



EUROPEAN COMMISSION
DG Competition

Case M.8314 - BROADCOM / BROCADE

Only the English text is available and authentic.

**REGULATION (EC) No 139/2004
MERGER PROCEDURE**

Article 6(1)(b) in conjunction with Art 6(2)
Date: 12/05/2017

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In the published version of this decision, some information has been omitted pursuant to Article 17(2) of Council Regulation (EC) No 139/2004 concerning non-disclosure of business secrets and other confidential information. The omissions are shown thus [...]. Where possible the information omitted has been replaced by ranges of figures or a general description.

PUBLIC VERSION

To the notifying parties

Subject: Case M.8314 – Broadcom / Brocade
Commission decision pursuant to Article 6(1)(b) in conjunction with Article 6(2) of Council Regulation No 139/2004¹ and Article 57 of the Agreement on the European Economic Area²

Dear Sir or Madam,

- (1) On 17 March 2017, the European Commission received notification of a proposed concentration pursuant to Article 4 of the Merger Regulation by which Broadcom Limited ("Broadcom", Singapore) intends to acquire within the meaning of Article 3(1)(b) of the Merger Regulation control of the whole of Brocade Communications Systems, Inc. ("Brocade", the United States) by way of a purchase of shares (the "Transaction").³ Broadcom is designated hereinafter as the "Notifying Party", and Broadcom and Brocade are together referred to as the "Parties", while the undertaking resulting from the Transaction is referred to as the "Merged Entity".

1. THE PARTIES AND THE OPERATION

- (2) Broadcom, the Notifying Party, is a technology company (with dual headquarters in the US and Singapore) that designs, develops and supplies a broad range of semiconductor devices – also referred to as integrated circuits ("ICs") or chips – for customers in four business segments: (i) wireless communications; (ii) wired

¹ OJ L 24, 29.1.2004, p. 1 (the 'Merger Regulation'). With effect from 1 December 2009, the Treaty on the Functioning of the European Union ('TFEU') has introduced certain changes, such as the replacement of 'Community' by 'Union' and 'common market' by 'internal market'. The terminology of the TFEU will be used throughout this decision.

² OJ L 1, 3.1.1994, p. 3 (the 'EEA Agreement').

³ Publication in the Official Journal of the European Union No C94 of 25.03.2017, p. 10.

infrastructure; (iii) enterprise storage; and (iv) industrial and other. Broadcom is essentially a "fabless" provider of semiconductor devices, as it primarily relies on third-party "fabrication" plants and only has limited in-house manufacturing capabilities.

- (3) Brocade, the target company, is a US-based technology company that supplies networking hardware, software, and services, including (i) Fibre Channel ("FC") Storage Area Network ("SAN") products, such as directors, fixed switches, embedded switches as well as network management and monitoring solutions; and (ii) Internet Protocol ("IP") networking products such as IP routers, Ethernet switches, network security, analytics and monitoring, as well as products used to manage application delivery. Brocade's products are used in communications and datacentre infrastructures and applications.
- (4) On 2 November 2016, Broadcom and Brocade entered into an Agreement and Plan of Merger pursuant to which Broadcom will acquire all shares in Brocade. The Transaction will thus lead to the acquisition by Broadcom of sole control over Brocade and therefore constitutes a concentration within the meaning of Article 3(1)(b) of the Merger Regulation.

2. UNION DIMENSION

- (5) The undertakings concerned have a combined aggregate world-wide turnover of more than EUR 5 000 million⁴ (Broadcom: EUR 13 610 million; Brocade: EUR 2 115 million). Each of them has a Union-wide turnover in excess of EUR 250 million (Broadcom: EUR [...] million; Brocade: EUR [...] million), but they do not achieve more than two-thirds of their aggregate Union-wide turnover within one and the same Member State. The notified operation therefore has a Union dimension within the meaning of Article 1(3) of the Merger Regulation.

3. RELEVANT MARKETS

- (6) The Transaction does not give rise to any horizontal overlaps between the Parties' activities. However, it results in a number of vertical and conglomerate relationships in relation to following products.

3.1. Application specific integrated circuits and application specific standard products

- (7) Broadcom is active with regard to the supply of both application specific integrated circuits ("ASICs") and application specific standard products ("ASSPs"). Vertical relationships arise as: (i) Broadcom's ASICs can be used as an input for Brocade's FC SAN switches; and (ii) Broadcom's ASICs and ASSPs can be used as inputs for Brocade's IP/Ethernet switches and routers.

⁴ Turnover calculated in accordance with Article 5 of the Merger Regulation and the Commission Consolidated Jurisdictional Notice (OJ C 95, 16.4.2008, p. 1).

3.1.1. Product market definition

3.1.1.1. Introduction

- (8) Semiconductors are materials that conduct electricity more easily than insulators (like glass) but less easily than conductors (like copper), which makes them ideal for manipulating electronic signals (reversing, amplifying). Semiconductor materials, most typically silicon, are used in semiconductor devices like microchips and their components (for example, diodes and transistors). Semiconductor devices can be found in virtually every electronic device today; end-products that contain semiconductor devices range from base stations, mobile phones, computers, domestic appliances and cars to medical equipment, identification systems, large-scale industry electronics and aerospace equipment.

3.1.1.2. Past decisional practice

- (9) In previous decisions, the Commission has considered dividing the market for semiconductors in a number of different ways.
- (10) The Commission has found that semiconductors for different industries are not substitutable, and can be differentiated on the basis of the sector for which they are intended, namely: (i) consumer; (ii) data processing; (iii) automotive; (iv) industrial; (v) military/aerospace; and (vi) communications.⁵ Further, within the market for communications applications, the Commission has considered that a distinction can be drawn between: (i) wireline applications; and (ii) wireless applications.⁶
- (11) The Commission has found that there are four main categories of semiconductors: (i) integrated circuits ("ICs"), commonly referred to as "chips", or "microchips"; (ii) discrettes; (iii) optical semiconductors; and (iv) sensors and actuators.⁷
- (12) With regard to ICs, the Commission has found that: (i) digital ICs; and (ii) analogue ICs; should be considered as separate markets.⁸ Also, with particular regard to digital ICs, the Commission has considered that this market should be sub-divided into three main sub-segments: (i) micro-components; (ii) memory ICs; and (iii) logic ICs.⁹ In turn, micro-components can be sub-segmented into: (i) microprocessors ("MPUs"); (ii) microcontrollers ("MCU"s); and (iii) digital signal processors ("DSPs").¹⁰ MCUs can be further sub-divided according to their

⁵ Commission decision of 24 June 2002 in case M.2820 – *STMicroelectronics / Alcatel Microelectronics*, paragraph 11; Commission decision of 17 September 2015 in case M.7585 - *NXP Semiconductors / Freescale Semiconductor*, paragraph 45.

⁶ Commission decision of 24 June 2002 in Case M.2820 – *STMicroelectronics / Alcatel Microelectronics*, paragraph 14. Commission decision of 23 November 2015 in case M.7686 – *Avago / Broadcom*, paragraph 31.

⁷ Commission decision of 17 September 2015 in case M.7585 - *NXP Semiconductors / Freescale Semiconductor*, paragraph 14.

⁸ Commission decision of 17 September 2015 in case M.7585 - *NXP Semiconductors / Freescale Semiconductor*, paragraph 38.

⁹ Commission decision of 17 September 2015 in case M.7585 - *NXP Semiconductors / Freescale Semiconductor*, paragraph 39.

¹⁰ Commission decision of 17 September 2015 in case M.7585 - *NXP Semiconductors / Freescale Semiconductor*, paragraphs 40 - 42.

technical parameters (i.e. number of bits) and whether they are either general purpose or used for specific application.¹¹

- (13) With respect to ICs, a segmentation can be made on the basis of the specific application for which they are intended, namely: (i) custom-made for a specific original equipment manufacturer ("OEM"), known as 'application specific integrated circuits' (ASICs); (ii) off-the-shelf or 'merchant' ICs, which can be purchased in identical form by a number of different customers, referred to as 'application specific standard products (ASSPs); or (iii) 'field programmable gate arrays', which can be configured and re-configured by customers after fabrication to perform desired logic and processing functions.¹²
- (14) Lastly, it is possible to distinguish ASICs and ASSPs according to the device in which they will be implemented,¹³ for example for: (i) IP/Ethernet switches;¹⁴ (ii) IP/Ethernet routers;¹⁵ (iii) FC SAN switches.¹⁶

3.1.1.3.The Notifying Party's views

- (15) The Notifying Party submits that it is not necessary to determine the exact scope of the relevant market for ASICs or ASSPs as the Transaction does not give rise to competition concerns under any possible market definition.
- (16) The Notifying Party submits specifically that it is not necessary to further segment the market for wireline communication ASICs according to end device. While ASIC vendors develop chips for a specific customer for a specific end device, there is full supply-side substitutability. In particular, it submits that: (i) ASICs for different types of switches are technically very similar, relying on similar IP blocks, packaging, power consumption; and (ii) there is no difference in the degree of technical complexity between ASICs for different switches. Accordingly, it is possible for all ASIC suppliers to develop and supply ASICs for each of the different types of switch. Equally, the Notifying Party submits that it is not appropriate to distinguish between ASSPs according to end device as there are no ASSP solutions for FC SAN switches, and while ASSPs are available for IP/Ethernet switches and fibre channel over Ethernet ("FCoE") switches, the same chips can be used in both products.

3.1.1.4.The Commission's assessment

- (17) First, the results of the market investigation indicate that application specific semiconductors (ASICs/ASSPs) used for wireline communications are not in the same product market as application specific semiconductors used in other product categories, including wireless communications, storage, or automotive.

¹¹ Commission decision of 17 September 2015 in Case M.7585 - *NXP Semiconductors / Freescale Semiconductor*, paragraph 43-44.

¹² Commission decision of 17 September 2015 in case M.7585 - *NXP Semiconductors / Freescale Semiconductor*, paragraph 46; Commission decision of 23 November 2015 in case M.7686 – *Avago / Broadcom*, paragraph 32.

¹³ Commission decision of 23 November 2015 in case M.7686 – *Avago / Broadcom*, paragraphs 34 - 41.

¹⁴ See paragraphs (47) - (56) below.

¹⁵ See paragraphs (47) - (56) below.

¹⁶ See paragraphs (29) - (33) below.

Respondents to the market investigation consider that application specific semiconductors are generally designed to support specific features consistent with the product categories for which they are designed and that there are different protocols and technologies.¹⁷

- (18) Second, the results of the market investigation indicate that ASICs and ASSPs are not in the same product market. While a number of suppliers consider that there is substitutability between ASICs and ASSPs, from the demand side all of the customers that responded to the market investigation consider that they are not substitutable. This is because of the significantly higher costs involved in developing a custom-made ASIC compared to purchasing ASSPs off the shelf, as well as differing technology and functionalities.¹⁸
- (19) Third, the results of the market investigation indicate that ASICs for FC SAN switches and ASICs for IP/Ethernet switches are not in the same product market. The vast majority of respondents consider that these different ASICs can be principally distinguished due to differing functionalities.¹⁹ Additionally, the majority of respondents consider that ASICs for different switches have different characteristics (size, technology), different design, need different know-how, and have different prices.²⁰
- (20) In any event, for the purpose of this decision, the precise product market definition for ASICs and ASSPs can be left open, as the Commission's assessment does not materially change regardless of whether ASICs and ASSPs are considered on the narrowest market definition (that is: (i) ASICs for FC SAN switches; (ii) ASICs for IP/Ethernet switches; (iii) ASICs for IP/Ethernet routers; (iv) ASSPs for IP/Ethernet switches; and (v) ASSPs for IP/Ethernet routers), or more broadly.

3.1.2. *Geographic market definition*

- (21) The Notifying Party submits that it is not necessary to determine the exact scope of the relevant market, because the Transaction does not give rise to competition concerns under any possible geographic market definition.
- (22) In previous cases, the Commission concluded that the relevant geographic markets for wireline communication ASICs and ASSPs should be considered worldwide in scope.²¹
- (23) The results of the market investigation confirm that the geographic scope of the markets for wireline communication ASICs and ASSPs is likely to be worldwide. Respondents highlight the facts that price levels are similar across the world, suppliers are active on a worldwide basis, and transport costs are not significant.²²
- (24) However, for the purpose of this decision, the exact geographic market definition can be left open, as the Transaction does not raise serious doubts as to its

¹⁷ See responses to question 6 of Q1 – FC SAN products.

¹⁸ See responses to question 5 of Q1 – FC SAN products and question 3 of Q2 – IP Networking.

¹⁹ See responses to question 7 of Q1 – FC SAN products and question 3 of Q2 – IP Networking.

²⁰ See responses to question 8 of Q1 – FC SAN products.

²¹ Commission decision of 23 November 2015 in case M.7686 – *Avago / Broadcom*, paragraph 39.

²² See responses to question 14 of Q1 – FC SAN products and question 5 of Q2 – IP Networking.

compatibility with the internal market regardless of whether the market is considered to be worldwide, or narrower.

3.2. Fibre Channel Storage Area Networking

- (25) Storage Area Networks ("SANs") are a type of high-speed data communication network. SANs connect servers to storage devices such as optical jukeboxes, tape libraries and storage arrays which enable storage devices to be accessed and operated as if they were locally attached to the server. Users of such networks include the financial services industry, governments and telecommunications and media companies.
- (26) A number of technologies exist for SAN infrastructures of which fibre channel ("FC") technology is the most prominent, accounting for approximately 70% of the market.²³
- (27) FC SAN networks contain a number of components including: (i) FC SAN switches, which connect servers and storage devices; and (ii) FC host bus adaptors ("FC HBAs"), which are cards mounted in servers or the storage device²⁴ and connect the host server to a FC SAN switch that determines the device of origin and destination and forwards the data to the intended destination. Both FC SAN switches and FC HBAs perform their main interconnect function through semiconductors. Vendors of FC HBAs and FC SAN switches generally supply their products to OEMs, which in turn supply servers and storage systems to end customers.
- (28) Broadcom is active with regard to FC HBAs and Brocade is active with regard to FC SAN switches, which gives rise to a conglomerate relationship. In addition, Broadcom's activities with regard to ASICs give rise to a vertical relationship as they can be used as an input for Brocade's FC SAN switches.

3.2.1. FC SAN switches

3.2.1.1. Product market definition

- (29) The Notifying Party submits that it is not necessary to determine the exact scope of the relevant market as the Transaction does not give rise to competition concerns under any possible market definition.
- (30) The Notifying Party submits that the basic purpose of FC SAN switches and IP/Ethernet switches is the same but FC SAN switches only provide connectivity to FC devices and cannot switch IP/Ethernet traffic or attach to IP/Ethernet devices. FC has its own protocol and the data in a FC network is transmitted in frames/packets which are different from and incompatible with those used on

²³ FC typically runs on optical fibre cables. Fibre is a lean type of medium that comparatively leads to lower levels of data depreciation or loss, compared to other media such as copper. As such, FC is particularly adapted for mission-critical or data sensitive tasks. Current mainstream FC solutions (fifth generation of FC) provide for transfer rates up to 16 Gigabit per second ("Gbps"), and the more recent equipment commercially released 2016 allows for 32 Gbps (sixth generation of FC). Other SAN technologies include: (i) internet small computer systems interface; (ii) fibre channel over Ethernet; and (iii) Infiniband.

²⁴ Only a minority (15%) of FC HBAs are used in storage arrays.

Ethernet. On the other hand, it submits that there is a long-term trend towards replacement of FC SAN networks (and therefore FC SAN switches) with IP based technologies (and therefore IP/Ethernet switches) as well as other technologies.

- (31) The Commission has not previously assessed the relevant product market in relation to FC SAN switches. In relation to switches and routers in general, the Commission has previously considered a distinction between switches and routers and, within switches, a segmentation based on the different protocols and network technologies that they support (for example TDM, ATM, IP/Ethernet, multi service, etc.) which could be applicable to FC technology (see paragraphs (47) to (56) below).
- (32) The results of the market investigation support the view that switches²⁵ should be segmented according to the technology/protocol used and thus, FC SAN switches and IP/Ethernet switches should be considered as distinct product markets. These two types of switches have different characteristics, capabilities and require different skill sets within a customer to manage.²⁶
- (33) For the purpose of this decision, the Commission will conduct its assessment on the basis of the narrowest possible product market, that is to say the market for FC SAN switches.

3.2.1.2. Geographic market definition

- (34) The Notifying Party submits that it is not necessary to determine the exact geographic scope of this market because the Transaction does not give rise to competition concerns under any possible market definition but that the segment for FC SAN switches should be considered as worldwide.
- (35) In previous decisions, the Commission has considered that the geographic market for all categories of networking products (including IP/Ethernet switches and routers) to be either EEA-wide or worldwide in scope.²⁷
- (36) The results of the market investigation indicate that the market for FC SAN switches is likely to be worldwide. In particular, respondents consider that suppliers operate on a worldwide basis, transport costs are not significant, location is not a factor for supplier selection and price levels are similar across regions.²⁸
- (37) However, for the purpose of this decision, the exact geographic market definition can be left open, as the Commission's assessment does not materially change regardless of whether the market is considered to be worldwide or EEA-wide.

²⁵ The market investigation also revealed that network switches and routers should be considered as distinct product markets because they perform fundamentally different functions – see below at paragraphs (47) - (56).

²⁶ See responses to question 10 of Q1 – FC SAN products.

²⁷ Commission decision of 19 September 2008 in case M.5300 - *Gores Group/Siemens Enterprise Communications*, paragraph 15; Commission decision of 24 July 2006 in case M.4214 – *Alcatel / Lucent Technologies*, paragraph 25 – 37; Commission decision of 12 February 2010 in case M.5732 – *Hewlett-Packard / 3Com*, paragraph 30; Commission decision of 2 March 2011 in case M.6095 – *Ericsson/Nortel Group (MSS & Global Services)*, paragraphs 25 and 26.

²⁸ See responses to question 15 of Q1 – FC SAN products.

3.2.2. FC HBAs

3.2.2.1. Product market definition

- (38) The Notifying Party submits that it is not necessary to determine the exact scope of the relevant market as the Transaction does not give rise to competition concerns under any possible market definition but notes that FC HBAs offer connectivity functionalities that cannot be offered by other devices or products that support another technology, such as IP/Ethernet HBAs.
- (39) The Commission has not previously defined the relevant product market for FC HBAs although it has undertaken an assessment of the electronic manufacturing services market broken down as far as the product level, including 'storage network HBAs'.²⁹
- (40) The results of the market investigation were mixed with regard to whether within the SAN space, the functionalities offered by FC HBAs can be offered by another device supporting another technology or protocol such as for example a converged network adaptor or an iSCSI adaptor. The market investigation indicates that it would not be possible to deploy a non-FC HBA into an existing FC network.³⁰
- (41) The majority of respondents did not consider it appropriate to further segment the market for FC HBAs, for example according to speed, interconnection, or generation.³¹
- (42) For the purpose of this decision, the Commission will conduct its assessment on the basis of the narrowest possible product market, that is to say the market for FC HBAs.

3.2.2.2. Geographic market definition

- (43) The Notifying Party submits that it is not necessary to determine the exact geographic scope of this market because the Transaction does not give rise to competition concerns under any possible market definition but that the segment for FC SAN switches should be considered as worldwide.
- (44) In previous decisions, the Commission has considered that the geographic market for all categories of networking products (including IP/Ethernet switches and routers) to be either EEA-wide or worldwide in scope which could be considered as also applicable to FC HBAs.³²
- (45) The results of the market investigation indicate that the market for FC HBAs is likely to be worldwide. In particular, respondents consider that suppliers operate

²⁹ Commission decision of 18 December 2003 in case M.3316 - *Celestica / MSL*, paragraph 20.

³⁰ See responses to question 12 of Q1 – FC SAN products.

³¹ See responses to question 13 of Q1 – FC SAN products.

³² Commission decision of 19 September 2008 in case M.5300 - *Gores Group/Siemens Enterprise Communications*, paragraph 15; Commission decision of 24 July 2006 in case M.4214 – *Alcatel / Lucent Technologies*, paragraphs 25–37; Commission decision of 12 February 2010 in case M.5732 – *Hewlett-Packard / 3Com*, paragraph 30; Commission decision of 2 March 2011 in case M.6095 – *Ericsson/Nortel Group (MSS & Global Services)*, paragraphs 25 and 26.

on a worldwide basis, transport costs are not significant, location is not a factor for supplier selection and price levels are similar across regions.³³

- (46) However, for the purpose of this decision, the exact geographic market definition can be left open, as the Commission's assessment does not materially change regardless of whether the market is considered to be worldwide or EEA-wide.

3.3. IP/Ethernet Networking

- (47) IP/Ethernet is one type of network technology. Switches and routers are combination of software and hardware devices, and are essential parts of telecommunication networks. They are the "knots" of a network used to interconnect different parts of a network, notably to route and exchange data packets between the various sub-networks. They analyse information contained in data packets to determine to which sub-network it must be transferred. Although it is not always possible to establish the precise difference between switches and routers in marketing or technical terms, routers are generally larger devices that connect different networks together while switches are generally used within the same network.³⁴
- (48) Brocade is active with regard to IP/Ethernet switches and routers. Vertical relationships arise as Broadcom's ASICs and ASSPs can be used as inputs for Brocade's IP/Ethernet switches and routers.

3.3.1. Product market definition

- (49) The Notifying Party submits that it is not necessary to determine the exact scope of the relevant market for IP/Ethernet switches and routers because the Transaction does not give rise to competition concerns under any possible market definition, in particular as Broadcom does not supply IP/Ethernet switches or routers. For the purpose of the competitive assessment, the Notifying Party provides information for the following potential markets: (i) IP/Ethernet switches; and (ii) IP/Ethernet routers.
- (50) The Commission has previously considered whether there is a product market encompassing both switches and routers, due to the growing multi-functionality and convergence between these products. The Commission found that despite a technological trend towards convergence between the products they still differed in terms of prices and functionalities.
- (51) Moreover, it found that switches are generally used for network connectivity within a Local Area Network³⁵ ("LAN") while routers on the other hand are used to interconnect networks across long distances and are used in wide area network

³³ See responses to question 16 of Q1 – FC SAN products.

³⁴ Commission decision of 2 March 2011 in case M.6095 – *Ericsson/Nortel Group (MSS & Global Services)*, paragraph 19.

³⁵ A LAN is a network that may include servers, personal computers, switches, routers and other devices such as printers operating in a limited area, generally a building.

("WAN") connectivity, such as connecting separate LANs or connecting LANs to the internet.³⁶

- (52) The results of the market investigation were mixed as to whether network switches and routers should be considered as part of the same market. While the majority consider that they should be in separate markets because of differing functionalities, the increased complexity of routers and the lower cost of switches, many other respondents noted that there were an increasing number of switches that were now enabled with some routing functionality.³⁷
- (53) **Switches:** In previous decisions, the Commission has considered dividing the market for switches in a number of ways but left the exact product market definition open. First, it has considered whether switches should be distinguished based on different technologies, such as: (i) time division mode ("TDM"); (ii) asynchronous transfer mode ("ATM"); (iii) IP/Ethernet; and (iv) multi service.³⁸ Second, whether the network switching equipment sector should be segmented by type of activity (manufacture, distribution and offering of integrated solutions).³⁹ Third, the Commission has also considered a possible segmentation for switches based on customer size.⁴⁰
- (54) The majority of respondents to the market investigation indicated that IP/Ethernet switches should be considered a part of a separate product market to switches based on other protocols and technologies as IP/Ethernet is now the dominant technology.⁴¹
- (55) **Routers:** Similarly to switches, the Commission has considered whether the market could be segmented according to the technology used (TDM, ATM, and IP/Ethernet) or on the basis of the number of users but ultimately left the market definition open.⁴²
- (56) In any event, for the purpose of this decision, the exact product market definition for IP/Ethernet switches and routers can be left open, as the Transaction does not raise serious doubts as to its compatibility with the internal market regardless of whether the market is divided between switches or routers or further sub-divided according to technology, type of activity, or customer size.

³⁶ See Commission decision of 19 September 2008 in case cM.5300 - *Gores Group/Siemens Enterprise Communications*, para 14; Commission decision of 24 July 2006 in case M.4214 - *Alcatel / Lucent Technologies*, paragraphs 26– 29; c Commission decision of 12 February 2010 in case M.5732 - *Hewlett-Packard / 3Com*, paragraphs 13 and 20.

³⁷ See responses to question 9 of Q1 – FC SAN products and question 4.2 of Q2 – IP Networking.

³⁸ See Commission decision of 12 February 2010 in case M.5732 - *Hewlett-Packard / 3Com*, paragraph 14; Commission decision of 24 July 2006 in case M.4214 - *Alcatel / Lucent Technologies*, paragraphs 26 - 29; Commission decision of 19 September 2008 in case M.5300 - *Gores Group/Siemens Enterprise Communications*, paragraph 14.

³⁹ Commission decision of 19 September 2008 in case M.5300 - *Gores Group/Siemens Enterprise Communications*, paragraph 14.

⁴⁰ See Commission decision of 12 February 2010 in case M.5732 - *Hewlett-Packard / 3Com*, paragraph 15.

⁴¹ See responses to question 4.1 of Q2 – IP Networking.

⁴² Commission decision of 24 July 2006 in case M.4214 - *Alcatel / Lucent Technologies*, paragraphs 25-27; Commission decision of 12 February 2010 in case M.5732 - *Hewlett-Packard / 3Com*, paragraph 20; Commission decision of 19 September 2008 in case M.5300 - *Gores Group/Siemens Enterprise Communications*, paragraph 14.

3.3.2. Geographic market definition

- (57) The Notifying Party submits that the market(s) for IP/Ethernet switches and routers should be considered as worldwide but that it is not necessary to determine the exact scope of the relevant market because the Transaction does not give rise to competition concerns under any possible geographic market definition. For the purpose of the competitive assessment, the Parties provide information for IP/Ethernet networking products on a worldwide basis.
- (58) In previous decisions, the Commission has considered that the geographic market for all categories of networking products (including IP/Ethernet switches and routers) to be either EEA-wide or worldwide in scope.⁴³
- (59) Respondents to the market investigation unanimously consider the geographic markets for IP/Ethernet switches and routers to be worldwide given the global nature of both supply and demand.⁴⁴
- (60) However, for the purpose of this decision, the exact geographic market definition can be left open, as the Transaction does not raise serious doubts as to its compatibility with the internal market regardless of whether the market is considered to be EEA- or worldwide.

4. COMPETITIVE ASSESSMENT

4.1. Analytical framework

- (61) Under Article 2(2) and (3) of the Merger Regulation, the Commission must assess whether a proposed concentration would significantly impede effective competition in the internal market or in a substantial part of it, in particular through the creation or strengthening of a dominant position.
- (62) In this respect, a merger may entail horizontal and/or non-horizontal effects. Non-horizontal effects are those deriving from a concentration where the undertakings concerned are active in different relevant markets.
- (63) As regards, non-horizontal mergers, two broad types of such mergers can be distinguished: vertical mergers and conglomerate mergers.⁴⁵ Vertical mergers involve companies operating at different levels of the supply chain.⁴⁶ Conglomerate mergers are mergers between firms that are in a relationship which is neither horizontal (as competitors in the same relevant market) nor vertical (as suppliers or customers).⁴⁷

⁴³ Commission decision of 19 September 2008 in Case M.5300 - *Gores Group/Siemens Enterprise Communications*, paragraph 15; Commission decision of 24 July 2006 in M.4214 - *Alcatel / Lucent Technologies*, paragraphs 25 - 37; Commission decision of 12 February 2010 in Case M.5732 - *Hewlett-Packard / 3Com*, paragraph 30; Commission decision of 2 March 2011 in Case M.6095 - *Ericsson/Nortel Group (MSS & Global Services)*, paragraphs 25 and 26.

⁴⁴ See responses to question 6 of Q2 - IP Networking.

⁴⁵ Non-Horizontal Merger Guidelines, paragraph 3.

⁴⁶ Non-Horizontal Merger Guidelines, paragraph 4.

⁴⁷ Non-Horizontal Merger Guidelines, paragraph 5.

- (64) The Commission appraises non-horizontal effects in accordance with the guidance set out in the relevant notice, that is to say the Non-Horizontal Merger Guidelines.⁴⁸
- (65) In this particular case, the Transaction does not give rise to any horizontal overlaps between the Parties' activities, but results in a number of vertical and conglomerate relationships. Accordingly, the Commission will only examine whether the Transaction is likely to give rise to non-horizontal effects.

4.2. Vertical assessment

4.2.1. Legal framework

- (66) According to the Non-Horizontal Merger Guidelines,⁴⁹ non-coordinated effects may significantly impede effective competition as a result of a vertical merger if such merger gives rise to foreclosure.
- (67) The Non-Horizontal Merger Guidelines distinguish between two forms of foreclosure. Input foreclosure occurs where the merger is likely to raise the costs of downstream competitors by restricting their access to an important input. Customer foreclosure occurs where the merger is likely to foreclose upstream competitors by restricting their access to a sufficient customer base.
- (68) In assessing the likelihood of an anticompetitive foreclosure scenario, the Commission examines, first, whether the merged entity would have, post-merger, the ability to substantially foreclose access to inputs or customers, second, whether it would have the incentive to do so, and third, whether a foreclosure strategy would have a significant detrimental effect on competition.⁵⁰
- (69) As regards ability to foreclose, under the Non-Horizontal Merger Guidelines, input foreclosure may lead to competition problems if the upstream input is important for the downstream product.⁵¹ For input foreclosure to be a concern, a vertically integrated merged entity must have a significant degree of market power in the upstream market. It is only in those circumstances that the merged entity can be expected to have significant influence on the conditions of competition in the upstream market and thus, possibly, on prices and supply conditions in the downstream market.⁵²
- (70) With respect to incentives to foreclose, paragraph 40 of the Non-Horizontal Merger Guidelines states that the incentive of the merged entity to foreclose depends on the degree to which foreclosure would be profitable. The vertically integrated firm will take into account how its supplies of inputs to competitors downstream will affect not only the profits of its upstream division, but also of its

⁴⁸ Guidelines on the assessment of non-horizontal mergers under the Council Regulation on the control of concentrations between undertakings ("Non-Horizontal Merger Guidelines"), OJ C 265, 18.10.2008.

⁴⁹ Guidelines on the assessment of non-horizontal mergers under the Council Regulation on the control of concentrations between undertakings ("Non-Horizontal Merger Guidelines"), OJ C 265, 18.10.2008, p. 6-25.

⁵⁰ See Non-Horizontal Merger Guidelines, paragraph 32.

⁵¹ See Non-Horizontal Merger Guidelines, paragraph 34.

⁵² See Non-Horizontal Merger Guidelines, paragraph 35.

downstream division. Essentially, the merged entity faces a trade-off between the profit lost in the upstream market due to a reduction of input sales to (actual or potential) rivals and the profit gain, in the short or longer term, from expanding sales downstream or, as the case may be, being able to raise prices to consumers.⁵³ Additionally, paragraph 42 of the Non-Horizontal Merger Guidelines indicates that “[t]he incentive for the integrated firm to raise rivals’ costs further depends on the extent to which downstream demand is likely to be diverted away from foreclosed rivals and the share of that diverted demand that the downstream division of the integrated firm can capture”.

- (71) As regards the effects of input foreclosure, the Non-Horizontal Merger Guidelines explain that such conduct raises competition concerns when it leads to increased prices on the downstream market. First, anticompetitive foreclosure may occur when a vertical merger allows the merging parties to increase the costs of downstream rivals in the market thereby leading to an upward pressure on their sales prices. Second, effective competition may be significantly impeded by raising barriers to entry to potential competitors.⁵⁴ The Horizontal Merger Guidelines further state that if there remain sufficient credible downstream competitors whose costs are not likely to be raised, for example because they are themselves vertically integrated or they are capable of switching to adequate alternative inputs, competition from those firms may constitute a sufficient constraint on the merged entity and therefore prevent output prices from rising above pre-merger levels.⁵⁵
- (72) Additionally, the Non-Horizontal Merger Guidelines recognise that a vertically integrated entity may gain access to commercially sensitive information on the activities of its upstream or downstream rivals. This may give the vertically integrated entity a competitive advantage to the detriment of consumers. For instance, a vertically integrated entity which is also the supplier of a downstream competitor may obtain critical information regarding the latter’s activities.⁵⁶

4.2.2. ASICs for FC SAN switches

4.2.2.1. Input foreclosure

(a) The Notifying Party's view

- (73) The Notifying Party claims that the Merged Entity will neither have the ability nor the incentive to foreclose access to ASICs for FC SAN switches to competing downstream FC SAN switch suppliers by refusing to supply ASICs or by charging excessive prices for its ASICs.
- (74) In particular, as regards the Merged Entity's lack of ability to foreclose, the Notifying Party submits that first, it has no market power on the upstream market for supply of ASICs for FC SAN switches where it faces significant competition from GlobalFoundries, which is a suitable alternative supplier (and is vertically integrated with its own manufacturing capabilities while Broadcom relies on third party foundries TSMC and Amcor for the physical manufacture of ASICs).

⁵³ See Non-Horizontal Merger Guidelines, paragraph 40.

⁵⁴ See Non-Horizontal Merger Guidelines, paragraphs 47-49.

⁵⁵ See Non-Horizontal Merger Guidelines, paragraph 50.

⁵⁶ See Non-Horizontal Merger Guidelines, paragraph 78.

Second, beside GlobalFoundries there are other ASICs suppliers from which a downstream competitor in FC SAN switches can source ASICs such as Intel, Texas Instruments, STMicroelectronics and eSilicon (some of which similarly to GlobalFoundries are vertically integrated and have their own silicon production facilities ("fabs")). Third, the Notifying Party claims that there is nothing unique in the ASIC design and development services offered by Broadcom and GlobalFoundries does offers the similar services and solutions such as place & route, IP design kits, physical verification, and packaging design.

- (75) Furthermore, the Notifying Party claims that the barriers to switch ASICs vendor for FC SAN switches for a new ASIC opportunity are low as there are no additional costs or delays. According to the Notifying Party each new ASIC opportunity is a discrete project with its own specifications, independent from previous projects regardless of the vendor. As regards existing generations of FC SAN switches the Notifying Party submits that the majority of the design and developing work for its only FC SAN ASICs customer besides Brocade, that is Cisco, is already done with Broadcom handling only the manufacturing process.
- (76) The Notifying Party also submits that it will not have the incentive to engage in input foreclosure post-Transaction because of the absence of market power upstream by Broadcom and because the Merged Entity would not be able to recoup any lost upstream revenue from ASICs on the downstream switch market as Cisco would source ASICs from an alternative vendor and still effectively compete in the switch market downstream. In addition, the Notifying Party submits that should the Merged Entity engage in input foreclosure it risks losing not only the FC SAN ASICs revenue but also significant revenue from Cisco in other business areas. According to the Notifying Party, Broadcom's total sales to Cisco amount to USD [...] annually, of which FC SAN ASICs sales represent less than [0-5]%.⁵⁷ The Notifying Party therefore submits that it has no incentive to disrupt its business relationship with Cisco and jeopardize the sale of products and solutions other than FC SAN ASICs to Cisco. Finally, the Notifying Party claims that any attempt to engage in input foreclosure would damage also its relationships with storage solution OEMs who would either support other FC SAN switch providers or even promote more actively alternative technological solutions at the expense of FC solutions, which will further accelerate the decline of the FC SAN market.
- (77) According to the Notifying Party, in any event any potential input foreclosure strategy will have no effects on competition as Cisco will remain a significant competitor in the downstream market for FC SAN switches as it will have alternatives for FC SAN ASICs supply and storage OEMs with countervailing buyer power will safeguard against any effect on competition downstream.
- (b) The Commission's assessment
- (78) The core "routing" function of networking equipment including switches and routers is undertaken by the switch ICs, which depending on the network device can be customized ASICs or obtained off-the-shelf ASSPs.
- (79) Customized ASICs are manufactured exclusively for a single OEM customer and are based primarily on the customer's own proprietary design. In an ASIC

⁵⁷ Top purchased products by Cisco from Broadcom are [...].

development, the vendor provides its proprietary Intellectual Property blocks (“IP Blocks”) to the customer, and the customer combines this vendor’s IP with its own to create a unique IC, which is used only by that customer for its application. The OEM architects, designs and verifies the chip for use in one of their equipment designs. The OEM takes that design to an ASIC vendor, who executes the design by placing and routing the components of the chip, verifying the physical design, designing the chip package, and getting the chip manufactured by a foundry or fab. Engineers belonging to FC SAN switch manufacturers design the features and functions that they want their ASICs to provide.

- (80) Custom-made ASIC constitutes a critical component for FC SAN switches which was confirmed by the results of the market investigation. As respondents explain the ASIC is "*the brain of the switch*" and it performs key functions in the FC SAN switch product that is to say the possibility to switch at the needed speed with needed power performance and protocols.⁵⁸ Moreover, according to Cisco, the ASIC is the most costly and technically complex component in the FC SAN switch.
- (81) Broadcom currently supplies ASICs for the FC SAN switches produced by both Brocade and Cisco.⁵⁹ Brocade sources ASICs for its FC SAN switches from both Broadcom and GlobalFoundries.
- (82) As illustrated in Table 1 below, GlobalFoundries is the leading FC ASICs supplier by value for 2016 with a [60-70]% market share with Broadcom following behind with a market share of [30-40]%.

Table 1 - Market share data for supply of ASICs for FC SAN switches worldwide from 2014 to 2016 – by value⁶⁰

	2014 (%)	2015 (%)	2016 (%)
Broadcom	[50-60]	[40-50]	[30-40]
GlobalFoundries	[50-60]	[50-60]	[60-70]
Others	-	-	-
TOTAL	100	100	100

Source: Parties' internal estimates – Annex 11 Form CO. The Notifying Party submits that volume data for these products is not available.

- (83) On the downstream market for FC SAN switches, as shown in Table 2 below, Brocade's FC SAN switches' market share amounted to [70-80]% worldwide in 2016, while its only significant competitor, Cisco, had a market share of [20-30]%.

⁵⁸ See replies to questionnaire Q1- FC SAN products of 17 March 2017, questions 18 and 18.1.

⁵⁹ Cisco sources ASICs for its FC SAN products [...] for its latest generation of FC SAN switches (32 Gbps generation) as well as for previous generations of Cisco's FC SAN switches (16 Gbps and 8 Gbps).

⁶⁰ The Notifying Party submits that there are no customers for the ASICs for FC SAN switches in the EEA, thus, there is no EEA market.

Table 2 – Market share data for the supply of FC SAN switches worldwide from 2014 to 2016 – by value and volume⁶¹

	2014		2015		2016	
	Value (%)	Volume (%)	Value (%)	Volume (%)	Value (%)	Volume (%)
Brocade	[60-70]	[70-80]	[70-80]	[70-80]	[70-80]	[70-80]
Cisco	[20-30]	[10-20]	[20-30]	[10-20]	[20-30]	[20-30]
Cavium⁶²	[0-5]	[5-10]	[0-5]	[5-10]	[0-5]	[5-10]
Others	[0-5]	[0-5]	[0-5]	[0-5]	[0-5]	[0-5]
TOTAL	100	100	100	100	100	100

Source: Dell'Oro, Form CO – Annex 11.

(84) Table 3 sets out the market shares for Brocade and its competitors at EEA-level in value.⁶³

Table 3 - Market share data for the supply of FC SAN switches in EEA from 2014 to 2016 – by value

	2014 (%)	2015 (%)	2016 (3Q) (%)
Brocade	[60-70]	[70-80]	[70-80]
Cisco	[30-40]	[20-30]	[20-30]
Cavium⁶⁴	[0-5]	[0-5]	[0-5]
TOTAL	100	100	100

Source: IDC WW Datacenter Networks Qview, Form CO – Annex 11.

(85) While the market share level of the Merged Entity on the upstream ASIC market would not be significantly above the 30% threshold set forth by paragraph 25 of the Non-Horizontal Merger Guidelines, Broadcom appears to have a certain level of market power upstream due to the fact that it is the only worldwide FC ASIC vendor together with GlobalFoundries.

(86) In any event, in light of the magnitude of its market presence, GlobalFoundries appears to be a viable alternative to Broadcom for the supply of FC ASIC to FC SAN switch manufacturers. This is also evidence by the fact that GlobalFoundries is currently supplying FC ASIC to Brocade, which is the leading FC SAN manufacturer.⁶⁵

(87) According to Cisco, GlobalFoundries' strengths lay in the fact that it has its own fabrication facilities, although Cisco considers it be lagging behind in terms of latest production technology ("node" generations) from the rest of the chip

⁶¹ Volumes are provided in number of ports.

⁶² In July 2013, QLogic announced its intention to discontinue the development of future FC SAN switches. However, it continues to supply its legacy range of FC SAN switches. The market shares for Cavium refer to QLogic, which is a subsidiary of Cavium since June 2016. For ease of reference, QLogic will be referred to as Cavium throughout this decision.

⁶³ EMEA is used as a proxy to EEA, as no industry report provide market shares at EEA-level. Based on IDC's report WW Datacenter Networks Qview (2013 – Q3 2016), the Notifying Party only provided market share data based on value.

⁶⁴ See footnote 62 above.

⁶⁵ For most generations of its FC SAN switch ASICs, including the latest generation of products, Brocade [...].

industry.⁶⁶ GlobalFoundries however considers that any possible differences between the fabrication technologies of GlobalFoundries and its ASIC fab competitors is irrelevant for FC ASICS and that GlobalFoundries' fabrication technologies allow it to build FC SAN ASICs as efficiently, and with the same quality as TSMC.⁶⁷

- (88) As to the possibility for ASICs supplier to also offer FC ASICs, Cisco considers eSilicon and STMicroelectronics to be potential alternative FC ASICs suppliers. eSilicon considers itself to be an alternative to Broadcom for the supply of FC ASIC and is acknowledged by GlobalFoundries as being its other main competitor for FC SAN ASICs beside Broadcom.⁶⁸ The market investigation did not provide any further insight as to the suitability of other ASIC vendors as viable alternatives for the supply of FC ASICs.
- (89) In light of the above considerations and based on the results of the market investigation, the Commission considers that, although it appears unclear to what extent ASIC providers such as eSilicon and STMicroelectronics can be considered as alternatives for the supply of FC ASICs, there is at least one viable alternative provider (GlobalFoundries) who can supply FC ASIC to FC SAN switch manufacturers competing with the Merged Entity in the event that post-Transaction the Merged Entity engages in full or partial FC ASIC foreclosure.
- (90) As regards possible entry of new FC ASICs suppliers, based on the results of the market investigation, entry barriers appear to be high in view of the considerable entry investment (including in IP) and the likelihood of new entrant in the foreseeable future is rather low. The majority of the respondents to the market investigation consider entry into the market for the supply of FC SAN ASIC to be difficult even for an established wireline communications ASICs provider, which is not currently active in FC SAN ASICs. As one market participant explains, FC SAN ASIC is very unique technology with limited industry expertise in a flat to declining market, so there is little room for growth and a steep learning curve for a firm looking to begin to develop the necessary ASIC design skill and expertise customers expect from their custom supplier.⁶⁹
- (91) The results of the market investigation suggest that switching FC ASICs vendor for **new/upcoming** generation of FC SAN switches is possible if done prior the launch of the design phase or sufficiently early in the design and development process: *"Any ASIC supplier change would have to occur at the architect/design stage to avoid incurring significant switching costs due to the custom nature of the products. The impact from switching significantly increases as you move further into the development cycle"*. Some respondents estimate the time necessary to switch to 24 months thus making switching feasible two to three years ahead of the new switch product launch.⁷⁰

⁶⁶ See replies of Cisco and eSilicon to Q1 - FC SAN products of 17 March 2017, question 17.1.

⁶⁷ See non-confidential version of Note to the File from conference call with GlobalFoundries on 23 February 2017.

⁶⁸ See replies to Q1 - FC SAN products of 17 March 2017, question 17.1 and non-confidential version of Note to the File from conference call with GlobalFoundries on 23 February 2017.

⁶⁹ See replies to Q1 - FC SAN products of 17 March 2017, question 23.

⁷⁰ See replies to Q1 - FC SAN products of 17 March 2017, question 20.

- (92) In contrast, when it comes to the possibility of switching provider for FC ASICs in **existing/current generation** of FC SAN switches (for which the design phase has been completed) the majority of the market respondents consider that it is not possible to switch in a timely manner and without incurring significant costs: "*Migration from one ASIC solution to another in this industry can take 2 – 3 years. Such a migration is considerable in cost, time and resources required to complete*". Further hurdle to switching pointed out by a market participant is that the ASICs from a new provider might be incompatible with the existing product.⁷¹
- (93) Cisco in particular considers that, while switching of FC ASIC is feasible from a technical point of view, such switching would lead to significant delays in the release to market⁷² of the products that would rely to the alternative FC ASIC supplier. In relation to the existing/current generations of ASIC Cisco explains that, should it decide to source FC ASIC for its 32 Gbps switches from a different supplier, it would miss most of the expected time period during which it could make significant sales of its 32 GBPS FC SAN switches before the release of the new generation of 64 Gbp FC SAN switches (which Cisco anticipates will take place around 2020).⁷³
- (94) In relation to existing FC ASIC the Commission notes that, as supported by the result of the market investigation, switching FC ASIC supplier at such a stage of the ASIC procurement process appears to be quite difficult and costly. However, the design and development phases of the FC ASIC procurement process for Cisco have been already finalised and at present Broadcom is handling, via a third party (TSMC and Amcor), only the physical fabrication of the FC ASIC.
- (95) The supply of FC ASIC from Broadcom to Cisco for all existing generations of FC ASIC that Cisco sources from Broadcom is governed by a Master Purchase Agreement between Broadcom and Cisco concluded in 2002 and subsequent Amendments⁷⁴ (the "2002 MPA and amendments"). Under the 2002 MPA and amendments Cisco [details of contractual provisions].
- (96) As regards supply of FC ASIC for future/next generation of FC SAN switches (64 Gbps) the Commission notes the following. First, as confirmed by the majority of the market participants, switching to a different FC ASIC supplier *before* the start of the design process or even sufficiently early in the design and development stage is possible without incurring significant delays or costs. Cisco has just released its latest generation of FC SAN switches (32 Gbps) in April 2017 (one year behind Brocade) but it has not yet selected the supplier for the design and development for the next generation of 64 Gbps switches. Therefore, should Cisco decide to go forward with a next generation of FC SAN switches of 64 Gbps, Cisco is in the position to turn to an alternative FC ASIC supplier in the event that the Merged Entity refuses to develop and supply FC ASIC for future generations

⁷¹ See replies to Q1 - FC SAN products of 17 March 2017, question 19.

⁷² The development cycle for FC SAN switches takes around 3 years: between 1.5-2 years for development of the FC ASIC, 6 months to design the circuit board into which the ASIC will be inserted as well as design of the other element of the hardware, and around 1 year to develop the software that will run on the switch. New generation of switches is customary released every 3 to 4 years. Non-confidential version of Cisco reply to question 2 of Request for Information N13 of 12 April 2017.

⁷³ See Cisco non-confidential reply to Q1 - FC SAN products of 17 March 2017, questions 19 and 20.

⁷⁴ [...].

of FC SAN switches or were to engage in partial input foreclosure in relation to the next generation of ASICs.

- (97) As already explained in paragraphs (86) to (89) above, there is at least one viable alternative FC ASIC vendor, GlobalFoundries, to which Cisco could turn for the design and manufacture of next generation FC ASICs.
- (98) It light of the above considerations and based on the results of the market investigation, the Commission concludes that it is unlikely that the Merged Entity will have the **ability** to engage in input foreclosure with regard to FC ASICs for both existing and future generations of FC SAN switches.
- (99) Concerning the incentive of the Merged Entity to engage in such foreclosure strategy and in particular to what extent such strategy would be profitable, it cannot be excluded that the Merged Entity would be able to recoup downstream the lost revenue from supply to Cisco with FC ASICs upstream. While the revenue from the design and supply of FC ASICs to Cisco amounts to USD [...] million for 2016, in view of the magnitude of the revenue of Brocade on the downstream market for FC SAN switches for the same period (USD [1 000 – 1 500] million) and the marginal presence of other FC SAN switch providers (mainly Cavium's legacy products) the Merged Entity would need to divert only a minimal amount of sales from Cisco to be able to offset the foregone revenue from FC ASIC supply.
- (100) Notwithstanding the above, the Merged Entity would risk in such a foreclosure scenario losing not only FC SAN revenue from Cisco, but also significant revenue from other products that it is currently supplying to Cisco: in 2016 Cisco for example purchased [...] ⁷⁵ for around USD [...] from Broadcom (as already mentioned in paragraph (76) above Broadcom's total sales to Cisco amount to USD [...] annually). In the presence of a number of alternative Ethernet switch ASSPs and ASICs vendors (see paragraphs (124) and (142) below) to which Cisco can switch the procurement of Ethernet switch ASICs and ASSPs this would represent considerable loss of revenue that the Merged Entity could not recoup so easily from diverting sale of FC SAN switches from Cisco.
- (101) The Commission therefore considers that to be a factor limiting any possible **incentive** the Merged Entity might have to engage in foreclosure in relation to FC ASICs.
- (102) As regards the possible effects of input foreclosure towards FC SAN switch providers and Cisco in particular, the Commission notes that post-Transaction, and, in particular, in relation to future generations of FC SAN switches, there will be viable alternatives for Cisco to source FC ASIC which will allow it to continue to compete effectively on the downstream market for switches against the Merged Entity. Moreover, the Commission also notes that FC SAN switch customers do not expect the Transaction to have any effect, be it positive or negative, in relation to ASICs for FC SAN switches.

⁷⁵ Both Ethernet ASICs and ASSPs are an input for Ethernet switches, where as indicated in Table 5, Cisco is the leading supplier with a global share of [50-60]% by value for 2016 and [60-70]% by value for the same period at EMEA level.

(103) In light of the evidence available to it and based on the results of the market investigation, the Commission considers that the Merged Entity will not have the ability nor the incentive to engage in input foreclosure due to the presence of GlobalFoundries as a viable alternative supplier of FC SAN ASIC, the possibility for FC SAN switch competitors to switch FC ASIC vendor for next generations of ASIC, the contractual obligations on Broadcom to continue the supply of current generations of ASIC to its customers, as well as the risk of losing significant revenue from its FC ASIC customers in the case of a foreclosure scenario. Therefore, the Commission concludes that the Transaction does not give rise to serious doubts as to its compatibility with the internal market as a result of an input foreclosure strategy by the Merged Entity in relation to FC ASIC.

4.2.2.2. Possible leakage of commercially sensitive information

(104) As explained in paragraph (80) above, as the ASIC used in an FC SAN switch is tailored for each customer and when an FC SAN switch ASIC program is awarded to an FC ASIC vendor such as Broadcom, the customer and the ASIC vendor work very closely together and the ASIC vendor receives IP and confidential information from the switch supplier for the development of the ASIC. The ASIC vendor also has visibility over other commercially sensitive information of the customer such as the switch supplier's product roadmap, time to market, cost, sales etc.

(105) The results of the market investigation have confirmed that various pieces of sensitive information are exchanged or made visible following the interactions between an FC ASICs vendor and its customer: *"ASIC supply relationships involve the need to exchange and license a great deal of IP between customer and supplier. All the reference architecture specification of the ASIC – hardware and firmware e.g. functionality, code etc. will be subject to IP protections and the parties must have the proper licenses and nondisclosure agreements in place to accomplish the design and build of the ASIC."*⁷⁶

(106) In addition, Cisco explains that the FC ASIC vendor has visibility also on the cost structure of the FC SAN switch (the most variable cost of the switch being the ASIC, which makes a sizeable portion of the overall cost), schedules (such as FC SAN switch release dates) and other product information such as technical characteristics, for example size, transistor density, power consumption, input/output pins, etc.⁷⁷

(107) In this respect, Cisco has raised the concern that post-Transaction Broadcom could misuse such Cisco commercially sensitive information (in relation to the current generations of Cisco FC SAN switches, which are likely to stay on the market for several years, but potentially also for future generations should Cisco decide not to switch ASIC supplier) to favour Brocade, Cisco's main competitor in FC SAN switches.

(108) According to market participants, typically there are safeguards in place to ensure preservation of the confidentiality of the information/IP exchange: confidentiality

⁷⁶ See replies to Q1 - FC SAN products of 17 March 2017, question 21.

⁷⁷ See Cisco's non-confidential reply to Q1 - FC SAN products of 17 March 2017, question 21.

agreements, licenses and non-disclosure agreements outlining the confidential information to be shared and any use restrictions on the information.⁷⁸

- (109) Similarly, the customer-supplier relationship between Broadcom and Cisco in relation to FC ASICs is subject to a number of confidentiality agreements: (i) a Master Mutual Non-Disclosure Agreement signed in 2000 ("the 2000 Master NDA", (ii) a Master Purchase Agreement from 2002 and Amendments incorporating the 2000 Master NDA by reference, and (iii) a Memorandum of Understanding that lays out in detail several steps that Brocade's ASIC design and development entity must take to protect Cisco's confidential information from disclosure to anyone who does not have a strict need to know the information in furtherance of Broadcom's relationship with Cisco (either inside the company or as a third party).
- (110) On [...], Broadcom entered into a new agreement with Cisco that supplements the confidentiality agreements previously in place between the two companies (the "New Confidentiality Agreement"). The New Confidentiality Agreement contains certain provisions aimed at preventing Cisco's confidential information from being disclosed to Broadcom personnel who is not responsible for developing Cisco's FC SAN switch ASICs. In addition, the New Confidentiality Agreement contains provisions that [details of contractual provisions].
- (111) In the case at hand, however, the Commission notes that Cisco would be particularly vulnerable to any potential breach by Broadcom of its confidentiality obligations and that it would be particularly difficult for Cisco to determine whether Broadcom's competitive behaviour in the downstream market for FC SAN switches is a result of the normal course of business or whether its behaviour has been impacted by access to commercially sensitive Cisco information. The Commission further notes that the sanctions on the Merged Entity in the event of a breach of the confidentiality provisions in relation to protection of Cisco's confidential information under the New Confidentiality Agreement and the 2002 MPA do not appear to provide a satisfactory level of deterrence to prevent a potential breach of confidentiality in view of the specific exposure of Cisco, as described in paragraphs (105) to (107) above.
- (112) The Commission therefore considers that the contractual provisions currently in place between Broadcom and Cisco are in themselves insufficient to ensure that, post-merger, the Merged Entity does not use any confidential information received from Cisco to the benefit of its downstream FC SAN switches activities. In light of the above considerations and based on the results of the market investigation, the Commission concludes that the Transaction raises serious doubts as to its compatibility with the internal market as a result of the risks of misuse by Broadcom of commercially sensitive information of Cisco exchanged between Cisco and the Merged Entity in the vertically related markets of ASICs for FC SAN switches and for FC SAN switches worldwide.

4.2.2.3. Customer foreclosure

- (113) As explained in paragraph (81) above Brocade currently sources FC ASIC from both Broadcom and GlobalFoundries. As post-Transaction the Merged Entity will

⁷⁸ See replies to Q1 - FC SAN products of 17 March 2017, question 22.

be vertically integrated, it could reduce the amount of FC ASIC sourced from third parties, that is to say from GlobalFoundries, or source internally the entire quantities of FC ASICs it needs.

- (114) The Notifying Party claims that there is no risk of customer foreclosure with regard to upstream suppliers of ASIC for the following reasons: (i) any possible loss (from either partial or full foreclosure of access to Brocade) can to a significant extent be offset by sales to Cisco which has an important share of demand for FC SAN ASICs; (ii) any possible foreclosure in relation to FC SAN ASIC will have only a minimal impact on the overall ASIC business of GlobalFoundries, [...].
- (115) The Commission considers that a customer foreclosure strategy would be unlikely for the following reasons.
- (116) In relation to current generations of FC ASIC the same considerations on barriers to switching outlined in paragraphs (92) to (94) above apply to Brocade. For most generations of its FC SAN switches (including for the most recent generation of switches, Gen6) Brocade sourced [...]. Given that Broadcom does not have its own fabrication facilities but relies on third party fabs it appears unlikely that Brocade will try post-Transaction to migrate the manufacturing of FC ASIC for its current generations of FC SAN switches away from GlobalFoundries. Accordingly, GlobalFoundries would still have access to Brocade as a customer for the current generation of FC ASICs, for the next two to three years.
- (117) For ASIC for the future generation of 64 Gbps FC SAN switches, [...]. Even if Brocade is to source the design, development and production of 64 Gbps FC ASIC internally with Broadcom, GlobalFoundries would still have access to Cisco, as a customer of FC ASICs. Cisco, with a FC SAN switch market share of [20-30]%, would continue to represent a possible non-integrated customer for the FC ASICs of GlobalFoundries.
- (118) Neither GlobalFoundries, nor any other market participant raised any customer foreclosure concerns in relation to FC ASICs during the market investigation.
- (119) In light of the above considerations and based on the results of the market investigation, the Commission concludes that, even if the Merged Entity eventually decides to source all of its FC ASIC internally and engage in customer foreclosure, it is highly unlikely that such conduct would result in the foreclosure or marginalisation of GlobalFoundries in relation to ASIC manufacturing to such an extent that competition for the provision of FC ASIC would be negatively affected.

4.2.2.4. Conclusion

- (120) The Commission concludes that as regards the above outlined vertical relationships, the Transaction raises serious doubts in relation to the effective protection of Cisco's commercially sensitive information. The Commission further concludes that the Transaction is unlikely to raise input or customer foreclosure concerns in relation to the supply of FC ASICs.

4.2.3. IP Networking Products

(121) As noted above, Broadcom is active upstream in the supply of both wireline communication ASSPs and ASICs to be used as inputs for both IP/Ethernet switches and routers which are manufactured and supplied by Brocade. Each of these four vertical relationships gives rise to affected markets.

(122) As the competitive situation in the downstream segments is similar (i.e. IP/Ethernet routers and IP/Ethernet switches), they are considered together in the following analysis.

4.2.3.1. Wireline communication ASSPs as an input for IP/Ethernet switches and routers

(123) In the upstream market for the supply of wireline communication ASSPs, Broadcom is the largest player with a market share of [40-50]% in the EEA and worldwide, with Intel and Marvell being the next largest players with around [10-20]% market share each in the EEA and worldwide. These market shares are set out in Table 4 below. Broadcom's market share increases to [70-80]% in the EEA and worldwide when considering a potential segment for ASSPs for IP/Ethernet switches and routers.

Table 4 - Market shares for the supply of wireline communication ASSPs - 2016 by value

	ASSPs		ASSPs for IP/Ethernet switches and Routers	
	EEA (%)	Worldwide (%)	EEA (%)	Worldwide (%)
Broadcom	[40-50]	[40-50]	[70-80]	[70-80]
Intel	[10-20]	[10-20]	-	-
Marvell	[5-10]	[5-10]	[10-20]	[10-20]
Qualcomm	[0-5]	[0-5]	[0-5]	[0-5]
Microsemi	[0-5]	[0-5]	[0-5]	[0-5]
Inphi	[0-5]	[0-5]	-	-
Realtek	[0-5]	[0-5]	-	-
Others	[30-40]	[30-40]	[0-5]	[0-5]
TOTAL	100	100	100	100

Source: Notifying Party's best estimates based on Gartner data; Form CO – Annex 11. The Notifying Party submits that volume data for these products is not available.

(124) With regard to the downstream market for the sale of IP/Ethernet switches and routers, the market shares for Brocade and its main competitors are set out in Table 5 and Table 6 respectively. Brocade is a small player with market shares of [0-5]% or less by value and volume in the EEA and worldwide. There are a number of larger players including Cisco and HPE and a large number of other small players.

Table 5 - Market shares for the supply of IP/Ethernet Switches - 2016 - by value and volume

	EMEA		Worldwide	
	Value (%)	Volume (%)	Value (%)	Volume (%)
Arista	[0-5]	[0-5]	[0-5]	[0-5]
Brocade	[0-5]	[0-5]	[0-5]	[0-5]
Cisco	[60-70]	[30-40]	[50-60]	[20-30]
Dell	[0-5]	[0-5]	[0-5]	[0-5]
HPE Aruba	[10-20]	[10-20]	[5-10]	[10-20]
Huawei	[5-10]	[5-10]	[5-10]	[5-10]
Juniper	[0-5]	[0-5]	[0-5]	[0-5]
Others	[10-20]	[40-50]	[10-20]	[40-50]
TOTAL	100	100	100	100

Source: Dell'Oro; Form CO – Annex 11.

Table 6 - Market shares for the supply of IP/Ethernet Routers - 2016 - by value and volume

	EMEA	Worldwide	
	Value (%)	Value (%)	Volume (%)
Cisco	[40-50]	[40-50]	[50-60]
Huawei	[10-20]	[10-20]	[10-20]
Juniper	[10-20]	[10-20]	[0-5]
Nokia	[10-20]	[10-20]	[5-10]
ZTE	[0-5]	[0-5]	[0-5]
Brocade	[0-5]	[0-5]	[0-5]
Others	[5-10]	[0-5]	[20-30]
TOTAL	100	100	100

Source: Dell'Oro; Form CO – Annex 11. The Notifying Party submits that Dell'Oro does not provide volume unit information by region on IP/Ethernet Routers.

- (125) The Notifying Party submits that post-Transaction it would not have the ability to engage in input foreclosure with regard to the supply of wireline communication ASSPs. First, it submits that it lacks market power with regard to the supply of ASSPs as there are multiple other suppliers including Intel/Altera, Marvell and Cavium, there has been recent entry into the market and customers are able to sponsor entry. Second, it submits that customers such as Cisco have strong countervailing buyer power.
- (126) Equally, the Notifying Party submits that it would not have the ability to engage in customer foreclosure with regard the purchasers of wireline communications ASSPs because Brocade is a marginal buyer of inputs for IP networking products. Moreover, it submits that in addition to OEM purchasers of these products, there are "white box" manufacturers that procure such inputs for network equipment devices.
- (127) The Commission does not consider that the Transaction raises input foreclosure concerns with regard to ASSPs for IP/Ethernet switches and routers for the following reasons.
- (128) Brocade has a limited position in the downstream markets for the supply of IP/Ethernet switches and IP/Ethernet routers; its share is less than [0-5]% on all measures and very few of the respondents to the Commission's market

investigation consider Brocade to be a top 5 supplier of either IP/Ethernet switches or routers.⁷⁹ Given this limited market position, it is unlikely that Brocade would benefit in the event that Broadcom stopped selling, increased prices, or otherwise degraded the terms of supply to competing downstream suppliers of IP/Ethernet switches and routers. The Merged Entity therefore would lack the incentive to adopt such a foreclosure strategy as it is unlikely that it would recuperate the revenues lost from withholding or otherwise degrading the supply of ASSPs for IP/Ethernet switches and routers to downstream competitors.

- (129) Moreover, the Merged Entity will continue to face competition from rivals in the upstream market for the supply of wireline communication ASSPs which would be in a position to continue supplying ASSPs for IP/Ethernet switches and routers to downstream competitors. In particular, the Merged Entity will continue to face competition from Marvell which is active with regard to ASSPs for IP/Ethernet routers and switches specifically with a market share of [10-20]% at the EEA and worldwide level, as well as other players such as Intel, Qualcomm and Realtek. The market investigation indicates that none of the competing suppliers of ASSPs to which customers could switch face capacity constraints that would prevent, or make it more difficult for, customers to switch suppliers.⁸⁰ In addition, entry has been seen in the market, for example from XPliant in 2011 (since acquired by Cavium),⁸¹ and Barefoot Networks in 2013 which was sponsored by Google and Tencent.
- (130) Equally, the Commission does not consider that the Transaction raises concerns of customer foreclosure as Brocade cannot be considered as an important customer in the downstream market for the acquisition of ASSPs. In 2016, Brocade procured approximately USD [0-50] million of wireline communication ASSPs in a market worth USD [5-10] billion⁸² equating to a market share of [0-5]% (when excluding ODM sales,⁸³ this figure falls to USD [0-50] million). Accordingly, if Brocade were to cease purchasing ASSPs from Broadcom's upstream rivals, these rivals would continue to have sufficient alternatives to which they could sell their output.
- (131) Moreover, by revenue, Brocade already sources [...] % of its ASSPs for IP/Ethernet switches and routers from Broadcom meaning that the Transaction will not have a significant effect on the situation that currently exists today.
- (132) The Commission therefore considers that the Merged Entity would not have the ability or the incentive to adopt a customer foreclosure strategy post-Transaction.
- (133) A number of respondents raised concerns regarding the possible impact of the Transaction on the market for IP/Ethernet ASSPs, in particular focusing on a potential reduction in quality of service following the merger or general concerns

⁷⁹ See responses to question 7 of Q2 – IP Networking.

⁸⁰ See responses to question 9 of Q2 – IP Networking.

⁸¹ See <http://www.cavium.com/XPliant-Ethernet-Switch-Product-Family.html>.

⁸² 2014 figures.

⁸³ An Original Design Manufacturer (“ODM”) is a company that designs and manufactures a product according to its clients’ specifications. The client will then market and sell the product to end customers under its own brand as its own product. Brocade uses ODMs for some of its wireline communications products, and some of those ODMs source ASSPs from Broadcom for the products that they design and manufacture for Brocade. There is no supplier-customer relationship between the ASSP vendor, e.g. Broadcom, and Brocade in regards to those ASSP sales.

regarding the degree of consolidation in the industry. The Commission does not consider some of these concerns to be merger specific and moreover, for the reasons set out above, the Commission does not consider that the Merged Entity will have the ability and incentive to implement either an input or customer foreclosure strategy with regard to IP/Ethernet ASSPs.

- (134) In light of the above considerations and based on the results of the market investigation, the Commission considers that the Transaction does not raise serious doubts as to its compatibility with the internal market with regard to the supply of ASSPs for IP/Ethernet switches and routers.
- (135) In any event, the Commission notes that Broadcom is disposing of Brocade's IP networking business, which would eliminate this vertical relationship. To this effect, Broadcom has entered into: (i) a binding agreement with ARRIS on 22 February 2017 for the sale of Brocade's Ruckus Wireless product family and Brocade's ICX Switch business;⁸⁴ and (ii) a binding agreement on 29 March 2017 with Extreme Networks for the sale of Brocade's datacentre switching, routing, and analytics business.⁸⁵
- (136) Both disposals are conditional upon Broadcom acquiring Brocade and have been notified to the antitrust authorities in the US and Germany. The German Federal Cartel Office has already approved both transactions. The US Federal Trade Commission has approved the ARRIS transaction and the Notifying Party expects its approval of the Extreme Networks transaction.

4.2.3.2. Wireline communication ASICs as an input for IP/Ethernet switches and routers

- (137) In the upstream market for the supply of wireline communication ASICs, Broadcom is one of the three largest players with a [30-40]% market share in the EEA and [20-30]% worldwide. The other large players are HiSilicon (Huawei) with [10-20]% in the EEA and [20-30]% worldwide and GlobalFoundries with [20-30]% in the EEA and [10-20]% worldwide. Broadcom has similar market shares when considering a potential sub-market of ASICs for IP/Ethernet switches and routers.

⁸⁴ See official press release, available at <https://www.broadcom.com/company/news/financial-releases/2248524>.

⁸⁵ See official press release, available at <https://www.broadcom.com/company/news/financial-releases/2257461>

Table 7 – Market shares for the supply of wireline communication ASICs - 2016 – by value

	ASICs		ASICs for IP/Ethernet switches and routers	
	EEA (%)	Worldwide (%)	EEA (%)	Worldwide (%)
HiSilicon (Huawei)	[10-20]	[20-30]	[10-20]	[20-30]
Broadcom	[30-40]	[20-30]	[30-40]	[20-30]
GlobalFoundries	[20-30]	[10-20]	[10-20]	[20-30]
STMicroelectronics	[10-20]	[5-10]	[5-10]	[5-10]
Texas Instruments	[5-10]	[0-5]	[0-5]	[0-5]
Global Unichip	[0-5]	[0-5]	[0-5]	[0-5]
Fujitsu Semiconductor	[0-5]	[0-5]	[0-5]	[0-5]
Others	[10-20]	[10-20]	[20-30]	[10-20]
Total	100	100	100	100

Source: Notifying Party's best estimates based on Gartner data; Form CO – Annex 11. The Notifying Party submits that volume data for these products is not available.

- (138) Brocade and its competitors' market positions with regard to the sale of IP/Ethernet switches and IP/Ethernet switches are shown above in Table 5 and Table 6 respectively.
- (139) The Notifying Party submits that post-Transaction it would not have the ability to engage in input foreclosure with regard to the supply of wireline communication ASICs. First, it submits that it lacks market power with regard to the supply of ASICs as it is a very competitive and fragmented market with a number of other suppliers including GlobalFoundries, HiSilicon/Huawei and STMicroelectronics. It also submits there has been recent entry into the market. Second, it submits that customers such as Cisco have strong countervailing buyer power and could approach foundries directly with their designs to have their chips manufactured.
- (140) Equally, the Notifying Party submits that it would not have the ability to engage in customer foreclosure with regard the purchaser of wireline communication ASICs because Brocade is a marginal buyer of inputs for IP networking products.
- (141) The Commission does not consider that the Transaction raises input foreclosure concerns with regard to ASICs for IP/Ethernet switches and routers for the following reasons.
- (142) The Merged Entity will continue to face significant competition from rivals in the upstream market for the supply of wireline communication ASICs. HiSilicon's (Huawei) market position has significantly increased in recent years, from a market share of [10-20]% in 2012 to [20-30]% in 2016; HiSilicon will remain a larger player than the Merged Entity post-Transaction. GlobalFoundries also has comparable market share to the Merged Entity: [10-20]% for all ASICs and [20-30]% for ASICs for IP/Ethernet routers and switches. The market investigation indicates that the competing suppliers of ASICs to which customers could switch do not face capacity constraints that would prevent or make it more difficult for customers to switch ASIC suppliers.⁸⁶
- (143) Moreover, as explained above, given Brocade's limited position in the downstream market, the Merged Entity is unlikely to have the incentive to engage in an input

⁸⁶ See responses to question 9 of Q2 – IP Networking.

foreclosure strategy as it is unlikely that Broadcom would recuperate the revenues it would lose from withholding or otherwise degrading the supply of ASICs to downstream competitors.

- (144) Equally, the Commission does not consider that the Transaction raises concerns of customer foreclosure as Brocade cannot be considered as an important customer in the downstream market for the acquisition of ASICs. Brocade procured approximately USD [0-50] million of wireline communication ASICs in 2016 equating to a market share of [0-5]%. Accordingly, if Brocade were to cease purchasing ASSPs from Broadcom's upstream rivals, these rivals would continue to have sufficient alternatives to which they could sell their output. The Commission therefore considers that the Merged Entity would not have the ability or the incentive to adopt a customer foreclosure strategy post-Transaction.
- (145) A few respondents to the market investigation raised concerns regarding the possible impact of the Transaction on the market for IP/Ethernet ASICs, in particular focusing on a potential reduction in quality of service following the merger, or general concerns regarding the degree of consolidation in the industry. The Commission does not consider some of these concerns to be merger specific and moreover, for the reasons set out above, the Commission does not consider that the Merged Entity will have the ability and incentive to implement either an input or customer foreclosure strategy with regard to IP/Ethernet ASICs.
- (146) In lights of the above considerations and the results of the market investigation, the Commission considers that the Transaction does not raise serious doubts as to its compatibility with the internal market in this market for the supply of ASICs for IP/Ethernet routers and switches.
- (147) In any event, Broadcom intends to divest Brocade's IP networking business which would eliminate this vertical relationship and has already entered into contractual arrangements with two third-party purchasers which are conditional on Broadcom's acquisition of Brocade as described above at paragraphs (135) - (136).

4.3. Conglomerate assessment

- (148) End customers that rely on FC SAN require both FC HBAs and FC SAN switches to build and operate an FC SAN. Similarly, most of the OEMs that supply such end customers purchase both FC SAN switches and FC HBAs.⁸⁷ Broadcom's FC HBAs can therefore be considered to be complementary or at least closely related to Brocade's FC SAN switches within the meaning of paragraph 91 of the Non-Horizontal Guidelines. Accordingly, the Commission will examine whether the Transaction may give rise to conglomerate effects in relation to Brocade's FC SAN switches and Broadcom's FC HBAs.
- (149) Section 4.3.1 below summarises the legal framework applicable to conglomerate relationships. Section 4.3.2 sets out the Parties' and their competitors' market shares in the markets relevant for the conglomerate assessment. Section 4.3.3 identifies the possible practices that could lead to conglomerate effects post-Transaction. Section 4.3.4 examines a possible interoperability degradation strategy aimed at foreclosing competing suppliers of FC HBAs. Section 4.3.5

⁸⁷ For further details, see paragraph (173) below.

assesses a possible use of confidential information from competing FC HBA suppliers aimed at favouring the Merged Entity's own position on the FC HBA market. Section 4.3.6 examines a possible mixed bundling strategy aimed at foreclosing competing suppliers of FC HBAs. Section 4.3.7 draws conclusions.

4.3.1. *Legal framework*

- (150) According to the Non-Horizontal Merger Guidelines, in most circumstances, conglomerate mergers do not lead to any competition problems.⁸⁸
- (151) However, foreclosure effects may arise when the combination of products in related markets may confer on the merged entity the ability and incentive to leverage a strong market position from one market to another closely related market by means of tying or bundling or other exclusionary practices. The Non-Horizontal Merger Guidelines distinguish between bundling, which usually refers to the way products are offered and priced by the merged entity⁸⁹ and tying, usually referring to situations where customers that purchase one good (the tying good) are required to also purchase another good from the producer (the tied good). Tying can take place on a technical or contractual basis. For instance, technical tying occurs when the tying product is designed in such a way that it only works with the tied product (and not with the alternatives offered by competitors). While tying and bundling have often no anticompetitive consequences, in certain circumstances such practices may lead to a reduction in actual or potential competitors' ability or incentive to compete. This may reduce the competitive pressure on the merged entity allowing it to increase prices.⁹⁰
- (152) In assessing the likelihood of such a scenario, the Commission examines, first, whether the merged firm would have the ability to foreclose its rivals,⁹¹ second, whether it would have the economic incentive to do so⁹² and, third, whether a foreclosure strategy would have a significant detrimental effect on competition, thus causing harm to consumers.⁹³ In practice, these factors are often examined together as they are closely intertwined.

4.3.2. *Market shares*

- (153) The market shares for Brocade and its competitors in the supply of FC SAN switches are set out in Table 2 and Table 3 in Section 4.2.2.1 above. Brocade is the market leader, with a worldwide market share of [70-80]% in 2016 (in value). The only notable competitor to Brocade is Cisco, with a worldwide market share of [20-30]% in 2016 (in value). Cavium (previously, QLogic)⁹⁴ announced in mid-

⁸⁸ See Non-Horizontal Guidelines, paragraph 92.

⁸⁹ Within bundling practices, the distinction is also made between pure bundling and mixed bundling. In the case of pure bundling the products are only sold jointly in fixed proportions. With mixed bundling the products are also available separately, but the sum of the stand-alone prices is higher than the bundled price.

⁹⁰ See Non-Horizontal Guidelines, paragraphs 91 and 93.

⁹¹ See Non-Horizontal Guidelines, paragraphs 95 to 104.

⁹² See Non-Horizontal Guidelines, paragraphs 105 to 110.

⁹³ See Non-Horizontal Guidelines, paragraphs 111 to 118.

⁹⁴ In June 2016, QLogic was acquired by Cavium, an integrated semiconductor provider. For ease of reference, QLogic will be referred to as Cavium in this decision.

2013 that it was exiting the FC SAN switch business and has thereafter ceased any further development.

- (154) The market shares for Broadcom and its competitors in the supply of FC HBAs are set out in Table 8 below. Broadcom is the second largest player, with a fairly stable worldwide market share of around [40-50]% over the last three years. The market leader in FC HBAs is Cavium, with a market share above [50-60]% in the last three years.

Table 8 - Market shares for the supply of FC HBAs – Worldwide, 2014 to 2016⁹⁵

	2014		2015		2016	
	Value (%)	Volume (%)	Value (%)	Volume (%)	Value (%)	Volume (%)
Cavium⁹⁶	[50-60]	[50-60]	[50-60]	[50-60]	[50-60]	[50-60]
Broadcom	[40-50]	[40-50]	[40-50]	[40-50]	[40-50]	[40-50]
Others	[0-5]	[0-5]	[0-5]	[0-5]	[0-5]	[0-5]
TOTAL	100	100	100	100	100	100

Source: Crehan, Form CO – Annex 11.

4.3.3. Possible practices leading to conglomerate effects

- (155) The Commission examined whether the Transaction could give rise to conglomerate non-coordinated effects consisting of the potential foreclosure of suppliers of FC HBAs that compete with Broadcom, and/or the foreclosure of suppliers of FC SAN switches that compete with Brocade.
- (156) As regards the potential foreclosure of competing suppliers of FC HBAs, on the basis of the submissions of market participants, the Commission has identified three main types of practices that the Merged Entity could engage in with a view to foreclosing its competitors in FC HBAs, namely: (i) degrading or differentiating the degree of technical interoperability between its own FC SAN switches and third-party FC HBAs, compared to its own FC HBAs (“interoperability degradation”); (ii) leaking and/or misusing confidential information of competing FC HBA suppliers that it has access to (“information leakage/misuse”); and/or (iii) incentivising the joint purchase of its own FC SAN switches and FC HBAs by offering those products at a discount if bought jointly and increasing the price of the products when purchased in a standalone form (“mixed bundling”). These practices will be assessed in detail in Sections 4.3.4, 4.3.5 and 4.3.6, respectively.
- (157) Conversely, the potential foreclosure of competing suppliers of FC SAN switches will not be assessed in detail, as the Commission considers that potential strategies of interoperability degradation and mixed bundling would unlikely be successful in foreclosing competing FC SAN switch suppliers (i.e. Cisco) for the following reasons.⁹⁷

⁹⁵ Volumes are provided in number of ports. According to the Notifying Party, there are no available market reports providing market shares for FC HBAs at EEA level. With regards to end customers in the EEA, the Notifying Party believes that Broadcom's market share would be comparable to its global market share as provided in Table 8.

⁹⁶ See footnote 62 above.

⁹⁷ On the basis of the information received from the Notifying Party and from the market investigation, the Commission considers that issues of information leakage/misuse of the type described under point (ii) in paragraph (156) are unlikely to arise in the present case in relation to FC SAN switch suppliers.

- (158) Regardless of whether or not the Merged Entity would enjoy sufficient market power in FC HBAs,⁹⁸ it would likely not have the ability and incentive to foreclose competitors in FC SAN switches by degrading the interoperability of its own FC HBAs with competitors' FC SAN switches. As explained in more detail in paragraphs (178) and (180) below, end customers are typically more reluctant to change supplier of FC SAN switches, compared to changing supplier of FC HBAs. As a result, in the event of a hypothetical degradation of interoperability between the Merged Entity's FC HBAs and competing FC SAN switches, those customers that have opted for an FC SAN switch provider competing with the Merged Entity (i.e. Cisco) would be likely to also source FC HBAs from a competing FC HBA supplier (i.e. Cavium), so as to ensure that their FC HBAs interoperate optimally with FC SAN switches of their choice.
- (159) In relation to mixed bundling strategies, as further explained in paragraphs (223) to (225), the Merged Entity will likely not have the ability and the incentive to engage in such strategies, due to (i) the asynchronous purchasing patterns for FC HBAs and FC SAN switches and to (ii) the OEMs' ability to unbundle the offer.
- (160) In light of the above, given the lack of ability and/or incentive of the Merged Entity to engage in interoperability degradation and/or mixed bundling strategies to the detriment of competing FC SAN switch suppliers, there is no need to examine the effects on competition of such potential strategies.

4.3.4. *Interoperability degradation towards competing FC HBAs*

- (161) In this Section, the Commission assesses the concern that the Merged Entity could leverage its market position from the market for FC SAN switches to the market for FC HBAs by degrading the interoperability of its own FC SAN switches with competitors' FC HBAs. The Commission will examine whether the Merged Entity would have the ability to foreclose competing FC HBA suppliers, whether it would have the economic incentive to do so and whether a foreclosure strategy would have a significant detrimental effect on competition in FC HBAs.

4.3.4.1. Ability to foreclose

(a) The Notifying Party's views

- (162) The Notifying Party submits that the Merged Entity would have no ability to foreclose competitors in FC HBAs for a number of reasons.
- (163) First, the Notifying Party argues that Brocade does not have market power in FC SAN switches, as Brocade is in reality constrained by several factors. Brocade faces competition from Cisco, which has a market share of approximately [20-30]%. Moreover, FC is a mature technology which has been losing ground to newer technologies, such as public cloud, IP or Ethernet storage networking solutions, as the speed and stability of those interconnects have improved.

⁹⁸ It is doubtful whether Broadcom would have sufficient market power in FC HBAs in view of its position on the FC HBA's market, where Cavium is the market leader with estimated global and EEA share of [50-60]% in 2016, whereas Broadcom is the second largest player (with a market share of around [40-50]% in the EEA and worldwide). See responses to questions 17.3 and 24 of Q1 – FC SAN Products.

- (164) Second, the Notifying Party emphasises that compliance with technical standards is critical for networking equipment, as standards ensure the maintenance of interoperability between devices in a particular network environment. Compliance with these standards means that FC HBAs manufactured by Broadcom must be fully interoperable with other vendors' FC SAN switches within the SAN infrastructure. According to the Notifying Party, as long as both devices are based on the same standards, the Merged Entity will therefore be unable to degrade the interoperability of other vendors' FC HBAs with Brocade's FC SAN switches, as this would result in the product not qualifying under the standard – a major downside in any comparison with competing offers.
- (165) Third, the Notifying Party claims that customers have buyer power and would thwart any attempt to engage in foreclosure strategies. Broadcom's ten largest customers account for around [90-100]% of its sales of FC HBAs and Brocade's ten largest customers account for more than [90-100]% of its FC SAN switches sales. These customers include OEMs such as [...] that have considerable power to force the Merged Entity to ensure interoperability of its FC products with those of other suppliers. The fact that such OEMs are sophisticated market participants was specifically recognized by the Commission in its decision in *Avago/Broadcom*.⁹⁹ Moreover, end customers often mix and match products from different FC suppliers, and require that all FC SAN components follow the T11 FC standard to ensure interoperability.

(b) The Commission's assessment

- (166) In order to assess the Merged Entity's ability to foreclose competing FC HBA suppliers, this Section will examine, first, the specific practices available to the Merged Entity to degrade interoperability of its FC SAN switches with competing FC HBAs and, second, the likely impact of such practices on competing FC HBA suppliers.

Possible practices to degrade interoperability

- (167) Within the FC SAN environment, certain technical standards are in place to ensure that FC SAN switches and FC HBAs can interoperate with each other even if they are supplied by different vendors.¹⁰⁰ However, unlike what the Notifying Party seeks to suggest, mere compliance with those standards is not sufficient to ensure optimal interoperability between FC SAN switches and FC HBAs of different vendors. Further cooperation between the FC SAN switches and the FC HBAs vendor is required for this purpose, as largely confirmed by the results of the market investigation.¹⁰¹

⁹⁹ Commission decision of 17 September 2015 in case M.7686 - *Avago / Broadcom*.

¹⁰⁰ According to information provided by the Notifying Party, the main relevant standards ensuring interoperability between FC HBAs and FC SAN switches are the technical standards applicable to the FC specifications. Technical specifications are managed by the T-11 Committee, which is a technical committee of the International Committee on Information Technology Standards ("INCITS").

¹⁰¹ Responses to questionnaire Q1 on FC SAN products of 17 March 2017, question 28.

- (168) In particular, during the development cycle of a new version of FC HBAs with a higher data transmission speed (also called new "generation" of FC HBAs),¹⁰² FC HBA vendors test their products to ensure that they will properly function when connected to an FC SAN switch. For this purpose, FC HBA vendors provide early access to their next-generation FC HBA to switch vendors (and vice versa), including access to items such as simulated packets, product plans, logs and traces. This process is referred to as the "qualification" process. According to information provided by the Notifying Party, the design cycle for an FC HBA lasts about two years, and FC HBA vendors begin their qualifying efforts about six months before their products are eventually released on the market.
- (169) In addition, after the product release of FC HBAs and once FC HBAs have been sold to the OEM or to the end customer, technical support from the FC SAN switch vendor may be required to solve technical issues such as FC HBA defects ("bugs") that occur at customers' sites. Such cooperation post-product release plays an important role to maintain customer satisfaction.
- (170) In light of the above, the main concern that emerged from the market investigation relates to the risk that, post-Transaction, the Merged Entity could reduce the technical cooperation that it provides to competing FC HBA suppliers at different stages of the FC HBA product cycle or take other steps to favour its own FC HBAs by disadvantaging competitors. In particular, the Merged Entity could, first, slow down or obstruct the qualification process of future generations of competing FC HBAs, for example by delaying or failing to transfer the necessary information and equipment to other FC HBA suppliers. This could lead to reduced interoperability of future generations of competing FC HBAs with the Merged Entity's FC SAN switches, reduced product reliability and possibly a delay in product release for competing FC HBAs. Furthermore, the Merged Entity could choose not to provide technical support in a sufficiently timely manner to rectify bugs at the premises of end customers that use competing FC HBAs (whether of current or future generations), thereby negatively affecting customer experience and thus the reputation of competing FC HBA suppliers. In addition, the Merged Entity could seek to favour its own FC HBAs by allowing them to function with new or improved features when interoperating with the Merged Entity's FC SAN switches, while at the same time denying such possibility to competing FC HBAs.
- (171) The market investigation has not revealed any particular obstacles to the technical feasibility of any of the practices described above. Accordingly, it can be concluded that the Merged Entity would have the ability to engage in a number of practices that would negatively affect the interoperability between its own FC SAN switches and competing FC HBAs (i.e. essentially, Cavium's FC HBAs), thus putting those FC HBAs at a competitive disadvantage compared to the Merged Entity's FC HBAs.

¹⁰² According to information provided by the Notifying Party, developers have introduced several generations of FC SAN solutions. Gen 4 refers to FC SANs that transmit data at up to 8 Gigabit per second ("Gbps"); current mainstream FC solutions (fifth generation of FC) provide for transfer rates up to 16 Gbps, and the more recent equipment commercially released in 2016 allows for 32 Gbps (sixth generation of FC). The FC protocol requires two generations of backwards compatibility, meaning that a 32 Gbps FC SAN switch must interoperate with both a 16 Gbps FC HBA and a 8 Gbps FC HBA. A new generation of FC HBAs is typically released every three to four years and FC HBA vendors tend to release their respective products at the same time.

Likely impact on competing FC HBAs

- (172) Whether the reduced interoperability of competing FC HBAs with the Merged Entity's FC SAN switches would effectively lead to foreclosure of competing FC HBA suppliers depends on the extent to which OEM and end customers would abandon competing FC HBAs as a reaction to such reduced interoperability. Relevant factors for the purpose of assessing this question include the existence of a sufficiently large pool of common customers of FC SAN switches and FC HBAs, the customers' propensity to switch FC HBA provider, the extent to which the Merged Entity enjoys market power in FC SAN switches, and the existence of possible counterstrategies available to competing FC HBA suppliers. Each of these factors will be examined below.
- (173) Vendors of FC HBAs and FC SAN switches generally supply their products to OEMs, which in turn supply them to end customers as part of their servers and storage offerings. Most of these OEMs (such as IBM, HPE, Dell/EMC, Lenovo, Fujitsu and Huawei) are suppliers of both server and storage systems and, therefore, tend to source both FC SAN switches and FC HBAs in order to offer them to the end customers. Moreover, as mentioned in paragraph (148) above, end customers that rely on FC SAN (such as financial institutions, telecom/media companies and government customers) require both FC HBAs and FC SAN switches to build and operate an FC SAN. As a result, FC SAN switches and FC HBAs are characterised by a large common pool of customers, both at the OEM and at the end customer level, which is an important premise for foreclosure to be a possible concern.¹⁰³
- (174) Regarding the likely reaction of OEMs and end customers to possible interoperability degradation strategies of the Merged Entity, the following can be noted.
- (175) Most OEMs typically qualify (i.e. test) and source FC HBAs from the two main FC HBA vendors, Broadcom and Cavium,¹⁰⁴ in order to be able to offer both options for sale to their customers. OEMs tend to purchase FC HBAs from vendors when they need them, i.e. on a "just-in-time" basis, usually for the cumulative need for the current quarter.¹⁰⁵
- (176) Contrary to the claim put forward by the Notifying Party, it cannot be assumed that the OEMs would thwart attempts by the Merged Entity to degrade interoperability. Given that OEMs essentially act as resellers of the FC HBAs to fulfil end customers' demand, they would not necessarily be able or willing to detect and counter interoperability degradation practices to a sufficient degree as to defeat the Merged Entity's strategy. Moreover, as most OEMs are already customers of Broadcom for FC HBAs (given the double-sourcing), in the event that a foreclosure strategy was put in place, they would only need to increase the amount of orders of FC HBAs that they already purchase from Broadcom, without having to enter into a commercial relationship with a new supplier and qualify new products.

¹⁰³ See Non-Horizontal Merger Guidelines, paragraph 100.

¹⁰⁴ Responses to questionnaire Q1 on FC SAN products of 17 March 2017, question 30.1.

¹⁰⁵ Notifying Party's reply to RFI No. 10, question 9.

- (177) Furthermore, regarding the Notifying Party's reference to the *Avago/Broadcom* decision, it suffices to note that, while that decision did indeed recognise that OEM customers are "*sophisticated market participants*", it referred specifically to "*other options*" available to those OEMs in the event of a tying strategy, "*including the possible option to start in-house production of certain chips or to support entry*".¹⁰⁶ In the present case, no evidence of such option has emerged from the market investigation. Quite the contrary, market respondents have indicated that barriers to enter the FC SAN space are significant and they do not expect any new player to enter the market in the next future.¹⁰⁷
- (178) End customers source FC HBAs and FC SAN switches either in the context of the installations of new (or "greenfield") datacentres (10% of sales), or in connection with replacement or upgrades (90% of sales). Generally, the market investigation suggested that, while some end customers tend to mix-and match FC HBAs from different vendors within the same datacentre, others do not.¹⁰⁸ Conversely, it appears that end customers typically do not mix-and-match FC SAN switches of different vendors within the same datacentre.¹⁰⁹ More generally, within FC SAN systems, FC SAN switches tend to be the "driving" product when it comes to the interaction between FC SAN switches and FC HBAs. Indeed, compared to FC SAN switches, FC HBAs exhibit a lower degree of product differentiation and are less expensive than FC SAN switches.¹¹⁰
- (179) When placing an order for FC HBAs for the purpose of new installations, end customers are essentially free to opt for either of the two FC HBA vendors. As a result, given the predominant role of FC SAN switches over FC HBAs, it is likely that most end customers who have a preference for the Merged Entity's FC SAN switches (for example, due to previous experience) may decide not to opt for Cavium FC HBAs for new installations to avoid the risk of reduced interoperability with their FC SAN switches.
- (180) As regards replacement/upgrades of FC HBAs, the market investigation revealed that, from an end customer perspective, switching supplier of FC HBAs tends to be less difficult in terms of costs, time and complexity (e.g. staff training, testing) than switching supplier of FC SAN switches.¹¹¹ Similarly, internal documents of the Parties confirm that the complexity of replacing FC SAN switches and the risk aversion of end customers [...] in FC SAN switches, resulting in end customers being generally reluctant to switching FC SAN switch vendor when replacing/upgrading switches.¹¹² As a result, faced with reduced interoperability between Cavium's FC HBAs and the Merged Entity's FC SAN switches, end customers of those products would likely be inclined to abandon Cavium FC HBAs in favour of the Merged Entity's FC HBAs when undertaking replacements or upgrades.

¹⁰⁶ Commission decision of 17 September 2015 in case M.7686 - *Avago / Broadcom*, paragraph 154.

¹⁰⁷ Responses to questionnaire Q1 on FC SAN products of 17 March 2017, questions 26 and 27.

¹⁰⁸ Responses to questionnaire Q1 on FC SAN products of 17 March 2017, question 33.

¹⁰⁹ Responses to questionnaire Q1 on FC SAN products of 17 March 2017, question 32.

¹¹⁰ The Notifying Party estimates the average FC SAN switch price per port is approximately USD 330, and the average FC HBA price per port is approximately USD 200.

¹¹¹ Responses to questionnaire Q1 on FC SAN products of 17 March 2017, question 34.

¹¹² Annex 7b to Form CO, slide 5.

- (181) Whether the migration of end customers away from Cavium FC HBAs to the Merged Entity's FC HBAs (for new installations and replacements/upgrades) would effectively be of such scale as to foreclose Cavium largely depends on the market strength that the Merged Entity enjoys in FC SAN switches.
- (182) As set out in Table 2 above, Brocade is by far the leading supplier of FC SAN switches, accounting for [70-80]% of the worldwide market in 2016 (by value). The only FC SAN switch competitor that Brocade faces is Cisco, which accounted for [20-30]% of the worldwide market in 2016 (by value). As explained by the Notifying Party, Brocade has historically been the first mover for each generation of FC SAN switches, leading Cisco by an average of 15-18 months. Not surprisingly, therefore, the results of the market investigation indicate that Brocade's FC SAN switches are regarded as a "must-stock" product by the large majority of OEMs.¹¹³ Contrary to the claim of the Notifying Party, it appears, therefore, that Brocade enjoys significant market power in FC SAN switches.¹¹⁴
- (183) Accordingly, if the Merged Entity were to engage in an interoperability degradation strategy, its very large base of FC SAN switch customers could provide it with significant leveraging power to expand its FC HBAs customer base to the detriment of Cavium's FC HBAs.
- (184) Finally, it is doubtful whether Cavium would be able to deploy effective and timely counterstrategies to offset the effects of the Merged Entity's interoperability degradation strategy. Regarding potential cooperation with other FC SAN switches providers, the only option currently available to Cavium would be to team up with Cisco. However, cooperation between the two companies to ensure interoperability between Cavium's FC HBAs and Cisco's FC SAN switches is already in place today. In any event, a hypothetical closer partnership between Cavium and Cisco would not remedy the lack of interoperability between Cavium's FC HBAs and the FC SAN switches of the market leader, i.e. the Merged Entity.¹¹⁵
- (185) Moreover, entry of new suppliers of FC SAN switches is unlikely to take place in the foreseeable future. The Notifying Party recognised that it is not aware of any likely entrants into the FC SAN switches market.¹¹⁶ Equally, the large majority of respondents to the market investigation do not expect any new entry to take place in the supply of FC SAN switches in the next three years.¹¹⁷ Barriers to entry into the market for FC SAN switches are high, notably because of the complex technology needed for the hardware and the software, the high development costs and the time needed to enter the market. The relatively limited size of the addressable market and the fact that the FC SAN switch market is occupied by two well-established players also act as deterrent for any potential new entrant. One market participant also pointed out that customers' reluctance to change FC SAN switch supplier would make any new entry in FC SAN switches difficult.¹¹⁸

¹¹³ Responses to questionnaire Q1 on FC SAN products of 17 March 2017, question 24.

¹¹⁴ The Notifying Party's argument regarding the constraint exercised by competing technologies to FC SAN is addressed in Section 4.3.4.2 below.

¹¹⁵ For further details, see Section 4.3.4.3 below.

¹¹⁶ Annex 7d to Form CO, slide 4.

¹¹⁷ See responses to question 26 of Q1 – FC SAN Products.

¹¹⁸ See responses to question 27 of Q1 – FC SAN Products.

- (186) In light of the above, it can be concluded that, by engaging into an interoperability degradation strategy, the Merged Entity would likely have the ability to foreclose Cavium and other potential competing suppliers of FC HBAs.

4.3.4.2. Incentive to foreclose

(a) The Notifying Party's views

- (187) The Notifying Party submits that the Merged Entity would have no incentive to foreclose competitors in FC HBAs for a number of reasons.
- (188) First, the Notifying Party argues that any covert attempt by the Merged Entity to make Brocade's FC SAN switches work less effectively with Cavium's FC HBA would quickly frustrate server and storage OEMs and lead them to either shift demand for FC SAN switches to Cisco, making the latter the 'neutral' option, or to abandon the FC SAN environment altogether, to the benefit of competing technologies including public cloud, IP or Ethernet solutions. This reaction would offset any potential gain from increased FC HBA sales and would also hurt the combined firm's replacement and upgrade business in FC SAN, where its products are used together with its competitors' products.
- (189) Second, the Notifying Party claims that any attempt to degrade interoperability in the FC space would tarnish the reputation of FC, by making it appear a less open and dynamic environment, and would accelerate the already on-going shift in demand towards public cloud, IP SAN and other technologies. Brocade, which has historically been active in FC SAN switches and FC HBAs, never engaged in such strategy. Similarly, Cavium, which has been the long-standing market leader in FC HBAs has not used its position to limit interoperability with competing FC SAN switches.
- (190) Finally, the Notifying Party claims that Broadcom has no history of attempting to foreclose competitors. In fact, Broadcom has a history of fair competition with some of its main customers. For example, Broadcom is currently working with Cavium to develop the ASIC for its 64G FC HBA.

(b) The Commission's assessment

- (191) The incentive of the Merged Entity to foreclose competing FC HBA suppliers through interoperability degradation depends on the degree to which this strategy would be profitable, taking into account possible associated costs and the possible gains from expanding market shares in FC HBAs.
- (192) According to the data provided by the Notifying Party, FC HBAs generate significant gross margins for Broadcom, namely [...] % in 2016. The gross margins from Brocade's sales of FC SAN switches are slightly lower, amounting to [...] % in 2016. In 2016, Broadcom's market share in FC HBAs was [40-50] % (in value), while Brocade's market share in FC SAN switches was [70-80] % (in value). As explained in paragraph (173) above, most OEM customers of FC SAN switches also demand FC HBAs, which they typically double-source from Broadcom and Cavium.
- (193) The high gross margins for FC HBAs and the existence of a significant (and easily accessible) portion of addressable market ([50-60] % of the FC HBA market)

would make a foreclosure strategy through interoperability degradation particularly attractive for the Merged Entity post-Transaction.

- (194) Contrary to the arguments of the Notifying Party, the possible draw-backs from engaging in such strategy do not appear to be sufficiently high to make the strategy unattractive. Indeed, while the Merged Entity may run the risk of frustrating or dissatisfying some of its customers of FC SAN switches that purchase Cavium FC HBAs, the risk of losing substantial FC SAN switch sales does not seem significant. Indeed, as explained in paragraph (180) above, end customers are typically reluctant to switch vendor of FC SAN switches. Moreover, as explained in paragraph (176) above, OEMs would likely continue to purchase Brocade FC SAN switches to be able to satisfy end customers' requirements. Moreover, no other disincentive for the Merged Entity to engage in an interoperability degradation strategy towards competing FC HBAs has emerged from the results of the market investigation.
- (195) Regarding the argument of the Notifying Party whereby Brocade's position in FC SAN switches would be threatened by competing technologies, it is unlikely that this alleged threat would affect the Merged Entity's ability or incentive to foreclose competing FC HBA suppliers through interoperability degradation strategies. According to the information provided by the Notifying Party, FC SAN currently still accounts for almost 69.7% of SAN technologies and for 38% of storage networking solutions. Moreover, Broadcom's internal documents indicate that other technologies (notably IP/Ethernet), while being potentially more cost effective, do not offer the same level of reliability and security as FC SAN. Those documents also indicate that the market for FC SAN will decline moderately over the next five years¹¹⁹ (notably as customers are expected to only transition some non-mission critical workloads from FC SAN),¹²⁰ and that FC will remain as the datacentre storage protocol of choice for the next decade.¹²¹
- (196) The technical advantages of FC SAN over competing technologies were also confirmed by the results of the market investigation. The majority of respondents explained that, while there is a rise in competing technologies in the storage environment, such as cloud storage, large enterprises will continue to invest in FC for performance critical systems. They also consider that, thanks to its speed characteristics, FC will likely remain important for flash storage technology, at least until other technologies develop further. In particular, one market participant noted that "*[t]he market for memory and storage is evolving with the growth of non-volatile memory technologies, and fibre channel SAN solutions will most likely grow into that space.*" Accordingly, most respondents to the market investigation indicated that they expect the presence of FC SAN to remain stable in the next three years.¹²²
- (197) As a result, the Commission considers that, for the foreseeable future, FC SAN will likely remain an important technology in business-critical applications, and thus the expected decline of FC SAN would not significantly impact the Merged Entity's ability or incentive to foreclose competing FC HBA suppliers.

119 Annex 7d to Form CO, slide 4; Annex 7f to Form CO, slide 75.

120 Annex 7f to Form CO, slide 39.

121 Annex 7c to Form CO, slide 19.

122 Responses to questionnaire Q1 on FC SAN products of 17 March 2017, question 4.

- (198) Furthermore, the Notifying Party's argument whereby Brocade and Cavium did not limit the interoperability of their FC SAN switches and FC HBAs with competing products in the past, even though they each had both products, cannot be accepted. Unlike in the present case, at least one of Brocade's or Cavium's products was not seen as attractive by customers. Although Brocade offered both FC SAN switches and FC HBAs under a certain period, its FC HBAs were not competitive and its market share never exceeded [0-5]% in the past five years. Similarly, although Cavium offered both products until 2013, its market share in FC SAN switches in the latest years did not exceed [0-5]% in value (which ultimately led to its decision to exit the FC SAN switch business).¹²³ On the contrary, post-Transaction, the Merged Entity would enjoy a strong market position in both FC SAN switches and FC HBAs, which would significantly increase the chances of an interoperability degradation strategy being successful.
- (199) Likewise, the fact that Broadcom, according to the Notifying Party, has no history of attempting to foreclose competitors does not mean that it would be unlikely to do so in the future.
- (200) In light of the above, it can be concluded that the Merged Entity would likely have the incentive to foreclose competing FC HBA suppliers by engaging in an interoperability degradation strategy.

4.3.4.3. Overall likely impact on effective competition

(a) The Notifying Party's views

- (201) The Notifying Party submits that a foreclosure strategy would not significantly impact competition in the market for FC HBAs. According to the Notifying Party, following the Transaction, Cavium will remain a significant competitor in FC HBAs. Cavium offers products that are similar to Broadcom's, preventing impact on customer choice. Cavium also has a number of counter strategies at its disposal, such as pricing more aggressively or teaming up with Cisco.

(b) The Commission's assessment

- (202) As explained in Sections 4.3.4.1 and 4.3.4.2 above, the Merged Entity is likely to have both the ability and the incentive to foreclose competing providers of FC HBAs post-Transaction. As regards the overall impact of such foreclosure strategy on effective competition in the FC HBA market, the following can be noted.
- (203) Currently, Cavium is the only competing manufacturer and supplier of FC HBAs worldwide. Entry of new providers of FC HBAs is unlikely to take place in the foreseeable future given the barriers to entry to this market, as also confirmed by the results of the market investigation.¹²⁴
- (204) On the basis of the information available, it appears that a deterioration of the interoperability of the Merged Entity's FC SAN switches vis-à-vis Cavium's FC HBAs could potentially lead to a significant loss of Cavium's market share in FC HBAs. Indeed, assuming that all or most customers of the Merged Entity's FC

¹²³ See paragraph (153) above.

¹²⁴ Responses to questionnaire Q1 on FC SAN products of 17 March 2017, questions 26-27.

SAN switches would start ordering FC HBAs only from Broadcom, a potential outcome is that, eventually, more than [70-80]% of customer demand for FC HBAs would be directed at Broadcom FC HBAs. This could translate into a possible reduction of Cavium's market share in FC HBAs from [50-60]% to less than [30-40]%. Even if Cavium were able to increase the sale of its FC HBAs among customers of Cisco FC SAN switches, such increased sales would be unlikely to be sufficient to compensate the significant loss of market share and hence of revenues.¹²⁵

- (205) A significant loss of FC HBAs revenues would not necessarily prevent Cavium from continuing manufacturing and supplying the current generations of FC HBAs for a certain period of time. Nevertheless, Cavium may eventually lack sufficient resources to continue investing in the development of future generations of FC HBAs. This is particularly likely to occur in light of the significant weight of FC HBA revenues on Cavium's overall business activities¹²⁶ and of the high R&D expenses required to innovate in the FC HBAs space.¹²⁷ Therefore, a substantial loss of market share in FC HBAs could potentially prevent Cavium from investing in new FC HBAs, thus relegating it to shipping and sustaining existing generations of FC HBAs going forward.
- (206) Should the Merged Entity's interoperability degradation strategy ultimately lead to Cavium's marginalisation in relation to future generations of FC HBAs, the Merged Entity would likely become the only worldwide provider of future generations of FC HBAs, with no or limited prospects of entry by new FC HBA suppliers. This would negatively impact choice of FC HBAs for OEMs and end customers. Moreover, faced with the absence of competitive pressure, the Merged Entity may eventually also have the ability and the incentive to increase prices of FC HBAs and/or to reduce innovation to the detriment of OEMs, end customers and ultimately consumers.
- (207) In light of the above, it can be concluded that the Merged Entity's interoperability degradation strategy would likely have a significant detrimental effect on competition in the FC HBA market.

4.3.5. *Leakage/misuse of FC HBA confidential information*

- (208) In this Section, the Commission assesses the concern that the Merged Entity could use the confidential information that it obtains from competing FC HBA suppliers to favour its own position on the FC HBA market. While this concern relates to a possible distinct behaviour by the Merged Entity that has in itself the potential to harm competing FC HBA suppliers, if implemented in combination with the

¹²⁵ This is consistent with the view put forward by Cisco, according to which it is questionable whether Cavium would continue to be viable in FC HBAs if it loses significant sales to customers of the Merged Entity's FC SAN switches, even if it were to replace some of the lost business with increased sales of FC HBAs to customers of Cisco FC SAN switches. See Cisco's reply to RFI No 11, question 3.

¹²⁶ According to information provided by the Notifying Party, the revenue obtained by QLogic (now Cavium) from FC HBAs in 2015 was USD [200-400] million. This accounts for more than [30-40]% of the total revenue of QLogic and Cavium (which are now part of one company) in 2015, based on publicly available information.

¹²⁷ Assuming Cavium's ratio of R&D cost to revenue for FC HBAs is similar to that of Broadcom, which would mean a ratio of around [20-30]%.

interoperability degradation strategy examined in Section 4.3.4 above, it could aggravate the possible detrimental effects of such strategy on competition in the FC HBA market.

- (209) As explained in paragraph (168) above, FC HBA suppliers provide certain information to FC SAN switches suppliers in the context of the qualification process aimed at ensuring interoperability between FC HBAs and FC SAN switches, and at later stages of the FC HBAs' product life. This information covers various technical¹²⁸ and non-technical items relating to both future and existing generations of FC HBAs.¹²⁹
- (210) To ensure the protection of such type of confidential information, non-disclosure agreements usually exist between the FC SAN switch manufacturer and the FC HBA supplier. In this context, Brocade and Cavium have a Mutual Nondisclosure Agreement in place dated [...], (the "MNA"), which sets out non-disclosure obligations on Brocade vis-à-vis Cavium's FC HBA confidential information. In case of breach of the MNA by one party, [details of contractual provisions].
- (211) The results of the market investigation revealed a concern relating to the possible leakage within the Merged Entity of commercially sensitive information shared by competing FC HBA vendors, including during the qualification process. In particular, post-Transaction, the business unit responsible for FC SAN switches of the Merged Entity could make this information accessible to the business unit responsible for FC HBAs, which could potentially misuse it to favour the Merged Entity's own FC HBAs to the detriment of competing FC HBA suppliers.
- (212) In relation to the above, similar considerations as the ones described in paragraphs (111) and (111) as regards Cisco's confidential FC ASICs and FC SAN switch information apply here. It would be problematic for Cavium to effectively monitor and detect a potential breach of the confidentiality provisions in the MNA given the difficulty of determining whether the behaviour of the Merged Entity in the provision of FC HBA is the result of genuine competition or has been influenced by access to confidential information regarding Cavium's FC HBA. Furthermore, the sanctions envisaged in the MNA in case of breach ([...])¹³⁰ do not appear to be adequate and enforceable in view of the fact that it will be difficult to trigger these sanctions. Triggering those would require Cavium to be able to effectively monitor and detect a breach of the confidentiality in the first place, which as explain is problematic for Cavium. Given the difficulty to trigger these sanctions the Commission considers that the sanctions do not seem to provide a satisfactory level of deterrence to prevent a potential leakage of confidential Cavium information within the Merged Entity.

¹²⁸ Such technical information includes but is not limited to detailed specifications and attributes of the FC HBA hardware including the FC ASIC; ASIC firmware; detailed specifications and settings on ASIC firmware; management software; detailed specifications and settings on management software; operating system software drivers; detailed specifications and settings on operating system software drivers; firmware or software with detailed descriptions and possible workarounds; test processes and procedures with test programs and test scripts; ideas; techniques; know-how; and processes. See Cavium's reply to RFI No. 14, question 3.

¹²⁹ The exchange of sensitive information also takes place later on, throughout the entire lifecycle of the FC SAN switch products, to allow FC HBAs to be fully interoperable also after updates to the FC SAN switch software and firmware are deployed.

¹³⁰ See paragraph 10 of the Mutual Nondisclosure Agreement between Brocade and Cavium of [...].

(213) Accordingly, the Commission considers that the contractual provisions currently in place between Brocade and Cavium are in themselves insufficient to ensure that, post-Transaction, the Merged Entity does not use any confidential information received from Cavium to the benefit of its own FC HBAs. In particular, for the reasons set out above, the Commission considers that Cavium would be unable to effectively monitor the Merged Entity's compliance with the relevant contractual obligations and that the sanctions provided for in the relevant agreement are insufficient to allow for sufficient deterrence vis-à-vis the Merged Entity.

4.3.6. *Mixed bundling of FC SAN switches and FC HBAs*

(214) In this Section, the Commission assesses the concern that the Merged Entity could leverage its market position from the market for FC SAN switches to the market for FC HBAs, with a view to foreclosing its competitors in FC HBAs, by incentivising the joint purchase of its own products by offering those products at a discount if bought jointly and by increasing the price of the products when purchased in a standalone form ("mixed bundling").¹³¹ The Commission will examine whether the Merged Entity would have the ability and economic incentive to foreclose competing FC HBA suppliers and whether a foreclosure strategy would have a significant detrimental effect on competition in FC HBAs.

4.3.6.1. Ability and incentive to foreclose

(a) The Notifying Party's views

(215) The Notifying Party submits that post-Transaction the Merged Entity will have no ability to leverage its market position in FC SAN switches to foreclose competing FC HBA suppliers through bundling practices with regard to the supply of FC SAN switches and FC HBAs.

(216) First, the Notifying Party submits that despite being the market leader in FC SAN switches, Brocade has no market power. Brocade faces significant competition from Cisco which has an established presence in FC SAN switches.

(217) Second, the Notifying Party submits that FC SAN switches and FC HBAs are purchased at different points in time which make mixed bundling strategies impossible. The procurement of FC HBAs is largely driven by the end customers' servers requirements and replacement cycles, which in turn are largely driven by Intel and its product roadmap for X86 server processors. The life cycle of servers is typically three years. Procurement of FC SAN switches, on the other hand, typically follows the storage equipment life cycles, which are typically five to seven years. Upgrades of FC SAN switches and FC HBAs therefore typically do not occur simultaneously.

(218) Third, the Notifying Party claims that although the same OEMs may purchase both FC HBAs and FC SAN switches, different teams at the OEMs are responsible for procurement and purchase decisions. FC HBAs are plugged in to the servers and

¹³¹ It appears less likely that the Merged Entity would engage in "pure bundling", that is by making FC SAN switches and FC HBAs available for purchase only jointly, as this practice would be even more complex to implement.

procured by dedicated server teams at the OEMs while FC SAN switches are part of the storage system and procured by dedicated storage teams at the OEMs.

- (219) Fourth, the Notifying Party submits that customers have buyer power and would defeat any attempt to engage in foreclosure strategies. The Notifying Party explains that Broadcom's ten largest customers account for around [90-100]% of its sales of FC HBAs and Brocade's ten largest customers account for more than [90-100]% of its FC SAN switches sales. These customers include OEMs such as [...] that have considerable power over Brocade and Broadcom because they have direct contact with end-users and can shift sales to Cisco and Cavium respectively or promote alternative technological solutions at the expense of FC SAN solutions.
- (220) Fifth, the Notifying Party argues that any attempt by the Merged Entity to engage in anticompetitive bundling would trigger a reaction from competitors. For example, the Notifying Party mentions that Cavium continues to have the technical capacity to produce FC SAN switches so that it could respond to any bundling strategy by re-entering the segment and offering a comparable bundle. Further, Cisco could develop its own FC HBAs, just like Brocade did in 2008 and offer its own bundles of FC SAN switches and FC HBAs. Cisco already has established customer relationships in the FC market and is active in the development and supply of Ethernet adapter cards, which perform a similar function in IP SANs (and LANSs) as FC HBAs do in FC SANs. Finally, Cavium and Cisco could also team up to offer similar bundles of FC HBAs and FC SAN switches.
- (221) As regards the incentive to foreclose FC HBA competitors through mixed bundling, the Notifying Party submits that the Merged Entity will have no incentive to engage in bundling strategies, because any attempt to bundle the FC SAN switches and FC HBAs would frustrate OEMs and would affect the Merged Entity's reputation.

(b) The Commission's assessment

- (222) As explained in paragraphs (182) and (183), the Commission considers that Brocade enjoys significant market power in FC SAN switches. Brocade is by far the market leader in the supply of FC SAN switches (market share of approximately [70-80]% in 2016) and faces only one notable competitor, Cisco. The market investigation's results confirmed that Brocade is a major player in FC SAN switches.¹³²
- (223) However, as the end customers have different purchasing cycles for the FC SAN switches and the FC HBAs, it seems unlikely that the Merged Entity will have the ability and the incentive to engage in effective mixed bundling strategy. The market investigation results indicated that the procurement cycles of the FC SAN switches and the FC HBAs can be aligned for new installations, but not necessarily for replacements and upgrades in a datacentre,¹³³ because the FC SAN switch and the FC HBA follow different replacement cycles.¹³⁴ Usually, the replacement cycle of FC HBAs is driven by the server replacement cycle which is somewhat

¹³² See responses to question 24 of Q1 – FC SAN Products.

¹³³ Approximately 90% of the FC SAN market consists of replacement and upgrade sales.

¹³⁴ See responses to question 29.5 of Q1 – FC SAN Products; Non-confidential version of Cavium's reply to RFI No.14 of 12 April 2017, question 5.

shorter than the FC SAN switch replacement cycle, typically three to four years, so that FC HBAs are replaced at the same time as the servers. The server replacement cycle is also influenced by the advances in processor architectures, reduced power consumption and other innovations.¹³⁵ Procurement of FC SAN switches, on the other hand, is largely driven by end customers' storage arrays requirements and replacements. The storage arrays and *a fortiori* the FC SAN switches typically follow a longer life cycle than the servers and are replaced approximately every five years. By way of example, HPE indicated that "*HBA purchases occur with a server purchase, while switches are bought when building out a SAN. In terms of product lifecycle pricing, servers and storage area networks purchases are not typically simultaneous.*"¹³⁶ One market participant also said that the selling processes of the FC SAN switch and the FC HBA are independent, continuous and forecasted differently. There is no direct correlation between the number of FC HBAs and the number of FC SAN switches that customers would need to procure, so that it would be difficult to align both selling processes.¹³⁷ Moreover, end customers' refreshment cycles are typically unknown to the FC SAN switch and the FC HBA manufacturers, as, most of the time, these suppliers do not typically sell directly to end customers (but rather to the OEMs) and do not know the identity of the end customers.¹³⁸

- (224) Moreover, in the unlikely scenario where the Merged Entity would sell FC SAN switches and FC HBAs directly to end customers, a bundling strategy would have to involve either a credible promise by the Merged Entity of a future discount conditional on the purchase of the other component of the bundle at a later stage, or a credible promise of a future purchase of the other component by the end customer in return for a future discount. However, due to the significant time period for many end customers between the purchases of the respective components, given the asynchronous purchase cycles, the value of this discount would be uncertain at the time of the first purchase. This uncertainty may act as a deterrent to both the manufacturer making such bundled offers and to the end customer deciding to take advantage of them.¹³⁹
- (225) In any event, regardless of the synchronicity of sales to end customers, the Merged Entity's OEM customers may be able to neutralize a potential mixed bundling strategy, at least partially. Indeed, OEMs would likely purchase the bundled products and profitably resell them unbundled according to individual end

¹³⁵ See Non-confidential version of Cisco's response to RFI No.7 of March 17 2017, question 5.

¹³⁶ See response of HPE to question 29.5 of Q1 – FC SAN Products.

¹³⁷ In a similar fashion, the Commission notes that FC SAN switches are generally purchased on a just-in-time basis and OEMs use a combination of just-in-time and inventory purchases for the FC HBAs. According to this purchasing pattern, it seems unlikely that the Merged Entity would be able to align the purchase of both products. See Notifying Party's reply to RFI No.12 of 12 April 2017, question 9; Non-confidential version of Cisco's response to RFI No.13 of 12 April 2017, question 6; Non-confidential version of Cavium's reply to RFI No.14 of 12 April 2017, question 9.

¹³⁸ See Notifying Party's reply to RFI No.12 of 12 April 2017, questions 7 and 8; Non-confidential version of Cisco's response to RFI No.13 of 12 April 2017, question 4; Non-confidential version of Cavium's reply to RFI No.14 of 12 April 2017, question 8.

¹³⁹ This value depends on an uncertain future demand for the second component by the end customer and on the uncertain future standalone (list) price for that component relative to the prices of rival components. The uncertainty regarding future demand and prices of rival components would imply higher transaction costs for mixed bundling deals for both the seller and the end customer and thus reduce its appeal.

customers' needs. In this respect, the Commission notes that OEMs act as intermediaries between the FC SAN switch and FC HBA manufacturers and the end customers and for a significant share of sales, the manufacturers do not know the identity of the end customers. A bundle of the FC SAN switch and the FC HBA would be attractive to the Merged Entity's customers, as allowing them to lower their procurement costs.¹⁴⁰ At the same time, the OEMs would have an incentive to engage in such unbundling as they sell products – and profit from those sales – of all the manufacturers. The OEMs will also likely have the incentive to continue to dual source FC HBAs and FC SAN switches in the foreseeable future. This is because, to the extent end customers prefer to combine products from different manufacturers, it will remain optimal for the OEMs to offer such combinations. In turn, due to the OEMs' unbundling strategy, the manufacturer's rationale to engage in mixed bundling would diminish – mixed bundling would no longer function as effectively as a price-differentiation device. In this scenario, OEMs would effectively undertake a price arbitrage and therefore cancel some positive effects of the mixed bundling strategy on profits of the Merged Entity and with that the incentive to engage in such strategy.¹⁴¹

- (226) Finally, the market investigation's results were not conclusive in relation to the availability of effective counterstrategies to competitors. Some market participants mention the possibility for Cisco and Cavium to team up.¹⁴² However, while Cisco and Cavium could in principle attempt to replicate the Merged Entity's mixed bundling practice, as they are in fact distinct entities, they could face some difficulties in matching the bundled price of the Merged Entity, such as having to agree on complex revenue sharing schemes. Some market participants consider that Cisco and Cavium may decide independently from one another to price their products more aggressively.¹⁴³ It was also indicated that Cisco could offer a combined bundle to compete with the Merged Entity.¹⁴⁴ In this respect, Cisco indicated that already today it acquires and resells FC HBAs from third parties. As such, Cisco does not have pricing power in the sale of the FC HBAs but could offer price reductions on a bundle of FC SAN switch and FC HBA to the detriment of its margin on the FC SAN switch.¹⁴⁵
- (227) In light of the above, it can be concluded that, by engaging into bundling strategies, the Merged Entity will likely not have the ability and the incentive to foreclose competing suppliers of FC HBAs, as FC SAN switches and FC HBAs follow different selling cycles and OEMs would likely defeat the Merged Entity's bundling practice.

¹⁴⁰ See Non-confidential version of Cisco's response to RFI No.7 of March 17 2017, question 13; Non-confidential version of Cisco's response to RFI No.13 of 12 April 2017, question 3.

¹⁴¹ An assumption is that the Merged Entity does not know the identity of the end customer and, therefore, cannot directly address the demand of the end customer. The market investigation showed that the large orders that go through OEMs and for which the manufacturer knows the final customer typically represent a small number of deals. See Notifying Party's reply to RFI No.12 of 12 April 2017, questions 7 and 8; Non-confidential version of Cisco's response to RFI No.13 of 12 April 2017, question 4; Non-confidential version of Cavium's reply to RFI No.14 of 12 April 2017, question 8. Accordingly, the arbitrage argument only concerns a certain share of end customers.

¹⁴² See responses to question 37 of Q1 – FC SAN Products.

¹⁴³ See responses to question 37 of Q1 – FC SAN Products.

¹⁴⁴ See responses to question 37 of Q1 – FC SAN Products.

¹⁴⁵ See for example Non-confidential version of Cisco's response to RFI No.7 of March 17 2017, question 13c and 15b.

4.3.6.2. Overall likely impact on effective competition

(a) The Notifying Party's views

(228) The Notifying Party argues that the foreclosure strategy would not be able to significantly impact competition on either the FC SAN switch market or on the FC HBA market. Following the Transaction, Cisco and Cavium will remain significant competitors in FC SAN switches and FC HBAs respectively, and Cavium as the market leader in FC HBAs.

(b) The Commission's assessment

(229) For the sake of completeness, the Commission also considers the potential impacts on effective competition of a mixed bundling strategy. Discounts on bundled offers, at least in the short run, often benefit certain groups of consumers and can improve overall consumer welfare. In circumstances, however, in which they lead to a foreclosure of an independent rival, they can be harmful as they may ultimately allow the Merged Entity to increase its prices.

(230) In the present case, the Commission considers that the risk of an anticompetitive foreclosure by means of mixed bundling is low. First, the Merged Entity will likely not have the ability to foreclose competing FC HBAs by engaging in mixed bundling for a significant share of its potential customers¹⁴⁶ due to the asynchronous purchasing patterns for FC HBAs and FC SAN switches. Second, the Merged Entity will also likely not have the ability to engage in such strategies because the OEMs may be able to effectively unbundle the offer, at least for the end customers whose identity would be unknown to the Merged Entity. In this way, the OEMs would perform a price arbitrage, abating the effectiveness of such a strategy.

(231) As the Merged Entity will likely not have the ability and the incentive to foreclose competitors by engaging into mixed bundling, the Commission considers that it is not necessary to analyse in detail whether a mixed bundling strategy of the Merged Entity would likely have or not a significant detrimental effect on competition in the FC HBA market. In addition, and in any event, no substantiated concerns were put forward by market participants that such mixed bundling practices would have a significant negative impact on their business and on the market for FC HBAs in general.

4.3.7. Conclusion on conglomerate effects

(232) In light of the above, the Commission considers that the Transaction only raises serious doubts as to its compatibility with the internal market as regards the worldwide market for FC HBAs in relation to a possible degradation of interoperability between the Merged Entity's FC SAN switches and competing FC HBAs and to a possible leakage and misuse by the Merged Entity of confidential information of competing FC HBA suppliers.

¹⁴⁶ Approximately 90% of the FC SAN market consists of replacement and upgrade sales.

5. COMMITMENTS

- (233) In order to remove the serious doubts in relation to the compatibility of the Transaction with the internal market relating to (i) the possible degradation of interoperability between the Merged Entity's FC SAN switches and competing FC HBAs and the possible leakage and misuse by the Merged Entity of confidential information of competing FC HBA suppliers (as described above in Sections 4.3.4 and 4.3.5); and (ii) the potential leakage of confidential information regarding ASICs for FC SAN switches (as described above in Section 4.2.2.2), on 19 April 2017 the Notifying Party submitted commitments pursuant to Article 6(2) of the Merger Regulation (the "Initial Commitments").
- (234) The Commission launched a market test of the Initial Commitments on 20 April 2017, seeking responses from FC HBA competitors, FC SAN switch competitors and other market participants such as ASIC vendors and OEMs. The Commission informed the Notifying Party of the results of the market test on 27 April 2017. Following the feedback received from market participants in the market test, the Notifying Party submitted a revised set of commitments on 3 May 2017 (the "Final Commitments").

5.1. Description of the Initial Commitments

- (235) The Initial Commitments comprised two sets of commitments. The first set of commitments were intended to address the Commission's concerns regarding the interoperability between the Merged Entity's FC SAN switches and FC HBAs of competing FC HBA suppliers (the "HBA Commitments"). The second set of Commitments were intended to assuage the Commission's concerns regarding the potential leakage of confidential Cisco information in the context of the supply by Broadcom of FC ASICs for Cisco's FC SAN switches (the "Cisco Commitments").
- (236) The Initial Commitments were applicable globally and in effect for ten years from the adoption of the Commission's decision under Article 6(1)(b) and Article 6(2) of the Merger Regulation.
- (237) The Initial Commitments provided for a monitoring trustee and for a fast-track dispute resolution procedure (the "Arbitration Mechanism").
- (238) The two sets of commitments constituting the Initial Commitments are described in detail below.

5.1.1. HBA Commitments

- (239) The HBA Commitments comprised two elements: an interoperability commitment and a commitment to protect confidential information of FC HBA suppliers.
- (240) In relation to interoperability, first, the Notifying Party committed to ensure, post-Transaction the same level of interoperability between competing FC HBAs and its FC SAN switches as it exists at any point in time between Brocade's FC SAN switches and Broadcom's FC HBAs.¹⁴⁷ This obligation was subject to an

¹⁴⁷ The commitment text refers to Emulex Connectivity Division ("ECD") which is Broadcom's FC HBA business.

exception, namely the existence of technical limitations in FC HBA suppliers' FC HBAs that do not allow to achieve the same level of interoperability. The Notifying Party also committed to provide in a timely fashion the same level of qualification support to competing FC HBA providers that Brocade provides to Broadcom for Broadcom's FC HBAs. Qualification referred to the product early simulation, qualification, testing, debugging at OEMs and customers and post-release support activities undertaken by the Merged Entity and an FC HBA supplier with a view to testing and ensuring that the latter's FC HBAs interoperate with the Merged Entity's FC SAN switches at any stage of the FC HBA product cycle.

- (241) These obligations were applicable in favour of any company that designs and markets FC HBAs in competition with the Merged Entity's FC HBAs. Moreover, they applied to any FC HBA products, including any current or future generations of FC HBAs.
- (242) In addition, the Notifying Party committed to a non-discrimination clause consisting of an obligation to refrain from (i) designing or engineering its FC SAN switches in such manner and (ii) implementing any technical changes to its FC SAN switches, and the way in which those switches interoperate with its FC HBAs, which would discriminate against competing FC HBA suppliers for the purpose of favouring its own FC HBAs, or would negatively affect the FC HBAs of competing suppliers. This non-discrimination commitment would not be breached in the event that any impact on competing supplier's FC HBAs would be a necessary by-product of engineering or design changes that provide an actual benefit or improvement to the Merged Entity's FC SAN switches.
- (243) Second, as regards the protection of FC HBA confidential information, the Notifying Party committed to ensure the protection of confidential information obtained from competing FC HBA providers during the qualification process. In particular, the Notifying Party committed to ensure that: (i) confidential information received from other FC HBA suppliers during qualification would be held in strict confidence; (ii) confidential information received from FC HBA suppliers during qualification would not be disclosed to unauthorized staff, in particular to any employees in the Merged Entity's division responsible for its FC HBA activities; and (iii) the Merged Entity would not use such FC HBA confidential information to favour its own FC HBA business. The Notifying Party committed to put in place necessary firewall measures in order to meet these commitments, which are spelled out in the commitment text.

5.1.2. Cisco Commitments

- (244) The Cisco Commitments related to the protection of confidential information provided to Broadcom in the context of its FC SAN ASICs supply agreement with Cisco.
- (245) In particular, the Notifying Party committed to comply with the New Confidentiality Agreement entered into between Cisco and Broadcom on [...], described above in paragraph (110), with regard to any current supply agreements as well as any potential future agreements between the two companies regarding FC ASICs. The Notifying Party committed to a number of measures intended to maintain complete separation of the development teams for ASICs for FC SAN switches for the Merged Entity and for Cisco.

- (246) In addition, the Notifying Party committed [...] to ensure that no information regarding Cisco's pricing be disclosed to employees active in the Merged Entity's FC SAN switch business.
- (247) The Notifying Party also committed to a number of measures to avoid discriminating against Cisco in favour of its own downstream FC SAN switch activities. First, it committed to make shared IP used in ASICs for FC SAN switches available to the teams developing the Cisco and the Merged Entity's FC ASICs on the same terms. Second, the Notifying Party committed to prioritise the development of Cisco's FC ASICs at least as high as FC ASICs for the Merged Entity's use. Third, it committed not to apply lead time extensions to Cisco FC ASICs unless the same lead time extensions were simultaneously applied to FC ASICs for use in the Merged Entity's own FC SAN switches or other FC SAN switching products. Fourth, the Notifying Party committed that any capacity constraints regarding the fabrication of FC wafers for ASICs would be borne equally between the Merged Entity and Cisco.

5.2. Results of the market test of the Initial Commitments

- (248) During the market test, the Commission sought the input of the Parties' competitors in FC HBAs and in FC SAN switches, as well as of other market participants such as ASIC vendors and OEM customers.
- (249) Responses to the market test highlighted certain shortcomings to the Initial Commitments, mainly in relation to the HBA Commitments.
- (250) First, respondents criticised the limitation, introduced to the commitment ensuring the same level of interoperability between competing FC HBAs and the Merged Entity's FC SAN switches, under which no degradation of the level of interoperability arises if the degradation is the necessary by-product of changes that provide an actual benefit or improvement to the Merged Entity's FC SAN switches.¹⁴⁸
- (251) Second, market participants perceived as problematic certain aspects of the technical limitations in competing suppliers' FC HBAs preventing the achievement of same level of interoperability: (i) the existence of such technical limitations would need to be demonstrated by the Merged Entity; and (ii) such technical limitations should exclude limitations resulting from changes introduced to the Merged Entity's FC SAN switches which have the *purpose* of negatively affecting the competing suppliers' FC HBAs.¹⁴⁹
- (252) Third, also in relation to the interoperability and the qualification process market participants suggested to more clearly define the timing of exchange of all necessary information during the qualification process to ensure the same level of interoperability so that no discrimination between competing HBA providers and

¹⁴⁸ See replies to question 7 of questionnaires Q3 – Proposed remedies of 20 April 2017 and Q4 – Proposed remedies (HBA) of 20 April 2017.

¹⁴⁹ See replies to question 1 of questionnaires Q3 – Proposed remedies of 20 April 2017 and Q4 – Proposed remedies (HBA) of 20 April 2017.

the Merged Entity's own FC HBAs takes place to favour the Merged Entity's own FC HBAs.¹⁵⁰

- (253) In addition, there were suggestions to define more precisely the notion of interoperability in order to make it clear that it refers to the possibility for FC HBAs and FC SAN switches to interact by *successfully* and *reliably* exchanging information.¹⁵¹
- (254) In the context of qualification market participants also flagged that the Merged Entity should provide also the same level of feedback and technical guidance to competing FC HBA suppliers that it provides to its own FC HBA business.¹⁵²
- (255) Finally, the results of the market test indicated that the notion of HBA Suppliers should explicitly cover not only existing FC HBA providers currently in competition with the Parties but also new entrants in the FC HBA space.
- (256) As regards the arbitration mechanism market respondents consider that this mechanism is appropriate to ensure the resolution of potential disputes. The only improvement suggested in the market test was to clarify that the arbitration mechanism does not prevent the requesting party from instituting also legal action against Broadcom.¹⁵³
- (257) Respondents to the market test also agree that the appointment of a Monitoring Trustee is necessary to ensure the effective implementation and enforcement of both the HBA and the Cisco commitments.¹⁵⁴
- (258) In light of the above, and in particular of the shortcomings of the HBA Commitments evidenced by the market test, the Commission considers that the Initial Commitments were insufficient to remove the serious doubts as to the Transaction's compatibility with the internal market.

5.3. Description of the Final Commitments

- (259) Following the communication to the Notifying Party of the results of the market test and the Commission's own assessment of the Initial Commitments, on 3 May 2017 the Notifying Party submitted revised commitments (the "Final Commitments"), aimed at improving the Initial Commitments.
- (260) The geographic and temporal scope of the Final Commitments is the same as that of the Initial Commitments (see paragraph (236) above).
- (261) In particular, the Final Commitments include the following modifications:

¹⁵⁰ See replies to question 7 of questionnaires Q3 – Proposed remedies of 20 April 2017 and Q4 – Proposed remedies (HBA) of 20 April 2017.

¹⁵¹ See replies to question 7.3 of questionnaires Q3 – Proposed remedies of 20 April 2017 and Q4 – Proposed remedies (HBA) of 20 April 2017.

¹⁵² See replies to question 1.1 of questionnaire Q3 – Proposed remedies of 20 April 2017.

¹⁵³ See replies to question 17 of questionnaires Q3 – Proposed remedies of 20 April 2017 and Q4 – Proposed remedies (HBA) of 20 April 2017.

¹⁵⁴ See replies to question 15 of questionnaires Q3 – Proposed remedies of 20 April 2017 and Q4 – Proposed remedies (HBA) of 20 April 2017.

- a) The limitation to ensuring the same level of interoperability, as described in paragraph (250) above was removed;
- b) When technical limitations in competing suppliers' FC HBAs preventing the achievement of the same level of interoperability between the Merged Entity's FC SAN switches and FC HBAs of competing suppliers exist, their existence will have to be demonstrated by the Merged Entity;
- c) Such technical limitations in the competing suppliers' FC HBAs shall not include limitations resulting from changes introduced in the FC SAN switches (or associated software and firmware) of the Merged Entity which have the purpose of negatively affecting competing suppliers' FC HBAs;
- d) The Merged Entity will provide qualification support to all FC HBA suppliers (including its own FC HBA business) timely and substantially in the same manner so that no discrimination in terms of timing takes place between the Merged Entity's own FC HBA business and FC HBA suppliers;
- e) The Merged Entity will also provide all FC HBA suppliers in a timely fashion and without undue delay with the same level of feedback and technical guidance during the qualification process that it provides to its own FC HBA business;
- f) The definitions of (i) Interoperability; (ii) Qualification and (iii) FC HBA suppliers (to cover also new FC HBA entrants) were clarified as per the suggestions of respondents to the market test;
- g) It was clarified that the Arbitration Mechanism does not impair on the rights of the Requesting Party to institute any legal action against Broadcom or maintaining any such action if previously instituted;
- h) [...].

5.4. Commission's assessment of the Final Commitments

5.4.1. Principles

- (262) Where a concentration raises serious doubts as to its compatibility with the internal market, the parties may undertake to modify the concentration so as to remove the grounds for the serious doubts identified by the Commission and thereby gain clearance of their merger in Phase I.¹⁵⁵
- (263) It is for the parties to the concentration to put forward commitments.¹⁵⁶ The Commission only has power to accept commitments that are deemed capable of rendering the concentration compatible with the internal market.¹⁵⁷ In Phase I, commitments can only be accepted where the competition problem is readily identifiable and can easily be remedied. The competition problem therefore needs

¹⁵⁵ Commission notice on remedies acceptable under Council Regulation (EC) No 139/2004 and under Commission Regulation (EC) No 802/2004 (the "Remedies Notice"), OJ 2008/C 267/01, paragraph 5.

¹⁵⁶ Remedies Notice, paragraph 6.

¹⁵⁷ Remedies Notice, paragraph 9.

to be so straightforward and the remedies so clear-cut that it is not necessary to enter into an in-depth investigation and that the commitments are sufficient to clearly rule out serious doubts within the meaning of Article 6(1)(c) of the Merger Regulation. Where the assessment confirms that the proposed commitments remove the grounds for serious doubts on this basis, the Commission clears the merger in Phase I.¹⁵⁸

- (264) As concerns the form of acceptable commitments, the Merger Regulation leaves discretion to the Commission as long as the commitments meet the requisite standard.
- (265) In the ultimate assessment of proposed commitments, the Commission considers all relevant factors including *inter alia* the type, scale and scope of the proposed commitments, judged by reference to the structure and particular characteristics of the market concerned, including the position of the parties and other participants on the market.¹⁵⁹ The commitments must be capable of being implemented effectively within a short period of time.¹⁶⁰
- (266) It is against this background that the Commission analysed the Final Commitments in this case.

5.4.2. *Assessment of the Final Commitments*

- (267) The Commission considers that the Final Commitments address the shortcomings of the Initial Commitments identified in the context of the market test and that, overall, they are sufficient to remove the serious doubts regarding the compatibility of the Transaction with the internal market.

5.4.2.1. HBA Commitments

- (268) The HBA Commitments aim, as general purpose, to: (i) ensure a level playing field between the Merged Entity's FC HBAs and competing FC HBAs as regards their ability to interoperate with FC SAN switches of the Merged Entity at any stage of the FC HBA product cycle (from development to post-product release), as regards the extent and the timeliness of the qualification support provided by the Merged Entity and as regards other factors that could affect the competitiveness of FC HBAs (such as product reliability, performance, feature richness, timing of market release, etc.); and (ii) prevent the Merged Entity's staff dealing with FC HBAs from having access to confidential information of competing FC HBA suppliers and prevent the Merged Entity from using any such confidential information in any way to favour its own FC HBAs business.
- (269) The HBA Commitments apply to any generation of FC HBAs (whether existing or future) and, following the input from the market test, to the benefit of all FC HBA suppliers (be it suppliers already active in the FC HBA market or potential new entrants).

¹⁵⁸ Remedies Notice, paragraph 81.

¹⁵⁹ Remedies Notice, paragraph 12.

¹⁶⁰ Remedies Notice, paragraph 9.

- (270) The Final Commitments ensure that FC HBAs of competing FC HBA suppliers will be afforded the same level of interoperability with the FC SAN switches of the Merged Entity as that afforded to the Merged Entity's own FC HBAs at any point in time. This obligation is subject to a limited exception (of which the burden of proof now lies on the Merged Entity) in the event of technical limitations affecting competing FC HBAs that do not allow for the same level of interoperability (not taking into account, however, technical limitations resulting from changes that have the purpose of negatively affecting competing FC HBAs).
- (271) Furthermore, the Final Commitments ensure that competing FC HBA suppliers will receive the same level of qualification support that the Merged Entity will provide to its own FC HBA division at any point in time, including in terms of information, documentation, technical items of any kind, teams and procedures necessary for interoperability purposes, as well as – following the input from the market test – feedback and technical guidance. Such qualification support shall be provided timely and substantially in the same manner to the Merged Entity and to any FC HBA suppliers. As a result, the Merged Entity will be prevented from slowing down or obstructing the qualification process of upcoming and future generations of competing FC HBAs. Also, the Merged Entity will be precluded from denying or delaying the technical support needed to rectify bugs at the premises of end customers that use competing FC HBAs.
- (272) Moreover, the Final Commitments prevent the Merged Entity from designing its FC SAN switches or implementing changes in the way in which those interact with the Merged Entity's FC HBAs (including through the addition, change or removal of functionalities) with the purpose of favouring its own FC HBAs or negatively affecting competing FC HBAs. Following the results of the market test, this obligation is no longer subject to the exception under which no interoperability degradation would be deemed to arise if it is the necessary by-product of changes that provide an improvement to the Merged Entity's FC SAN switches.
- (273) In addition, the Final Commitments ensure the protection of confidential information that competing FC HBA providers share with the Merged Entity in the context of the qualification process for FC HBAs. In particular, the commitments prevent the Merged Entity from sharing such information with the employees of the division responsible for its FC HBA activities and from using it to favour its own FC HBA business.
- (274) Finally, the implementation and monitoring of the Final Commitments will be ensured by a monitoring trustee.
- (275) In light of the above, the Commission considers that the HBA Commitments address the serious doubts as to the compatibility of the Transaction with the internal market in relation to a possible degradation of interoperability between the Merged Entity's FC SAN switches and competing FC HBAs, and of a possible leakage and misuse of confidential information of competing FC HBA suppliers.

5.4.2.2. Cisco Commitments

- (276) The Cisco Commitments aim, as general purpose, to prevent the disclosure to any unauthorized staff of the Merged Entity of Cisco confidential information, as well as any use of any such Cisco confidential information by the Merged Entity to favour its own FC SAN switches.

- (277) In relation to the protection of information that is confidential to Cisco the Final Commitments indeed ensure that any commercially sensitive information, relating to both the technical and commercial aspects of Cisco's FC SAN switches and the FC SAN switch ASICs sourced by Broadcom, that Cisco shares with Broadcom as part of the design, development and manufacturing process for FC ASIC is kept confidential and is not shared with any unauthorised staff within the Merged Entity (that is to say any staff of the Merged Entity that is not responsible for the development and production of Cisco's FC ASICs).
- (278) As to the scope of the confidential to Cisco information the Final Commitments explicitly cover also confidential information on the pricing of Cisco's FC ASICs as well as some additional safeguards in relation to the non-discrimination of the Cisco's FC ASICs (described in paragraph (247) above) as Cisco would not be able to monitor and detect any potential discrimination in this regard. [...].
- (279) The Final Commitments further ensure the existence of strong deterrence on the Merged Entity that post-Transaction no Cisco competitively sensitive information would be used to the detriment of Cisco and to favour the FC ASIC or FC SAN switches of the Merged Entity. The implementation and monitoring of the Final Commitments will be ensured by a monitoring trustee. The monitoring trustee will have extensive powers to verify that the firewalls and relevant measures to protect Cisco's confidential information are implemented, including having full access to the Parties' documents, personnel and facilities.
- (280) In light of the above, the Commission considers that the Cisco Commitments address the serious doubts as to the compatibility of the Transaction with the internal market in relation to the disclosure of Cisco confidential information and the use of such information by the Merged Entity to favour its own FC SAN switches.

5.4.3. *Conclusion*

- (281) Based on the preceding considerations and in light of the outcome of the market investigation and in view of the information made available to it, the Commission concludes that the Final Commitments remove the serious doubts identified as regards the compatibility of the Transaction with the internal market in relation to the markets for ASICs for FC SAN switches, FC SAN switches and FC HBAs.

5.5. Conditions and obligations

- (282) Under the first sentence of the second subparagraph of Article 6(2) of the Merger Regulation, the Commission may attach to its decision conditions and obligations intended to ensure that the undertakings concerned comply with the commitments they have entered into vis-à-vis the Commission with a view to rendering the concentration compatible with the internal market. The achievement of the measure that gives rise to the change of the market is a condition, whereas the implementing steps which are necessary to achieve this result are generally obligations on the parties. Where a condition is not fulfilled, the Commission's decision declaring the concentration compatible with the internal market no longer stands. Where the undertakings concerned commit a breach of an obligation, the Commission may revoke the clearance decision in accordance with Article 6(3)(b) of the Merger Regulation. The undertakings concerned may also be subject to fines

and periodic penalty payments under Articles 14(2) and 15(1) of the Merger Regulation.

- (283) In accordance with the basic distinction between conditions and obligations described above, all requirements set out in the commitments are considered to constitute obligations.
- (284) The full text of the Final Commitments is annexed to this decision as Annex 1 and forms an integral part thereof.

6. CONCLUSION

- (285) For the above reasons, the Commission has decided not to oppose the notified operation as modified by the commitments and to declare it compatible with the internal market and with the functioning of the EEA Agreement, subject to full compliance with the obligations in sections B and C of the Final Commitments annexed to the present decision. This decision is adopted in application of Article 6(1)(b) in conjunction with Article 6(2) of the Merger Regulation and Article 57 of the EEA Agreement.

For the Commission

(Signed)

Margrethe VESTAGER
Member of the Commission

CASE M.8314 – BROADCOM/BROCADE
COMMITMENTS TO THE EUROPEAN COMMISSION

- i. Pursuant to Article 6(2), of Council Regulation (EC) No 139/2004 (the "**Merger Regulation**"), Broadcom Limited (the "**Notifying Party**") hereby enters into the following Commitments (the "**Commitments**") vis-à-vis the European Commission (the "**Commission**") with a view to rendering its proposed acquisition of sole control of Brocade Communication Systems, Inc. (the "**Concentration**") compatible with the internal market and the functioning of the EEA Agreement.
- ii. This text shall be interpreted in the light of the Commission's decision pursuant to Article 6(1)(b) of the Merger Regulation to declare the Concentration compatible with the internal market and the functioning of the EEA Agreement (the "**Decision**"), in the general framework of European Union law, in particular in the light of the Merger Regulation and by reference to the Commission Notice on remedies acceptable under the Council Regulation (EC) No 139/2004 and under Commission Regulation (EC) No 802/2004.

SECTION A - DEFINITIONS

1. For the purpose of the Commitments, the following terms shall have the following meaning:

Affiliated Undertakings: undertakings controlled by the Parties and/or by the ultimate parents of the Parties, whereby the notion of control shall be interpreted pursuant to Article 3 of the Merger Regulation and in light of the Commission Consolidated Jurisdictional Notice under Council Regulation (EC) No 139/2004 on the control of concentrations between undertakings (the "**Consolidated Jurisdictional Notice**").

APD means Broadcom's ASIC Product Division in charge of the design and development of ASICs including ASICs for Cisco FC SAN Switches.

ASICs means Application-Specific Integrated Circuits.

Broadcom means Broadcom Limited and affiliated companies or businesses.

Brocade means Brocade Communications Systems, Inc. and affiliated companies or businesses.

Cavium refers to Cavium, Inc., a Delaware (USA) corporation with registered address at 2315 North First Street, San Jose, CA 95131, USA.

Cisco refers to Cisco Systems, Inc., a California (USA) corporation with registered address at 170 West Tasman Dr., San Jose, CA 95134, USA.

Cisco Confidentiality Agreements refers to the following agreements in place between Broadcom and/or its Affiliated Undertakings and Cisco: [...].

Cisco Confidential Information means the following information disclosed by Cisco to APD: [...].

Combined Entity means the combined Broadcom and Brocade businesses together with their successors, assigns and affiliates including as a result of the Concentration, following the consummation of the Concentration.

Cycle means the procedure, currently conducted twice a year by Brocade, whereby Brocade tests storage vendor products for their compatibility with Brocade's current and last generation products and issues software fixes to HBA Suppliers and others.

ECD refers to the Emulex Connectivity Division, the HBA business of Broadcom.

Effective Date means the date of the adoption of the Decision.

FC ASIC refers to ASICs for use in FC SAN Switches.

FC ASIC Confidentiality Agreement refers to the Fibre Channel Confidentiality Agreement entered into between Cisco and [Broadcom] [...].

FC SAN Switch refers to devices that route data from servers to storage devices and between storage devices in a Fibre Channel ("FC") Storage Area Network ("SAN"). FC SAN Switch shall cover any current or future generation of FC SAN Switch.

HBA refers to Fibre Channel Host Bus Adapters, i.e. boards with firmware used mostly in servers to interconnect the server's processor with storage hard drives or solid-state drives through a FC SAN Switch. HBA shall cover any current or future generation of HBAs.

HBA Confidential Information means any and all technical and nontechnical information provided by the HBA Supplier to the Combined Entity for purposes of interoperability testing, feature development, and specification and roadmap alignment between the HBA Supplier's HBA products and the Combined Entity's FC SAN Switch products, including but not limited to the HBA Supplier's (a) patent and patent applications, (b) trade secrets, and (c) proprietary information, including ideas, samples, media, techniques, sketches, drawings, works of authorship, models, inventions, know-how, processes, apparatuses, equipment, algorithms, software programs, software source documents, network traces and diagnostic traces related to the current, future and proposed products and services of the HBA Supplier, and including, without limitation, the HBA Supplier's information concerning research, experimental work, development, design details and specifications, engineering, financial information, procurement requirements, purchasing, manufacturing, customer lists, investors, employees, business and contractual relationships, business forecasts, sales and merchandising, marketing plans and information the HBA Supplier provides regarding third parties.

HBA Supplier refers to a company designing and marketing HBAs.

HBA Nondisclosure Agreement refers to the Mutual Nondisclosure Agreement by and between Cavium and Brocade [...].

Interoperability in the specific context of these Commitments refers to the possibility for HBAs and FC SAN Switches to interact by successfully and reliably exchanging information and mutually using the information that has been successfully and reliably exchanged, providing a useful and fully-functional combined system.

Parties refers to Broadcom, Brocade and Affiliated Undertakings.

Qualification refers to the product simulation, engineering testing and verification, debugging at OEMs and customers and post-release support activities undertaken by Brocade (and following consummation of the Concentration, the Combined Entity) and an HBA Supplier with a view to testing and ensuring that the latter's HBAs interoperate with

Brocade's/the Combined Entity's FC SAN Switches at any stage of the HBA product cycle.

Qualification Team means the team, which at the Effective Date is based at Brocade's facility in Broomfield, Colorado, that is responsible for interoperability testing and in particular for ensuring that HBAs map to the storage arrays of vendors such as EMC, Fujitsu, Hitachi, HPE, Huawei, IBM, Inspur, and NetApp.

Unauthorized Staff means any employee of the Combined Entity, other than employees and contractors who have a bona fide need to have access to and knowledge of (i) the Cisco Confidential Information solely for the purposes of working on a Cisco FC ASIC project or (ii) the HBA Confidential Information solely for the purpose of Qualification.

SECTION B – THE HBA COMMITMENTS

B.1. HBA Interoperability and Non-Discrimination Commitment

2. The Combined Entity shall ensure the same level of Interoperability between HBA Suppliers' HBAs with the Combined Entity's FC SAN Switches as it exists at any point in time between ECD's HBAs and the Combined Entity's FC SAN Switches, unless the Combined Entity demonstrates that there are technical limitations in HBA Suppliers' HBAs that do not allow to achieve the same level of Interoperability. Such technical limitations in HBA Suppliers' HBAs shall not include the limitations resulting from changes in the Combined Entity's FC SAN switches or associated software and firmware which have the purpose of negatively affecting HBA Suppliers' HBAs.
3. The Combined Entity shall provide HBA Suppliers with at least the same level of Qualification support that Brocade provides at any point in time to ECD for its HBAs including, without limitation:
 - a. providing all HBA Suppliers with facilitation of early stage simulation exchange of frame/functions with Brocade, and the test commands, logs, traces and other data, information, documentation or equipment necessary to allow such HBAs to qualify to interoperate with the Combined Entity's FC SAN Switches.
 - b. Providing all HBA Suppliers with access to Brocade's Qualification Team and access to Cycles, as part of Brocade's qualification cycle.
 - c. Providing all HBA Suppliers in a timely fashion and without undue delay, with the same level of feedback and of technical guidance during the testing process that Brocade provides to ECD.
4. Such Qualification support shall be provided:
 - a. to all HBA Suppliers (including ECD) timely and substantially in the same manner (notably in the sense that there shall be no difference in lead time between the Qualification support provided to any HBA Suppliers).
 - b. To any new vendor in HBAs (with a viable product), if the vendor notifies Brocade of its product 16 weeks prior to Brocade's expected release date of its next product cycle, and delivers (at the cost of the vendor) the product to Brocade 12 weeks prior to Brocade's expected release date of its next product cycle. This will allow Brocade to plan appropriate cycles in its Qualification cycle to test and work with the new vendor.
5. The Combined Entity shall refrain from (i) designing or engineering its FC SAN switches in such manner or (ii) implementing any changes to the Combined Entity's FC SAN Switches (including, but not limited to, additions, changes, or removals of functionalities in the hardware, or the associated software, firmware or interfaces) or to the way in which those switches interoperate with the Combined Entity's HBAs that would discriminate against the HBA Suppliers' HBAs for the purpose of favouring the Combined Entity's own HBA or of

negatively affecting HBA Suppliers' HBAs (including, but not limited to, in terms of degree of product reliability, timing of Qualification or market release, performance (speed) and feature richness).

B.2. Protection of HBA Confidential Information

6. The Combined Entity shall ensure:
 - a. that the HBA Confidential Information received from HBA Suppliers during Qualification is held in strict confidence;
 - b. that HBA Confidential Information received from HBA Suppliers during Qualification is not disclosed to Unauthorized Staff and in particular to any employees of ECD;
 - c. that the Combined Entity does not use such HBA Confidential Information to favour its own HBA Business.
7. The Combined Entity commits to put in place necessary firewall measures to meet its Commitments under paragraph 6 and to prevent the Combined Entity from using any HBA Confidential Information to favour or develop its own HBAs.
8. The firewall measures that the Combined Entity shall adopt shall include the following:
 - a. Maintaining the activities relating to the design and development of the Combined Entity's own HBAs in separate physical locations from the Combined Entity's activities relating to Qualification;
 - b. Not allowing any movement of employees between ECD and Brocade without giving prior notice to the HBA Suppliers and subject to a minimum of 12-month waiting period after the employee stops working for the former team;
 - c. Ensuring that any Combined Entity's team working on Qualification uses storage and access hardware systems separate from, and inaccessible to, the ECD team working on the Combined Entity's HBAs;
 - d. Ensuring that data related to the Combined Entity's HBAs is separated through a logical separation of networks from HBA Confidential Information;
 - e. Preventing any storage of HBA Confidential Information outside the firewall created for the Combined Entity's personnel working on Qualification without the third party HBA Supplier's prior written consent;
 - f. Ensuring the organizational separation up to the Vice President and General Manager of the personnel involved in Qualification from any Combined Entity's personnel responsible for developing the Combined Entity's own HBAs.

SECTION C – THE CISCO COMMITMENTS

C.1 Protection of Cisco Confidential Information

9. The Combined Entity shall ensure that no Cisco Confidential Information is disclosed to Unauthorized Staff and in particular to staff outside the Combined Entity's APD (including to the Combined Entity's FC SAN Switches business) and/or that no such information is used by the Combined Entity to favour its own FC SAN Switches.
10. With respect to any FC ASIC program Cisco has awarded to the Combined Entity, the Combined Entity shall continue to comply with all of its obligations under the FC ASIC Confidentiality Agreement and all such other applicable agreements between the Combined Entity and Cisco with respect to the FC ASICs that Cisco has awarded to the Combined Entity.
11. With respect to any awards to the Combined Entity in the future, the Combined Entity undertakes not to disclose any Cisco Confidential Information to Unauthorized Staff and in

particular to staff outside the Combined Entity's APD (including the Combined Entity's FC SAN Switches business).

12. The Combined Entity's business unit responsible for front-end development (Chip Architecture, RTL) of the FC ASICs for the Combined Entity's own FC SAN Switches will not be involved in developing the FC ASICs for Cisco FC SAN Switches.
13. Developers working on FC ASICs for Cisco must be physically separate from any team working on FC ASICs for the Combined Entity's own FC SAN Switches. Physical separation shall mean at least that the R&D development teams are in different locations at least 5 miles apart. No movement of employees between teams shall be allowed absent prior written notice to Cisco, subject to a minimum of 12-month waiting period after the employee stops working for the former team.
14. The APD team working on FC ASICs for Cisco must use storage and access hardware systems separate from, and inaccessible to, any APD team working on FC ASICs for the Combined Entity's FC SAN Switches (including the Combined Entity's FC SAN Switches business). The Combined Entity shall implement a logical separation of networks so as to ensure separation of all such data related to FC ASICs for Cisco and data related to FC ASICs for the Combined Entity's FC SAN Switches (firewalls, passwords, etc.). No such data about FC ASICs developed for Cisco may be stored outside the firewall created for the APD team working on FC ASICs for use in Cisco FC SAN Switches without Cisco's prior written consent.
15. The FC ASIC development for any future Cisco FC ASIC program awarded to the Combined Entity shall be organizationally separate up to the VP, Engineering level from any Combined Entity's business responsible for developing FC ASICs for the Combined Entity's internal consumption (including the FC SAN Switch business), including separate VP, Engineering reporting to Senior Vice President and General Manager of APD. In addition, the Combined Entity will have separate sales and marketing teams.
16. Personnel responsible for marketing, sales, development, supply chain operations, customer service for the Combined Entity's FC SAN Switches, or responsible for making decisions regarding the pricing of the Combined Entity's FC SAN Switches (including list prices, suggested resale prices, or discounts given to specific customers) will not have access to Cisco FC ASIC pricing. In addition, the Combined Entity shall not disclose information about Cisco FC ASIC pricing to anyone except the APD personnel and the Combined Entity's personnel supporting APD who are focused on sales and support to Cisco.

C.2 Non-Discrimination of Cisco FC SAN Switches

17. The Combined Entity undertakes to make available the Shared IP ([...]) developed within the Combined Entity to the APD team developing the Cisco FC ASICs at same time as, and with the same quality of information and documentation provided to, the APD team developing FC ASICs for use in the Combined Entity's FC SAN Switches.
18. The Combined Entity undertakes to provide to the development of Cisco FC ASICs at least as high a priority relative to fabrication as it provides to the development of FC ASICs for the Combined Entity's FC SAN Switches.
19. The Combined Entity undertakes not to apply lead time extensions to Cisco FC ASICs unless the same lead time extensions are simultaneously applied to FC ASICs for use in the Combined Entity's own FC SAN Switches or other FC switching products.
20. The Combined Entity undertakes that any capacity constraint that limits the volume of wafers that can be fabricated in a particular time period to a number below the sum of orders for FC wafers for ASICs to be used in the Combined Entity's FC SAN Switches and FC wafers to be used in third-party (non-Cisco) FC SAN Switches, will be applied to reduce the number of wafers fabbed in equal proportions (with any deviation from equal proportions applied only to increase the quantity of Cisco FC ASICs).

SECTION D. MONITORING TRUSTEE

D.1. Appointment

21. Broadcom shall appoint a Monitoring Trustee to carry out the functions specified in paragraph 30 below in relation to the Commitments. The Notifying Party commits not to close the Concentration before the appointment of a Monitoring Trustee.
22. The Monitoring Trustee shall at the time of appointment, be independent of Broadcom and Brocade and their Affiliated Undertakings, possess the necessary experience, competence and qualifications to carry out its mandate, and shall neither have nor become exposed to a conflict of interest. In particular, the Monitoring Trustee shall have experience in the application of competition rules to the information and communications technology sector.
23. The Monitoring Trustee shall be remunerated by the Combined Entity in a way that does not impede the independent and effective fulfillment of the Monitoring Trustee's mandate.

Proposal by Broadcom

24. No later than two weeks after the Effective Date, Broadcom shall submit the name or names of one or more natural or legal persons whom Broadcom proposes to appoint as the Monitoring Trustee to the Commission for approval. The proposal shall contain sufficient information for the Commission to verify that the person or persons proposed as Monitoring Trustee possesses the requirements set out in paragraph 22 and shall include:
 - a. the full terms of the proposed mandate, which shall include all provisions necessary to enable the Monitoring Trustee to fulfill its duties under these Commitments;
 - b. the outline of a work plan, which shall describe how the Monitoring Trustee intends to carry out its duties under these Commitments.

Approval or rejection by the Commission

25. The Commission shall have the discretion to approve or reject the proposed Monitoring Trustee(s) and to approve the proposed mandate subject to any modifications it deems necessary for the Monitoring Trustee to fulfill its obligations. If only one name is approved, Broadcom shall appoint or cause to be appointed the individual or institution concerned as Monitoring Trustee, in accordance with the mandate approved by the Commission. If more than one name is approved, Broadcom shall be free to appoint the Monitoring Trustee from among the names approved. The Monitoring Trustee shall be appointed within one week of the Commission's approval, in accordance with the mandate approved by the Commission.

New proposal by Broadcom

26. If all the proposed Monitoring Trustees are rejected, Broadcom shall propose at least two more natural or legal persons within one week of being informed of the rejection, in accordance paragraphs 21 and 25 of these Commitments.

Monitoring Trustee nominated by the Commission

27. If all further proposed Monitoring Trustees are rejected by the Commission, the Commission shall nominate a Monitoring Trustee, whom Broadcom shall appoint, or cause to be appointed, in accordance with a trustee mandate approved by the Commission. In any event, this Monitoring Trustee shall also possess the technical qualifications set forth in paragraph 21.

D.2. Functions of the Monitoring Trustee

28. The Monitoring Trustee shall assume its specified duties in order to ensure compliance with the Commitments. The Commission may, on its own initiative or at the request of the Monitoring Trustee or the Combined Entity, give any orders or instructions to the Monitoring

Trustee in order to ensure compliance with the conditions and obligations attached to the Decision. The Combined Entity is not entitled to give instructions to the Monitoring Trustee.

29. The Monitoring Trustee will act on behalf of the Commission as a trusted expert in the fast track dispute settlement procedure described in Section D.
30. The Monitoring Trustee shall:
 - a. monitor the implementation of the HBA Commitments by the Combined Entity, as set out in provisions from 2 to 8 above;
 - b. monitor the implementation of the Cisco Commitments by the Combined Entity, as set out in provisions from 9 to 20;
 - c. broker a resolution of any dispute that would arise between the Combined Entity and an HBA Supplier or Cisco regarding compliance with the conditions and obligations set out in the Commitments;
 - d. advise and, if need be, make written recommendations to the Commission as to the Combined Entity's compliance with the conditions and obligations attached to the Decision when any dispute between an HBA Supplier or Cisco and the Combined Entity regarding such compliance would be brought before the Arbitral Tribunal referred to in paragraph 43 and subsequent below;
 - e. provide to the Commission, sending the Combined Entity a non-confidential copy at the same time, a report on 31 December of every year during the term of the Commitments as indicated in paragraph 68, regarding the status and outcome of any dispute between an HBA Supplier or Cisco and the Combined Entity in which the Monitoring Trustee has participated;
 - f. propose to the Combined Entity such measures as the Monitoring Trustee considers necessary to ensure the Combined Entity's compliance with the Commitments;
 - g. promptly report in writing to the Commission, sending the Combined Entity a non-confidential copy at the same time, if it concludes on reasonable grounds that the Combined Entity is failing to comply with the Commitments.
31. The Monitoring Trustee shall provide a detailed work plan to the Commission within one month of its appointment, sending a copy to the Combined Entity at the same time, describing how it intends to carry out its mandate.
32. The documents provided for in paragraphs 30 and 31 shall be prepared in English.

D.3. Duties and obligations of the Combined Entity in relation to the Monitoring Trustee

33. The Combined Entity shall provide and shall cause its advisors to provide the Monitoring Trustee with all such co-operation, assistance and information as the Monitoring Trustee may reasonably require to perform its tasks.
34. The Monitoring Trustee shall have full and complete access to any of the Combined Entity's books, records, documents, management or other personnel, facilities, sites and technical information reasonably necessary for fulfilling its duties under the Commitments. The Combined Entity shall make available to the Monitoring Trustee one or more offices on their premises and shall be available for meetings in order to provide the Monitoring Trustee with all information reasonably necessary for the performance of its tasks.
35. The Combined Entity shall indemnify the Monitoring Trustee and its employees and agents (each an "**Indemnified Party**") and hold each Indemnified Party harmless against, and hereby agrees that an Indemnified Party shall have no liability to the Combined Entity for any liabilities arising out of the performance of the Monitoring Trustee's duties under the Commitments, except to the extent that such liabilities result from the willful default,

recklessness, gross negligence or bad faith of the Monitoring Trustee, its employees, agents or advisors.

36. At the expense of the Combined Entity, the Monitoring Trustee may appoint advisors, subject to the Combined Entity's approval (this approval not to be unreasonably withheld or delayed) if the Monitoring Trustee reasonably considers the appointment of such advisors necessary or appropriate for the performance of its duties and obligations under the Mandate, provided that any fees and other expenses incurred by the Monitoring Trustee are reasonable. Should the Combined Entity refuse to approve the appointment of advisors or any individual advisor proposed by the Monitoring Trustee, the Commission may approve the appointment of such advisors instead, after having heard the Combined Entity. Only the Monitoring Trustee shall be entitled to issue instructions to the advisors.
37. The Combined Entity agrees that the Commission may share Confidential Information proprietary to the Combined Entity with the Monitoring Trustee. The Monitoring Trustee shall not disclose such information and the principles contained in Article 17 (1) and (2) of the Merger Regulation apply *mutatis mutandis*.
38. The Notifying Party agrees that the contact details of the Monitoring Trustee are published on the website of the Commission's Directorate-General for Competition and they shall inform interested third parties, in particular any potential purchasers, of the identity and the tasks of the Monitoring Trustee.
39. For a period of 10 years from the Effective Date the Commission may request all information from the Combined Entity that is reasonably necessary to monitor the effective implementation of these Commitments.

D.4. Replacement, discharge and re-appointment of the Monitoring Trustee

40. If the Monitoring Trustee ceases to perform its functions under the Commitments or for any other good cause, including its exposure to a conflict of interest:
 - a. the Commission may, after hearing the Monitoring Trustee and the Combined Entity, require the Combined Entity to replace the Monitoring Trustee; or
 - b. the Combined Entity, with the prior approval of the Commission, may replace the Monitoring Trustee.
41. If the Monitoring Trustee is removed according to paragraph 40, the Monitoring Trustee may be required to continue in its function until a new Monitoring Trustee is in place to whom the Monitoring Trustee has effected a full hand-over of all relevant information. The new Monitoring Trustee shall be appointed in accordance with the procedure referred to paragraphs 21 to 27.
42. Besides the removal according to paragraph 40, the Monitoring Trustee shall cease to act as Monitoring Trustee only after the Commission has discharged it from its duties after the Commitments with which the Monitoring Trustee has been entrusted have lapsed. However, the Commission may at any time require the reappointment of the Monitoring Trustee if it subsequently appears that the Commitments might not have been fully and properly implemented.

SECTION E. FAST TRACK DISPUTE RESOLUTION

43. In the event that an HBA Supplier or Cisco claims that the Combined Entity is failing to comply with its obligations arising from the Commitments set out in Section B (HBA Interoperability and Non-Discrimination and Protection of HBA Confidential Information) and

Section C (Protection of Cisco Confidential Information and Non-Discrimination of Cisco FC SAN switches), the fast track dispute resolution procedure as described herein shall apply.

44. The HBA Supplier or Cisco (the “**Requesting Party**”) shall send a written request to the Combined Entity (with a copy to the Trustee) setting out in detail the reasons why it believes that the Combined Entity is failing to comply with the Commitments. The Requesting Party and the Combined Entity shall use their best efforts to resolve all differences of opinion and to settle all disputes that may arise through co-operation and consultation within a reasonable period of time not to exceed fifteen 15 working days after receipt of the request.
45. The Trustee shall present its own proposal (the “**Trustee Proposal**”) for resolving the dispute within eight 8 working days, specifying in writing the action, if any, to be taken by the Combined Entity or an Affiliated Undertaking in order to ensure compliance with the Commitments vis-à-vis the Requesting Party, and be prepared, if requested, to facilitate the settlement of the dispute.
46. Should the Requesting Party and the Combined Entity (together the “**Parties to the Arbitration**”) fail to resolve their differences of opinion in the consultation phase, the Requesting Party shall serve a notice (the “**Notice**”), in the sense of a request for arbitration, to the International Chamber of Commerce (“**ICC**”, hereinafter the “**Arbitral Institution**”), with a copy of such Notice and request for arbitration to the Combined Entity.
47. The Notice shall set out in detail the dispute, difference or claim (the “**Dispute**”) and shall contain, inter alia, all issues of both fact and law, including any suggestions as to the procedure, and all documents relied upon shall be attached, e.g. documents, agreements, expert reports, and witness statements. The Notice shall also contain a detailed description of the action to be undertaken by the Combined Entity (including, if appropriate, a draft contract comprising all relevant terms and conditions) and the Trustee Proposal, including a comment as to its appropriateness.
48. The Combined Entity shall, within 10 working days from receipt of the Notice, submit its answer (the “**Answer**”), which shall provide detailed reasons for its conduct and set out, *inter alia*, all issues of both fact and law, including any suggestions as to the procedure, and all documents relied upon, e.g. documents, agreements, expert reports, and witness statements. The Answer shall, if appropriate, contain a detailed description of the action which the Combined Entity proposes to undertake vis-à-vis the Requesting Party (including, if appropriate, a draft contract comprising all relevant terms and conditions) and the Trustee Proposal (if not already submitted), including a comment as to its appropriateness.

Appointment of the Arbitrators

49. The Arbitral Tribunal shall consist of three persons. The Requesting Party shall nominate its arbitrator in the Notice; the Combined Entity shall nominate its arbitrator in the Answer. The arbitrator nominated by the Requesting Party and by the Combined Entity shall, within five working days of the nomination of the latter, nominate the chairman, making such nomination known to the parties and the Arbitral Institution which shall forthwith confirm the appointment of all three arbitrators.
50. Should the Requesting Party wish to have the Dispute decided by a sole arbitrator it shall indicate this in the Notice. In this case, the Requesting Party and the Combined Entity shall agree on the nomination of a sole arbitrator within five working days from the communication of the Answer, communicating this to the Arbitral Institution.
51. Should the Combined Entity fail to nominate an arbitrator, or if the two arbitrators fail to agree on the chairman, or should the Parties to the Arbitration fail to agree on a sole arbitrator, the default appointment(s) shall be made by the Arbitral Institution.

52. The three-person arbitral tribunal or, as the case may be, the sole arbitrator, are herein referred to as the “**Arbitral Tribunal**”.

Arbitration Procedure

53. The Dispute shall be finally resolved by arbitration under the ICC Rules of Arbitration, with such modifications or adaptations as foreseen herein or necessary under the circumstances (the “**Rules**”). The arbitration shall be conducted in San Francisco, California, USA, in the English language.
54. The procedure shall be a fast-track procedure. For this purpose, the Arbitral Tribunal shall shorten all applicable procedural time-limits under the Rules as far as appropriate in the circumstances. The Parties to the Arbitration shall consent to the use of e-mail for the exchange of documents.
55. The Arbitral Tribunal shall, as soon as practical after the confirmation of the Arbitral Tribunal, hold an organisational conference to discuss any procedural issues with the parties to the Arbitration. Terms of Reference shall be drawn up and signed by the parties to the Arbitration and the Arbitral Tribunal at the organisational meeting or thereafter and a procedural time-table shall be established by the Arbitral Tribunal. An oral hearing shall, as a rule, be established within two months of the confirmation of the Arbitral Tribunal.
56. In order to enable the Arbitral Tribunal to reach a decision, it shall be entitled to request any relevant information from the Combined Entity or the Requesting Party, to appoint experts and to examine them at the hearing, and to establish the facts by all appropriate means. The Arbitral Tribunal is also entitled to ask for assistance by the Trustee in all stages of the procedure if the parties to the Arbitration agree.
57. The arbitrators shall not disclose confidential information and apply the standards attributable to confidential information under the Merger Regulation. The Arbitral Tribunal may take the measures necessary for protecting confidential information in particular by restricting access to confidential information to the Arbitral Tribunal, the Trustee and outside counsel and experts of the opposing party.
58. The burden of proof in any dispute governed under the Rules shall be borne as follows: (i) the Requesting Party must produce evidence of a prima facie case; (ii) if that the Requesting Party does so, the Arbitral Tribunal must find in favour of the Requesting Party unless the Combined Entity can produce evidence to the contrary.

Involvement of the Commission

59. The Commission shall be allowed and enabled to participate in all stages of the procedure by:
- a. receiving all written submissions (including documents and reports, etc.) made by the parties to the Arbitration;
 - b. receiving all orders, interim and final awards and other documents exchanged by the Arbitral Tribunal with the parties to the arbitration (including Terms of Reference and procedural time-table);
 - c. giving the Commission the opportunity to file *amicus curiae* briefs; and
 - d. being present at the hearing(s) and being allowed to ask questions to parties, witnesses and experts.
60. The Arbitral Tribunal shall forward, or shall order the parties to the Arbitration to forward, the documents mentioned to the Commission without delay.
61. In the event of disagreement between the parties to the Arbitration regarding the interpretation of the Commitments, the Arbitral Tribunal may seek the Commission’s interpretation of the Commitments before finding in favour of any party to the Arbitration and shall be bound by the interpretation.

Decisions of the Arbitral Tribunal

62. The Arbitral Tribunal shall decide the dispute on the basis of the Commitments and the Decision. Issues not covered by the Commitment and the Decision shall be decided (in the order as stated) by reference to the Merger Regulation, EU law and general principles of law common to the legal orders of the Member States without a requirement to apply a particular national system. The Arbitral Tribunal shall take all decisions by majority vote.
63. Upon request of the Requesting Party, the Arbitral Tribunal may make a preliminary ruling on the Dispute. The preliminary ruling shall be rendered within one month after the confirmation of the Arbitral Tribunal, shall be applicable immediately and, as a rule, remain in force until a final decision is rendered.
64. The Arbitral Tribunal shall, in the preliminary ruling as well as in the final award, specify the action, if any, to be taken by the Combined Entity in order to comply with the Commitments vis-à-vis the Requesting Party (e.g. specify a contract including all relevant terms and conditions). The final award shall be final and binding on the parties to the Arbitration and shall resolve the Dispute and determine any and all claims, motions or requests submitted to the Arbitral Tribunal. The arbitral award shall also determine the reimbursement of the costs of the successful party and the allocation of the arbitration costs. In case of granting a preliminary ruling or if otherwise appropriate, the Arbitral Tribunal shall specify that terms and conditions determined in the final award apply retroactively.
65. The final award shall, as a rule, be rendered within six months after the confirmation of the Arbitral Tribunal. The time-frame shall, in any case, be extended by the time the Commission takes to submit an interpretation of the Commitments if asked by the Arbitral Tribunal.
66. The parties to the Arbitration shall prepare a non-confidential version of the final award, without business secrets. The Commission may publish the non-confidential version of the award.
67. Nothing in the above-described arbitration procedure shall affect the powers of the Commission to take decisions in relation to the Commitments in accordance with its powers under the Merger Regulation. [...].

SECTION F. GENERAL PROVISIONS

68. These Commitments shall be effective worldwide and shall remain in effect for ten years.

SECTION G. REVIEW

69. The Commission may, where appropriate, in response to a request from the Combined Entity showing good cause, waive, modify or substitute, in exceptional circumstances, one or more of the undertakings in these Commitments. This request shall be accompanied by a report from the Monitoring Trustee, who shall, at the same time send a non-confidential copy of the report to the Notifying Party. The request shall not have the effect of suspending the application of the undertaking and, in particular, of suspending the expiry of any time period in which the undertaking has to be complied with.

SECTION H. ENTRY INTO FORCE

70. The Commitments shall take effect upon the Effective Date.

(Signed)

Duly authorised for and on behalf of Broadcom Limited