokia 8 Sirocco	HMD Global	2018/04	Android 8.0 Oreo
Nokia 3.1	HMD Global	2018/05	Android 8.0 Oreo
Nokia 5.1 Plus	HMD Global	2018/07	Android 8.1 Oreo
Nokia 2.1	HMD Global	2018/08	Android 8.1 Oreo
Nokia 5.1	HMD Global	2018/08	Android 8.0 Oreo
Nokia 6.1 Plus	HMD Global	2018/08	Android 8.1 Oreo
Nokia 3.1 Plus	HMD Global	2018/10	Android 8.1 Oreo
Nokia 7.1	HMD Global	2018/10	Android 8.1 Oreo
Nokia 8.1	HMD Global	2018/12	Android 9 Pie
Nokia 9 PureView	HMD Global	2019/02	Android 9 Pie
Nokia 1 Plus	HMD Global	2019/03	Android 9 Pie
Nokia 4.2	HMD Global	2019/04	Android 9 Pie
Nokia 3.2	HMD Global	2019/05	Android 9 Pie
Nokia 2.2	HMD Global	2019/06	Android 9 Pie
Nokia 6.2	HMD Global	2019/09	Android 9 Pie
Nokia 7.2	HMD Global	2019/09	Android 9 Pie
Nokia 2.3	HMD Global	2019/12	Android 9 Pie
Nokia C1	HMD Global	2019/12	Android 9 Pie
Nokia C2	HMD Global	2020/03	Android 9 Pie

Nokia 1.3	HMD Global	2020/04	Android 10
Nokia 5.3	HMD Global	2020/04	Android 10
Nokia C2 Tava	HMD Global	2020/05	Android 10
Nokia C5 Endi	HMD Global	2020/06	Android 10
Nokia C2 Tennen	HMD Global	2020/06	Android 10
Nokia C3	HMD Global	2020/08	Android 10
Nokia 2.4	HMD Global	2020/09	Android 10
Nokia 3.4	HMD Global	2020/10	Android 10
Nokia C1 Plus	HMD Global	2020/12	Android 10
Nokia 5.4	HMD Global	2021/01	Android 10
Nokia 1.4	HMD Global	2021/02	Android 10
Nokia C20	HMD Global	2021/04	Android 11
Nokia G10	HMD Global	2021/04	Android 11
Nokia G20	HMD Global	2021/05	Android 11
Nokia X20	HMD Global	2021/05	Android 11
Nokia C10	HMD Global	2021/06	Android 11
Nokia X10	HMD Global	2021/06	Android 11
Nokia C01 Plus	HMD Global	2021/06	Android 11
Nokia C20 Plus	HMD Global	2021/06	Android 11
Nokia C30	HMD Global	2021/08	Android 11
Nokia XR20	HMD Global	2021/08	Android 11
Nokia G50	HMD Global	2021/10	Android 11
Nokia G300	HMD Global	2021/10	Android 11
Nokia X100	HMD Global	2021/11	Android 11
Nokia G21	HMD Global	2022/02	Android 11
Nokia G11	HMD Global	2022/03	Android 11
Nokia C2 2nd Edition	HMD Global	2022/04	Android 11
Nokia C21 Plus	HMD Global	2022/04	Android 11
Nokia C21	HMD Global	2022/05	Android 11
Nokia C100/C200	HMD Global	Q2 2022	Android 12
Nokia G11 Plus	HMD Global	2022/07	Android 12

Nokia G400	HMD Global	2022/08	Android 12
Nokia C31	HMD Global	2022/09	Android 12
Nokia X30	HMD Global	2022/09	Android 12
Nokia C12	HMD Global	2023/02	Android 12
Nokia G22	HMD Global	2023/02	Android 12
Nokia C22/C32	HMD Global	2023/02	Android 13
Nokia C12 Pro	HMD Global	2023/03	Android 12
Nokia C02	HMD Global	2023/05	Android 12
Nokia C12 Plus	HMD Global	2023/05	Android 12
Nothing Phone 1	Nothing	2022/07	Android 12
Nothing Phone 2	Nothing	2023/07	Android 13
Nubia Z5	ZTE	2012/12	Android 4.1 Jelly Bean
Nubia Z5S	ZTE	2013/12	Android 4.1 Jelly Bean
Nubia Z5S mini NX403A	ZTE	2013/12	Android 4.1 Jelly Bean
Nubia X6	ZTE	2014/03	Android 4.1 Jelly Bean
Nubia Z7/Max/mini	ZTE	2014/07	Android 4.4 KitKat
Nubia Z5S mini NX405H	ZTE	2014/08	Android 4.1 Jelly Bean
Nubia Z9 Max	ZTE	2015/04	Android 5.0 Lollipop
Nubia Z9 mini	ZTE	2015/04	Android 5.0 Lollipop
Nubia Z9	ZTE	2015/05	Android 5.0 Lollipop
Nubia My Prague	ZTE	2015/06	Android 5.0 Lollipop
Nubia Prague S	ZTE	2016/01	Android 5.0 Lollipop
Nubia Z11 mini	ZTE	2016/04	Android 5.0 Lollipop
Nubia Z11 Max	ZTE	2016/06	Android 5.0 Lollipop
Nubia Z11	ZTE	2016/06	Android 6.0 Marshmallow
Nubia N1	ZTE	2016/07	Android 6.0 Marshmallow
Nubia Z11 mini S	ZTE	2016/10	Android 6.0 Marshmallow
Nubia M2/lite	ZTE	2017/03	Android 6.0 Marshmallow
Nubia N2	ZTE	2017/03	Android 6.0 Marshmallow
Nubia N1 lite	ZTE	2017/04	Android 6.0 Marshmallow
Nubia Z17 mini	ZTE	2017/04	Android 6.0 Marshmallow

Nubia Z17	ZTE	2017/06	Android 7.0 Nougat
Nubia Z17 lite	ZTE	2017/08	Android 7.0 Nougat
Nubia Z17 miniS	ZTE	2017/10	Android 7.0 Nougat
Nubia Z17s	ZTE	2017/10	Android 7.0 Nougat
Nubia N3	ZTE	2018/03	Android 7.0 Nougat
Nubia V18	ZTE	2018/03	Android 7.0 Nougat
Nubia Z18 mini	ZTE	2018/04	Android 8.0 Oreo
Nubia Red Magic	ZTE	2018/04	Android 8.0 Oreo
Nubia Z18	ZTE	2018/09	Android 8.0 Oreo
Nubia X	ZTE	2018/11	Android 8.0 Oreo
Nubia Red Magic Mars	ZTE	2018/12	Android 9 Pie
Nubia Red Magic 3	ZTE	2019/05	Android 9 Pie
Nubia Z20	ZTE	2019/08	Android 9 Pie
Nubia Red Magic 3s	ZTE	2019/09	Android 9 Pie
Nubia Red Magic 5G	ZTE	2020/03	Android 10
Nubia Play	ZTE	2020/06	Android 10
Nubia Red Magic 5G Lite	ZTE	2020/06	Android 10
Nubia Red Magic 5S	ZTE	2020/08	Android 10
Nubia Red Magic 6/Pro	ZTE	2021/03	Android 11
Nubia Z30 Pro	ZTE	2021/05	Android 11
Nubia Red Magic 6R	ZTE	2021/06	Android 11
Nubia Red Magic 6s/Pro	ZTE	2021/03	Android 11
Nubia Red Magic 7/Pro	ZTE	2022/02	Android 12
Nubia Z40 Pro	ZTE	2022/03	Android 12
Nubia Red Magic 7S/Pro	ZTE	2022/07	Android 12
Nubia Z40S Pro	ZTE	2022/07	Android 12
Nubia Z50	ZTE	2022/12	Android 13
Nubia Red Magic 8 Pro/Pro+	ZTE	2022/12	Android 13
Nubia Z50 Ultra	ZTE	2023/03	Android 13
Ofedit			
Model	Developer	Release date	Android version at release

OnePlus One	OnePlus	2014/04	Android 4.4 KitKat
OnePlus 2	OnePlus	2015/07	Android 5.0 Lollipop
OnePlus X	OnePlus	2015/10	Android 5.0 Lollipop
OnePlus 3	OnePlus	2016/06	Android 6.0 Marshmallow
OnePlus 3T	OnePlus	2016/11	Android 6.0 Marshmallow
OnePlus 5	OnePlus	2017/06	Android 7.0 Nougat
OnePlus 5T	OnePlus	2017/11	Android 7.0 Nougat
OnePlus 6	OnePlus	2018/04	Android 8.0 Oreo
OnePlus 6T	OnePlus	2018/11	Android 9 Pie
OnePlus 7/Pro	OnePlus	2019/05	Android 9 Pie
OnePlus 7T/Pro	OnePlus	2019/10	Android 10
OnePlus 8/Pro	OnePlus	2020/04	Android 10
OnePlus Nord	OnePlus	2020/08	Android 10
OnePlus 8T	OnePlus	2020/10	Android 11
OnePlus Nord N10 5G	OnePlus	2020/11	Android 10
OnePlus Nord N100	OnePlus	2020/11	Android 10
OnePlus 9/Pro	OnePlus	2021/03	Android 11
OnePlus Nord CE 5G	OnePlus	2021/06	Android 11
OnePlus Nord N200 5G	OnePlus	2021/06	Android 11
OnePlus Nord 2 5G	OnePlus	2021/07	Android 11
OnePlus 10 Pro	OnePlus	2022/01	Android 12
Oppo Finder	Oppo	2012/06	Android 4.0 Ice Cream Sandwich
Oppo Find 5	Oppo	2012/12	Android 4.1 Jelly Bean
Oppo N1	Oppo	2013/12	Android 4.1 Jelly Bean
Oppo Find 5 Mini	Oppo	2014/01	Android 4.1 Jelly Bean
Oppo Neo	Oppo	2014/02	Android 4.1 Jelly Bean
Oppo Find 7/7a	Oppo	2014/03	Android 4.1 Jelly Bean
Oppo Joy	Oppo	2014/02	Android 4.1 Jelly Bean
Oppo N1 mini	Oppo	2014/08	Android 4.1 Jelly Bean
Oppo Neo 3/5	Oppo	2014/08	Android 4.1 Jelly Bean
Oppo N3	Oppo	2014/10	Android 4.4 KitKat

Oppo Joy Plus	Oppo	2015/08	Android 4.4 KitKat
Oppo Neo 5s	Oppo	2015/05	Android 4.4 KitKat
Oppo R7	Oppo	2015/05	Android 4.4 KitKat
Oppo Neo 5 (2015)	Oppo	2015/08	Android 4.4 KitKat
Oppo Joy 3	Oppo	2015/08	Android 4.4 KitKat
Oppo Neo 7	Oppo	2015/10	Android 5.0 Lollipop
Oppo F1	Oppo	2016/01	Android 5.0 Lollipop
Oppo R11	Oppo	2017/06	Android 7.0 Nougat
Oppo F7	Oppo	2018/04	Android 8.0 Oreo
Oppo R15 Pro	Oppo	2018/04	Android 8.0 Oreo
Oppo Find X	Oppo	2018/07	Android 8.0 Oreo
Oppo F9	Oppo	2018/08	Android 8.0 Oreo
Oppo R17	Oppo	2018/09	Android 8.0 Oreo
Oppo Reno	Oppo	2019/04	Android Pie
Oppo Reno2	Oppo	2019/09	Android Pie
Oppo A9 (2020)	Oppo	2019/09	Android Pie
Oppo Reno3 5G/Pro 5G	Oppo	2019/12	Android 10
Oppo Reno3 Pro	Oppo	2020/03	Android 10
Oppo Find X2/Pro	Oppo	2020/03	Android 10
Oppo Reno3	Oppo	2020/03	Android 10
Oppo Ace2	Oppo	2020/04	Android 10
Oppo A12	Oppo	2020/04	Android Pie
Oppo A52	Oppo	2020/04	Android 10
Oppo A72/A92s	Oppo	2020/04	Android 10
Oppo Find X2 Lite/Neo	Oppo	2020/05	Android 10
Oppo A92	Oppo	2020/05	Android 10
Oppo Reno4 5G/Pro 5G	Oppo	2020/06	Android 10
Oppo A12s	Oppo	2020/07	Android Pie
Oppo A72 5G	Oppo	2020/07	Android 10
Oppo Reno4/Pro	Oppo	2020/08	Android 10
Oppo F17/Pro	Oppo	2020/09	Android 10

Oppo Reno4 SE	Oppo	2020/09	Android 10
Oppo Reno4 Lite	Oppo	2020/09	Android 10
Oppo Reno4 Z 5G	Oppo	2020/10	Android 10
Oppo A93/Reno4 F	Oppo	2020/10	Android 10
Oppo A73	Oppo	2020/11	Android 10
Oppo A73 5G	Oppo	2020/11	Android 10
Oppo Reno5 5G/Pro 5G/Pro+ 5G	Oppo	2021/01	Android 11
Oppo Reno5	Oppo	2021/01	Android 11
Oppo Find X3/Pro	Oppo	2021/03	Android 11
Oppo Find X3 Neo/Lite	Oppo	2021/03	Android 11
Oppo A94	Oppo	2021/03	Android 11
Oppo F19 Pro/Pro+	Oppo	2021/03	Android 11
Oppo Reno5 Lite/F	Oppo	2021/03	Android 11
Oppo Reno5 Z	Oppo	2021/04	Android 11
Oppo F19	Oppo	2021/04	Android 11
Oppo A35	Oppo	2021/04	Android 10
Oppo A94 5G	Oppo	2021/05	Android 11
Oppo A95 5G	Oppo	2021/05	Android 11
Oppo A54 5G/A74 5G	Oppo	2021/04	Android 11
Oppo A74	Oppo	2021/05	Android 11
Oppo A53s 5G	Oppo	2021/05	Android 11
Oppo K9	Oppo	2021/05	Android 11
Oppo Reno6 5G/Pro/Pro+	Oppo	2021/06	Android 11
Oppo A16	Oppo	2021/07	Android 11
Oppo Reno6	Oppo	2021/08	Android 11
Oppo A16s	Oppo	2021/08	Android 11
Oppo Reno6 Z	Oppo	2021/08	Android 11
Oppo Reno6 Pro (Snapdragon)	Oppo	2021/09	Android 11
Oppo K9 Pro	Oppo	2021/09	Android 11
Oppo F19s	Oppo	2021/09	Android 11

Oppo A55	Oppo	2021/10	Android 11
Oppo K9s	Oppo	2021/10	Android 11
Oppo A56 5G	Oppo	2021/11	Android 11
Oppo A54s	Oppo	2021/11	Android 11
Oppo A16k	Oppo	2021/11	Android 11
Oppo A95	Oppo	2021/11	Android 11
Oppo Reno7 (China)/Pro/SE	Oppo	2021/12	Android 11
Oppo Frind N	Oppo	2021/12	Android 11
Oppo K9x	Oppo	2021/12	Android 11
Oppo A11s	Oppo	2021/12	Android 11
Oppo A36	Oppo	2022/01	Android 11
Oppo A96 5G	Oppo	2022/01	Android 11
Oppo Reno6 Lite	Oppo	2022/01	Android 11
Oppo Reno7	Oppo	2022/02	Android 11
Oppo A76	Oppo	2022/02	Android 11
Oppo Find X5/Pro	Oppo	2022/03	Android 12
Oppo Find X5 Lite	Oppo	2022/03	Android 11
Oppo Reno7 Z	Oppo	2022/03	Android 11
Oppo A16e	Oppo	2022/03	Android 11
Oppo A96	Oppo	2022/03	Android 11
Oppo K10	Oppo	2022/03	Android 11
OSOM OV1	OSOM	2022/2	Android 12.0 Snow Cone
P[edit]			
Model	Developer	Release date	Android version at release
Palm	Palm, Inc.	2018/10	Android 8.0 Oreo
Panasonic P100	Panasonic	2018/02	Android 7.0 Nougat
Pantech Pocket	Pantech or AT&T	2011/12	Android 2.3 Gingerbread
Pepsi P1/P1S	Pepsi	2015/11	Android 5.1 "Lollipop"
Pixel/XL	Google	2016/10	Android 7.1 "Nougat"
Pixel 2/XL	Google	2017/10	Android 8.0 Oreo
Pixel 3/XL	Google	2018/10	Android Pie

Pixel 3a/XL	Google	2019/03	Android Pie
Pixel 4/XL	Google	2019/10	Android 10
Pixel 4a	Google	2020/08	Android 10
Pixel 4a (5G)	Google	2020/11	Android 11
Pixel 5	Google	2020/10	Android 11
Pixel 5a	Google	2021/08	Android 11
Pixel 6/Pro	Google	2021/10	Android 12
Pixel 6a	Google	2022/07	Android 12
Pixel 7/Pro	Google	2022/10	Android 13
Pixel 7a	Google	2023/05	Android 13
Pixel 8/Pro	Google	2023/10	Android 14
Xiaomi Pocophone F1	Xiaomi	2018/08	Android 8.1 Oreo
POCO X2	Xiaomi	2020/02	Android 10
POCO F2 Pro	Xiaomi	2020/05	Android 10
POCO M2 Pro	Xiaomi	2020/07	Android 10
POCO X3 NFC	Xiaomi	2020/09	Android 10
POCO M2	Xiaomi	2020/09	Android 10
POCO X3	Xiaomi	2020/09	Android 10
POCO C3	Xiaomi	2020/10	Android 10
POCO M3	Xiaomi	2020/11	Android 10
POCO X3 Pro	Xiaomi	2021/03	Android 11
POCO F3	Xiaomi	2021/03	Android 11
POCO M2 Reloaded	Xiaomi	2021/04	Android 10
POCO M3 Pro	Xiaomi	2021/05	Android 11
POCO F3 GT	Xiaomi	2021/07	Android 11
POCO X3 GT	Xiaomi	2021/08	Android 11
POCO C31	Xiaomi	2021/10	Android 10
POCO M4 Pro 5G	Xiaomi	2021/12	Android 11
POCO M4 Pro	Xiaomi	2022/02	Android 11
POCO X4 Pro 5G	Xiaomi	2022/02	Android 11
POCO F4 GT	Xiaomi	2022/04	Android 12

POCO M4 5G	Xiaomi	2021/09	Android 12
POCO C40	Xiaomi	2022/06	Android 11
POCO X4 GT	Xiaomi	2022/06	Android 12
POCO F4	Xiaomi	2022/06	Android 12
POCO M5/M5s	Xiaomi	2022/09	Android 12
POCO C50	Xiaomi	2023/01	Android 12
POCO X5/Pro	Xiaomi	2023/02	Android 12
POCO C55	Xiaomi	2023/02	Android 12
POCO C51	Xiaomi	2023/04	Android 13
POCO F5/Pro	Xiaomi	2023/05	Android 13
POCO M6 Pro	Xiaomi	2023/08	Android 13
POCO C65	Xiaomi	2023/11	Android 13
Q[edit]			
Model	Developer	Release date	Android version at release
Q Phone	Qoobex	2018/07	Android 9 Pie
R[edit]			
Model	Developer	Release date	Android version at release
Razer Phone	Razer Inc.	2017/11	Android 7.1 Nougat
Razer Phone 2	Razer Inc.	2018/10	Android 8.1 Oreo
Realme 1	Realme	2018/05	Android 8.1 Oreo
Realme 2	Realme	2018/09	Android 8.1 Oreo
Realme C1	Realme	2018/10	Android 8.1 Oreo
Realme 2 Pro	Realme	2018/10	Android 8.1 Oreo
Realme U1	Realme	2018/12	Android 8.1 Oreo
Realme 3	Realme	2019/03	Android 9 Pie
Realme C2	Realme	2019/05	Android 9 Pie
Realme 3 Pro	Realme	2019/05	Android 9 Pie
Realme X	Realme	2019/07	Android 9 Pie
Realme 3i	Realme	2019/07	Android 9 Pie
Realme 5	Realme	2019/08	Android 9 Pie
Realme 5 Pro	Realme	2019/09	Android 9 Pie

Realme XT	Realme	2019/09	Android 9 Pie
Realme X2	Realme	2019/09	Android 9 Pie
Realme X2 Pro	Realme	2019/10	Android 9 Pie
Realme 5i	Realme	2020/01	Android 9 Pie
Realme X50	Realme	2020/01	Android 10
Realme C3	Realme	2020/02	Android 10
Realme X50 Pro	Realme	2020/03	Android 10
Realme 6	Realme	2020/03	Android 10
Realme 6 Pro	Realme	2020/03	Android 10
Realme 6i	Realme	2020/03	Android 10
Realme X50 Pro Player	Realme	2020/06	Android 10
Realme X3 SuperZoom	Realme	2020/06	Android 10
Realme Narzo	Realme	2020/06	Android 10
Realme C3i	Realme	2020/06	Android 10
Realme X3	Realme	2020/06	Android 10
Realme C11	Realme	2020/06	Android 10
Realme C15	Realme	2020/07	Android 10
Realme V5	Realme	2020/08	Android 10
Realme C12	Realme	2020/08	Android 10
Realme V3	Realme	2020/09	Android 10
Realme X7/Pro	Realme	2020/09	Android 10
Realme 7 (Asia)/Pro	Realme	2020/09	Android 10
Realme 7i	Realme	2020/09	Android 10
Realme C17	Realme	2020/09	Android 10
Realme Narzo 20/Pro/20A	Realme	2020/09	Android 10
Realme 7 (Global)	Realme	2020/10	Android 10
Realme Q2/Pro/2i	Realme	2020/10	Android 10
Realme 7 5G	Realme	2020/11	Android 10
Realme 7i (Global)	Realme	2020/12	Android 10
Realme V15	Realme	2021/01	Android 10
Realme C20	Realme	2021/01	Android 10

Realme X7 (India)	Realme	2021/02	Android 10
Realme V11	Realme	2021/02	Android 11
Realme Narzo 30 Pro/30A	Realme	2020/03	Android 10
Realme C21	Realme	2021/03	Android 10
Realme GT	Realme	2021/03	Android 11
Realme C25	Realme	2021/03	Android 11
Realme 8/Pro	Realme	2021/03	Android 11
Realme V13	Realme	2021/04	Android 11
Realme GT Neo	Realme	2021/04	Android 11
Realme X7 Pro Ultra	Realme	2021/04	Android 11
Realme 8 5G	Realme	2021/04	Android 11
Realme Q3/Pro/3i	Realme	2021/04	Android 11
Realme C20A	Realme	2021/05	Android 10
Realme narzo 30	Realme	2021/05	Android 11
Realme GT Neo Flash	Realme	2021/06	Android 11
Realme Q3 Pro Carnival	Realme	2021/06	Android 11
Realme narzo 30 5G	Realme	2021/06	Android 11
Realme X7 Max	Realme	2021/06	Android 11
Realme C25s	Realme	2021/06	Android 11
Realme C11 2021	Realme	2021/06	Android 11
Realme C21Y	Realme	2021/07	Android 11
Realme GT Master Edition	Realme	2021/07	Android 11
Realme GT Explorer Master Edition	Realme	2021/07	Android 11
Realme 8i/8s 5G	Realme	2021/09	Android 11
Realme C25Y	Realme	2021/09	Android 11
Realme GT Neo2	Realme	2021/09	Android 11
Realme V11s	Realme	2021/10	Android 11
Realme narzo 50A/50i	Realme	2021/10	Android 11
Realme Q3s	Realme	2021/11	Android 11

Realme GT Neo2T	Realme	2021/11	Android 11
Realme Q3t	Realme	2021/11	Android 11
Realme GT2/Pro	Realme	2022/01	Android 12
Realme 9i	Realme	2022/01	Android 11
Realme C35	Realme	2022/02	Android 11
Realme 9 Pro/Pro+	Realme	2022/02	Android 12
Realme narzo 50	Realme	2022/02	Android 11
Realme V25	Realme	2022/03	Android 12
Realme 9 5G (India)/5G Speed Edition	Realme	2022/03	Android 11
Realme narzo 50A Prime	Realme	2022/03	Android 11
Realme GT Neo3/150W	Realme	2022/03	Android 12
Realme 9	Realme	2022/04	Android 12
Realme Q5i	Realme	2022/04	Android 12
Realme Q5/Pro	Realme	2022/04	Android 12
Realme V23	Realme	2022/04	Android 12
Realme narzo 50 5G/Pro	Realme	2022/05	Android 12
Realme 9 5G	Realme	2022/06	Android 12
Realme V20	Realme	2022/06	Android 12
Realme GT Neo3T	Realme	2022/06	Android 12
Realme C30	Realme	2022/06	Android 11
Realme narzo 50i Prime	Realme	2022/06	Android 11
Realme GT2 Explorer Master Edition	Realme	2022/07	Android 12
Realme 9i 5G	Realme	2022/08	Android 12
Realme C33	Realme	2022/09	Android 12
Realme C30s	Realme	2022/09	Android 12
Realme 10/5G	Realme	2022/06	Android 12
Realme 10 Pro/Pro+	Realme	2022/11	Android 13
Realme 10s	Realme	2022/12	Android 12
Realme GT Neo5/240W	Realme	2023/02	Android 13
Realme C55	Realme	2023/03	Android 13

Realme V30/V30t	Realme	2023/03	Android 12
Realme 10T	Realme	2023/03	Android 12
Realme GT Neo5 SE	Realme	2023/04	Android 13
Realme narzo N55	Realme	2023/04	Android 13
Realme GT3	Realme	2023/05	Android 13
Redmi 1	Xiaomi	2013/08	Android 4.2 "Jelly Bean"
Redmi 1S	Xiaomi	2014/02	Android 4.3 Jelly Bean
Redmi Note (3G)	Xiaomi	2014/03	Android 4.2 Jelly Bean
Redmi Note 4G	Xiaomi	2014/08	Android 4.2 Jelly Bean
Redmi 2	Xiaomi	2015/01	Android 4.4 KitKat
Redmi 2A	Xiaomi	2015/04	Android 4.4 KitKat
Redmi 2 Prime	Xiaomi	2015/08	Android 4.4 KitKat
Redmi Note 2	Xiaomi	2015/08	Android 5.0 Lollipop
Redmi 2 Pro	Xiaomi	2015/10	Android 4.4 KitKat
Redmi Note 3 (MTK)	Xiaomi	2015/11	Android 5.0 Lollipop
Redmi Note Prime	Xiaomi	2015/12	Android 4.4 KitKat
Redmi 3	Xiaomi	2016/01	Android 5.1 Lollipop
Redmi Note 3/Pro	Xiaomi	2016/03	Android 5.1 Lollipop
Redmi 3 Pro	Xiaomi	2016/04	Android 5.1 Lollipop
Redmi 3S	Xiaomi	2016/06	Android 6.0 Marshmallow
Redmi 3X	Xiaomi	2016/07	Android 6.0 Marshmallow
Redmi 3S Prime	Xiaomi	2016/08	Android 6.0 Marshmallow
Redmi Pro	Xiaomi	2016/08	Android 6.0 Marshmallow
Redmi Note 4 (MTK)	Xiaomi	2016/08	Android 6.0 Marshmallow
Redmi 4/Pro/Prime	Xiaomi	2016/08	Android 6.0 Marshmallow
Redmi 4A	Xiaomi	2016/11	Android 6.0 Marshmallow
Redmi Note 4/4X	Xiaomi	2017/01	Android 6.0 Marshmallow
Redmi 4X	Xiaomi	2017/02	Android 6.0 Marshmallow
Redmi Note 5A/Prime	Xiaomi	2017/09	Android 7.1 "Nougat"
Redmi 5A	Xiaomi	2017/10	Android 7.1 "Nougat"
Redmi 5/5 Plus	Xiaomi	2017/12	Android 7.1 "Nougat"

Redmi Note 5 Pro	Xiaomi	2018/02	Android 7.1 "Nougat"
Redmi Note 5	Xiaomi	2018/03	Android 8.1 "Oreo"
Redmi S2/Y2	Xiaomi	2018/05	Android 8.1 "Oreo"
Redmi 6/6A/6 Pro	Xiaomi	2018/06	Android 8.1 "Oreo"
Redmi Note 6 Pro	Xiaomi	2018/10	Android 8.1 "Oreo"
Redmi Note 7	Xiaomi	2019/02	Android 9 Pie
Redmi Go	Xiaomi	2019/02	Android 8.1 Oreo
Redmi Note 7 Pro	Xiaomi	2019/03	Android 9 Pie
Redmi 7	Xiaomi	2019/03	Android 9 Pie
Redmi Y3	Xiaomi	2019/04	Android 9 Pie
Redmi 7A	Xiaomi	2019/05	Android 9 Pie
Redmi K20/Pro	Xiaomi	2019/06	Android 9 Pie
Redmi Note 8/Pro	Xiaomi	2019/09	Android 9 Pie
Redmi 8A	Xiaomi	2019/09	Android 9 Pie
Redmi 8	Xiaomi	2019/10	Android 9 Pie
Redmi Note 8T	Xiaomi	2019/11	Android 9 Pie
Redmi K30/5G	Xiaomi	2019/12	Android 10
Redmi 8A Dual	Xiaomi	2020/02	Android 9 Pie
Redmi Note 9 Pro (India)/Pro Max/9S	Xiaomi	2020/03	Android 10
Redmi K30 Pro/Pro Zoom	Xiaomi	2020/03	Android 10
Redmi Note 9/Pro (Global)	Xiaomi	2020/05	Android 10
Redmi 10X/Pro	Xiaomi	2020/06	Android 10
Redmi 9	Xiaomi	2020/06	Android 10
Redmi 9A	Xiaomi	2020/07	Android 10
Redmi 9C	Xiaomi	2020/08	Android 10
Redmi 9 Prime	Xiaomi	2020/08	Android 10
Redmi K30 Ultra	Xiaomi	2020/08	Android 10
Redmi K30S Ultra	Xiaomi	2020/11	Android 10
Redmi Note 9 4G/5G/Pro 5G	Xiaomi	2020/11	Android 10

Redmi 9 Power	Xiaomi	2020/12	Android 10
Redmi 9T/Note 9T	Xiaomi	2021/01	Android 10
Redmi K40/Pro/Pro+	Xiaomi	2021/03	Android 11
Redmi Note 10/Pro/Pro Max	Xiaomi	2021/03	Android 11
Redmi Note 10S/5G	Xiaomi	2021/04	Android 11
Redmi K40 Gaming	Xiaomi	2021/04	Android 11
Redmi Note 8 2021	Xiaomi	2021/05	Android 11
Redmi Note 10 Pro 5G	Xiaomi	2021/06	Android 11
Redmi Note 10T	Xiaomi	2021/07	Android 11
Redmi Note 10 JE	Xiaomi	2021/08	Android 11
Redmi 10	Xiaomi	2021/08	Android 11
Redmi 10 Prime	Xiaomi	2021/09	Android 11
Redmi 9 Activ	Xiaomi	2021/09	Android 10
Redmi 9A Sport/9i Sport	Xiaomi	2021/09	Android 10
Redmi Note 10 Lite	Xiaomi	2021/10	Android 11
Redmi Note 11 5G/Pro (China)/Pro+ 5G	Xiaomi	2021/11	Android 11
Redmi Note 11 4G	Xiaomi	2021/12	Android 11
Redmi Note 11T	Xiaomi	2021/12	Android 11
Redmi Note 11/11S	Xiaomi	2022/02	Android 11
Redmi Note 11 Pro/11 Pro 5G	Xiaomi	2022/02	Android 11
Redmi K50G	Xiaomi	2022/02	Android 12
Redmi Note 11E	Xiaomi	2022/03	Android 12
Redmi Note 11E Pro	Xiaomi	2022/03	Android 11
Redmi Note 11 Pro+ (India)	Xiaomi	2022/03	Android 11
Redmi 10 (India)	Xiaomi	2022/03	Android 11
Redmi 10C	Xiaomi	2022/03	Android 11
Redmi K40S	Xiaomi	2022/03	Android 12
Redmi K50/Pro	Xiaomi	2022/03	Android 12
Redmi 10A	Xiaomi	2022/03	Android 11

Redmi Note 11S 5G	Xiaomi	2022/04	Android 11
Redmi 10 Power	Xiaomi	2022/04	Android 11
Redmi 10 2022	Xiaomi	2022/05	Android 11
Redmi 10 Prime 2022	Xiaomi	2022/05	Android 11
Redmi Note 11SE	Xiaomi	2022/05	Android 11
Redmi Note 11T Pro/Pro+	Xiaomi	2022/05	Android 12
Redmi 10 5G	Xiaomi	2022/06	Android 12
Redmi K50i	Xiaomi	2022/06	Android 12
Redmi K50 Ultra	Xiaomi	2022/08	Android 12
Redmi Note 11 SE	Xiaomi	2022/08	Android 11
Redmi A1/+	Xiaomi	2022/09	Android 12
Redmi 11 Prime/Prime 5G	Xiaomi	2022/09	Android 12
Redmi Note 11R	Xiaomi	2022/09	Android 12
Redmi Note 12 5G (China)/Pro 5G/Pro+/Discovery Edition	Xiaomi	2022/11	Android 12
Redmi Note 12 Pro Speed Edition	Xiaomi	2022/12	Android 12
Redmi K60/Pro/K60E	Xiaomi	2023/01	Android 13
Redmi 12C	Xiaomi	2023/01	Android 12
Redmi Note 12 5G	Xiaomi	2023/01	Android 12
Redmi A2/+	Xiaomi	2023/03	Android 13
Redmi Note 12	Xiaomi	2023/03	Android 13
Redmi Note 12 Turbo	Xiaomi	2023/03	Android 13
Redmi Note 12 Pro	Xiaomi	2023/04	Android 11
Redmi Note 12S	Xiaomi	2023/04	Android 13
Redmi Note 12R Pro	Xiaomi	2023/04	Android 12
Redmi Note 12T Pro	Xiaomi	2023/06	Android 13
Redmi 12	Xiaomi	2023/06	Android 13
Redmi Note 12R	Xiaomi	2023/06	Android 13
S[edit]			
Model	Developer	Release date	Android version at release

Samsung Galaxy	Samsung Electronics	2009/04	Android 1.5 "Cupcake"
Samsung Galaxy S1	Samsung Electronics	2010/06	Android 2.0 Eclair
Samsung Galaxy S2	Samsung Electronics	2011/04	Android 2.3 Gingerbread
Samsung Galaxy Xcover	Samsung Electronics	2011/10	Android 2.3 Gingerbread
Samsung Galaxy Note	Samsung Electronics	2011/10	Android 2.3 Gingerbread
Samsung Galaxy Y DUOS	Samsung Electronics	2012/02	Android 2.3 Gingerbread
Samsung Galaxy S3	Samsung Electronics	2012/05	Android 4.0 Ice Cream Sandwich
Samsung Galaxy Beam	Samsung Electronics	2012/07	Android 2.3.6 "Gingerbread"
Samsung Galaxy Note 2	Samsung Electronics	2012/09	Android 4.0 Ice Cream Sandwich
Samsung Galaxy Xcover 2	Samsung Electronics	2013/03	Android 4.1 Jelly Bean
Samsung Galaxy S4	Samsung Electronics	2013/04	Android 4.2 "Jelly Bean"
Samsung Galaxy S4 Zoom	Samsung Electronics	2013/07	Android 4.2 "Jelly Bean"
Samsung Galaxy Note 3	Samsung Electronics	2013/09	Android 4.3 "Jelly Bean"
Samsung Galaxy Note 3 Neo	Samsung Electronics	2014/02	Android 4.3 "Jelly Bean"
Samsung Galaxy S5	Samsung Electronics	2014/04	Android 4.4 KitKat
Samsung Galaxy Beam 2	Samsung Electronics	2014/04	Android 4.2.2 "Jelly Bean"
Samsung Galaxy Alpha	Samsung Electronics	2014/09	Android 4.4 KitKat
Samsung Galaxy Grand Prime	Samsung Electronics	2014/09	Android 4.4 "KitKat"
Samsung Galaxy Note 4	Samsung Electronics	2014/10	Android 4.4 KitKat
Samsung Galaxy Note Edge	Samsung Electronics	2014/11	Android 4.4 KitKat
Samsung Galaxy A5 Duos	Samsung Electronics	2014/11	Android 4.4 KitKat
Samsung Galaxy A5	Samsung Electronics	2014/12	Android 4.4 KitKat
Samsung Galaxy A3/Duos	Samsung Electronics	2014/12	Android 4.4 KitKat
Samsung Galaxy E7	Samsung Electronics	2015/02	Android 4.4 KitKat
Samsung Galaxy A7/Duos	Samsung Electronics	2015/02	Android 4.4 KitKat
Samsung Galaxy S6/Edge	Samsung Electronics	2015/04	Android 5.0 Lollipop

Samsung Galaxy Xcover 3	Samsung Electronics	2015/04	Android 4.4 KitKat
Samsung Galaxy A8/Duos	Samsung Electronics	2015/08	Android 5.1 "Lollipop"
Samsung Galaxy Note 5	Samsung Electronics	2015/08	Android 5.1 "Lollipop"
Samsung Galaxy S6 Edge+	Samsung Electronics	2015/08	Android 5.1 "Lollipop"
Samsung Galaxy A3 (2016)/A5 (2016)/A7 (2016)	Samsung Electronics	2015/12	Android 5.1 "Lollipop"
Samsung Galaxy A9 (2016)	Samsung Electronics	2016/01	Android 5.1 "Lollipop"
Samsung Galaxy S7/Edge	Samsung Electronics	2016/03	Android 6.0 Marshmallow
Samsung Galaxy Xcover 3 G389F	Samsung Electronics	2016/04	Android 6.0 Marshmallow
Samsung Galaxy A9 Pro (2016)	Samsung Electronics	2016/05	Android 6.0 Marshmallow
Samsung Galaxy C7	Samsung Electronics	2016/06	Android 6.0 Marshmallow
Samsung Galaxy Note 7	Samsung Electronics	2016/09	Android 6.0 Marshmallow
Samsung Galaxy A8 (2016)	Samsung Electronics	2016/10	Android 6.0 Marshmallow
Samsung Galaxy C9 Pro	Samsung Electronics	2016/11	Android 6.0.1 "Marshmallow"
Samsung Galaxy A3 (2017)/A5 (2017)/A7 (2017)	Samsung Electronics	2017/01	Android 6.0 Marshmallow
Samsung Galaxy Xcover 4	Samsung Electronics	2017/04	Android 7.0 Nougat
Samsung Galaxy S8/+	Samsung Electronics	2017/04	Android 7.0 Nougat
Samsung Galaxy Note FE	Samsung Electronics	2017/07	Android 7.0 Nougat
Samsung Galaxy Note 8	Samsung Electronics	2017/08	Android 7.0 Nougat
Samsung Galaxy C8	Samsung Electronics	2017/09	Android 7.1 "Nougat"
Samsung Galaxy C5	Samsung Electronics	2017/10	Android 7.1 "Nougat"
Samsung Galaxy A8 (2018)/+	Samsung Electronics	2018/01	Android 7.0 Nougat
Samsung Galaxy S9/+	Samsung Electronics	2018/03	Android 8.0 Oreo
Samsung Galaxy A6/+	Samsung Electronics	2018/05	Android 8.0 Oreo

Samsung Galaxy A8 Star	Samsung Electronics	2018/06	Android 8.0 Oreo
Samsung Galaxy Note 9	Samsung Electronics	2018/08	Android 8.0 Oreo
Samsung Galaxy A7 (2018)	Samsung Electronics	2018/10	Android 8.0 Oreo
Samsung Galaxy A9 (2018)	Samsung Electronics	2018/11	Android 8.0 Oreo
Samsung Galaxy A6s	Samsung Electronics	2018/11	Android 8.0 Oreo
Samsung Galaxy A8s	Samsung Electronics	2018/12	Android Pie
Samsung Galaxy A10	Samsung Electronics	2019/03	Android Pie
Samsung Galaxy A30	Samsung Electronics	2019/03	Android Pie
Samsung Galaxy A50	Samsung Electronics	2019/03	Android Pie
Samsung Galaxy S10/e/+	Samsung Electronics	2019/03	Android Pie
Samsung Galaxy S10 5G	Samsung Electronics	2019/04	Android Pie
Samsung Galaxy A20/A40	Samsung Electronics	2019/04	Android Pie
Samsung Galaxy A2 Core	Samsung Electronics	2019/04	Android 8.0 Oreo
Samsung Galaxy A20e	Samsung Electronics	2019/05	Android Pie
Samsung Galaxy A70	Samsung Electronics	2019/05	Android Pie
Samsung Galaxy A80	Samsung Electronics	2019/05	Android Pie
Samsung Galaxy A60	Samsung Electronics	2019/06	Android Pie
Samsung Galaxy Xcover 4s	Samsung Electronics	2019/07	Android Pie
Samsung Galaxy A10e	Samsung Electronics	2019/08	Android Pie
Samsung Galaxy Note 10/+	Samsung Electronics	2019/08	Android Pie
Samsung Galaxy A10s	Samsung Electronics	2019/08	Android Pie
Samsung Galaxy A30s/A50s	Samsung Electronics	2019/09	Android Pie
Samsung Galaxy A90 5G	Samsung Electronics	2019/09	Android Pie
Samsung Galaxy A70s	Samsung Electronics	2019/09	Android Pie
Samsung Galaxy Z Fold	Samsung Electronics	2019/09	Android Pie
Samsung Galaxy A20s	Samsung Electronics	2019/10	Android Pie
Samsung Galaxy A51/A71	Samsung Electronics	2019/12	Android 10

Samsung Galaxy A01	Samsung Electronics	2020/01	Android 10
Samsung Galaxy Xcover Pro	Samsung Electronics	2020/01	Android 10
Samsung Galaxy Z Flip	Samsung Electronics	2020/02	Android 10
Samsung Galaxy S20+/Ultra	Samsung Electronics	2020/03	Android 10
Samsung Galaxy Xcover FieldPro	Samsung Electronics	2020/04	Android 8.0 Oreo
Samsung Galaxy A31	Samsung Electronics	2020/04	Android 10
Samsung Galaxy A11	Samsung Electronics	2020/05	Android 10
Samsung Galaxy A41	Samsung Electronics	2020/05	Android 10
Samsung Galaxy A51 5G/A71 5G	Samsung Electronics	2020/06	Android 10
Samsung Galaxy A21	Samsung Electronics	2020/06	Android 10
Samsung Galaxy A21s	Samsung Electronics	2020/07	Android 10
Samsung Galaxy A71 5G UW	Samsung Electronics	2020/06	Android 10
Samsung Galaxy Z Flip 5G	Samsung Electronics	2020/08	Android 10
Samsung Galaxy Note 20/Ultra	Samsung Electronics	2020/08	Android 10
Samsung Galaxy Z Fold 2	Samsung Electronics	2020/08	Android 10
Samsung Galaxy A01 Core	Samsung Electronics	2020/08	Android 10
Samsung Galaxy A51 5G UW	Samsung Electronics	2020/08	Android 10
Samsung Galaxy A42 5G	Samsung Electronics	2020/09	Android 10
Samsung Galaxy S20 FE	Samsung Electronics	2020/10	Android 10
Samsung Galaxy F41	Samsung Electronics	2020/10	Android 10
Samsung Galaxy M21s	Samsung Electronics	2020/11	Android 10
Samsung Galaxy A12	Samsung Electronics	2020/12	Android 10
Samsung Galaxy A02s/M02s	Samsung Electronics	2021/01	Android 10
Samsung Galaxy A32 5G	Samsung Electronics	2021/01	Android 11
Samsung Galaxy S21	Samsung Electronics	2021/01	Android 11
Samsung Galaxy S21+	Samsung Electronics	2021/01	Android 11

Samsung Galaxy S21 Ultra	Samsung Electronics	2021/01	Android 11
Samsung Galaxy A02	Samsung Electronics	2021/01	Android 10
Samsung Galaxy M02	Samsung Electronics	2021/02	Android 10
Samsung Galaxy M12	Samsung Electronics	2021/02	Android 11
Samsung Galaxy F62	Samsung Electronics	2021/02	Android 11
Samsung Galaxy M62	Samsung Electronics	2021/03	Android 11
Samsung Galaxy A32	Samsung Electronics	2021/03	Android 11
Samsung Galaxy Xcover 5	Samsung Electronics	2021/03	Android 11
Samsung Galaxy A52/A52 5G	Samsung Electronics	2021/03	Android 11
Samsung Galaxy A72	Samsung Electronics	2021/03	Android 11
Samsung Galaxy F02s	Samsung Electronics	2021/04	Android 10
Samsung Galaxy F12	Samsung Electronics	2021/04	Android 11
Samsung Galaxy Quantum 2	Samsung Electronics	2021/04	Android 11
Samsung Galaxy F52 5G	Samsung Electronics	2021/06	Android 11
Samsung Galaxy M32	Samsung Electronics	2021/06	Android 11
Samsung Galaxy A22/A22 5G	Samsung Electronics	2021/07	Android 11
Samsung Galaxy Z Fold 3/Z Flip 3	Samsung Electronics	2021/08	Android 11
Samsung Galaxy M52 5G	Samsung Electronics	2021/10	Android 11
Sony Ericsson Xperia X10	Sony Ericsson	2010/03	Android 1.6 "Donut"
Sony Ericsson Xperia X8	Sony Ericsson	2010/06	Android 1.6 "Donut"
Sony Ericsson Xperia Play	Sony Ericsson	2011/04	Android 2.3 Gingerbread
Sony Ericsson Xperia pro	Sony Ericsson	2011/10	Android 2.3 Gingerbread
Sony Xperia Z	Sony Mobile	2013/02	Android 4.1 Jelly Bean
Sony Xperia Z Ultra	Sony Mobile	2013/09	Android 4.1 Jelly Bean
Sony Xperia Z1	Sony Mobile	2013/09	Android 4.1 Jelly Bean
Sony Xperia Z1 Compact	Sony Mobile	2014/02	Android 4.1 Jelly Bean
Sony Xperia Z2	Sony Mobile	2014/05	Android 4.4 KitKat

Sony Xperia Z3/Compact	Sony Mobile	2014/09	Android 4.4 KitKat
Sony Xperia Z4	Sony Mobile	2015/06	Android 5.0 Lollipop
Sony Xperia Z5/Compact	Sony Mobile	2015/10	Android 5.0 Lollipop
Sony Xperia Z5 Premium	Sony Mobile	2015/11	Android 5.0 Lollipop
Sony Xperia X/Performance	Sony Mobile	2016/02	Android 6.0 Marshmallow
Sony Xperia XA	Sony Mobile	2016/06	Android 6.0 Marshmallow
Sony Xperia XA Ultra	Sony Mobile	2016/07	Android 6.0 Marshmallow
Sony Xperia X Compact	Sony Mobile	2016/09	Android 6.0 Marshmallow
Sony Xperia XZ	Sony Mobile	2016/09	Android 6.0 Marshmallow
Sony Xperia XZs/Premium	Sony Mobile	2017/02	Android 7.0 Nougat
Sony Xperia XA1	Sony Mobile	2017/04	Android 7.0 Nougat
Sony Xperia XA1 Ultra	Sony Mobile	2017/05	Android 7.0 Nougat
Sony Xperia L1	Sony Mobile	2017/06	Android 7.0 Nougat
Sony Xperia XZ1/Compact	Sony Mobile	2017/08	Android 8.0 Oreo
Sony Xperia XA1 Plus	Sony Mobile	2017/10	Android 7.0 Nougat
Sony Xperia L2	Sony Mobile	2018/01	Android 7.0 Nougat
Sony Xperia XA2/Ultra	Sony Mobile	2018/02	Android 8.0 Oreo
Sony Xperia XZ2/Compact	Sony Mobile	2018/02	Android 8.0 Oreo
Sony Xperia XZ2 Premium	Sony Mobile	2018/04	Android 8.0 Oreo
Sony Xperia XZ3	Sony Mobile	2018/08	Android Pie
Sony Xperia XA2 Plus	Sony Mobile	2018/09	Android 8.0 Oreo
Sony Xperia 10/10 Plus	Sony Mobile	2019/02	Android Pie
Sony Xperia L3	Sony Mobile	2019/02	Android 8.0 Oreo
Sony Xperia 1	Sony Mobile	2019/05	Android 9 Pie
Sony Xperia 5	Sony Mobile	2019/09	Android 9 Pie
Sony Xperia 8	Sony Mobile	2019/10	Android 9 Pie
Sony Xperia L4	Sony Mobile	2020/04	Android 9 Pie
Sony Xperia 1 II	Sony Mobile	2020/05	Android 10

Sony Xperia 10 II	Sony Mobile	2020/05	Android 10
Sony Xperia 5 II	Sony Mobile	2020/10	Android 10
Sony Xperia Pro	Sony Mobile	2021/01	Android 10
Sony Xperia 10 III	Sony Mobile	2021/04	Android 11
Sony Xperia 5 III	Sony Mobile	2021/04	Android 11
Sony Xperia 1 III	Sony Mobile	2021/04	Android 11
Surface Duo	Microsoft	2020/09	Android 10
T[edit]			
Model	Developer	Release date	Android version at release
T-Mobile G1	T-Mobile	2008/09	Android 1.0
TCL Plex	TCL	2019/10	Android 9 Pie
TCL 10L	TCL	2020/05	Android 10
TCL 10 Pro	TCL	2020/05	Android 10
TCL 10 SE	TCL	2020/07	Android 10
TCL 10 5G	TCL	2020/07	Android 10
TCL 10 Plus	TCL	2020/09	Android 10
Tecno Phantom 6/Plus	Tecno Mobile	2016/09	Android 6.0 Marshmallow
Tecno Camon CX	Tecno Mobile	2017/03	Android 7.0 Nougat
Tecno Camon CX Air	Tecno Mobile	2017/04	Android 7.0 Nougat
Tecno Spark	Tecno Mobile	2017/05	Android 7.0 Nougat
Tecno Spark Plus	Tecno Mobile	2017/06	Android 7.0 Nougat
Tecno Phantom 8	Tecno Mobile	2017/09	Android 7.0 Nougat
Tecno Spark Pro	Tecno Mobile	2017/10	Android 7.0 Nougat
Tecno Camon CM	Tecno Mobile	2017/12	Android 7.0 Nougat
Tecno Spark CM	Tecno Mobile	2017/12	Android 7.0 Nougat
Tecno Camon X/Pro	Tecno Mobile	2018/03	Android 8.1 "Oreo"
Tecno Spark 2	Tecno Mobile	2018/06	Android 8.1 "Oreo"
Tecno Camon 11/Pro	Tecno Mobile	2018/09	Android 8.1 "Oreo"
Tecno Camon iACE2/2X	Tecno Mobile	2019/02	Android 8.1 "Oreo"
Tecno Spark 3/Pro	Tecno Mobile	2019/04	Android 9 Pie
Tecno Phantom 9	Tecno Mobile	2019/07	Android 9 Pie

Tecno Spark Go	Tecno Mobile	2019/08	Android 9 Pie
Tecno Spark 4/Air/Lite	Tecno Mobile	2016/08	Android 9 Pie
Tecno Camon 12	Tecno Mobile	2019/08	Android 9 Pie
Tecno Camon 12 Pro	Tecno Mobile	2019/09	Android 9 Pie
Tecno Camon 12 Air	Tecno Mobile	2019/10	Android 9 Pie
Tecno Camon 15/Pro	Tecno Mobile	2020/02	Android 10
Tecno Camon 15 Air/Premier	Tecno Mobile	2020/04	Android 10
Tecno Spark 5	Tecno Mobile	2020/05	Android 10
Tecno Camon 19	Tecno Mobile	2022/06	Android 12
Tecno Spark 5 Air	Tecno Mobile	2020/05	Android 10
Tecno Spark 5 Pro	Tecno Mobile	2020/05	Android 10
Tecno Spark Power 2	Tecno Mobile	2020/06	Android 10
Tecno Pouvoir 4/Pro	Tecno Mobile	2020/07	Android 10
Tecno Camon 16 Premier	Tecno Mobile	2020/09	Android 10
Tecno Spark 6 Air	Tecno Mobile	2020/09	Android 10
Tecno Spark 6	Tecno Mobile	2020/09	Android 10
Tecno Spark 9	Tecno Mobile	2022/06	Android 12
Tecno Camon 16	Tecno Mobile	2020/10	Android 10
Tecno Pova	Tecno Mobile	2020/10	Android 10
U[edit]			
Model	Developer	Release date	Android version at release
Ubuntu Edge	Canonical	Unreleased	Unknown Android Version
Unihertz TickTock	Unihertz	2021	Android 11
Umidigi A9/+/Max	Umidigi	2020/12	Android 11
V[edit]			
Model	Developer	Release date	Android version at release
Vertu Ti	Vertu	2013/02	Android 4.0 Ice Cream Sandwich
Vivo X1	Vivo	2012/11	Android 4.1 Jelly Bean
Vivo X3	Vivo	2013/08	Android 4.1 Jelly Bean
Vivo X3S	Vivo	2014/12	Android 4.1 Jelly Bean
Vivo X5/Max	Vivo	2014/12	Android 4.4 KitKat

Vivo X5Max+	Vivo	2015/03	Android 4.4 KitKat
Vivo X5Pro	Vivo	2015/05	Android 5.0 Lollipop
Vivo X5Max Platinum	Vivo	2015/06	Android 4.4 KitKat
Vivo V1	Vivo	2015/07	Android 5.0 Lollipop
Vivo V1 Max	Vivo	2015/08	Android 5.0 Lollipop
Vivo X6/Plus	Vivo	2015/11	Android 5.0 Lollipop
Vivo X6S/Plus	Vivo	2016/03	Android 5.0 Lollipop
Vivo V3/Max	Vivo	2016/04	Android 5.0 Lollipop
Vivo X7/Plus	Vivo	2016/07	Android 5.0 Lollipop
Vivo X9/Plus	Vivo	2016/07	Android 6.0 Marshmallow
Vivo V5	Vivo	2016/11	Android 6.0 Marshmallow
Vivo V5 Plus	Vivo	2017/01	Android 6.0 Marshmallow
Vivo V5 Lite/Y66	Vivo	2017/02	Android 6.0 Marshmallow
Vivo V5s	Vivo	2017/05	Android 6.0 Marshmallow
Vivo X9s/Plus	Vivo	2017/07	Android 7.0 Nougat
Vivo V7+	Vivo	2017/09	Android 7.0 Nougat
Vivo X20/Plus	Vivo	2017/09	Android 7.0 Nougat
Vivo V7	Vivo	2017/12	Android 7.0 Nougat
Vivo X20 Plus UD	Vivo	2018/01	Android 7.0 Nougat
Vivo X21/UD	Vivo	2018/03	Android 8.0 Oreo
Vivo V9/Youth	Vivo	2018/04	Android 8.0 Oreo
Vivo X21i	Vivo	2018/05	Android 8.0 Oreo
Vivo NEX	Vivo	2018/06	Android 8.0 Oreo
Vivo V11	Vivo	2018/09	Android 8.0 Oreo
Vivo X23	Vivo	2018/09	Android 8.0 Oreo
Vivo V11i	Vivo	2018/09	Android 8.0 Oreo
Vivo NEX Dual Display	Vivo	2018/12	Android Pie
Vivo V15/Pro	Vivo	2019/03	Android Pie
Vivo X27/Pro	Vivo	2019/03	Android Pie
Vivo V17 Neo	Vivo	2019/08	Android Pie
Vivo NEX 3	Vivo	2019/09	Android Pie

Vivo V17 Pro	Vivo	2019/09	Android Pie
Vivo V17	Vivo	2019/12	Android Pie
Vivo X30/Pro	Vivo	2019/12	Android Pie
Vivo NEX 3S	Vivo	2020/03	Android 10
vivo Z5	Vivo	2019	Android 9
vivo Z6 5G	Vivo	2020/04	Android 10
Vivo V19	Vivo	2020/04	Android 10
Vivo X50 Lite	Vivo	2020/05	Android 10
Vivo X50/Pro/Pro+	Vivo	2020/06	Android 10
Vivo V19 Neo	Vivo	2020/06	Android 10
Vivo V20 Pro	Vivo	2020/09	Android 10
Vivo X50e	Vivo	2020/10	Android 10
Vivo V20 SE	Vivo	2020/10	Android 10
Vivo V20	Vivo	2020/10	Android 11
Vivo X51	Vivo	2020/10	Android 10
Vivo V20 (2021)	Vivo	2020/12	Android 11
Vivo X60/Pro/Pro+	Vivo	2021/01	Android 11
vivo Y12s	Vivo	2020	Android 10
vivo Y12s	Vivo	2020	Android 10
vivo Y1s	Vivo	2020	Android 10
vivo Y20	Vivo	2021	Android 10
vivo V21e	Vivo	2021	Android 11
vivo V21	Vivo	2021	Android 11
vivo Y53s	Vivo	2021	Android 11
vivo S10	Vivo	2021	Android 11
Vivo X70/Pro/Pro+	Vivo	2021/09	Android 11
vivo V23e	Vivo	2021/11	Android 11
vivo V23e 5G	Vivo	2021/12	Android 11
vivo Y21T	Vivo	2022/01	Android 11
vivo Y33t	Vivo	2022/01	Android 11
vivo Y55 5G	Vivo	2022	Android 11

vivo Y75 5G	Vivo	2022	Android 11
vivo V23/Pro	Vivo	2022/01	Android 12
vivo iQOO 9/SE	Vivo	2022/02	Android 12
Vivo Y21a	Vivo	2022	Android 11
Vivo Y01	Vivo	2022/03	Android 11
Vivo Y21G	Vivo	2022/04	Android 11
Vivo X80/Pro	Vivo	2022/04	Android 12
Vivo X Note/Fold	Vivo	2022/04	Android 12
Vivo X Fold+	Vivo	2022/09	Android 12
Vivo X90/Pro/Pro+	Vivo	2022/11	Android 13
Vivo X Fold2/Flip	Vivo	2022/04	Android 13
Vivo X90s	Vivo	2023/06	Android 13
Vivo X100/Pro	Vivo	2023/11	Android 14
Vivo Y100i	Vivo	2023/12	Android 13
Vivo Y36i	Vivo	2023/12	Android 13
Vivo S18/Pro/e	Vivo	2023/12	Android 14
X[edit]			
Model	Developer	Release date	Android version at release
Xiaomi Mi 1	Xiaomi	2011/12	Android 2.3 Gingerbread
Xiaomi Mi 1S	Xiaomi	2012/08	Android 4.0 Ice Cream Sandwich
Xiaomi Mi 2	Xiaomi	2012/10	Android 4.1 Jelly Bean
Xiaomi Mi 2S/A	Xiaomi	2013/04	Android 4.1 Jelly Bean
Xiaomi Mi 3/TD	Xiaomi	2013/12	Android 4.3 Jelly Bean
Xiaomi Mi 4	Xiaomi	2014/08	Android 4.4 KitKat
Xiaomi Mi Note	Xiaomi	2015/01	Android 4.4 KitKat
Xiaomi Mi Note Pro	Xiaomi	2015/05	Android 5.0 Lollipop
Xiaomi Mi 4i	Xiaomi	2015/04	Android 5.0 Lollipop
Xiaomi Mi 4c	Xiaomi	2015/09	Android 5.1 Lollipop
Xiaomi Mi 4S	Xiaomi	2016/03	Android 5.1 Lollipop
Xiaomi Mi 5	Xiaomi	2016/04	Android 6.0 Marshmallow
Xiaomi Mi Max/Pro	Xiaomi	2016/05	Android 6.0 Marshmallow

Xiaomi Mi 5s/Plus	Xiaomi	2016/10	Android 6.0 Marshmallow
Xiaomi Mi Note 2	Xiaomi	2016/11	Android 6.0 Marshmallow
Xiaomi Mi MIX	Xiaomi	2016/11	Android 6.0 Marshmallow
Xiaomi Mi 5c	Xiaomi	2017/03	Android 6.0 Marshmallow
Xiaomi Mi 6	Xiaomi	2017/04	Android 7.1 "Nougat"
Xiaomi Mi Max 2	Xiaomi	2017/06	Android 7.1 "Nougat"
Xiaomi Mi 5X/Mi A1	Xiaomi	2017/08	Android 7.1 "Nougat"
Xiaomi Mi Note 3	Xiaomi	2017/09	Android 7.1 "Nougat"
Xiaomi Mi MIX 2	Xiaomi	2017/09	Android 7.1 "Nougat"
Xiaomi Mi MIX 2S	Xiaomi	2018/04	Android 8.1 "Oreo"
Xiaomi Mi 6X/Mi A2	Xiaomi	2018/04	Android 8.1 "Oreo"
Xiaomi Black Shark	Xiaomi	2018/04	Android 8.0 "Oreo"
Xiaomi Mi 8/SE/EE	Xiaomi	2018/06	Android 8.1 "Oreo"
Xiaomi Mi Max 3	Xiaomi	2018/07	Android 8.1 "Oreo"
Xiaomi Mi 8 Pro/Lite	Xiaomi	2018/09	Android 8.1 "Oreo"
Xiaomi Mi MIX 3	Xiaomi	2018/11	Android 9 Pie
Xiaomi Black Shark Helo	Xiaomi	2018/11	Android 8.0 Oreo
Xiaomi Mi Play	Xiaomi	2018/12	Android 8.1 Oreo
Xiaomi Mi 9/SE	Xiaomi	2019/03	Android 9 Pie
Xiaomi Black Shark 2	Xiaomi	2019/03	Android 9 Pie
Xiaomi Mi MIX 3 5G	Xiaomi	2019/05	Android 9 Pie
Xiaomi Mi 9T	Xiaomi	2019/06	Android 9 Pie
Xiaomi Mi A3	Xiaomi	2019/07	Android 9 Pie
Xiaomi Mi 9T Pro	Xiaomi	2019/08	Android 9 Pie
Xiaomi Black Shark 2 Pro	Xiaomi	2019/08	Android 9 Pie
Xiaomi Mi 9 Lite	Xiaomi	2019/09	Android 9 Pie
Xiaomi Mi 9 Pro	Xiaomi	2019/09	Android 9 Pie
Xiaomi Mi Note 10/Pro	Xiaomi	2019/11	Android 9 Pie
Xiaomi Mi 10/Pro	Xiaomi	2020/02	Android 10
Xiaomi Black Shark 3/Pro	Xiaomi	2020/03	Android 10
Xiaomi Mi 10 Lite	Xiaomi	2020/05	Android 10

Xiaomi Mi 10 Youth	Xiaomi	2020/05	Android 10
Xiaomi Mi Note 10 Lite	Xiaomi	2020/05	Android 10
Xiaomi Mi 10 Ultra	Xiaomi	2020/08	Android 10
Xiaomi Mi 10T/Pro/Lite	Xiaomi	2020/10	Android 10
Xiaomi Mi 11	Xiaomi	2021/01	Android 11
Xiaomi Mi 10i	Xiaomi	2021/01	Android 10
Xiaomi Mi 10S	Xiaomi	2021/03	Android 11
Xiaomi Black Shark 4/Pro	Xiaomi	2021/03	Android 11
Xiaomi Mi 11 Pro/Ultra/11i	Xiaomi	2021/04	Android 11
Xiaomi Mi 11 Lite/Lite 5G	Xiaomi	2021/04	Android 11
Xiaomi Mi MIX Fold	Xiaomi	2021/04	Android 11
Xiaomi Mi 11X/Pro	Xiaomi	2021/04	Android 11
Xiaomi MIX 4	Xiaomi	2021/08	Android 11
Xiaomi 11T/Pro	Xiaomi	2021/09	Android 11
Xiaomi 11 Lite 5G NE	Xiaomi	2021/09	Android 11
Xiaomi 12/Pro/X	Xiaomi	2021/12	Android 12
Xiaomi 11i/HyperCharge	Xiaomi	2022/01	Android 11
Xiaomi Civi 1S	Xiaomi	2022/04	Android 12
Xiaomi 12 Pro Dimensity	Xiaomi	2022/07	Android 12
Xiaomi 12S/Pro/Ultra	Xiaomi	2022/07	Android 12
Xiaomi 12 Lite	Xiaomi	2022/07	Android 12
Xiaomi MIX Fold 2	Xiaomi	2022/08	Android 12
Xiaomi Civi 2	Xiaomi	2022/09	Android 12
Xiaomi 12T/Pro	Xiaomi	2022/10	Android 12
Xiaomi 13/Pro	Xiaomi	2022/12	Android 13
Xiaomi 13 Lite	Xiaomi	2023/03	Android 12
Xiaomi 13 Ultra	Xiaomi	2023/04	Android 13
Xiaomi Civi 3	Xiaomi	2023/05	Android 13
Xiaomi MIX Fold 3	Xiaomi	2023/08	Android 13
Xiaomi 13T/Pro	Xiaomi	2023/09	Android 13
Xiaomi 14/Pro	Xiaomi	2023/11	Android 14

Y[edit]			
Model	Developer	Release date	Android version at release
YotaPhone	Yota	2013/11	Android 4.2.2 Jelly Bean
YotaPhone 2	Yota	2014/12	Android 4.4.3 KitKat
YU Yureka	YU Televentures	2015/01	Android 4.4.4 KitKat
Z[edit]			
Model	Developer	Release date	Android version at release
ZTE Racer	ZTE	2010/07	Android 2.0 Eclair
ZTE Blade	ZTE	2010/11	Android 2.0 Eclair
ZTE Libra	ZTE	2011/09	Android 2.0 Eclair
ZTE Racer II	ZTE	2011/09	Android 2.2 Froyo
ZTE Skate	ZTE	2011/09	Android 2.3 Gingerbread
ZTE Score	ZTE	2011/09	Android 2.3 Gingerbread
ZTE Warp	ZTE	2011/10	Android 2.3 Gingerbread
ZTE Avail	ZTE	2011/12	Android 2.3 Gingerbread
ZTE FTV Phone	ZTE	2011/12	Android 2.2 Froyo
ZTE Blade II V880+	ZTE	2012/03	Android 2.3 Gingerbread
ZTE Score M	ZTE	2012/03	Android 2.3 Gingerbread
ZTE V880E	ZTE	2012/05	Android 2.3 Gingerbread
ZTE Kis V788	ZTE	2012/07	Android 2.3 Gingerbread
ZTE Grand X	ZTE	2012/07	Android 4.0 Ice Cream Sandwich
ZTE Grand X IN	ZTE	2012/09	Android 4.0 Ice Cream Sandwich
ZTE Blade III	ZTE	2012/09	Android 4.0 Ice Cream Sandwich
ZTE Grand Era	ZTE	2012/09	Android 4.0 Ice Cream Sandwich
ZTE Warp Sequent	ZTE	2012/09	Android 4.0 Ice Cream Sandwich
ZTE Grand X LTE	ZTE	2012/11	Android 4.0 Ice Cream Sandwich
ZTE Flash	ZTE	2012/11	Android 4.0 Ice Cream Sandwich
ZTE Groove X501	ZTE	2012/11	Android 2.3 Gingerbread
ZTE Kis III V790	ZTE	2012/11	Android 2.3 Gingerbread
ZTE N910	ZTE	2012/12	Android 4.0 Ice Cream Sandwich
ZTE Era	ZTE	2012/12	Android 4.0 Ice Cream Sandwich

ZTE V887	ZTE	2012/12	Android 4.0 Ice Cream Sandwich
ZTE V889M	ZTE	2012/12	Android 4.0 Ice Cream Sandwich
ZTE Avid 4G	ZTE	2012/12	Android 4.0 Ice Cream Sandwich
ZTE Grand S	ZTE	2013/03	Android 4.1 Jelly Bean
ZTE Director	ZTE	2013/03	Android 4.0 Ice Cream Sandwich
ZTE Blade C V807	ZTE	2013/04	Android 4.1 Jelly Bean
ZTE Blade III Pro	ZTE	2013/04	Android 4.1 Jelly Bean
ZTE Blade G V880G	ZTE	2013/04	Android 4.1 Jelly Bean
ZTE Blade G2	ZTE	2013/07	Android 4.1 Jelly Bean
ZTE Blade V	ZTE	2013/09	Android 4.1 Jelly Bean
ZTE Blade Q/Maxi/Mini	ZTE	2013/10	Android 4.1 Jelly Bean
ZTE Blade L2	ZTE	2014/05	Android 4.1 Jelly Bean
ZTE Blade Vec 3G/4G	ZTE	2014/11	Android 4.4 KitKat
ZTE Blade S6	ZTE	2015/02	Android 5.0 Lollipop
ZTE Blade G/Lux	ZTE	2015/02	Android 4.4 KitKat
ZTE Blade L3	ZTE	2015/02	Android 5.0 Lollipop
ZTE Blade L3 Plus	ZTE	2015/03	Android 4.4 KitKat
ZTE Blade S6 Plus	ZTE	2015/04	Android 5.0 Lollipop
ZTE Blade Qlux 4G	ZTE	2015/06	Android 4.4 KitKat
ZTE Blade Q Pro	ZTE	2015	Android 5.0 Lollipop
ZTE Blade Apex 3	ZTE	2015/06	Android 4.4 KitKat
ZTE Blade A410	ZTE	2015/06	Android 5.0 Lollipop
ZTE Blade A460	ZTE	2015/06	Android 5.0 Lollipop
ZTE Axon Pro/Lux	ZTE	2015/07	Android 5.0 Lollipop
ZTE Blade D6	ZTE	2015/07	Android 5.0 Lollipop
ZTE Axon Elite	ZTE	2015/09	Android 5.0 Lollipop
ZTE Axon mini	ZTE	2015/10	Android 5.0 Lollipop
ZTE Blade S7	ZTE	2015/10	Android 5.0 Lollipop
ZTE Axon	ZTE	2015/10	Android 5.0 Lollipop
ZTE Blade X3/5/9	ZTE	2015/11	Android 5.0 Lollipop
ZTE Axon Max	ZTE	2015/12	Android 5.0 Lollipop

ZTE Blade V7/Lite	ZTE	2016/02	Android 6.0 Marshmallow
ZTE Axon 7	ZTE	2016/05	Android 6.0 Marshmallow
ZTE Axon 7 mini	ZTE	2016/09	Android 6.0 Marshmallow
ZTE Axon 7 Max	ZTE	2016/10	Android 6.0 Marshmallow
ZTE Axon 7s	ZTE	2017/04	Android 7.0 Nougat
ZTE Maven 2	ZTE	2017/07	Android 6.0 Marshmallow
ZTE Blade A6	ZTE	2017/08	Android 7.0 Nougat
ZTE Axon M	ZTE	2017/10	Android 7.0 Nougat
ZTE Blade X	ZTE	2017/10	Android 7.0 Nougat
ZTE Blade A3	ZTE	2017/11	Android 7.0 Nougat
ZTE Tempo Go	ZTE	2018/02	Android 8.0 Oreo
ZTE Blade V9/Vita	ZTE	2018/02	Android 8.0 Oreo
ZTE Axon 9 Pro	ZTE	2018/08	Android 8.0 Oreo
ZTE Blade A7 Vita	ZTE	2018/12	Android 8.0 Oreo
ZTE Blade V10/Vita	ZTE	2019/02	Android Pie
ZTE Axon 10 Pro/5G	ZTE	2019/02	Android Pie
ZTE Blade L8	ZTE	2019/04	Android Pie
ZTE Blade A3 (2019)	ZTE	2019/04	Android Pie
ZTE Blade A7	ZTE	2019/05	Android Pie
ZTE Blade A5 (2019)	ZTE	2019/05	Android Pie
ZTE Blade A20	ZTE	2019/10	Android Pie
ZTE Blade 10 Prime	ZTE	2019/11	Android Pie
ZTE Blade A7 Prime	ZTE	2019/11	Android Pie
ZTE Blade Max View	ZTE	2019/11	Android 7.0 Nougat
ZTE Axon 10s Pro 5G	ZTE	2020/02	Android 10
ZTE Axon 11 4G/5G	ZTE	2020/03	Android 10
ZTE Blade V 2020	ZTE	2020/05	Android 10
ZTE Axon 11 SE 5G	ZTE	2020/06	Android 10
ZTE Axon 20 5G	ZTE	2020/09	Android 10
ZTE Blade A7s 2020	ZTE	2020/09	Android 10
ZTE Blade 20 5G	ZTE	2020/09	Android 10

ZTE Axon 20 4G	ZTE	2020/09	Android 10
ZTE S30/Pro/SE	ZTE	2021/04	Android 11
ZTE Axon 30 Pro/Ultra	ZTE	2021/04	Android 11
ZTE Blade 11 Prime	ZTE	2021/04	Android 10
ZTE Blade A51	ZTE	2021/05	Android 11
ZTE Blade A31	ZTE	2021/07	Android 11
ZTE Axon 30	ZTE	2021/08	Android 11
ZTE Blade A71	ZTE	2021/10	Android 11
ZTE Blade L9	ZTE	2021/10	Android 11
ZTE Blade A31 Plus	ZTE	2021/10	Android 11
ZTE Voyage 20 Pro	ZTE	2021/08	Android 11

8.2.2 WEAR OS WATCHES

Brand	Name	Date Released	Latest OS
Asus	ZenWatch	2014-11-09	Android Wear 1.5
	ZenWatch 2	2015-09	Android Wear 2.0
	ZenWatch 3	2016-11	Android Wear 2.0
Casio	Smart Outdoor Watch WSD-F10	2016-03-25	Wear OS 1.0[1]
	Smart Outdoor Watch WSD-F20	2017-04-21	Wear OS 2.27
	Smart Outdoor Watch WSD-F30	2019-01-18	Wear OS 2.6
Fossil	Q Founder(Gen 1)	2015-10-05	Android Wear 2.16
	Q Marshal(Gen 2)	2016-03-15	Wear OS 2.0
	Q Wander(Gen 2)	2016-03-15	Wear OS 2.1[10]
	Q Explorist(Gen 3)	2017-08-28	Android Wear 2.17
	Q Venture(Gen 3)	2017-08-28	Wear OS 2.9
	Q Control(Gen 3)	2017-11-12	Wear OS 2.10
	Q Explorist HR(Gen 4)	2018-08-06	Wear OS 2.34
	Q Venture HR(Gen 4)	2018-08-06	Wear OS 2.6
	Q Sport(Gen 4)	2018-11-12	Wear OS 2.12

	Q The Carlyle HR (Gen 5)	2019-08-05	Wear OS 2.37
	Q Julianna HR(Gen 5)	2019-08-05	Wear OS 2.17
	Garrett HR(Gen 5)	2019-08-26	Wear OS 2.17
	HR(Gen 6)	2021-09-22	Wear OS 3.5
Google	Pixel Watch	2022-10-06	Wear OS 3.5
	Pixel Watch 2	2023-10-04	Wear OS 4.0
Huawei	Watch	2015-09-02	Android Wear 2.35
	Watch 2	2017-04-18	Wear OS 2.27
	Watch 2 Classic	2017-04-18	Wear OS 2.9
Kate Spade	Scallop Smartwatch 2	2019-01-20	Wear OS 2.6
LG	G Watch (W100)	2014-06-25	Android Wear 1.5[31]
	G Watch R (W110)	2014-10-25	Android Wear 2.24
	Watch Urbane (W150)	2015-04-27	Android Wear 2.23
	Watch Urbane 2nd Edition (W200V)	2016-03	Android Wear 2.15
	Watch Style (W270)	2017-02-09	Wear OS 2.27
	Watch Sport (W280A)	2017-02-09	Wear OS 2.30
	Watch W7(W315)	2018-10	Android Wear 2.0
Louis Vuitton	Tambour Horizon (2017)	2017	Wear OS 2.6
	Tambour Horizon (2019)	2019	
Michael Kors	Access		Wear OS 2.6
	Runway	2018-09	Wear OS 2.17
Misfit	Vapor	2017-10-31	Wear OS 2.6
	Vapor 2	2018-10-23	Wear OS 2.6
	Vapor X	2019-8-14	Wear OS 2.8
Mobvoi	TicWatch S & E	2018-01	Wear OS 2.24
	TicWatch Pro	2018-07-10	Wear OS 2.24
	TicWatch Pro 4G	2019-07	Wear OS 2.24
	TicWatch Pro 2020	2020-02	Wear OS 2.24
	TicWatch C2	2018-12-06	Wear OS 2.24
	TicWatch S2 & E2	2019-01-22	Wear OS 2.24
	TicWatch Pro 3 GPS	2020-09-24	Wear OS 2.37

	TicWatch E3	2021-06-16	Wear OS 2.32
	TicWatch Pro 5	2023-05-24	Wear OS 3.5
Montblanc	Summit	2017-05	Wear OS 2.6
	Summit 2	2018-10-15	Wear OS 2.27
	Summit 3	2022-07-15	Wear OS3.0
Motorola	Moto 360 (1st generation)	2014-09-05	Android Wear 1.4
	Moto 360 (2nd generation)	2015-09-15	Android Wear 2.17
	Moto 360 Sport	2016-01	Wear OS 2.9
	Moto 360 (3rd generation)	2020-09-10	Wear OS 2.44
New Balance	RunIQ Watch		Android Wear 2.15
Nixon	Mission	2016-10-10	Wear OS 2.6
Oppo	OPPO Watch46mm (LTE)	2020-03-20	Wear OS 2.23
	OPPO Watch46mm (Wi-Fi)	2020-03-20	Wear OS 2.23
	OPPO Watch 41mm (Wi-Fi)	2020-03-20	Wear OS 2.23
	Oppo Watch 2	2021-07-27	
	Oppo Watch 3	2022-08-29	
	Oppo Watch 3 Pro	2022-08-29	
Polar	M600		Wear OS 2.3[46]
Samsung	Gear Live	2014-06-25	Android Wear 1.5[31]
	Galaxy Watch 4	2021-08-27	Wear OS 3.5
	Galaxy Watch 4 Classic		
	Galaxy Watch 5	2022-08-26	Wear OS 3.5
	Galaxy Watch 5 Pro		
	Galaxy Watch 6	2023-08-11	Wear OS 4.0
	Galaxy Watch 6 Classic		
Skagen	Falster 2	2018-08-12	Wear OS 2.11
	Falster 3	2020-01-07	Wear OS 2.11
	Falster 6	2021-08	Wear OS 3
Sony	SmartWatch 3	2014-11	Android Wear 1.5[31]
Suunto		7 2020-01-31	Wear OS 2.23

Tag Heuer	Connected		Android Wear 2.0[31]
	Connected Modular 45		Wear OS 2.6
	Connected E4		Wear OS 3.2
Verizon	Wear24	2017-02-08	Android Wear 2.21
Xiaomi	Mi Watch	2019-11-05	Wear OS 2.27
Xiaomi	Watch pro 2	2023-10-13	Wear OS 3
ZTE	Quartz	2017-04-14	Android Wear 2.20

8.2.3 IPHONE MODELS

Gen	Model	Announced	Released
6	iPhone 5	September 12, 2012	September 21, 2012; 11 years ago
6	iPhone 5c	September 10, 2013	September 20, 2013; 10 years ago
7	iPhone 5s	September 10, 2013	September 20, 2013; 10 years ago
8	iPhone 6	September 9, 2014	September 19, 2014; 9 years ago March 10, 2017; 6 years ago (32 GB model)
8	iPhone 6 Plus	September 9, 2014	September 19, 2014; 9 years ago
9	iPhone 6s	September 9, 2015	September 25, 2015; 8 years ago
9	iPhone 6s Plus	September 9, 2015	September 25, 2015; 8 years ago
9	iPhone SE (1st generation)	March 21, 2016	March 31, 2016; 7 years ago
10	iPhone 7	September 7, 2016	September 16, 2016; 7 years ago
10	iPhone 7 Plus	September 7, 2016	September 16, 2016; 7 years ago
11	iPhone 8	September 12, 2017	September 22, 2017; 6 years ago
11	iPhone 8 Plus	September 12, 2017	September 22, 2017; 6 years ago
11	iPhone X	September 12, 2017	November 3, 2017; 6 years ago
12	iPhone XR	September 12, 2018	October 26, 2018; 5 years ago
12	iPhone XS	September 12, 2018	September 21, 2018; 5 years ago
12	iPhone XS Max	September 12, 2018	September 21, 2018; 5 years ago
13	iPhone 11	September 10, 2019	September 20, 2019; 4 years ago
13	iPhone 11 Pro	September 10, 2019	September 20, 2019; 4 years ago
13	iPhone 11 Pro Max	September 10, 2019	September 20, 2019; 4 years ago

13	iPhone SE (2nd generation)	April 15, 2020	April 24, 2020; 3 years ago
14	iPhone 12	October 13, 2020	October 23, 2020; 3 years ago
14	iPhone 12 Mini	October 13, 2020	November 13, 2020; 3 years ago
14	iPhone 12 Pro	October 13, 2020	October 23, 2020; 3 years ago
14	iPhone 12 Pro Max	October 13, 2020	November 13, 2020; 3 years ago
15	iPhone 13	September 14, 2021	September 24, 2021; 2 years ago
15	iPhone 13 Mini	September 14, 2021	September 24, 2021; 2 years ago
15	iPhone 13 Pro	September 14, 2021	September 24, 2021; 2 years ago
15	iPhone 13 Pro Max	September 14, 2021	September 24, 2021; 2 years ago
15	iPhone SE (3rd generation)	March 8, 2022	March 18, 2022; 23 months ago
16	iPhone 14	September 7, 2022	September 16, 2022; 17 months ago
16	iPhone 14 Plus	September 7, 2022	October 7, 2022; 16 months ago
16	iPhone 14 Pro	September 7, 2022	September 16, 2022; 17 months ago
16	iPhone 14 Pro Max	September 7, 2022	September 16, 2022; 17 months ago
17	iPhone 15	September 12, 2023	September 22, 2023; 4 months ago
17	iPhone 15 Plus	September 12, 2023	September 22, 2023; 4 months ago
17	iPhone 15 Pro	September 12, 2023	September 22, 2023; 4 months ago
17	iPhone 15 Pro Max	September 12, 2023	September 22, 2023; 4 months ago