Difference Between a Zenneck Wave and a Surface Wave

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When a TM wave is incident at an air dielectric interface it has a reflection coefficient which determines how much of the wave will be reflected into air and how much will be transmitted in to the dielectric. The reflection coefficient is a ration al function with a numerator and a denominator. There can be possible zeros for the numerator which yields the well known Brewster angle and the resultant wave is known as the Zenneck wave. The interesting property of the Brewster angle is that if the dielectric constant of the second medium is complex the imaginary part has a second order effect. Also the field distribution for the Brewster angle becomes independent of frequency. Propagation of radio Waves falls in that category as will be illustrated by computational results that the reflected wave has a field variation which does not change too much with frequency and the wave is an evanescent wave. When the denominator becomes zero then one obtains a pole and the corresponding wave is termed a surface wave. So when the reflection coefficient is infinity that implies that there is a reflected wave and a transmitted wave without an incident wave. Therefore true surface waves cannot be generated by an incident wave as the fields exist even without an incident wave. They are generated by an evanescent wave which behaves as a quasi particle and vibrates the electrons resulting in the evanescent surface wave. The fields of a surface wave are highly concentrated across the interface with an increase of frequency and it is also an evanescent wave. Surface Plasmon falls into this category.

Illustrations will be presented to illustrate these two special cases for propagation of waves across an interface.