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TERMS, DEFINITIONS, ABBREVIATIONS,

SYMBOLS AND UNITS

ESA/SCC Basic Specification No. 21300

space components
coordination group

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		P2. DCN		None
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TABLE OF CONTENTS

1. SCOPE

This specification defines the terms, definitions, abbreviations, symbols and units used in the ESA/SCC Basic, Generic and Detail Specifications which together form the overall SCC System.

Terms, definitions, abbreviations, symbols and units used for, and applicable to, individual components only are defined in ancillary Detail Specifications belonging to the 21300 series of specifications (see Section 4).

Each Detail Specification shall be read in conjunction with this specification.

2. TERMS AND DEFINITIONS FOR GENERAL PURPOSES

2.1 BASIC TERMS

2.1.1 Classification

Family of Components
- A group of components which display a particular and predominant physical characteristic and/or fulfil a specific function.

Family of Structurally Similar Components
- A family of components that are structurally similar, but separately identifiable, covered by a single Detail Specification.

  Such components shall be produced by one Manufacturer, consist of essentially the same materials and be manufactured according to the same basic design, processes and techniques. They shall differ only in electrical characteristics.

Subfamily of Components
- A group of components belonging to the same component family and produced according to similar technological methods.

Type and Style
- Type and style of a specific component are defined in the relevant Detail Specification.

Capability Domain
- A set of defined technologies subjected to Capability Approval review and limited by the capability boundaries.

Capability Boundary
- One of the electrical, physical or mechanical parameters, design rules, materials, equipment or software forming the limits of the capability domain. These boundaries are proved initially and defined, by the Manufacturer, in the Process Identification Document.

2.1.2 Specifications

Specification
- A document containing the rules and requirements, including inspection procedures, applicable to component procurement.

Basic Specification
- Such specification is applicable to all component families or a large group of components to the extent specified in the applicable Generic or Detail Specification.

Generic Specification
- A specification applicable to a family or subfamily of components and containing all those requirements that are common to a component family or subfamily.

Detail Specification
- A specification derived from a Generic Specification which covers a particular component or a recognised range of components. It describes that component, or range of components, together with rated and/or limit values and characteristics. A Detail Specification also includes inspection requirements or refers in respect of such requirements to the applicable Generic Specification.

2.1.3 Procedure

Approval of a Manufacturer
- A procedure which results in the recognition that a Manufacturer has a competent organisation for the production and inspection of particular components in accordance with the requirements laid down in ESA/SCC Basic Specifications.

Qualification Approval
- Qualification approval is the decision by the proper authority that a particular Manufacturer can be considered as able to produce reasonable quantities of the component type which meets the specification requirements.

Raw Material Lot
- The material has to be manufactured:
  - With the same process, specifications and procedures.
  - With the same equipment.

Diffusion Lot
- Wafers shall be processed within an uninterrupted period of 6 weeks:
  - With wafer raw material from the same crystal.
  - With the same process, specifications and procedures (diffusion).
  - With the same design, construction and geometry (mask).
  - With the same equipment.

Piece Parts Lot
- The piece parts have to be manufactured:
  - With the same process, specifications and procedures.
  - With the same design, construction and geometry.
  - With the same equipment.

Assembly Lot	- An assembly lot is a quantity of components or family of structurally similar components which, as well as their piece parts are manufactured: - With semiconductor dice out of one diffusion lot. - With basic raw material out of one raw material lot. - With piece parts out of one piece parts lot. - Through to the end of Final Production Tests. - With the same process, specifications and procedures. - With the same design, construction and geometry. - With the same equipment.
Inspection Lot	- A quantity of components presented for inspection and submission to lot-by-lot testing in accordance with the sampling document.
Delivery Lot	- A quantity of components delivered against an order and originating from the same assembly lot. It can include flight parts and Qualification/Lot Acceptance Test samples.
Selected Sublot	- A portion of an assembly lot, if the assembly lot comprises more units than are required for mechanical, environmental and endurance tests and delivery. A selected sublot shall consist of a minimum of the components necessary for delivery, test sublot and allowable failures during burn-in. More than one selected sublot can be extracted from an assembly lot.
Test Sublot	- A test sublot consists of those components that are required for the performance of mechanical, environmental and endurance tests according to the applicable Generic Specification. Such components shall be randomly taken from a selected sublot after successful completion of burn-in and parameter drift screening.
Deliverable Components	- Components to be delivered shall be processed and inspected according to the production flow chart and shall pass all tests specified for the required testing level.
Certificate of Conformity	- A document issued with a delivery lot, stating that the components have been taken from one or more inspection lots released in conformity with ESA/SCC basic rules.
Mark of Conformity	- A mark applied to the packing and/or component, indicating that the components originate from an inspection lot which has been released in accordance with ESA/SCC basic rules.

Capability Approval - An approval granted to a Manufacturer when it has been established that his capability for design, manufacture and quality control of products, within a defined technological domain, fulfils ESA/SCC requirements.

Chip Component - A component in its ultimate state of miniaturisation.

Test Structure - An element or component specifically intended to test one or more Parametric boundaries of the capability domain and used in testing to obtain Capability Approval.

2.2 RELIABILITY CONCEPTS

2.2.1 Reliability

Reliability (general definition) - The ability of an item to perform a required function under stated conditions and for a stated period of time.

Reliability (probability definition) - The characteristic of an item expressed by the probability that it will perform a required function under stated conditions and for a stated period of time.

2.2.2 Failure Concepts

Failure - The termination of the ability of an item to perform its required function, or excessive change of any characteristic of an item, or the loss of traceability of an item.

A failure may be effected by inherent weakness of a component during operation or storage within rated conditions, or by wrong handling of a component, of insufficient or wrong documentation during manufacturing, testing, storage or shipping.

Failure Mode - The effect by which a failure is observed.

Sudden Failure - A failure that could not be anticipated by prior examination.

Gradual Failure - A failure that could be anticipated by prior examination.

Partial Failure - A partial failure shall be identified as a drift or limit failure.

Drift Failure - A failure resulting from deviation in characteristic(s) beyond the specified parameter drift values, during burn-in and parameter drift screening tests, but not causing complete failure of the required function.

Limit Failure - A failure resulting from deviation in characteristic(s) beyond the specified limits and causing failure of the required function.

Complete Failure	- A failure resulting from deviations in characteristic(s) beyond specified limits causing loss of the required function.
Catastrophic Failure	- A failure which is both sudden and complete.
Degradation Failure	- A failure which is both gradual and partial.
Early Failure Period	- The early stages of a period which starts at a specified point in time and during which the failure rate decreases rapidly.
Constant Failure Rate Period	- A period during which it is possible that failures occur at an approximately uniform rate.
Wear-out Failure Period	- A period during which it is possible that the failure rate increases rapidly due to deterioration processes.
Mean Failure Rate	- A quantity of items which is related to a time unit and which, having survived up to an arbitrary instant, are no longer active at the instant $t+\Delta t$. The instantaneous mean failure rate is equal to the density of the conditional probability of failure.
Mean Time to Failure - MTTF	- For truncated tests and during a defined life period of an item, the sum of the operating time of a population, divided by the total number of failures in the population during the period in given stress conditions (cumulative operating time is a product or sum of products).
Mean Time Between Failures -MTBF	- For a stated period in the life of an item, the mean value of the duration of operating times between consecutive failures under given stress conditions.
Mean Life Observed	- Mean value of observed times to failure of all the individuals in a population of items under stated conditions.
Failure Analysis - FA	- The logical, systematic examination of an item or its diagram(s) to identify and analyse the probability, causes and consequences of potential and real failures.
Defect	- The nonfulfillment of an intended ESA/SCC requirement or a reasonable expectation, for the use of a component, including one concerned with safety.
Minor Defect	- A defect that is not likely to reduce materially the usability of the unit of product for its intended purpose or its departure from established standards, having little bearing on the effective use or operation of the unit.
Minor Defective	- A unit of product that contains one or more defects, but contains no critical or major defect.

Non-conformance - The failure of a unit of product to conform to specified requirements for any quality characteristic.

2.2.3 Test Concepts

Qualification Test - Qualification of a product is a complete series of tests carried out on a number of specimens representative of the type with the object of determining whether a particular Manufacturer can be considered capable of manufacturing products which meet the specification.

Screening Test - A test, or combination of tests, intended to remove unsatisfactory items or those likely to exhibit early failures.

Burn-in - Non-destructive testing to stabilise the characteristics of an assembly lot and to screen good parts without either effective or potential failures.

Final Production Test - FPT - All test and measurement operations which are performed on all of the assembled (finished) components.

Environmental and Endurance Tests - The testing (destructive or non-destructive) of samples for product qualification purposes. Such testing may include:

- Shock.
- Vibration.
- Constant acceleration.
- Seal.
- Weldability.
- Solderability.
- Thermal shock.
- Moisture resistance.
- Terminal strength.
- Electrical measurements.
- Operating life.
- High temperature storage.

Extended Endurance Test - Extended endurance tests are tests required to obtain information about the reliability of a component. They may include:

- Operating life, i.e. 10 000 hours
- High temperature storage for a long time, i.e. 10 000 hours.

Destructive Physical Analysis - DPA - Determination of the type and quality of materials, technology and processes used by a Manufacturer in the production of a particular component to establish its suitability for Space applications, or to maintain the standard of approved materials, technology and processes.

2.3 QUALITY ASSURANCE TERMS

2.3.1 General

Quality - The totality of characteristics of an item or component that bear on its ability to satisfy stated and implied needs.

Quality Assurance - QA - A planned and systematic pattern of all actions necessary to provide adequate confidence that the item or product conforms to established technical requirements.

Quality Control - QC - A management function whereby control of quality of raw or produced material is exercised for the purpose of preventing production of defective material.

Qualification - The entire process by which products are obtained from Manufacturers or Distributors, examined and tested, and then identified in Qualified Product Lists.

Qualified Part - A component type which has been demonstrated to meet the ESA/SCC requirements for inclusion in the ESA/SCC Qualified Parts List.

Safety - The state in which the risk of harm (to persons) or damage arising from component handling or intended use is limited to an acceptable level.

2.3.2 Statistics, Sampling and Testing

Acceptable Quality Level (A.Q.L.) - The maximum percentage of defectives (or the maximum number of defects per 100 units) which, for the purpose of sampling inspection, can be considered satisfactory as a process average.

Acceptance Number - The maximum number of defects or defective units in a sample that will permit acceptance of the inspection lot or batch.

Rejection Number - The minimum number of defects or defective units in a sample that will cause rejection of the lot represented by the sample.

Defects per 100 Units - The number of defects per 100 units of any given quantity of a product is the number of defects contained therein divided by the total number of units of product, the quotient multiplied by 100 (1 or more defects being possible in any unit of product). Expressed as an equation:-

$$\text{Defects per 100 units} = \frac{\text{Number of defects} \times 100}{\text{Number of units}}$$

Inspection Level - An indication of the relative sample size for a given amount of product.

Inspection Tightened - Inspection under a sampling plan using the same quality level as for normal inspection, but requiring more stringent acceptance criteria.

Reduced Inspection - Inspection under a sampling plan, using the same quality level as for normal inspection, but requiring a smaller sample for inspection.

100% Inspection - Inspection in which specified characteristics of each unit of product are examined or tested to determine conformance to requirements.

Percent Defective Allowable - PDA - The allowable percent defective of any given quantity of units of product is 100 times the number of defective units of product contained therein divided by the total number of units of product, i.e.:-

$$\text{Allowable percent defective} = \frac{\text{Number of defectives} \times 100}{\text{Number of units inspected}}$$

Process Average - Is the average percentage of defective or average number of defects per 100 units of product submitted by the supplier for original inspection.

Lot or Batch - The term lot or batch shall mean "inspection lot" or "inspection batch", i.e. a collection of electronic components from which a sample is to be drawn and inspected to determine compliance with the acceptability criteria, and may differ from a collection of electronic components designated as a lot or batch for other purposes (e.g. production, shipment, etc.).

Lot Size - The number of units of product in a lot.

Sample - A sample consists of 1 or more electronic components from a lot or batch, the units of the sample being selected at random. The number of electronic components in the sample is the sample size.

Sample Size - The number of units of product in the sample selected for inspection.

Sample Unit - A unit of product selected to be part of a sample.

Unit of Product - A unit of product is the thing inspected in order to determine its classification as defective or non-defective or to count the number of defects. It may be a single article, a pair, a set, a length, an area, an operation, a volume, a component of an end product, or the end product itself. The unit of product may, or may not, be the same as the unit of purchase, supply, production or shipment.

Sampling Frequency - The sampling frequency 'f' is the ratio between the number of units of product randomly selected for inspection at an inspection to the number of product passing the inspection station.

Sampling Plan - A statement of the sample size or sizes to be used and the associated acceptance and rejection criteria.

Resubmitted Lot - A lot which has been rejected, subjected to either examination or testing, or both, for the purpose of removing all defective units which may or may not be reworked or replaced, and submitted again for acceptance.

Testing - Is an element of inspection and generally denotes the determination by technical means of the properties of elements of supplies, or components thereof, including functional operation, and involves the application of established scientific principles and procedures.

Testing Levels - Testing levels are identifiable qualities of components arrived at by prescribing the determination of testing. Testing level 'B' is the highest defined level.

2.3.3 Inspection

Calibration - Comparison of 2 instruments or measuring devices, 1 of which is a standard of known accuracy traceable to national standards, to detect, correlate, report or eliminate by adjustment any discrepancy in accuracy of the instrument or measuring device being compared with the standard.

Measuring and Test Equipment - All devices used to measure, gauge, test, inspect, diagnose or otherwise examine materials, supplies and equipment to determine compliance with technical requirements.

Attribute - A characteristic or property which is appraised in terms of whether it does or does not exist (e.g. go or not go) with regard to a given requirement.

Inspection - The examination and testing of supplies and services (including, when appropriate, raw materials, components and intermediate assemblies) to determine whether they conform to specified requirements.

Lot-by-lot Inspection - Lot-by-lot inspection is that inspection carried out on each lot either on a sample drawn from the lot or on the complete lot. The results of tests in this category are used to determine whether the lot complies with the specified requirements.

Periodic Inspection - Periodic inspection is that inspection carried out periodically on a sample drawn either from an individual lot or from a number of lots. The lot(s) from which the sample is drawn shall have been shown to comply with the requirements for lot-by-lot inspection. The results from tests in this category are used to verify that the level of technical performance is being maintained.

Inspection by Attribute - Inspection whereby either the unit of product or characteristic thereof is classified simply as defective or non-defective, or the number of defects in the unit of product is counted, in respect of a given requirement.

Inspection by Variables - Inspection wherein certain quality characteristics of sample are evaluated in respect of a continuous numerical scale and expressed as precise points along this scale. Variables inspection records the degree of conformance or non-conformance of the unit with specified requirements for the quality characteristics involved.

Inspection In-process - Inspection which is performed during the manufacturing or repair cycle in an effort to prevent defectives from occurring and to inspect the characteristics and attributes which are not capable of being inspected at final inspection.

Examination - An element of inspection consisting of investigation, without the use of special laboratory appliances or procedures, of supplies and services to determine conformance to those specified requirements which can be determined by such investigations. Examination is generally non-destructive and includes, but is not limited to, visual, auditory, olfactory, tactile, gustatory and other investigations; simple physical manipulations; gauging; and measurement.

Traceability - The means of knowing at all times during production or a specific period of utilisation of a component any historical detail of each production and reliability processing step, starting from the raw materials source, the inspector or worker, the state of the machine, etc.

2.3.4 Documents

Inspection Record - Recorded data concerning the results of inspection action.

Deviation - Written authorisation, granted prior to the manufacture of an item, to depart from a particular performance or design requirement of a contract, specification or referenced document, for a specific number of units or specific period of time.

Waiver - A written authorisation to accept a configuration item or other designated items which, during production or after having been submitted for inspection, are found to depart from specified requirements, but nevertheless are considered suitable for use "as is" or after rework by an approved method.

Inspection Quality Conformance - All examinations and tests performed on items or services for the purpose of determining conformance with specified requirements.

Certificate of Conformance

- A Contractor's written statement, when authorised by contract, certifying that supplies or services comply with contract requirements.

Production Flow Chart

- The production flow chart is a drawing which shows the overall processing and testing, the manufacturing sequences of a particular part of production line, including inspection and process control points.

N.B.
Essential elements of the production flow chart are as follows:

- Raw materials.
- Processing steps.
- Inspection.

- Reference to all corresponding specifications with revision letter or number.

Overall Flow Chart

- The overall flow chart is a drawing which includes a simplified production flow chart, sequences of testing operations, indication of recorded data and documents to be delivered.

Qualified Parts List - QPL

- The qualified parts list is a list of components and materials accepted under the SCC Specification System, including the names and plant addresses of Manufacturers or distribution.

Survey, Product-oriented

- A review and evaluation to determine the adequacy of the technical requirements relating to quality and product conformance to design intent.

Authorised Representatives

- Representatives authorised in accordance with the Space Agency rules to act on its behalf in the National and European component fields.

Qualifying Space Agency - QSA

- The qualifying space agency is the national authority recognised by the SCCG inspection authority.

Process Identification Document - PID

- A Process Identification Document comprises all documents relevant to the manufacture of a specific component. It shall include, as a minimum:-

  (a) The production flow chart.

  (b) All process specifications.

  (c) All inspection procedures.

  (d) Constructional details of the component, including photographs where applicable.

  (e) The test programme.

  (f) An organigram of the Manufacturer's organisation.

Capability Abstract

- A comprehensive synopsis of a capability domain in terms of technology boundaries, circuit function and performance, construction rules, package and design data etc. The document shall have no commercial sensitivity, thus rendering it suitable for inclusion in the Qualified Products List.

2.4 IRRADIATION TERMS

2.4.1 Irradiation In Orbit

The main influence on electronic components will be caused by:

- High energy electrons.
- Protons.
- Heavy ions.
- X-ray.
- Gamma ray.

2.4.2 Irradiation Resistance Testing

To assure the correct behaviour of a semiconductor device in a Space radiation environment, it is advisable to check its vulnerability to this environment by radiation stress testing in the laboratory. An exact radiation profile with all its different components and wide energetic spectrum cannot be duplicated in the laboratory. Instead of this, the influence of the radiation species, their energy and also the influence of the response of the semiconductor material and technology can be determined by experiments.

Though the particle type and dose rate, that may prevail, are disregarded, it is possible to determine behaviour under irradiation by dosage from a single radiation source. The effects of such a total dose bear a rough approximation to actual conditions for doses from approximately 1kRad up to 1MRad.

2.4.3 The Basic Definitions

The source of these definitions, units and parameters that are internationally accepted is IEC Publication 50:

- RAD : A dose of one RAD imparts 100 ERG of ionising exitation energy per gramme of material irradiated; 1 RAD (Si) = 100 ERG/g (Si).
- GRAY (GY) : 1 Joule/kg (100RAD).
- DOSE LEVEL : In RAD (material); 1RAD (Si) = 100 ERG/g (Si).
- DOSE RATE : In RAD (material)/sec.
- FLUENCE : Particles/cm^2.
- FLUX : Particles/cm^2/sec.

2.4.4 Expressions used in ESA/SCC Basic Specification No. 22900

- Co 60 Source: A source with a steady state dose.
- Steady State Irradiation Testing: Testing the irradiation resistance of a component under a steady state (non-pulsating) source (A Cobalt 60 source for example).

- Total Dose Ionising Radiation: The amount of radiation that is absorbed by the component under test, expressed in RAD (Si) or GRAY (Si).
- In-situ Testing: Electrical testing of the component on the location where the component is irradiated.
- Remote Testing: Electrical testing of the component on another location than where the component is irradiated.
- Dosimetry: A method to measure the deposited energy or particle fluence in order to quantify the steady state radiation exposure.
- Faraday Cup: The most widely used instrument for monitoring the FLUX and FLUENCE and for absolute determination of charged particle fluxes. The total charge built up on the Faraday Cup divided by the charge per particle gives the total number of particles which have fallen on the cup.
- Device Biasing: The device under test has an outside voltage supplied during irradiation exposure.
- Unidirectional Incident Radiation: Exposure to a parallel (collimated) beam of radiation.
- Corrections for Source Decay: The irradiating source will change its fluence in time. Co-60 sources have a decrease with a half life of approximately 5 years.
- Annealing: Recovery of certain devices after removal of the irradiation source. This recovery to normal situation is called annealing.

3. ABBREVIATIONS, SYMBOLS AND UNITS FOR GENERAL PURPOSES

3.1 CURRENTS, VOLTAGES AND POWERS

I, i	=	Current	A	=	Ampère
V, v	=	Voltage	V	=	Volts
P, p	=	Power	W	=	Watts

3.2 SUBSCRIPTS

AV, av	=	Average
F, f	=	Forward.

3.3 LETTER SYMBOLS FOR ELECTRICAL PARAMETERS

Symbol		Definition	Unit
B, b	=	Susceptance	mhos
C	=	Capacitance	Farad
G, g	=	Conductance	mhos
H, h	=	Hybrid parameter	
L	=	Inductance	Henry
R, r	=	Resistance	Ohm
X, x	=	Reactance	Ohm
Y, y	=	Admittance	mhos
Z, z	=	Impedance	Ohm.

3.4 SUBSCRIPTS FOR ELECTRICAL PARAMETERS

I, i	=	Input
O, o	=	Output.

3.5 LETTER SYMBOLS FOR TEMPERATURE

amb = Ambient
case = Case
J, j = Junction
stg = Storage
R_{th} = Thermal Resistance
op = Operating.

3.6 OTHER SYMBOLS

t = Time
f = Frequency
B = Bandwidth
d = Distortion
F = Noise figure
G = Gain
T = Temperature.

3.7 STANDARD VALUES

The standard values for 'E' ranges are shown in Appendix 'A'.

When an 'E' range is specified for a Range of Components in a Detail Specification, all values within the indicated range are available, within the limits specified.

The tolerance on values within each individual 'E' range will be as shown in Appendix 'A', unless otherwise stated in the Detail Specification.

4. ANCILLARY DETAIL SPECIFICATIONS

The following supplementary specifications have been issued:-

ESA/SCC 2133000 - Terms, Definitions, Abbreviations, Symbols and Units for Capacitors.

ESA/SCC 2133400 - Terms, Definitions, Abbreviations, Symbols and Units for Electrical Connectors.

ESA/SCC 2133600 - Terms, Definitions, Abbreviations, Symbols and Units for Electromagnetic Relays.

ESA/SCC 2134000 - Terms, Definitions, Abbreviations, Symbols and Units for Resistors.

ESA/SCC 2135000 (1) - Terms, Definitions, Abbreviations, Symbols and Units for Discrete Non-Microwave Semiconductor Devices.

ESA/SCC 2139000 - Terms, Definitions, Abbreviations, Symbols and Units for Integrated Circuits.

ESA/SCC 2139020 - Terms, Definitions, Abbreviations, Symbols and Units for Charge Coupled Devices.

NOTES

1. For Discrete Microwave Semiconductor Devices (ESA/SCC Generic No. 5010), no individual ancillary specification for Terms, ... exists. ESA/SCC 2135000 should be used to the extent applicable.

APPENDIX 'A'

STANDARD VALUES LIST

E6 ±20%	E12 ±10%	E24 ±5.0%	E48 ±2.0%	E96 ±1.0%	E192 ±0.5%
100	100	100	100	100	100
					101
				102	102
					104
			105	105	105
					106
				107	107
					109
		110	110	110	110
					111
				113	113
					114
			115	115	115
					117
				118	118
	120	120			120
			121	121	121
					123
				124	124
					126
			127	127	127
					129
		130		130	130
					132
			133	133	133
					135
				137	137
					138
			140	140	140
					142
				143	143
					145
			147	147	147
					149
150	150	150		150	150
					152
			154	154	154
					156
				158	158
		160			160
			162	162	162
					164
				165	165
					167
			169	169	169
					172
				174	174
					176
			178	178	178
	180	180			180
				182	182
					184
			187	187	187
					189
				191	191
					193
			196	196	196
					198
		200		200	200
					203
			205	205	205
					208
				210	210
					213
			215	215	215
					218

E6 ±20%	E12 ±10%	E24 ±5.0%	E48 ±2.0%	E96 ±1.0%	E192 ±0.5%
220	220	220		221	221
					223
			226	226	226
					229
				232	232
					234
			237	237	237
		240			240
				243	243
					246
			249	249	249
					252
				255	255
					258
			261	261	261
					264
		270	270	267	267
					271
			274	274	274
					277
				280	280
					284
			287	287	287
					291
				294	294
					298
		300	301	301	301
					305
				309	309
					312
			316	316	316
					320
				324	324
					328
330	330	330			
			332	332	332
					336
				340	340
					344
			348	348	348
					352
				357	357
		360			361
			365	365	365
					370
				374	374
					379
			383	383	383
					388
		390		392	392
					397
			402	402	402
					407
				412	412
					417
			422	422	422
					427
		430		432	432
					437
			442	442	442
					448
				453	453
					459
			464	464	464
470	470	470			470
				475	475
					481

E6 ±20%	E12 ±10%	E24 ±5.0%	E48 ±2.0%	E96 ±1.0%	E192 ±0.5%
			487	487	487
					493
				499	499
					505
		510	511	511	511
					517
				523	523
					530
			536	536	536
					542
				549	549
					556
	560	560	562	562	562
					569
				576	576
					583
			590	590	590
					597
				604	604
					612
		620	619	619	619
					626
				634	634
					642
			649	649	649
					657
				665	665
					673
680	680	680	681	681	681
					690
				698	698
					706
			715	715	715
					723
				732	732
					741
		750	750	750	750
					759
				768	768
					777
			787	787	787
					796
				806	806
					816
	820	820	825	825	825
					835
				845	845
					856
			866	866	866
					876
				887	887
					898
		910	909	909	909
					920
				931	931
					942
			953	953	953
					965
				976	976
					988