Refutation of the Frauchiger-Renner thought experiment with modal operators as a paradox

Abstract: We use modal logic to evaluate a quantum rendition of the Frauchiger-Renner thought experiment to refute it as paradox (contradiction) *and* as tautology.

We assume the method and apparatus of Meth8/VŁ4 with Tautology as the designated *proof* value, F as contradiction, N as truthity (non-contingency), and C as falsity (contingency). The 16-valued truth table is row-major and horizontal.

LET   p, q, r, s: u, w, a, b;
         ~ Not; + Or ; & And; > Imply; = Equivalent; @ Not Equivalent;
          % possibility, for one or some;   # necessity, for all or every;
         (p=p) ok; (q@q) fail; (%r>#r), (%s>#s) ordinal one, 1.

From: Nurgalieva, N.; del Rio, L. (2018). Inadequacy of modal logic in quantum settings.
         arxiv.org/pdf/1804.01106.pdf   delrio@phys.ethz.ch

Remark 0: The paper described the thought experiment in several ways, however examples for *t* were not clear. Therefore we relied on the simpler equations of results from the sketch of the reasoning of agents.

$(u = ok) \rightarrow (b = 1)$		(1.1)
(p=(p=p)) > (s=(%s>#s)) ;	TCTC TCTC TNTN TNTN	(1.2)
$(b = 1) \rightarrow (a = 1)$;		(2.1)
(s=(%s>#s)) > (r=(%r>#r)) ;	TTTT NNNN CCCC TTTT	(2.2)
$(a = 1) \rightarrow (w = fail)$		(3.1)
(r=(%r>#r)) > (q=(q@q)) ;	TTNN TTCC TTNN TTCC	(3.2)

The text injects "w =" into the antecedent of Eq. 1.1 as "(w = u = ok)" for:

(w = Eqs. 1.1) → 2.1 → 3.1		(4.1)
(((((p=q)=(p=p))>(s=(%s>#s)))>((s=(%s>#s))>(r=(%r>#r))))>		
((r=(%r>#r))>(q=(q@q))) ;	TTNN TTCC TTNN TTCC	(4.2)

> **Remark 5:** Without the injection, Eqs. 1.1 → 2.1 → 3.1, with the table result
> as that for 4.2: (5.1)
> (((p=(p=p))>(s=(%s>#s)))>((s=(%s>#s))>(r=(%r>#r))))>
> ((r=(%r>#r))>(q=(q@q))) ;   TTNN TTCC TTNN TTCC   (5.2)

Eqs. 1.2-5.2 as rendered are *not* tautologous, meaning the quantum example of the Frauchiger-Renner thought experiment is refuted as a paradox (contradiction), and using modal operators. We stopped evaluation of the paper title at this point.