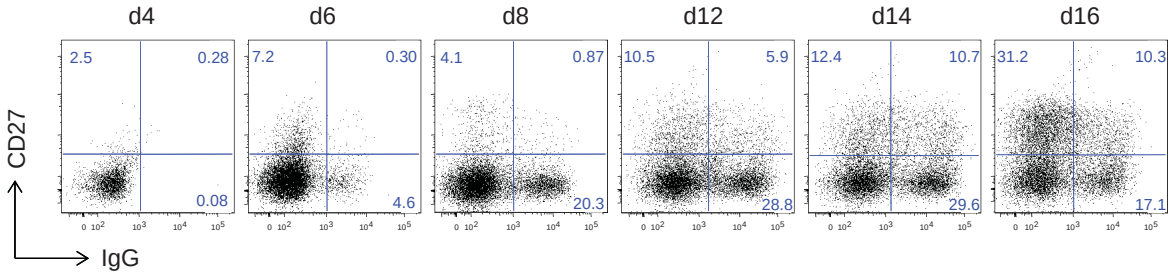
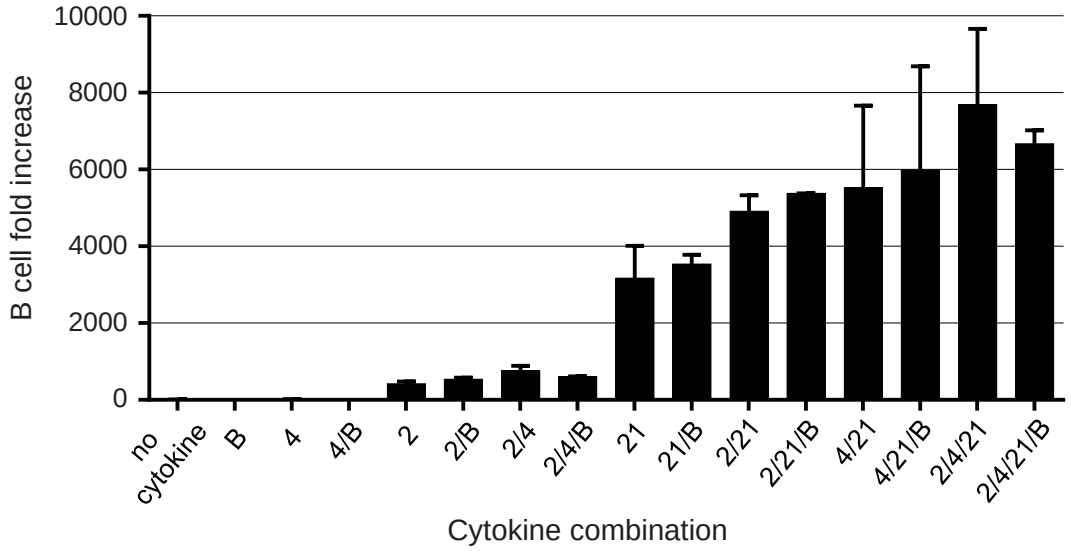
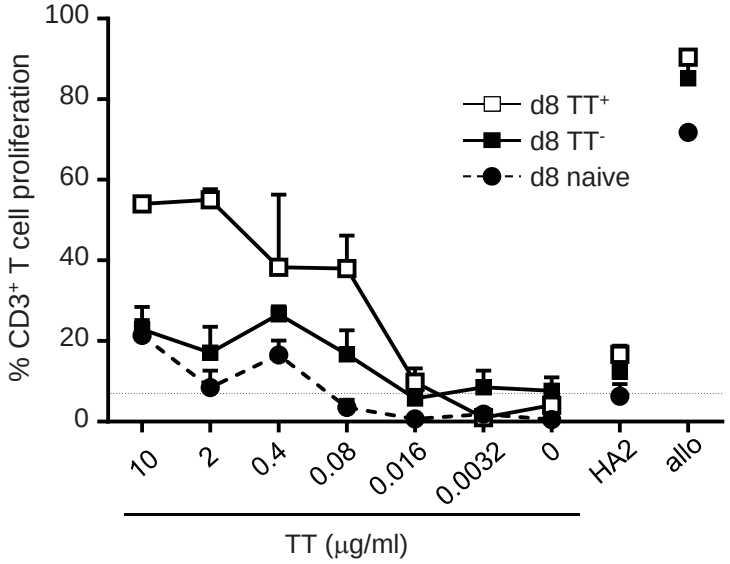


SUPPLEMENTARY FIGURE 1. Surface IgG and CD27 expression on CD B cells.
Human naive, mature B cells were enriched from PBMCs and cultured in CD culture system. Data shown are representative flow diagrams of IgG by CD27 expression on CD B cells (pre-gated on $CD19^{+}$) at various time points during cultures (days 4-16). Similar results were obtained from 2 independent donors.



SUPPLEMENTARY FIGURE 2. **Effects of cytokines on expansion of CD B cells.** Human naïve, mature B cells were isolated from PBMCs and cultured in CD culture system with various combinations of cytokines for 8 days. Cells were fed with fresh R5 medium containing the corresponding tested cytokines on days 4 and 6. B-cell numbers were determined on day 8 after culture by flow cytometry with Calibrite beads. B-cell proliferation is shown as fold-increases in viable B-cell ($7AAD^{-}CD45^{+}CD19^{+}$) numbers compared to the number of input cells on day 0 (300 cells). Duplicate cultures were established. Results were from single experiment.



SUPPLEMENTARY FIGURE 3. TT-binding memory CD B cells induce T-cell proliferation more efficiently than do naive CD B cells in the presence of TT. Frozen aliquots of day 8 cultured cells established from TT-PE$^+$ enriched IgG memory B cells or TT-PE$^-$ enriched IgG memory B cells or unenriched naïve B cells were thawed and co-cultured with CFSE-labeled, autologous T cells or heterologous T cells (allo) for 7 days in the presence of indicated concentrations of antigens. T-cell proliferation was estimated by CFSE dilution among all (CD3$^+$) T cells. Experiments were performed using T cells from Donors *A* who had recently received tetanus-diphtheria booster. TT (10 μg/ml and 5-fold serial dilutions into 5 additional doses) or recombinant influenza HA (H3/Wisconsin, 2 μg/ml) was added into individual co-cultures. Cultures without added antigen (TT 0 μg/ml) served as negative controls. Compiled results of 2-5 replicate samplings from 2 independent experiments are shown.

Table SI. Top 10 TCRβ clone sequences from freshly isolated CD4^{+} T cells, anti-CD3/CD28-activated CD4^{+} T cells and TT-activated CD4^{+} T cells.

Sample Name	Rank	TCRβ Nucleotide Sequence	Frequency	V	D	J
Donor A_Unstim CD4	1	AATGTGAACGCCTTGGAGCTGGACGACTCGGCCCTGTATCTCTGTGCCAGCAGCTTGGGAGGGGGCTACGAGCAGTACTTCGGGCCG	0.176	TCRBV05-04*01	TCRBD01-01*01	TCRBJ02-07*01
Donor A_Unstim CD4	2	TTGGAGATCCAGCGCACAGAGCAGGGGGACTCGGCCATGTATCTCTGTGCCAGCAGCCACGCAAGCGGCCACACGTACTTCGGGCCG	0.158	TCRBV07-09	TCRBD02-01	TCRBJ02-07*01
Donor A_Unstim CD4	3	TCTAAGAAGCTCCTCCTCAGTGACTCTGGCTTCTATCTCTGTGCCTGGAGTGTACAGACAGTGGACACTGAAGCTTTCTTTGGACAA	0.134	TCRBV30-01*02	TCRBD01-01*01	TCRBJ01-01*01
Donor A_Unstim CD4	4	CTGACAGTGACCAGTGCCCATCCTGAAGACAGCAGCTTCTACATCTGCAGTGCTAGAGATAACGGGGGTGAAGCTTTCTTTGGACAA	0.130	TCRBV20	TCRBD02-01*01	TCRBJ01-01*01
Donor A_Unstim CD4	5	CAGCGCACAGAGCAGGGGGACTCGGCCATGTATCTCTGTGCCAGCAGCCCTTATGGGGGGATGAGCACTGAAGCTTTCTTTGGACAA	0.116	TCRBV07-09	TCRBD02-01*01	TCRBJ01-01*01
Donor A_Unstim CD4	6	CTTCACATCAATTCCCTGGAGCTTGGTGACTCTGCTGTGTATTTCTGTGCCAGCAGCCAAACGGCCTCCGAGCAGTACTTCGGGCCG	0.088	TCRBV03	unresolved	TCRBJ02-07*01
Donor A_Unstim CD4	7	ATCCAGCAGGTAGTGCGAGGAGATTCGGCAGCTTATTTCTGTGCCAGCTCACCACGAGACAGGGCTGAAAAACTGTTTTTTGGCAGT	0.083	TCRBV18-01*01	TCRBD01-01*01	TCRBJ01-04*01
Donor A_Unstim CD4	8	ATCCAGCGCACAGAGCAGGGGGACTCGGCCATGTATCTCTGTGCCAGCAGCCCCAAGACAGGGAACACTGAAGCTTTCTTTGGACAA	0.083	TCRBV07-09	TCRBD01-01*01	TCRBJ01-01*01
Donor A_Unstim CD4	9	CACACCCTGCAGCCAGAAGACTCGGCCCTGTATCTCTGTGCCAGCAGCCAGGAGGAGAGTCCTTCCTACGAGCAGTACTTCGGGCCG	0.079	TCRBV04-02*01	TCRBD02-01*02	TCRBJ02-07*01
Donor A_Unstim CD4	10	ACGATCCAGCGCACACAGCAGGAGGACTCGGCCGTGTATCTCTGTGCCAGCAGCTTAGTTGGCGGAACTGAAGCTTTCTTTGGACAA	0.065	TCRBV07-02*01	TCRBD02-01	TCRBJ01-01*01
Donor A_3/28 activated	1	CTCACTCTGGAGTCTGCTGCCTCCTCCCAGACATCTGTATATTTCTGCGCCAGCAGTGATAAGGGCCATGAGCAGTTCTTCGGGCCA	0.496	TCRBV10-01	unresolved	TCRBJ02-01*01
Donor A_3/28 activated	2	CTGCTGTCGGCTGCTCCCTCCCAGACATCTGTGTACTTCTGTGCCAGCACCCCACCCGGGGGGGCACTGAAGCTTTCTTTGGACAA	0.235	TCRBV06-05*01	TCRBD02-01*01	TCRBJ01-01*01
Donor A_3/28 activated	3	GTGACCAGTGCCCATCCTGAAGACAGCAGCTTCTACATCTGCAGTGCCCCTACACCTGGGGGGGACACTGAAGCTTTCTTTGGACAA	0.220	TCRBV20	TCRBD02-01*01	TCRBJ01-01*01
Donor A_3/28 activated	4	CAGCCTGCAGAACTGGAGGATTCTGGAGTTTATTTCTGTGCCAGCAGCCTCCACCTCGCGGGGAATTCACCCCTCCACTTTGGGAAC	0.215	TCRBV14-01*01	TCRBD02-01*01	TCRBJ01-06*01
Donor A_3/28 activated	5	AGCTCTCTGGAGCTGGGGGACTCAGCTTTGTATTTCTGTGCCAGCAGCGACCGGACAGGGGGCGGGGAAAAACTGTTTTTTGGCAGT	0.194	TCRBV09-01	TCRBD01-01*01	TCRBJ01-04*01
Donor A_3/28 activated	6	ATCAATTCCCTGGAGCTTGGTGACTCTGCTGTGTATTTCTGTGCCAGCAGCAGCCGACAGACTGGAAACACCATATATTTTGGAGAG	0.189	TCRBV03	TCRBD01-01*01	TCRBJ01-03*01
Donor A_3/28 activated	7	CTGGAGTCTGCTGCCTCCTCCCAGACATCTGTATATTTCTGCGCCAGCAGACCGGACAGCCAAGTCCCTGAAGCTTTCTTTGGACAA	0.184	TCRBV10-01	TCRBD01-01*01	TCRBJ01-01*01
Donor A_3/28 activated	8	AAGATCCAGCGCACAGAGCGGGGGGACTCAGCCGTGTATCTCTGTGCCAGCAGCTTACCCCGACCACTGAAGCTTTCTTTGGACAA	0.179	TCRBV07-03*01	unresolved	TCRBJ01-01*01
Donor A_3/28 activated	9	GAGTCCGCCAGCACCAACCAGACATCTATGTACCTCTGTGCCACGAATGGGGAGGGGAGCGGCAATCAGCCCCAGCATTTTGGTGAT	0.174	TCRBV28-01*01	TCRBD02-01*02	TCRBJ01-05*01
Donor A_3/28 activated	10	AATGTGAACGCCTTGGAGCTGGACGACTCGGCCCTGTATCTCTGTGCCAGCAGCTTGGGAGGGGGCTACGAGCAGTACTTCGGGCCG	0.148	TCRBV30-01*01	TCRBD02-01*01	TCRBJ01-02*01
Donor A_TT-Specific	1	GCCTTGGAGCTGGACGACTCGGCCCTGTATCTCTGTGCCAGCAGCTTGGCCTCCGGGACGGTGTCCTACGAGCAGTACTTCGGGCCG	4.566	TCRBV05-04*01	unresolved	TCRBJ02-07*01
Donor A_TT-Specific	2	ATCCAGCCCTCAGAACCCAGGGACTCAGCTGTGTACTTCTGTGCCAGCAGTTTTGTCGCGGAGGGAACTGAAGCTTTCTTTGGACAA	4.425	TCRBV12	TCRBD02-01*02	TCRBJ01-01*01
Donor A_TT-Specific	3	ATCCGGTCCACAAAGCTGGAGGACTCAGCCATGTACTTCTGTGCCAGCAGGCCGGGACAGCCCCCCTACGAGCAGTACTTCGGGCCG	3.805	TCRBV02-01*01	TCRBD01-01*01	TCRBJ02-07*01
Donor A_TT-Specific	4	GAGTCGGCTGCTCCCTCCCAGACATCTGTGTACTTCTGTGCCAGCAGTGCTGTCTGGGCGCGGAACACTGAAGCTTTCTTTGGACAA	2.663	TCRBV06-01*01	TCRBD01-01*01	TCRBJ01-01*01
Donor A_TT-Specific	5	TCGGCCCAAAAGAACCCGACAGCTTTCTATCTCTGTGCCAGTAGAATTGGGACGGATCACTCTGGAAACACCATATATTTTGGAGAG	2.368	TCRBV19-01	unresolved	TCRBJ01-03*01
Donor A_TT-Specific	6	CTGTCCCTAGAGTCTGCCATCCCCAACCAGACAGCTCTTTACTTCTGTGCCACCAGTGCGAGGGCGAATGAGCAGTTCTTCGGGCCA	2.311	TCRBV24	TCRBD02-01*02	TCRBJ02-01*01
Donor A_TT-Specific	7	AACATGAGCCCTGAAGACAGCAGCATATATCTCTGCAGCGTTGAAGATATGACGGCGAATTTTTTCTATGGCTACACCTTCGGTTCG	1.888	TCRBV29-01*01	unresolved	TCRBJ01-02*01
Donor A_TT-Specific	8	ATCCGGTCCACAAAGCTGGAGGACTCAGCCATGTACTTCTGTGCCAGCAGTGGAGGACAGCCCCCCTACGAGCAGTACTTCGGGCCG	1.649	TCRBV02-01*01	TCRBD01-01*01	TCRBJ02-07*01
Donor A_TT-Specific	9	CTGCTGTCGGCTGCTCCCTCCCAGACATCTGTGTACTTCTGTGCCAGCACCCCACCCGGGGGGGGCACTGAAGCTTTCTTTGGACAA	1.635	TCRBV06-05*01	TCRBD02-01*01	TCRBJ01-01*01
Donor A_TT-Specific	10	TCGGCCCAAAAGAACCCGACAGCTTTCTATCTCTGTGCCAGTAGTATTACCCCCCTATTGAACACCGGGGAGCTGTTTTTTGGAGAA	1.635	TCRBV19-01	TCRBD02-01	TCRBJ02-02*01
Donor D_Unstim CD4	1	CAGCGCACAGAGCAGGGGGACTCGGCCATGTATCTCTGTGCCAGCAGTCCCAGGGGGGGTTCGGACACTGAAGCTTTCTTTGGACAA	1.611	TCRBV07-09	unresolved	TCRBJ01-01*01
Donor D_Unstim CD4	2	CGCACACAGCAGGAGGACTCGGCCGTGTATCTCTGTGCCAGCAGTAGTATAGCGGGAGTGAACACCGGGGAGCTGTTTTTTGGAGAA	1.335	TCRBV07-02*01	TCRBD02-01*02	TCRBJ02-02*01
Donor D_Unstim CD4	3	AAGATCCGGTCCACAAAGCTGGAGGACTCAGCCATGTACTTCTGTGCCAGCAGTGAGCTTGAAGGGACTAGCTATCTCTTCGGGCCA	0.880	TCRBV02-01*01	TCRBD02-01	TCRBJ02-01*01
Donor D_Unstim CD4	4	TCCACAAAGCTGGAGGACTCAGCCATGTACTTCTGTGCCAGCAGTGAAAGTGGGTTCCGGAGACTCGGGGAGCTGTTTTTTGGAGAA	0.699	TCRBV02-01*01	TCRBD02-01	TCRBJ02-02*01
Donor D_Unstim CD4	5	GAGTCGGCTGCTCCCTCCCAAACATCTGTGTACTTCTGTGCCAGCAGAGAAACGGGGGGTGGAGGCTCACCCCTCCACTTTGGGAAC	0.180	TCRBV06	TCRBD02-01*01	TCRBJ01-06*01
Donor D_Unstim CD4	6	TTGCACTCTGAACTAAACCTGAGCTCTCTGGAGCTGGGGGACTCAGCTTTGTATTTCTGTGCCAGCAGTGAAGCTTTCTTTGGACAA	0.170	TCRBV09-01	unresolved	TCRBJ01-01*01
Donor D_Unstim CD4	7	ACCAGTGCCCATCCTGAAGACAGCAGCTTCTACATCTGCAGTGCTCTGCAGGGGGAAGAAAGCGCAGATACGCAGTATTTTGGCCCA	0.159	TCRBV20	TCRBD01-01*01	TCRBJ02-03*01
Donor D_Unstim CD4	8	ACCAGTGCCCATCCTGAAGACAGCAGCTTCTACATCTGCAGTGGAGGGGTAGCGGGAGAGGGCACAGATACGCAGTATTTTGGCCCA	0.085	TCRBV20	TCRBD02-01*02	TCRBJ02-03*01
Donor D_Unstim CD4	9	ACTGTGACATCGGCCCAAAAGAACCCGACAGCTTTCTATCTCTGTGCCAGTAGCCGGGACTACATCAATGAGCAGTTCTTCGGGCCA	0.064	TCRBV20	unresolved	TCRBJ02-02*01
Donor D_Unstim CD4	10	AGTGCCCATCCTGAAGACAGCAGCTTCTACATCTGCAGTGCTCTCGAGGGGGCGGGAGAGGGTACCGGGGAGCTGTTTTTTGGAGAA	0.064	TCRBV19-01	TCRBD02-01	TCRBJ02-01*01
Donor D_3/28 activated	1	CAGCCTGCAGAACTGGAGGATTCTGGAGTTTATTTCTGTGCCAGCAGCATCATCCGTCGGGGGCACACTGAAGCTTTCTTTGGACAA	0.175	TCRBV14-01*01	unresolved	TCRBJ01-01*01
Donor D_3/28 activated	2	AAGATCCAGCGCACAGAGCGGGGGGACTCAGCCATGTATCTCTGTGCCAGCAGCTTAGGCAGGGACACTGAAGCTTTCTTTGGACAA	0.161	TCRBV07-03*01	TCRBD01-01*01	TCRBJ01-01*01
Donor D_3/28 activated	3	CTACACGCCCTGCAGCCAGAAGACTCAGCCCTGTATCTCTGCGCCAGCAGCCAAGATGCGGGAACCGGGGAGCTGTTTTTTGGAGAA	0.129	TCRBV04-01*01	TCRBD02-01*02	TCRBJ02-02*01
Donor D_3/28 activated	4	ACTGTGACATCGGCCCAAAAGAACCCGACAGCTTTCTATCTCTGTGCCAGTAATCAGGTTAGCAATCAGCCCCAGCATTTTGGTGAT	0.124	TCRBV19-01	TCRBD01-01*01	TCRBJ01-05*01
Donor D_3/28 activated	5	TCGCCCAGCCCCAACCAGACCTCTCTGTACTTCTGTGCCAGCAGTTTCACTACTAGCGGGAGGGCCTACGAGCAGTACTTCGGGCCG	0.120	TCRBV27-01*01	TCRBD02-01*02	TCRBJ02-07*01
Donor D_3/28 activated	6	GAGATCCAGCGCACAGAGCAGGGGGACTCGGCCATGTATCTCTGTGCCAGCAGTGTGGGCCCGCGCTACGAGCAGTACTTCGGGCCG	0.115	TCRBV06-04	TCRBD01-01*01	TCRBJ01-04*01
Donor D_3/28 activated	7	TCTGCTGTACCCTCTCAGACATCTGTGTACTTCTGTGCCACTCCCCGACAGGGACGAGCAACTAATGAAAAACTGTTTTTTGGCAGT	0.115	TCRBV11-02*02	TCRBD02-01	TCRBJ02-07*01
Donor D_3/28 activated	8	CTCAAGATCCAGCCTGCAAAGCTTGAGGACTCGGCCGTGTATCTCTGTGCCAGCAGCTTTCGGTCATACGAGCAGTACTTCGGGCCG	0.115	TCRBV07-09	TCRBD01-01*01	TCRBJ02-07*01
Donor D_3/28 activated	9	ATCCGGTCCACAAAGCTGGAGGACTCAGCCATGTACTTCTGTGCCAGCAGTCGAGTTAAGGGATACACTGAAGCTTTCTTTGGACAA	0.111	TCRBV02-01*01	unresolved	TCRBJ01-01*01
Donor D_3/28 activated	10	CGCACACAGCAGGAGGACTCGGCCGTGTATCTCTGTGCCAGCAGTAGTATAGCGGGAGTGAACACCGGGGAGCTGTTTTTTGGAGAA	0.111	TCRBV07-02*01	TCRBD02-01*02	TCRBJ02-02*01
Donor D_TT-Specific	1	AAGATCCGGTCCACAAAGCTGGAGGACTCAGCCATGTACTTCTGTGCCAGCAGTGAGCTTGAAGGGACTAGCTATCTCTTCGGGCCA	6.608	TCRBV02-01*01	TCRBD02-01	TCRBJ02-01*01
Donor D_TT-Specific	2	AGTTCTAAGAAGCTCCTTCTCAGTGACTCTGGCTTCTATCTCTGTGCCTGGAGTGTGAGGGTGGACACTGAAGCTTTCTTTGGACAA	3.245	TCRBV30-01*01	TCRBD02-01*02	TCRBJ01-01*01
Donor D_TT-Specific	3	CAGCAGGTAGTGCGAGGAGATTCGGCAGCTTATTTCTGTGCCAGCTCACCGGGACAGCAAAACACCGGGGAGCTGTTTTTTGGAGAA	3.068	TCRBV18-01*01	TCRBD01-01*01	TCRBJ02-02*01
Donor D_TT-Specific	4	GAGTCCGCCAGCACCAACCAGACATCTATGTACCTCTGTGCCAGCAGTTCACCCAGGGATATCGTCACTGAAGCTTTCTTTGGACAA	1.888	TCRBV28-01*01	TCRBD01-01*01	TCRBJ01-01*01
Donor D_TT-Specific	5	AGCACCTTGGAGCTGGGGGACTCGGCCCTTTATCTTTGCGCCAGCAGCTTGGTAGCCGGGACTAAAGCTGAAGCTTTCTTTGGACAA	1.770	TCRBV05-01*01	TCRBD02-01	TCRBJ01-01*01
Donor D_TT-Specific	6	ACCTTGGAGCTGGGGGACTCGGCCCTTTATCTTTGCGCCAGCAGCTCCTACTCAGAAGGGGTCGCAGATACGCAGTATTTTGGCCCA	1.711	TCRBV05-01*01	TCRBD01-01*01	TCRBJ02-03*01
Donor D_TT-Specific	7	ACTCTGGAGTCCGCTACCAGCTCCCAGACATCTGTGTACTTCTGTGCCATCAGTGAGTCGGTTAACTATGGCTACACCTTCGGTTCG	1.593	TCRBV10-03*01	unresolved	TCRBJ01-02*01
Donor D_TT-Specific	8	CTGATTCTGGAGTCCGCCAGCACCAACCAGACATCTATGTACCTCTGTGCCAGCAGGGGAGACAGGGTTGGCTACACCTTCGGTTCG	1.475	TCRBV28-01*01	TCRBD01-01*01	TCRBJ01-02*01
Donor D_TT-Specific	9	AATGTGAACGCCTTGGAGCTGGACGACTCGGCCCTGTATCTCTGTGCCAGCAGCTTGGGGACAGACGAAAAACTGTTTTTTGGCAGT	1.416	TCRBV05-04*01	TCRBD01-01*01	TCRBJ01-04*01
Donor D_TT-Specific	10	ACTCTGAAGATCCGGTCCACAAAGCTGGAGGACTCAGCCATGTACTTCTGTGCCAGCGGGGGACCAAACTTGCAGTATTTTGGCCCA	1.298	TCRBV07-08*01	TCRBD01-01*01	TCRBJ02-05*01

*The components of CDR3 nucleotide sequence are color coded as V-gene (green), N1 junction (purple), D-gene (blue), N2 junction (pink) and J-gene(orange).