510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION
DECISION SUMMARY
ASSAY AND INSTRUMENT

I Background Information:

A 510(k) Number
K212769/S002

B Applicant
Dynex Technologies Inc.

C Proprietary and Established Names
DYNEX SmartPLEX MMRV IgG Assay Kit

D Regulatory Information

Product Code(s)	Classification	Regulation Section	Panel
OPL	Class II	21 CFR 866.3510; Rubella Virus Serological Reagents -	Microbiology

II Submission/Device Overview:

A Purpose for Submission:
Clearance of a new device

B Measurand:
IgG antibodies specific to Measles, Mumps, Rubella, and Varicella-Zoster Virus (VZV)

C Type of Test:
Qualitative multiplex immunoassay

III Intended Use/Indications for Use:

A Intended Use(s):
See Indications for Use below.

B Indication(s) for Use:

The DYNEX SmartPLEX MMRV IgG Assay Kit is a multiplex immunoassay intended for the qualitative detection of IgG antibodies to Measles, Mumps, Rubella, and Varicella-Zoster Virus (VZV) in human serum. The DYNEX SmartPLEX MMRV IgG Assay Kit is intended for use with the DYNEX Multiplier Analyzer.

The DYNEX SmartPLEX MMRV IgG Assay Kit is intended to be used as an aid in the determination of serological status to Measles, Mumps, Rubella, and Varicella-Zoster Virus (VZV) in human serum from adults and pediatrics age above 1 year. This kit is not intended for screening blood or plasma donors.

The performance of this device has not been established for use in neonates, pediatric patients below 1 year of age, and immunocompromised patients, or for use at point of care facilities.

C Special Conditions for Use Statement(s):
Rx - For Prescription Use Only

D Special Instrument Requirements:
DYNEX Multiplier Analyzer

IV Device/System Characteristics:

A Device Description:

The DYNEX SmartPLEX MMRV IgG Assay Kit uses multiplex immunoassay, a methodology that greatly resembles traditional ELISA, while permits simultaneous detection and identification of different antibodies in a single well. The reaction is processed in a 96 well microtiter plate, with six polystyrene beads embedded in each well of the plate. Four (4) different beads are coated with antigens for the detection of IgG antibodies to Measles, Mumps, Rubella and Varicella-Zoster Virus in human serum. Two additional beads are included in each reaction well as filler beads. Specimen processing is fully automated on the DYNEX Multiplier Analyzer.The assay plate incorporates four beads in each well, each of which is individually coated with purified virus antigens to give targets for IgG binding to measles, mumps, rubella, and varicella- zoster antigens respectively. Unbound antibodies are removed in the wash step. Bound IgG is detected by the addition of rabbit anti-human IgG conjugated with horseradish peroxidase.

Excess conjugate is removed in a second wash step. Luminol substrate is then added to the wells. If IgG has bound, a chemiluminescent reaction takes place, which is detected by an integrated camera. The luminescent signal is proportional to the IgG concentration.

B Principle of Operation:

The Multiplier Analyzer adds the human serum and reagents to each well of the 96 well plate, after which the mixture is incubated at 37°C. After a wash cycle, unbound antibodies are removed. Anti-human IgG conjugated to horseradish peroxidase (HRP) is added after which the mixture is incubated at 37°C with shaking. A second wash step removes excess conjugate, then luminol substrate is added to each well. The amount of antibody captured by the antigen is determined by the chemiluminescence produced by the antigen antibody bound HRP. Raw data are captured as light photons via an imaging camera. The amount of light photons are converted into relative light intensity units (RLU).

The Multiplier software analyzes the image and generates a report that details the mean RLU signal for each target bead (MMRV) by test sample. In every plate a calibrator is included. The DYNEX SmartPLEX MMRV IgG Assay Kit is qualitative and produces a result defined as negative (NEG), equivocal (EQV) or positive (POS) for each target analyte.

<u>Interpretation of results of the DYNEX SmartPLEX MMRV IgG Assay Kit:</u>

The results for each of the antibodies are expressed in Index units. For Measles, Mumps, Rubella and VZV antibodies, results with Index values ≤ 0.9 Index are reported as Negative, results between >0.9 and <1.1 Index are reported as Equivocal, and results of ≥ 1.1 Index are reported as positive, as indicated in the table below:

Result* (Index value)	Status	Interpretation**
≤0.9	NEG	Negative: No detectable IgG antibodies to Measles, Mumps, Rubella or VZV detected. Such individual is presumed not to have had a previous exposure to MMRV through infection or vaccination
>0.9 - <1.1	EQV	Equivocal: Samples should be retested, if the result remains equivocal, the samples should be tested on an alternative method.
≥1.1	POS	Positive: IgG antibodies to Measles, Mumps, Rubella, or VZV detected. This may indicate that the individual was exposed to MMRV through infection or vaccination

*The numeric Index value of the final result is not indicative of the amount of anti-Measles, Mumps, Rubella, or VZV IgG antibodies present.
**Test results should be interpreted in conjunction with the clinical history, epidemiological data and other information available to the attending physician in evaluating the patient

C Instrument description Information

1. Instrument Name:

   DYNEX Multiplier Analyzer

The Multiplier is a Multiplex ELISA Analyzer which measures chemiluminescent signal, allowing for the simultaneous measurement of multiple analytes in a single well.

The DYNEX Multiplier Analyzer automates the steps of Multiplex ELISA assays, performing liquid pipetting, plate washing and results reading of the DYNEX SmartPLEX MMRV IgG Assay Kit in addition to producing a result report. Sample distribution, incubation, reagent addition, washing and detection phases of the ELISA tests are fully automated.

The Multiplier hardware comprises of all the physical parts of the instrument that are controlled by the firmware and the Multiplier software. The hardware includes an arm, incubator, pipette, camera, barcode scanner, washer, and reader. The instrument also contains an embedded personal computer (PC) with its own hard drive that executes the Multiplier software.

The Multiplier software consists of five main parts: Grapevine (data access layer), System Control (software interface layer to hardware), Watchdog (a monitoring system), User Interface, and firmware.

2. Specimen Identification:

An 1D scanner for reading barcoded sample tubes.
The only specimen type to be used with the DYNEX SmartPLEX MMRV IgG Assay Kit is serum.

V Substantial Equivalence Information:

A Predicate Device Name(s):
BioPlex 2200 MMRV IgG

B Predicate 510(k) Number(s):
K091616

C Comparison with Predicate(s):

Device & Predicate Device(s):	Candidate Device K212769	Predicate Device K091616
Device Trade Name	DYNEX SmartPLEX MMRV IgG Assay Kit	BioPlex 2200 MMRV IgG
General Device Characteristic Similarities		
Intended Use/Indications For Use	The DYNEX SmartPLEX MMRV IgG Assay Kit is a multiplex immunoassay intended for the qualitative detection of IgG antibodies to Measles, Mumps, Rubella, and Varicella-Zoster Virus (VZV) in human serum. The DYNEX SmartPLEX MMRV IgG Assay Kit is intended for use with the DYNEX Multiplier Analyzer. The DYNEX SmartPLEX MMRV IgG Assay Kit is intended to be used as an aid in the determination of serological status to Measles, Mumps, Rubella, and Varicella-Zoster Virus (VZV) in human serum from adults and pediatrics age above 1 year. This kit is not intended for screening blood or plasma donors. The performance of this device has not been established for use in neonates, pediatric patients below 1 year of age, and immunocompromised patients, or for use at point of care facilities.	The BioPlex 2200 MMRV IgG kit is a multiplex flow immunoassay intended for the qualitative detection of IgG antibodies to Measles, Mumps, Rubella, and Varicella-zoster virus (VZV) in human serum and EDTA or heparinized plasma. The BioPlex 2200 MMRV IgG kit is intended for use with the Bio-Rad BioPlex 2200 System. This kit is intended as an aid in the determination of serological status to Measles, Mumps, Rubella, and VZV. This kit is not intended for use in screening blood or plasma donors. The performance of this assay has not been established for use in neonates, pediatrics and immunocompromised patients, or for use at point of care facilities.
Prescription vs Over-the- Counter Use	Same	Prescription use only

Technology	Multiplex immunoassay	Multiplex flow immunoassay
Assay Processing	Automated on the Multiplier Analyzer	Automated on the BioPlex 2200 System
Controls	Same	Negative control and Multi-analyte Positive control
General Device Characteristic Differences		
Target Population	Adults and pediatrics age above 1 year	Not indicated for use in the pediatric population
	Not to be used in neonates, pediatric patients below 1 year of age, and immunocompromised patients, or for use at point of care facilities.	Not to be used in neonates, pediatrics and immunocompromised patients, or at point of care facilities.
Reagents	Rabbit anti-human IgG conjugated to horseradish peroxidase	Murine anti-human IgG conjugated to phycoerythrin
Matrices	Serum	Serum and EDTA or Heparinized Plasma
Solid phase	96-well microtiter plate – antigen coated polystyrene beads	Bead reagent - dyed antigen coated beads
Signal Detection	Chemiluminescence measured by an imaging camera	Fluorescence measured by spectrophotometer

VI Standards/Guidance Documents Referenced:

62366-1: ANSI AAMI ISO - Medical Devices - Part 1: Application of Usability Engineering To Medical Devices (Edition 1) - 02/01/2015

62304: ANSI AAMI ISO - Medical Device Software - Software Life Cycle Processes (Edition 1.1) – 06/26/2015

EP05-A3: Clinical Laboratory Standards Institute - Evaluation of Precision of Quantitative Measurement Procedures; Approved Guideline (Third Edition) - 10/01/2014

61010-1: ANSI AAMI IEC - Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1: General Requirements (AMD1) - 01/10/2017

VII Performance Characteristics (if/when applicable):

A Analytical Performance:

1. Precision/Reproducibility:

a. Within-Laboratory Precision Study:

A within-laboratory precision study was performed evaluating 22 serum samples using three lots of the DYNEX SmartPLEX MMRV IgG Assay Kit and 1 DYNEX Multiplier Analyzer. Samples were tested in duplicate, two times a day for 20 days, for a total of 240 replicates per sample across all three-reagent kit lots. Within laboratory precision results are reported for each analyte separately in tables 01 to 04 below:

Table 01: Within Laboratory Precision – Measles IgG

Analyte Level for Anti-Measles	Samples	N	Mean (Index)	Within run		Between run		Between Day		Between Lot		Total	
				SD	%CV	SD	%CV	SD	%CV	SD	%CV	SD	%CV
Low Negative	5	240	0.22	0.01	5.9%	0.008	3.8%	0.0.005	2.4%	0.193	3.6%	0.018	8.3%
	6	240	0.38	0.03	6.8%	0.018	4.8%	0.0.009	2.5%	0.001	0.3%	0.033	8.7%
	8	240	0.68	0.04	6.5%	0.029	4.3%	0.013	2.0%	0.000	0.0%	0.054	8.0%
High Negative	10	240	0.70	0.04	6.3%	0.028	3.9%	0.016	2.3%	0.000	0.0%	0.055	7.8%
	3	240	0.74	0.053	7.2%	0.024	3.3%	0.019	2.6%	0.000	0.0%	0.061	8.3%
	2	240	0.82	0.048	5.8%	0.035	4.3%	0.020	2.4%	0.188	3.7%	0.069	8.4%
	19	240	0.87	0.049	5.6%	0.037	4.3%	0.000	0.0%	0.077	2.0%	0.064	7.4%
	21	240	0.89	0.062	7.0%	0.041	4.6%	0.014	1.5%	0.003	0.4%	0.076	8.5%
Equivocal	14	240	0.92	0.060	6.6%	0.039	4.2%	0.010	1.1%	0.071	2.2%	0.075	8.2%
	11	240	0.96	0.055	5.7%	0.035	3.7%	0.027	2.8%	0.067	2.0%	0.073	7.5%
	1	240	1.01	0.055	5.5%	0.045	4.4%	0.021	2.1%	0.139	3.0%	0.080	7.9%
	15	240	1.06	0.067	6.3%	0.055	5.2%	0.000	0.0%	0.004	0.5%	0.086	8.2%
Low Positive	17	240	1.26	0.071	5.6%	0.056	4.5%	0.037	3.0%	0.000	0.0%	0.098	7.7%
	16	240	1.28	0.077	6.0%	0.060	4.7%	0.000	0.0%	0.116	2.7%	0.103	8.0%
	18	240	1.29	0.076	5.9%	0.045	3.5%	0.030	2.3%	0.076	2.1%	0.097	7.5%
Moderate Positive	12	240	1.57	0.095	6.1%	0.046	3.0%	0.039	2.5%	0.021	1.1%	0.114	7.3%
	20	240	1.61	0.086	5.4%	0.071	4.4%	0.046	2.8%	0.089	2.3%	0.126	7.8%
	9	240	1.75	0.098	5.6%	0.065	3.7%	0.036	2.1%	0.216	3.7%	0.139	7.9%
	7	240	2.14	0.118	5.5%	0.079	3.7%	0.000	0.0%	0.044	1.4%	0.145	6.8%
	13	240	2.36	0.139	5.9%	0.104	4.4%	0.000	0.0%	0.022	1.1%	0.175	7.4%
High Positive	22	240	2.90	0.136	4.7%	0.100	3.5%	0.078	2.7%	0.073	1.8%	0.193	6.7%
	4	240	3.04	0.134	4.4%	0.140	4.6%	0.032	1.0%	0.137	2.6%	0.211	6.9%

Table 02: Within Laboratory Precision – Mumps IgG

Analyte Level for Anti-Mump	Samples	N	Mean (Index)	Within Run		Between Run		Between Day		Between Lot		Total	
				SD	%CV	SD	%CV	SD	%CV	SD	%CV	SD	%CV
Low Negative	19	240	0.37	0.022	5.9%	0.016	4.3%	0.000	0.0%	0.437	6.4%	0.036	9.7%
	2	240	0.47	0.027	5.7%	0.012	2.5%	0.007	1.5%	0.497	6.3%	0.042	9.0%
	3	240	0.53	0.031	5.9%	0.019	3.6%	0.003	0.6%	0.360	5.2%	0.046	8.7%
	8	240	0.56	0.029	5.1%	0.019	3.3%	0.000	0.0%	0.322	4.2%	0.042	7.4%
	1	240	0.60	0.034	5.6%	0.020	3.3%	0.005	0.8%	0.379	5.1%	0.050	8.3%

High Negative	6	240	0.63	0.031	4.9%	0.022	3.5%	0.015	2.3%	0.130	2.5%	0.044	6.9%
	18	240	0.68	0.037	5.4%	0.021	3.0%	0.014	2.1%	0.434	5.7%	0.059	8.7%
	12	240	0.71	0.037	5.2%	0.020	2.8%	0.019	2.6%	0.045	1.4%	0.047	6.7%
	13	240	0.74	0.040	5.4%	0.028	3.8%	0.000	0.0%	0.231	3.6%	0.055	7.5%
	7	240	0.78	0.043	5.5%	0.023	2.9%	0.011	1.4%	0.359	4.8%	0.062	8.0%
Equivocal	11	240	0.99	0.049	4.9%	0.033	3.3%	0.018	1.8%	0.471	5.8%	0.084	8.5%
	20	240	1.01	0.081	8.0%	0.000	0.0%	0.053	5.2%	0.261	5.7%	0.113	11.1 %
	9	240	1.06	0.052	4.9%	0.039	3.7%	0.029	2.8%	0.245	3.8%	0.082	7.8%
Low Positive	16	240	1.36	0.073	5.4%	0.043	3.2%	0.000	0.0%	0.321	4.3%	0.102	7.5%
	22	240	1.39	0.063	4.5%	0.046	3.3%	0.030	2.1%	0.454	5.5%	0.113	8.1%
	15	240	1.43	0.079	5.5%	0.054	3.8%	0.005	0.4%	0.052	1.6%	0.099	6.9%
Moderate Positive	21	240	1.52	0.079	5.2%	0.046	3.0%	0.040	2.7%	0.157	2.8%	0.108	7.2%
	5	240	1.54	0.071	4.6%	0.044	2.8%	0.024	1.6%	0.325	3.9%	0.105	6.8%
	10	240	2.35	0.111	4.7%	0.056	2.4%	0.042	1.8%	0.160	2.4%	0.143	6.1%
	14	240	2.49	0.121	4.9%	0.048	1.9%	0.061	2.5%	0.479	5.5%	0.199	8.0%
High Positive	17	240	2.99	0.152	5.1%	0.081	2.7%	0.026	0.9%	0.212	3.0%	0.196	6.6%
	4	240	3.48	0.163	4.7%	0.102	2.9%	0.000	0.0%	0.186	2.6%	0.213	6.1%

Table 03: Within Laboratory Precision – Rubella IgG

Analyte Level for Anti-Rubella	Samples	N	Mean (Index)	Within Run		Between Run		Between Day		Between Lot		Total	
				SD	%CV	SD	%CV	SD	%CV	SD	%CV	SD	%CV
Low Negative	6	240	0.42	0.019	4.4%	0.010	2.5%	0.008	2.0%	0.111	1.9%	0.024	5.8%
	5	240	0.50	0.020	4.0%	0.005	1.1%	0.011	2.3%	0.099	1.6%	0.025	5.0%
	19	240	0.60	0.024	4.0%	0.013	2.1%	0.015	2.5%	0.094	1.7%	0.033	5.5%
High Negative	8	240	0.61	0.028	4.5%	0.012	1.9%	0.012	1.9%	0.172	2.4%	0.035	5.8%
	12	240	0.61	0.025	4.0%	0.013	2.2%	0.005	0.9%	0.133	1.8%	0.03	5.0%
	9	240	0.62	0.025	4.1%	0.021	3.4%	0.005	0.9%	0.116	1.9%	0.035	5.7%
	13	240	0.62	0.031	5.0%	0.021	3.4%	0.000	0.0%	0.018	0.8%	0.037	6.0%
	3	240	0.75	0.029	3.9%	0.013	1.7%	0.014	1.9%	0.137	1.8%	0.037	5.0%
	2	240	0.86	0.032	3.7%	0.023	2.6%	0.019	2.2%	0.026	0.8%	0.044	5.1%
	21	240	0.90	0.036	4.0%	0.022	2.5%	0.018	2.0%	0.058	1.3%	0.047	5.2%
Equivocal	1	240	0.96	0.039	4.1%	0.020	2.1%	0.021	2.2%	0.008	0.4%	0.049	5.1%
	18	240	1.00	0.038	3.8%	0.015	1.5%	0.014	1.4%	0.029	0.7%	0.043	4.4%
	15	240	1.05	0.039	3.8%	0.022	2.1%	0.009	0.9%	0.135	1.7%	0.049	4.7%
	7	240	1.08	0.036	3.3%	0.016	1.5%	0.028	2.6%	0.047	1.0%	0.049	4.6%
Low Positive	11	240	1.18	0.042	3.6%	0.029	2.4%	0.017	1.4%	0.058	1.1%	0.055	4.7%
	20	240	1.34	0.063	4.7%	0.014	1.0%	0.032	2.4%	0.037	1.1%	0.074	5.5%
	16	240	1.34	0.048	3.6%	0.026	1.9%	0.025	1.9%	0.008	0.4%	0.061	4.5%
Moderate Positive	14	240	1.52	0.048	3.2%	0.035	2.3%	0.029	1.9%	0.036	0.8%	0.067	4.4%
	17	240	1.68	0.049	2.9%	0.034	2.0%	0.028	1.6%	0.000	0.0%	0.066	3.9%
	10	240	2.01	0.063	3.1%	0.040	2.0%	0.027	1.3%	0.000	0.0%	0.079	3.9%
	4	240	2.44	0.063	2.6%	0.064	2.6%	0.028	1.1%	0.000	0.0%	0.094	3.9%

High Positive	22	240	3.37	0.101	3.0%	0.065	1.9%	0.069	2.1%	0.100	1.4%	0.146	4.3%

Table 04: Within Laboratory Precision – VZV IgG

Analyte Level for Anti-VZV	Samples	N	Mean (Index)	Within Run		Between Run		Between Day		Between Lot		Total	
				SD	%CV	SD	%CV	SD	%CV	SD	%CV	SD	%CV
Low Negative	7	240	0.26	0.015	5.9%	0.005	2.0%	0.009	3.3%	0.086	2.2%	0.019	7.4%
	13	240	0.26	0.018	6.9%	0.004	1.6%	0.006	2.2%	0.079	2.2%	0.020	7.8%
High Negative	2	240	0.63	0.033	5.2%	0.018	2.8%	0.011	1.8%	0.079	1.8%	0.040	6.4%
	8	240	0.83	0.042	5.0%	0.024	2.9%	0.014	1.7%	0.199	3.0%	0.056	6.7%
	19	240	0.84	0.040	4.8%	0.021	2.5%	0.024	2.9%	0.154	2.6%	0.056	6.7%
Equivocal	12	240	1.00	0.045	4.5%	0.027	2.7%	0.022	2.2%	0.104	1.9%	0.060	6.0%
Low Positive	15	240	1.22	0.050	4.1%	0.037	3.0%	0.014	1.1%	0.093	1.7%	0.067	5.5%
	17	240	1.24	0.059	4.7%	0.026	2.1%	0.003	0.2%	0.156	2.2%	0.070	5.6%
	18	240	1.29	0.057	4.4%	0.024	1.9%	0.020	1.6%	0.118	1.8%	0.069	5.4%
	1	240	1.31	0.064	4.9%	0.032	2.4%	0.028	2.2%	0.055	1.4%	0.079	6.1%
	9	240	1.35	0.059	4.4%	0.042	3.1%	0.000	0.0%	0.124	2.0%	0.078	5.7%
Moderate Positive	20	240	1.63	0.079	4.9%	0.044	2.7%	0.027	1.6%	0.139	2.3%	0.102	6.2%
	6	240	1.69	0.074	4.4%	0.049	2.9%	0.000	0.0%	0.118	1.9%	0.094	5.6%
	5	240	2.00	0.082	4.1%	0.055	2.8%	0.043	2.2%	0.269	3.3%	0.126	6.3%
	3	240	2.45	0.095	3.9%	0.059	2.4%	0.046	1.9%	0.082	1.5%	0.126	5.2%
High Positive	21	240	2.62	0.104	4.0%	0.076	2.9%	0.071	2.7%	0.050	1.3%	0.151	5.8%
	22	240	2.63	0.097	3.7%	0.070	2.7%	0.055	2.1%	0.209	2.6%	0.148	5.6%
	14	240	2.69	0.100	3.7%	0.070	2.6%	0.062	2.3%	0.133	2.0%	0.147	5.5%
	11	240	3.01	0.107	3.6%	0.106	3.5%	0.000	0.0%	0.115	1.8%	0.161	5.3%
	16	240	3.03	0.113	3.7%	0.084	2.8%	0.013	0.4%	0.156	2.0%	0.154	5.1%
	10	240	3.06	0.111	3.6%	0.075	2.5%	0.060	2.0%	0.160	2.1%	0.160	5.2%
	4	240	3.31	0.120	3.6%	0.108	3.3%	0.059	1.8%	0.147	2.2%	0.186	5.6%

b. Reproducibility:

The reproducibility of the DYNEX SmartPLEX MMRV IgG Assay Kit was evaluated using 22 serum samples, in duplicate, twice a day, over 20 days, at three sites located in the US, using one reagent kit lot per site. Reproducibility results are reported for each analyte separately in tables 05 to 08 below:

Table 05: Reproducibility – Measles IgG

Analyte Level for Anti-Measles	Samples	N	Mean (Index)	Within Run		Between Run		Between Day		Between Site/ Lot		Total	
				SD	%CV	SD	%CV	SD	%CV	SD	%CV	SD	%CV
Low Negative	5	240	0.21	0.014	6.4%	0.009	4.3%	0.004	1.7%	0.115	2.8%	0.018	8.4%
	6	240	0.38	0.029	7.8%	0.013	3.5%	0.007	1.9%	0.033	1.6%	0.034	8.9%
High Negative	8	240	0.67	0.043	6.4%	0.026	3.9%	0.011	1.7%	0.000	0.0%	0.051	7.7%
	10	240	0.69	0.045	6.6%	0.030	4.4%	0.015	2.2%	0.035	1.5%	0.058	8.3%
	3	240	0.73	0.064	8.8%	0.039	5.3%	0.000	0.0%	0.000	0.0%	0.075	10.3%

	2	240	0.82	0.038	4.6%	0.044	5.3%	0.000	0.0%	0.150	2.9%	0.063	7.6%
	19	240	0.85	0.054	6.3%	0.035	4.1%	0.000	0.0%	0.040	1.5%	0.066	7.7%
	21	240	0.88	0.061	7.0%	0.031	3.5%	0.000	0.0%	0.083	2.3%	0.072	8.2%
Equivocal	14	240	0.91	0.058	6.4%	0.041	4.5%	0.000	0.0%	0.062	2.0%	0.074	8.1%
	11	240	0.95	0.055	5.7%	0.040	4.2%	0.018	1.9%	0.166	3.3%	0.076	8.0%
	1	240	1.02	0.057	5.6%	0.056	5.5%	0.000	0.0%	0.153	3.3%	0.087	8.5%
	15	240	1.05	0.056	5.4%	0.047	4.4%	0.004	0.4%	0.056	1.7%	0.075	7.2%
Low Positive	17	240	1.23	0.095	7.7%	0.054	4.4%	0.017	1.4%	0.000	0.0%	0.111	9.0%
	18	240	1.25	0.066	5.3%	0.050	4.0%	0.033	2.6%	0.145	2.9%	0.097	7.7%
	16	240	1.27	0.085	6.7%	0.040	3.1%	0.006	0.5%	0.085	2.2%	0.098	7.7%
Moderate Positive	12	240	1.55	0.088	5.7%	0.051	3.3%	0.000	0.0%	0.072	1.8%	0.106	6.8%
	20	240	1.59	0.100	6.3%	0.038	2.4%	0.029	1.8%	0.102	2.4%	0.117	7.4%
	9	240	1.73	0.108	6.3%	0.057	3.3%	0.036	2.1%	0.361	5.6%	0.159	9.2%
	7	240	2.11	0.103	4.9%	0.080	3.8%	0.046	2.2%	0.050	1.5%	0.142	6.7%
	13	240	2.33	0.136	5.8%	0.071	3.1%	0.050	2.1%	0.078	2.0%	0.168	7.2%
High Positive	22	240	2.33	0.148	5.2%	0.082	2.9%	0.079	2.8%	0.158	2.8%	0.204	7.1%
	4	240	2.99	0.153	5.1%	0.092	3.1%	0.016	0.5%	0.210	3.1%	0.202	6.7%

Table 06: Reproducibility – Mumps IgG

Analyte Level for Anti-Mumps	Samples	N	Mean (Index)	Within Run		Between Run		Between Day		Between Site/ Lot		Total	
				SD	%CV	SD	%CV	SD	%CV	SD	%CV	SD	%CV
Low Negative	19	240	0.37	0.023	6.2%	0.011	3.1%	0.013	3.5%	0.112	2.7%	0.030	8.2%
	2	240	0.47	0.024	5.2%	0.018	3.8%	0.011	2.4%	0.211	3.6%	0.036	7.7%
	3	240	0.53	0.028	5.3%	0.019	3.6%	0.013	2.5%	0.205	3.5%	0.040	7.7%
	8	240	0.57	0.038	6.6%	0.020	3.5%	0.000	0.0%	0.127	2.9%	0.046	8.0%
High Negative	1	240	0.60	0.035	5.8%	0.023	3.8%	0.022	3.6%	0.055	1.9%	0.048	8.1%
	6	240	0.64	0.034	5.4%	0.018	2.9%	0.008	1.2%	0.000	0.0%	0.040	6.2%
	18	240	0.68	0.035	5.1%	0.026	3.9%	0.025	3.7%	0.151	3.1%	0.054	8.0%
	12	240	0.71	0.037	5.2%	0.028	3.9%	0.019	2.7%	0.076	2.0%	0.052	7.3%
	13	240	0.75	0.045	5.9%	0.038	5.0%	0.000	0.0%	0.078	2.2%	0.061	8.1%
	7	240	0.78	0.044	5.7%	0.031	4.0%	0.024	3.0%	0.176	3.5%	0.065	8.3%
Equivocal	11	240	0.99	0.064	6.5%	0.021	2.2%	0.028	2.8%	0.273	4.5%	0.086	8.7%
	20	240	1.00	0.067	6.6%	0.047	4.7%	0.000	0.0%	0.057	2.0%	0.084	8.4%
	9	240	1.06	0.056	5.3%	0.039	3.7%	0.031	3.0%	0.046	1.6%	0.077	7.3%
Low Positive	16	240	1.36	0.073	5.4%	0.051	3.8%	0.011	0.8%	0.150	2.8%	0.097	7.2%
	22	240	1.39	0.065	4.7%	0.057	4.1%	0.033	2.3%	0.285	4.2%	0.109	7.8%
	15	240	1.47	0.084	5.7%	0.062	4.3%	0.055	3.7%	0.000	0.0%	0.118	8.0%
Moderate Positive	21	240	1.51	0.079	5.3%	0.054	3.6%	0.036	2.4%	0.039	1.4%	0.104	6.9%
	5	240	1.55	0.072	4.6%	0.075	4.8%	0.000	0.0%	0.156	2.9%	0.113	7.3%
	10	240	2.37	0.131	5.5%	0.114	4.8%	0.000	0.0%	0.039	1.5%	0.177	7.5%
	14	240	2.47	0.121	4.9%	0.084	3.4%	0.059	2.4%	0.265	3.8%	0.185	7.5%
High Positive	17	240	3.05	0.288	9.5%	0.145	4.8%	0.020	0.6%	0.046	2.3%	0.331	10.9%
	4	240	3.52	0.165	4.7%	0.146	4.2%	0.062	1.8%	0.119	2.4%	0.244	6.9%

Table 07: Reproducibility - Rubella IgG

Analyte Level for Anti-Rubella	Samples	N	Mean (Index)	Within Run		Between Run		Between Day		Between Site/ Lot		Total	
				SD	%CV	SD	%CV	SD	%CV	SD	%CV	SD	%CV
Low Negative	6	240	0.41	0.017	4.0%	0.013	3.1%	0.003	0.8%	0.192	2.5%	0.023	5.7%
	5	240	0.50	0.021	4.2%	0.012	2.3%	0.003	0.6%	0.125	1.8%	0.026	5.2%
	19	240	0.59	0.026	4.4%	0.015	2.5%	0.009	1.5%	0.190	2.6%	0.035	5.9%
	12	240	0.60	0.024	4.1%	0.018	3.0%	0.009	1.4%	0.007	0.4%	0.031	5.2%
High Negative	9	240	0.60	0.026	4.3%	0.016	2.7%	0.011	1.8%	0.026	0.9%	0.033	5.5%
	13	240	0.60	0.043	7.0%	0.026	4.4%	0.000	0.0%	0.147	3.4%	0.054	9.0%
	8	240	0.61	0.027	4.5%	0.023	3.8%	0.000	0.0%	0.013	0.7%	0.036	5.9%
	3	240	0.75	0.029	3.8%	0.022	3.0%	0.000	0.0%	0.074	1.4%	0.038	5.1%
	2	240	0.85	0.037	4.3%	0.018	2.1%	0.010	1.2%	0.255	2.9%	0.049	5.8%
	21	240	0.88	0.032	3.7%	0.021	2.4%	0.015	1.7%	0.037	0.9%	0.043	4.8%
Equivocal	1	240	0.96	0.039	4.0%	0.031	3.2%	0.020	2.1%	0.170	2.5%	0.059	6.1%
	18	240	0.98	0.035	3.5%	0.031	3.2%	0.000	0.0%	0.068	1.3%	0.048	4.9%
	15	240	1.04	0.043	4.1%	0.025	2.4%	0.000	0.0%	0.040	1.0%	0.051	4.9%
	7	240	1.06	0.038	3.6%	0.036	3.4%	0.000	0.0%	0.133	1.9%	0.056	5.3%
Low Positive	11	240	1.17	0.043	3.7%	0.029	2.5%	0.021	1.8%	0.000	0.0%	0.055	4.8%
	20	240	1.31	0.058	4.4%	0.000	0.0%	0.017	1.3%	0.168	2.1%	0.066	5.1%
	16	240	1.33	0.045	3.4%	0.031	2.3%	0.000	0.0%	0.080	1.2%	0.057	4.3%
Moderate Positive	14	240	1.50	0.044	2.9%	0.031	2.1%	0.023	1.5%	0.011	0.4%	0.059	3.9%
	17	240	1.65	0.103	6.2%	0.000	0.0%	0.016	1.0%	0.068	1.7%	0.108	6.5%
	10	240	1.97	0.060	3.1%	0.061	3.1%	0.000	0.0%	0.000	0.0%	0.085	4.3%
	4	240	2.40	0.063	2.6%	0.063	2.6%	0.000	0.0%	0.011	0.4%	0.089	3.7%
High Positive	22	240	3.36	0.111	3.3%	0.069	2.0%	0.000	0.0%	0.000	0.0%	0.130	3.9%

Table 08: Reproducibility - VZV IgG

Analyte Level for Anti-VZV	Samples	N	Mean (Index)	Within Run		Between Run		Between Day		Between Site/ Lot		Total	
				SD	%CV	SD	%CV	SD	%CV	SD	%CV	SD	%CV
Low Negative	7	240	0.26	0.016	6.2%	0.007	2.8%	0.006	2.1%	0.065	1.9%	0.019	7.4%
	13	240	0.27	0.020	7.3%	0.011	4.1%	0.006	2.2%	0.000	0.0%	0.024	8.7%
High Negative	2	240	0.63	0.038	6.0%	0.017	2.7%	0.013	2.0%	0.020	1.0%	0.044	7.0%
	8	240	0.83	0.050	6.1%	0.023	2.8%	0.014	1.7%	0.013	0.8%	0.058	6.9%
	19	240	0.85	0.044	5.2%	0.036	4.3%	0.011	1.3%	0.000	0.0%	0.058	6.8%
Equivocal	12	240	1.02	0.043	4.2%	0.036	3.5%	0.018	1.8%	0.135	2.3%	0.063	6.2%
Low Positive	15	240	1.22	0.048	3.9%	0.047	3.8%	0.006	0.5%	0.000	0.0%	0.067	5.5%
	17	240	1.25	0.083	6.6%	0.035	2.8%	0.007	0.5%	0.084	2.2%	0.094	7.5%
	18	240	1.28	0.057	4.4%	0.043	3.4%	0.042	3.3%	0.000	0.0%	0.083	6.4%
	1	240	1.32	0.062	4.7%	0.063	4.8%	0.000	0.0%	0.000	0.0%	0.088	6.7%
	9	240	1.35	0.058	4.3%	0.051	3.7%	0.028	2.1%	0.000	0.0%	0.082	6.1%

Moderate Positive	20	240	1.63	0.083	5.1%	0.052	3.2%	0.000	0.0%	0.014	0.7%	0.099	6.1%
	6	240	1.69	0.069	4.1%	0.060	3.5%	0.011	0.7%	0.158	2.4%	0.100	5.9%
	5	240	1.98	0.091	4.6%	0.076	3.8%	0.000	0.0%	0.008	0.5%	0.119	6.0%
	3	240	2.48	0.105	4.2%	0.061	2.5%	0.051	2.0%	0.233	2.9%	0.150	6.1%
High Positive	22	240	2.65	0.100	3.8%	0.085	3.2%	0.000	0.0%	0.270	3.0%	0.153	5.8%
	21	240	2.66	0.117	4.4%	0.057	2.2%	0.040	1.5%	0.313	3.4%	0.164	6.2%
	14	240	2.7	0.103	3.8%	0.053	2.0%	0.073	2.7%	0.267	3.0%	0.159	5.9%
	11	240	3.01	0.115	3.8%	0.072	2.4%	0.081	2.7%	0.193	2.6%	0.176	5.9%
	10	240	3.03	0.114	3.8%	0.093	3.1%	0.037	1.2%	0.157	2.2%	0.166	5.5%
	16	240	3.06	0.126	4.1%	0.070	2.3%	0.039	1.3%	0.366	3.7%	0.188	6.2%
	4	240	3.34	0.128	3.8%	0.106	3.2%	0.090	2.7%	0.207	2.9%	0.212	6.4%

2. Linearity:
Not applicable

3. Analytical Specificity/Interference:

a. Potential Cross-reactivity:

Potential cross-reactivity for the DYNEX SmartPLEX MMRV IgG Assay Kit was determined by testing serum samples from individuals containing antibodies to other microorganisms or with medical conditions unrelated to MMRV infections. The data showed no cross reactivity with various disease state specimens evaluated, except for one specimen for HSV 2 IgG which gave an equivocal result on the assay for Mumps IgG. Additional testing of negative samples for measles, mumps, rubella and VZV IgG remained negative when the other three measurands in the well were positive.

Table 09: Potential Cross-reactivity

Sample Type	Measles IgG		Mumps IgG		Rubella IgG		VZV IgG	
	N	Negative Agreement	N	Negative Agreement	N	Negative Agreement	N	Negative Agreement
Anti-nuclear antibody (ANA) IgG	5	5/5	5	5/5	5	5/5	5	5/5
Cytomegalovirus (CMV) IgG	6	6/6	5	5/5	5	5/5	8	8/8
Epstein-Barr virus (EBV) IgG	10	10/10	11	11/11	8	8/8	6	6/6
Hepatitis B virus (HBV) Anti- HBs	5	5/5	0	-	1**	1/1	0	-
Hepattis C virus (HCV) IgG**	7	7/7	2	2/2	4	4/4	1	1/1
HSV 1 IgG**	3	3/3	1	1/1	3	3/3	3	3/3
HSV 2 IgG**	1	1/1	3	2/3*	2	2/2	3	3/3
Parvovirus B19 IgG**	2	2/2	1	1/1	0	-	1	1/1
Toxoplasma IgG**	2	2/2	0	-	1	1/1	2	2/2
Myeloma IgG	7	7/7	10	10/10	7	7/7	6/6	6/6

Mumps, Rubella, & VZV IgGs***	7	7/7	-	N/A	-	N/A	-	N/A
Measles, Rubella, & VZV IgGs***	-	N/A	6	6/6	-	N/A	-	N/A
Measles, Mumps, & VZV IgGs***	-	N/A	-	N/A	18	18/18	-	N/A
Measles, Mumps, & Rubella IgGs***	-	N/A	-	N/A	-	N/A	14	14/14

* One HSV 2 IgG sample had an Equivocal result for Mumps IgG with the DYNEX SmarPLEX MMRV Assay Kit while had a high negative result for Mumps IgG with the predicate.
** Potential cross-reactivity was not well assessed due to limited sample size.
*** Three measurands were evaluated together for potential cross reactivity

b. Potential Interfering endogenous substances:

The DYNEX SmartPLEX MMRV IgG Assay Kit was evaluated for potential interference of endogenous substances using negative, low positive, and high positive serum samples for Measles, Mumps, Rubella, and VZV IgG antibodies in the presence and absence of potential endogenous interference substances. No interference was observed at the maximum concentrations reported below in the table.

Table 10: Interference tested

Interfering Substance	Concentration
Bilirubin (conjugated)	5 mg/dL
Bilirubin (unconjugated)	40 mg/dL
Cholesterol total	250 mg/dL
Triglycerides total	500 mg/dL
Albumin	50 g/dL
Hemoglobin	500 mg/dL

4. Assay Reportable Range:
Not Applicable

5. Traceability, Stability, Expected Values (Controls, Calibrators, or Methods):
Calibrator:

- The Rubella calibrator and control of the DYNEX SmartPLEX MMRV IgG Assay Kit are traceable to the WHO International Standard Anti-Rubella Immunoglobulin, Human NIBSC code: RUBI-1-94,
- The Measles, Mumps, VZV calibrator and controls are traceable to a DYNEX internal standard.

Sample Stability:

The data support the following storage conditions for the serum samples to be tested with the DYNEX SmartPLEX MMRV IgG Assay Kit:

Table 14: Sample stability

Storage Temperature/Condition	Storage Time (or cycles number)
Room Temperature	Up to 24 hours
2-8°C	Up to 7 days
-20°C	Up to 3 months
Freeze/Thaw Cycles	Up to 5 cycles

6. Detection Limit:
   Not applicable

7. Assay Cut-Off:
   A study to establish the DYNE SmartPLEX MMRV IgG Assay Kit cutoff was performed using 669 serum samples.
   The cut-off values and assignment of the calibrators were determined by performing concordance and Receiver Operator Characteristic (ROC) analysis, using predicate results as the standard.

8. Accuracy:

   Not Applicable

9. Sample Carry-Over:
   The DYNEX SmartPLEX MMRV IgG Assay Kit is not susceptible to within-assay sample carryover.

10. High Dose Hook Effect:
    The DYNEX SmartPLEX MMRV IgG Assay Kit is not susceptible to high dose hook effect (or interference from specimens with high levels MMRV antibodies).

B Comparison Studies:

1. Method Comparison with Predicate Device:

   Performance of the DYNEX SmartPLEX MMRV IgG Assay Kit was evaluated against corresponding commercially available Measles, Mumps, Rubella and VZV immunoassays using a total of 2512 retrospective serum samples. Serum specimens from adults (N=1676), pregnant woman (N=500) and pediatric (N=336) were evaluated. The study was conducted at two sites. To demonstrate the clinical performance of the DYNEX SmartPLEX MMRV IgG Assay Kit, Positive Percent Agreement (PPA) and Negative Percent Agreement (NPA) between the results of the DYNEX SmartPLEX MMRV IgG Assay Kit and an FDA-cleared comparator tests were calculated.

   The demographic information of the populations tested is listed below:

   Table 15: Demographic information

Specimen Cohort	Sex	Age Range	Total (N)
Adult	Female	22-88	910
	Male	22-84	766
Pediatric	Female	1-21	134
	Male	1-21	202
Pregnant	Female	16-47	500
Total			2512

The clinical performance results for all populations are shown in Tables 16 to 19, below.

Table 16: Clinical Performance per Cohort - Measles IgG

Cohort	Measles IgG Results		Comparator Final Results				Percentage Agreement	
			Positive	Equiv	Negative	Total	PPA *(95% CI)*	NPA *(95% CI)*
Pediatrics	DYNEX Smart PLEX MMRV IgG Assay Kit	Positive	250	0	0	250	87.70% 250/285 (83.4 – 91.0%)	100% 51/51 (93.0 - 100%)
		Equivocal	12	0	0	12		
		Negative	18	5	51	74		
		Total	280	5	51	336		
			Positive	**Equiv**	**Negative**	**Total**	**PPA *(95% CI)***	**NPA *(95% CI)***
Pregnant women	DYNEX Smart PLEX MMRV IgG Assay Kit	Positive	387	0	0	387	84.30% 387/459 (80.7 – 87.4%)	100% 41/41 (91.4 - 100%)
		Equivocal	34	0	0	34		
		Negative	31	7	41	79		
		Total	452	7	41	500		
			Positive	**Equiv**	**Negative**	**Total**	**PPA *(95% CI)***	**NPA *(95% CI)***
Pediatric and Adult	DYNEX Smart PLEX MMRV IgG Assay Kit	Positive	1545	0	1	1546	87.00% 1545/1775 (85.4 – 88.5%)	98.70% 234/237 (96.3 – 99.6%)
		Equivocal	70	0	2	72		
		Negative	137	23	234	394		
		Total	1752	23	237	2012		

Table 17: Clinical Performance per Cohort - Mumps IgG

Cohort	Mumps IgG Results		Comparator Final Results				Percentage Agreement	
			Positive	Equiv	Negative	Total	PPA *(95% CI)*	NPA *(95% CI)*
Pediatrics	DYNEX Smart PLEX MMRV IgG Assay Kit	Positive	270	0	6	276	94.40% 270/286 (91.1 - 96.5%)	76.00% 38/50 (62.6 - 85.7%)
		Equivocal	5	0	6	11		
		Negative	8	3	38	49		
		Total	283	3	50	336		
			Positive	**Equiv**	**Negative**	**Total**	**PPA *(95% CI)***	**NPA *(95% CI)***
Pregnant women	DYNEX Smart PLEX MMRV IgG Assay Kit	Positive	463	0	2	465	96.90% 463/478 (94.9 – 98.1%)	90.90% 20/22 (72.2 – 97.5%)
		Equivocal	5	0	0	5		
		Negative	5	5	20	30		
		Total	473	5	22	500		

			Positive	Equiv	Negative	Total	PPA *(95% CI)*	NPA *(95% CI)*
Pediatric and Adult	DYNEX Smart PLEX MMRV IgG Assay Kit	Positive	1672	2	22	1696	94.70% 1672/1765 (93.6 – 95.7%)	78.90% 194/246 (73.3 – 83.5%)
		Equivocal	32	1	28	61		
		Negative	47	14	194	255		
		Total	1751	17	244	2012		

Table 18: Clinical Performance per Cohort - Rubella IgG

Cohort	Rubella IgG Results		Comparator Final Results				Percentage Agreement	
			Positive	Equiv	Negative	Total	PPA *(95% CI)*	NPA *(95% CI)*
Pediatrics	DYNEX Smart PLEX MMRV IgG Assay Kit	Positive	278	0	0	278	92.70% 278/300 (89.1 – 95.1%)	100% 36/36 (90.4 - 100%)
		Equivocal	14	0	0	14		
		Negative	8	0	36	44		
		Total	300	0	36	336		
			Positive	**Equiv**	**Negative**	**Total**	**PPA *(95% CI)***	**NPA *(95% CI)***
Pregnant women	DYNEX Smart PLEX MMRV IgG Assay Kit	Positive	449	0	0	449	92.00% 449/488 (89.3 – 94.1%)	100% 12/12 (75.8 - 100%)
		Equivocal	15	0	0	15		
		Negative	24	0	12	36		
		Total	488	0	12	500		
			Positive	**Equiv**	**Negative**	**Total**	**PPA *(95% CI)***	**NPA *(95% CI)***
Pediatric and Adult	DYNEX Smart PLEX MMRV IgG Assay Kit	Positive	1656	0	1	1657	92.40% 1656/1793 (91.0 – 93.5%)	99.50% 218/219 (97.5 – 99.9%)
		Equivocal	61	0	0	61		
		Negative	71	5	218	294		
		Total	1788	5	219	2012		

Table 19: Clinical Performance per Cohort - VZV IgG

Cohort	VZV IgG Results		Comparator Final Results				Percentage Agreement	
			Positive	Equiv	Negative	Total	PPA *(95% CI)*	NPA *(95% CI)*
Pediatrics	DYNEX Smart PLEX MMRV IgG Assay Kit	Positive	215	0	2	217	91.50% 215/235 (87.2 – 94.4%)	93.90% 92/98 (87.3 – 97.2%)
		Equivocal	11	3	4	18		
		Negative	4	5	92	101		
		Total	230	8	98	336		
			Positive	**Equiv**	**Negative**	**Total**	**PPA *(95% CI)***	**NPA *(95% CI)***

Pregnant women	DYNEX Smart PLEX MMRV IgG Assay Kit	Positive	453	2	1	456	97.20% 453/466 (95.3 – 98.4%)	84.80% 28/33 (69.1 – 93.3%)
		Equivocal	6	1	2	9		
		Negative	5	2	28	35		
		Total	464	5	31	500		
			Positive	**Equiv**	**Negative**	**Total**	**PPA *(95% CI)***	**NPA *(95% CI)***
Pediatric and Adult	DYNEX Smart PLEX MMRV IgG Assay Kit	Positive	1667	8	11	1686	96.70% 1667/1723 (95.8 – 97.5%)	88.00% 243/276 (83.7 – 91.4%)
		Equivocal	27	13	14	54		
		Negative	17	12	243	272		
		Total	1711	33	268	2012		

2. Matrix Comparison:
   Not applicable. Serum is the only matrix claimed.

C Clinical Studies:

1. Clinical Sensitivity:
   Not applicable

2. Clinical Specificity:
   Not applicable

3. Other Clinical Supportive Data (When 1. and 2. Are Not Applicable):
   Not applicable

D Clinical Cut-Off:
See Assay Cut-Off

E Expected Values/Reference Range:
Not Applicable

VIII Proposed Labeling:

The labeling supports the finding of substantial equivalence for this device.

IX Conclusion:

The submitted information in this premarket notification is complete and supports a substantial equivalence decision.