Alveo U280 Data Center Accelerator Card Data Sheet

DS963 (v1.0) February 15, 2019

Summary

The Xilinx® Alveo™ U280 Data Center accelerator card supports PCI Express® Gen3 x16 and Gen4 x8, is equipped with 8 GB high-bandwidth memory (HBM2), and is designed to accelerate memory-bound, compute intensive applications including database analytics and machine learning inference.

A deployment shell enables the card to be configured from onboard flash memory and upgraded through PCI Express.

Alveo Product Details

Table 1: **Alveo U280 Accelerator Card Product Details**

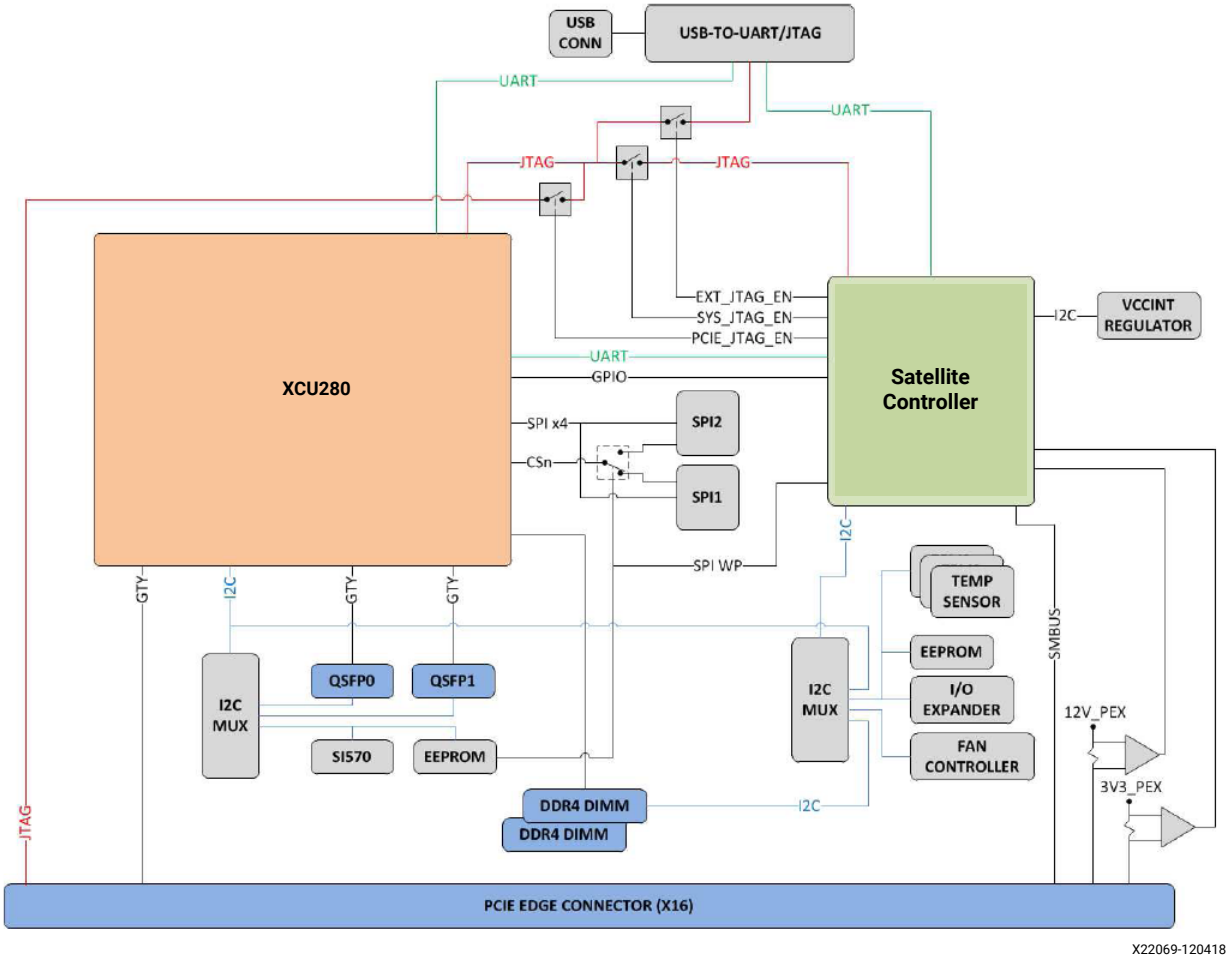
Specification [1]	Active Cooling Version	Passive Cooling Version
Total electrical card load [2]	225W	225W
Thermal cooling solution	Active	Passive
Weight	1187g	1130g
Form factor	U280 cards fully comply with the dual-slot PCIe form factor.	U280 cards fully comply with the dual-slot PCIe form factor.

Notes:

1. The specifications in this data sheet apply to production U280 cards. Any differences in U280 ES1 card specifications and capabilities are documented in the U280 ES1 Known Issues Xilinx Answer 71925.
2. The 225W PCIe CEM card can take 65W from the standard connector 12V supply and an additional 150W from the AUX connector 12V supply. The 3.3V supply from the standard connector is not used on this card. The CEM card requires that a 150W PCIe AUX power cable be connected to the card.

The following figure shows the components within an Alveo U280 accelerator card.

Figure 1: **U280 Block Diagram**



Card Specifications

Dimensions

The card is compliant with the PCIe CEM rev.3.0 Specification as a dual-slot, standard height card. The card with the passive cooling enclosure is three-quarter length, and the card with the active cooling enclosure is full length.

Table 2: **Card Dimensions**

Parameter	Dimension
Height	4.375 inch (111.15 mm)
PCB thickness (+/- 0.1 3 mm (0.005 inch))	1.484 inch (37.7 mm)
Length	9.53 inch (242 mm)
Active cooling enclosure installed	
Assembly length	11.73 inch (298 mm)
Assembly thickness	1.52 inch (38.6 mm)

Table 2: **Card Dimensions** *(cont'd)*

Parameter	Dimension
Passive cooling enclosure installed	
Assembly length	9.53 inch (242 mm)
Assembly thickness	1.52 inch (38.6 mm)

PCIe Connector/Data Rates

The Alveo U280 accelerator card uses an UltraScale+™ FPGA containing a PCIE4C block. The PCIE4C block is compliant to the PCI Express Base Specification v3.1 supporting up to 8.0 GT/s (Gen3 x16) and compatible with PCI Express Base Specification v4.0 supporting up to 16.0 GT/s (Gen4 x8). The PCIE4C block is also compliant with CCIX Base Specification Revision 1.0 v0.9, supporting speeds up to 16.0 GT/s.

Table 3: **PCI Express Data Transfer Rate Performance**

PCI Express Generation	Performance
Gen 1	2.5 GigaTransfers per second (GT/s)
Gen 2	5.0 GT/s
Gen 3	8.0 GT/s
Gen 4	16.0 GT/s

DDR4 Specifications

Two 288-pin DDR4 DIMM sockets are populated with single rank DIMMs capable of operating at data rates up to 2400 MegaTransfers per second (MT/s).

Table 4: **DDR4 Interfaces**

Parameter	Description
Manufacturer	Micron
Part Number	MTA18ASF2G72PZ-2G3B1
Description	16 GB 288-pin DDR4 RDIMM
	Configuration: 2Gb x 72
	Single rank
	Supports ECC error detection and correction
	Supports 2400 MT/s

Network Interfaces

The Alveo U280 accelerator cards host two 100G interfaces, each comprised of a 4-lane QSFP28 connector, which accepts up to 5W modules. QSFP connectors are not supported in the current version of the deployment shell. Each connector is housed within a single QSFP cage assembly located at the I/O bracket.

USB Maintenance Port

The Alveo U280 accelerator cards include a micro-USB maintenance port located at the front of the card opposite end of the I/O bracket.

Validated Servers

The Alveo accelerator cards have been validated for interoperability by Xilinx in the following servers.

Table 5: **Validated Servers**

Manufacturer	Model/Platform[1]
Dell EMC	PowerEdge R7425
Dell EMC	PowerEdge R730
Dell EMC	PowerEdge R740
HPE	ProLiant DL380 G10
SuperMicro	SYS-4028GR-TR
SuperMicro	SYS-4029GP-TRT
SuperMicro	SYS-7049GP-TRT

Notes:

1. Servers listed are validated on U280 ES1 accelerator cards. Validation with U280 production cards will complete at a future date.

Operating System Compatibility

The following operating systems are supported:

- Centos 7.4/7.5 with 3.10.0-693 and 3.10.0-862, respectively
- RHEL 7.4/7.5
- Ubuntu 16.04 with 4.4.0-116-generic
- Ubuntu 18.04 with 4.15.0-23-generic

FPGA Resource Information

At the heart of the Xilinx Alveo U280 accelerator card is a custom-built UltraScale+ FPGA that runs optimally (and exclusively) on Alveo architecture. The Alveo U280 card features the XCU280 FPGA, which uses Xilinx stacked silicon interconnect (SSI) technology to deliver breakthrough FPGA capacity, bandwidth, and power efficiency. This technology allows for increased density by combining multiple super logic regions (SLRs). The XCU280 comprises three SLRs with the bottom SLR (SLR0) integrating an HBM controller to interface with the adjacent 8GB HBM2 memory.

The deployment shell that handles device bring-up and configuration over PCIe is contained within the static region of the FPGA. The remaining dynamic region is available for application developers to implement custom accelerators.

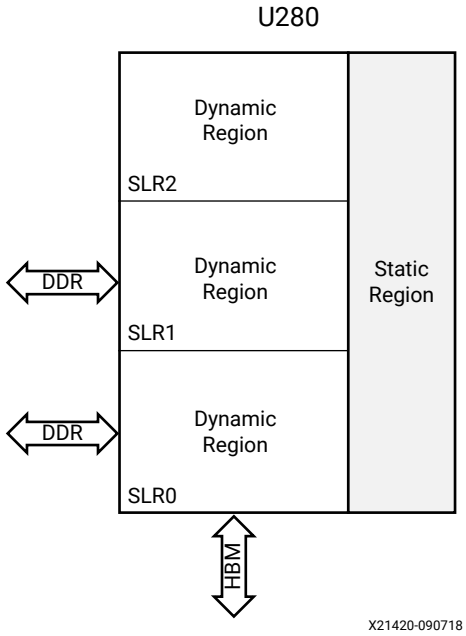
To access instructions on how to assign resources or kernels to the different SLRs in the device, refer to the "SLR Assignments for Kernels" appendix of the *SDAccel Environment User Guide* (UG1023).

Dynamic Regions

The resources in the dynamic region are available for creating custom accelerators. The following figure and table show the amount and location of resources available. For more information on the various resources and their capabilities, see the Xilinx® UltraScale+™ documentation.

The following figure shows the static and dynamic regions of the XCU280 device.

Figure 2: **Floorplan of the XCU280 Device**



The bottom SLR (SLR0) contains an HBM controller comprising 32 HBM AXI interfaces to communicate with the 8GB (two 4GB stacks) of HBM2 within the FPGA. Through a built-in switch mechanism, any of the 32 HBM AXI interfaces can access any memory address on either of the HBM stacks.

The following table lists available resources in the XCU280 device after the static region is programmed with the development shell.

Table 6: **Dynamic Region Resources**

Resource	Total	SLR0	SLR1	SLR2
Look-Up tables (LUTs) (K)	1082	360	352	370
Registers (K)	2180	736	710	734
36 Kb block RAMs	1490	490	490	510
288 Kb UltraRAMs	960	320	320	320
DSP slices	8490	2733	2877	2800

Thermal Specification

Ambient Conditions

The ambient conditions are detailed in the following sections.

Operating and Storage Temperature Conditions

Table 7: **Operating and Storage Temperatures and Humidity Conditions**

Specification	Condition
Operating temperature	0°C to 45°C
Storage temperature	-40°C to 75°C
Operating humidity, non-condensing	8% to 90%
Storage humidity, non-condensing	5% to 95%

Related Information
Operating Conditions

Standard Compliance Details

The Alveo U280 accelerator cards are compliant with ASHRAE classes A1, A2, and A3. The maximum operating altitude is 1200m above sea level.

Table 8: **Standard Compliance Details**

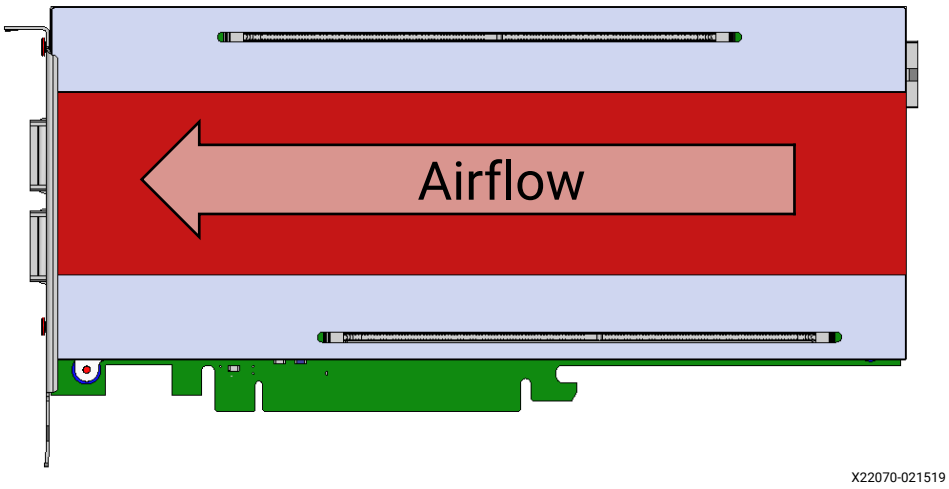
Standard		Operation		Recommended	
		Temperature (°C)	Humidity Ratio	Temperature (°C)	Humidity Ratio
ASHRAE	A1	15 to 32	20% to 80%	18 to 27	-9°C to 15°C DP and 60% RH
	A2	10 to 35	20% to 80%	18 to 27	-9°C to 15°C DP and 60% RH
	A3	5 to 40	-12°C DP and 8% to 85%	18 to 27	-9°C to 15°C DP and 60% RH
	A4	5 to 45	-12°C DP and 8% to 90%	18 to 27	-9°C to 15°C DP and 60% RH

The inlet ambient temperature for long-term operation under the stated standard must not exceed the 45°C inlet to the card.

Airflow Direction Support

Passive cards do not include a built-in fan and therefore require forced airflow when the card is powered at all times. The passively cooled Alveo U280 cards support front-to-back airflow. The following figure illustrates this supported airflow.

Figure 3: **Airflow Direction for Passively Cooled Cards**



Operating Conditions

Inlet Temperature versus Airflow Requirement in Server

The following tables state the required airflow rate and airflow speed to the card under different operating conditions.

Table 9: **Inlet Temperature versus Airflow Requirement for the U280 Card at Sea Level**

Inlet Temperature versus Airflow Requirement PCIe Card Slot (34.8 mm x 106.65 mm) at Sea Level for 85°C Rated QSFP[1]		
Inlet Temperature to the Card (°C)	**Linear Feet per Minute (LFM)**	**Cubic Feet per Minute (CFM)**
25	425	17
30	425	17
35	475	19
40	525	21
45	600	24
50	700	28

Notes:

1. Airflow requirements are for U280 production cards. For U280 ES1 airflow requirements, see the U280 ES1 Known Issues Xilinx Answer 71925.

Table 10: **Inlet Temperature versus Airflow Requirement for the U280 Card above Sea Level**

Inlet Temperature versus Airflow Requirement PCIe Card Slot (34.8 mm x 106.65 mm) at 1200m above Sea Level for 85°C Rated QSFP[1]		
Inlet Temperature to the Card (°C)	**Linear Feet per Minute (LFM)**	**Cubic Feet per Minute (CFM)**
25	425	17
30	425	17
35	525	21
40	575	23

Table 10: **Inlet Temperature versus Airflow Requirement for the U280 Card above Sea Level** *(cont'd)*

Inlet Temperature versus Airflow Requirement PCIe Card Slot (34.8 mm x 106.65 mm) at 1200m above Sea Level for 85°C Rated QSFP[1]		
Inlet Temperature to the Card (°C)	**Linear Feet per Minute (LFM)**	**Cubic Feet per Minute (CFM)**
45	650	26
50	750	30

Notes:

1. Airflow requirements are for U280 production cards. For U280 ES1 airflow requirements, see the U280 ES1 Known Issues Xilinx Answer 71925.

Temperature Gradient

The Alveo accelerator card and its thermal management device should be able to operate at a temperature/time gradient of 15°C/hour in its ambient surroundings. The thermal management device is the heat sink, shroud, backplate, top plate, and fan (for active solutions).

Humidity

The Alveo accelerator card and its thermal management device should be able to operate in a RH (relative humidity) range of 8% to 85% and a dew point of -12°C DP without condensation.

Storage and Non-Operating Conditions

The Alveo accelerator card and its thermal management device should be stored or maintained in non-operating conditions in a RH range of 5% to 90% without condensation and an ambient temperature range of -40°C to 75°C.

Regulatory Compliance Statements

FCC Class A Products

Regulatory Compliance Statements are valid for the production version of Alveo™ cards; not for ES cards.

***Note*:** These devices are for use with UL Listed Servers or I.T.E.

Safety Compliance

The following safety standards apply to all products listed above.

- UL 60950-1, 2nd Edition, 2014-10-14 (Information Technology Equipment - Safety - Part 1: General Requirements)
- CSA C22.2 No. 60950-1-07, 2nd Edition, 2014-10-14 (Information Technology Equipment - Safety - Part 1: General Requirements)
- EN 60950-1:2006+A11:2009+A1:2012+A12:2011+A2:2013 (European Union)
- IEC 60950-1:2005 (2nd Edition); Am 1:2009 (International)

- EU LVD Directive 2014/35/EC

EMC Compliance

The following standards apply.

Class A Products

- FCC Part 15 – Radiated & Conducted Emissions (USA)
- CAN ICES-3(A)/NMB-3(A) – Radiated & Conducted Emissions (Canada)
- CISPR 32 – Radiated & Conducted Emissions (International)
- EN55032: 2015 – Radiated & Conducted Emissions (European Union)
- EN55024: 2010 +A1:2001+A2:2003 – Immunity (European Union)
- EMC Directive 2014/30/EC
- VCCI (Class A)– Radiated & Conducted Emissions (Japan)
- CNS13438 – Radiated & Conducted Emissions (Taiwan)
- CNS 15663 - RoHS (Taiwan)
- AS/NZS CISPR 32 – Radiated and Conducted Emissions (Australia/New Zealand)
- Article 58-2 of Radio Waves Act, Clause 3 (Korea)

Regulatory Compliance Markings

When required, these products are provided with the following Product Certification Markings:

- UL Listed Accessories Mark for the USA and Canada
- CE mark
- FCC markings
- VCCI marking
- Australian C-Tick mark
- Korea MSIP mark
- Taiwan BSMI mark

FCC Class A User Information

The Class A products listed above comply with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

IMPORTANT! *This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his or her own expense.*

IMPORTANT! *Cet équipement a été testé et jugé conforme à la Class A digital device, conformément à la règle 15 du standard FCC. Ces limites sont conçues pour fournir des protections contre des interférences nuisibles lorsque l'équipement est utilisé dans un environnement commercial. Cet équipement génère, utilise et peut émettre des énergies de radio-fréquence et, s'il n'est pas installé et utilisé conformément aux instructions, peut nuire aux communications radio. L'exploitation de cet équipement dans une zone résidentielle est susceptible de causer des interférences nuisibles, auquel cas auquel cas l'utilisateur peut être tenu de prendre des mesures adéquates à ses propres frais.*

Wichtig! *Dieses Gerät wurde getestet und entspricht den Grenzwerten für digitale Geräte der Klasse A gemäß Teil 15 der FCC-Bestimmungen. Diese Grenzwerte bieten einen angemessenen Schutz gegen schädliche Interferenzen, wenn das Gerät in einer gewerblichen Umgebung betrieben wird. Dieses Gerät erzeugt und verwendet Hochfrequenzenergie und kann diese abstrahlen. Wenn es nicht gemäß den Anweisungen installiert und verwendet wird, kann dies Funkstörungen verursachen. Der Betrieb dieses Geräts in einem Wohngebiet kann schädliche Interferenzen verursachen. In diesem Fall muss der Benutzer die Interferenz auf eigene Kosten beheben.*

CAUTION! *If the device is changed or modified without permission from Xilinx, the user may void his or her authority to operate the equipment.*

ATTENTION! *Si l'appareil est modifié sans l'autorisation de Xilinx, l'utilisateur peut annuler son abilité à utiliser l'équipement.*

Vorsicht! *Wenn das Gerät ohne Erlaubnis von Xilinx geändert wird, kann der Benutzer seine Berechtigung zum Betrieb des Geräts verlieren.*

Canadian Compliance (Industry Canada)

CAN ICES-3(A)/NMB-3(A)

VCCI Class A Statement

この装置は、クラス A 情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。
この場合には使用者が適切な対策を構ずるよう要求されることがあります。 VCCI-A

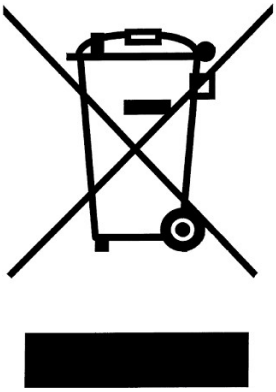
KCC Notice Class A (Republic of Korea Only)

A급 기기 (업무용 방송통신기기) **CLASS A device** (commercial broadcasting and communication equipment	이 기기는 업무용(A급)으로 전자파적합등록을 한 기기이오니 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다. This device has been appoved by EMC registration. Distributors or users pay attention to this point. This device is usually aimed to be used in other area except at home

BSMI Class A Notice (Taiwan)

警告使用者: 此為甲類資訊技術設備，於居住環境中使用時，可能會造成射頻擾動，在此種情況下，使用者會被要求採取某些適對當的對策。

EU WEEE Logo



Manufacturer Declaration European Community

CE

Manufacturer Declaration

Xilinx declares that the equipment described in this document is in conformance with the requirements of the European Council Directive listed below:

- Low Voltage Directive 2014/35/EC
- EMC Directive 2014/30/EC
- RoHS Directive 2011/65/EU

These products follow the provisions of the European Directive 2014/53/EU.

Dette produkt er i overensstemmelse med det europæiske direktiv 1999/5/EC.

Dit product is in navolging van de bepalingen van Europees Directief 1999/5/EC.

Tämä tuote noudattaa EU-direktiivin 1999/5/EC määräyksiä.

Ce produit est conforme aux exigences de la Directive Européenne 1999/5/EC.

Dieses Produkt entspricht den Bestimmungen der Europäischen Richtlinie 1999/5/EC.

Þessi vara stenst reglugerð Evrópska Efnahags Bandalagsins númer 1999/5/EC.

Questo prodotto è conforme alla Direttiva Europea 1999/5/EC.

Dette produktet er i henhold til bestemmelsene i det europeiske direktivet 1999/5/EC.

Este produto cumpre com as normas da Diretiva Européia 1999/5/EC.

Este producto cumple con las normas del Directivo Europeo 1999/5/EC.

Denna produkt har tillverkats i enlighet med EG-direktiv 1999/5/EC.

This declaration is based upon compliance of the Class A products listed above to the following standards:

EN 55032 (CISPR 32 Class A) RF Emissions Control.
EN 55024:2010 (CISPR 24) Immunity to Electromagnetic Disturbance.
EN 60950-1:2006/A11:2009A1:2010/A12:2011 Information Technology Equipment- Safety-Part 1: General Requirements.
EN 50581:2012 - Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances.

CAUTION! *In a domestic environment, Class A products may cause radio interference, in which case the user may be required to take adequate measures.*

ATTENTION! *Dans un environnement domestique, les produits de Classe A peuvent causer des interférences radio, auquel cas l'utilisateur peut être tenu de prendre des mesures adéquates.*

Vorsicht! *In einer häuslichen Umgebung können Produkte der Klasse A Funkstörungen verursachen. In diesem Fall muss der Benutzer möglicherweise geeignete Maßnahmen ergreifen.*

Responsible Party

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References

The following document provides additional information.

Revision History

The following table shows the revision history for this document.

Section	Revision Summary
02/15/2019 Version 1.0	
Initial release.	N/A

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