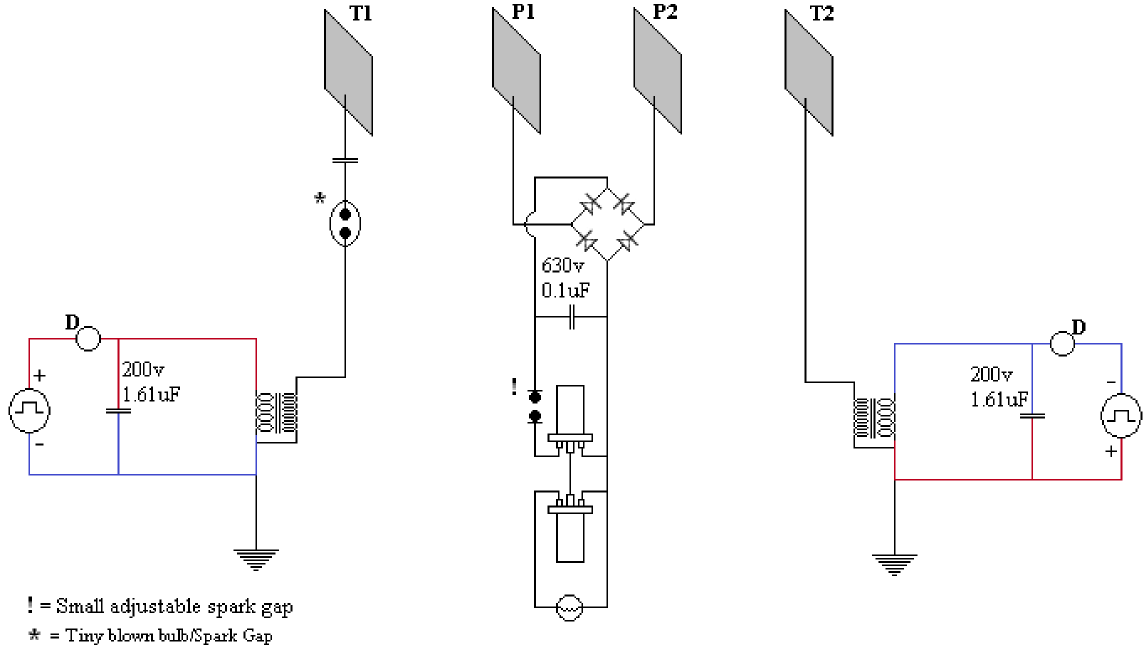
Question : What kind of voltages can I expect out of the "receive" station?.

-*with the following circuit schematic diagram*



Answer :

So, lets attempt to calculate the voltage you asked about...
the Ignition coil data file (in the link on the line below)
www.hella.com/ePaper/Sensoren/Zuendspulen_EN/document.pdf
states that the coils are constructed with 50,000 turns on the secondary winding with a turn ratio of 1:100, so 50,000 divided by 100 is 500, and that calculate the number of turns in the primary winding (50,000/500=500:50,000).
So primary has 500 turns of coated copper wire about 0.6-0.9 mm thick, with a resistance ofabout 0.2-3.0 Ohm.
And transformer secondary terminal output voltage (peak) can be calculated by dividing the product of primary voltage (13.8v) and number of turns in secondary windings (50,000) (=690,000) by the number of turns in the primary winding (500) (690,000/500= 1380v).

If we do the same calculation for the variables given in the ignition coil data we can confirm my above calculation (just to be sure)...
So the datasheet says the typical input voltage is between 300v and 400v and the expected output voltage can be upto 40Kv (40,000v), we will use an average of the resistance values given above (0.2-3.0Ω) of 1.6Ω (that is about the half way point), so 300v by 50,000 is 15000000 and that divided by 500 is 30,000v and that is well within the

expected output voltage range as specified by the datasheet

So yeah your peak output voltage given a 13.8v DC input would be 1380v at the terminal of the transmitter...
The atmosphere has an estimated average "vertical" resistance range value of 1.3×10^{16} to $3.3\times10^{16}\Omega$ per meter (between ground and earth, unfortunately, and not horizontal resistance at a elevation, so this is actually an incorrect calculation but that is still quite close to the mark and the best i can do at the moment sorry) at 20°C in fair weather conditions (13000000000000000 to 33,000,000,000,000,000Ω/m, thirty-three thousand billion or 33 quadrillion ohm... i think lol), so with I=V/R that equates to 0.0000000000001061a at 1380v (on the lower resistance scale at a meter), this equation does not however take into account resonance or resistance drop to higher voltages (the higher the voltage presented to the atmosphere, the less the resistance should be) but given fixed values, 1,000,000v it equates to 0.0000000000769230a and 100,000,000v equates to 0.00000000769230769a, but now consider a lightning bolt, they are considered to be in the range of 100,000,000v (100 million volts) but are estimated to be between 10,000a and 30,000a (10 to 30 thousand ampere), however i have heard of reports of up to current values of 50,000a, so as you can see the above calculations not quite true, it seems the exponential value of the resistance drop is a hard/difficult constant to find/search on the internet and in research papers unfortunately but never-the-less, i think that leads to part of the excitement during experimentation, discovering new values and constants in mathematics, i would imagine that the value has been calculated and is a known constant, you might have better luck finding such information but however, if we do the lightning variable in reverse with R=V/I, we can determine the resistance of the atmosphere at that voltage and at that particular period in time, so at 30,000a and 100,000,000v we have 3333.33333333333Ω, quite a massive difference! and a huge drop in resistance value!...
And lets recalculate the initial figures with a resistance of say 10,000Ω to determine a current value in amperage, so, once again, and that equates to 0.138a things are starting too look better, and would be even better still at higher voltages
With that we ummm, could assume for instance (and to account for the vertical resistance factor mentioned before), the receiver circuit actually takes up a part of that 10,000Ω, lets assume that the actual receiving circuit consists of a 1500Ω load resistance, so now we are left with 8500Ω of resistance and the V=RI (8500Ω by 0.138a) equation results in 1173v, (that will be the effective voltage loss), so we can subtract 1173v from the original voltage of 1380v to get a source supply voltage for the receiver circuit (at the antenna) at 207v at a range of 1 meter from the transmitter.
So don't lose hope with the initial calculations, it is just a difficult thing to calculate accurately, the resistance will also drop with a higher moisture content in the atmosphere leading to a larger amount of current available at the receiver.