

# Collage Display Feature for 3rd and 4th Generation Intel<sup>®</sup> Core<sup>™</sup> Processor Family

**Feature List**

---

***Revision 1.0***



INFORMATION IN THIS DOCUMENT IS PROVIDED IN CONNECTION WITH INTEL PRODUCTS. NO LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE, TO ANY INTELLECTUAL PROPERTY RIGHTS IS GRANTED BY THIS DOCUMENT. EXCEPT AS PROVIDED IN INTEL'S TERMS AND CONDITIONS OF SALE FOR SUCH PRODUCTS, INTEL ASSUMES NO LIABILITY WHATSOEVER AND INTEL DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY, RELATING TO SALE AND/OR USE OF INTEL PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

A "Mission Critical Application" is any application in which failure of the Intel Product could result, directly or indirectly, in personal injury or death. SHOULD YOU PURCHASE OR USE INTEL'S PRODUCTS FOR ANY SUCH MISSION CRITICAL APPLICATION, YOU SHALL INDEMNIFY AND HOLD INTEL AND ITS SUBSIDIARIES, SUBCONTRACTORS AND AFFILIATES, AND THE DIRECTORS, OFFICERS, AND EMPLOYEES OF EACH, HARMLESS AGAINST ALL CLAIMS COSTS, DAMAGES, AND EXPENSES AND REASONABLE ATTORNEYS' FEES ARISING OUT OF, DIRECTLY OR INDIRECTLY, ANY CLAIM OF PRODUCT LIABILITY, PERSONAL INJURY, OR DEATH ARISING IN ANY WAY OUT OF SUCH MISSION CRITICAL APPLICATION, WHETHER OR NOT INTEL OR ITS SUBCONTRACTOR WAS NEGLIGENT IN THE DESIGN, MANUFACTURE, OR WARNING OF THE INTEL PRODUCT OR ANY OF ITS PARTS.

Intel may make changes to specifications and product descriptions at any time, without notice. Designers must not rely on the absence or characteristics of any features or instructions marked "reserved" or "undefined". Intel reserves these for future definition and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to them. The information here is subject to change without notice. Do not finalize a design with this information.

UNLESS OTHERWISE AGREED IN WRITING BY INTEL, THE INTEL PRODUCTS ARE NOT DESIGNED NOR INTENDED FOR ANY APPLICATION IN WHICH THE FAILURE OF THE INTEL PRODUCT COULD CREATE A SITUATION WHERE PERSONAL INJURY OR DEATH MAY OCCUR.

This document contains information on products in the design phase of development.

All products, platforms, dates, and figures specified are preliminary based on current expectations, and are subject to change without notice. All dates specified are target dates, are provided for planning purposes only and are subject to change.

This document contains information on products in the design phase of development. Do not finalize a design with this information. Revised information will be published when the product is available. Verify with your local sales office that you have the latest datasheet before finalizing a design.

The products described in this document may contain design defects or errors known as errata which may cause the product to deviate from published specifications. Current characterized errata are available on request.

Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products.

Code names featured are used internally within Intel to identify products that are in development and not yet publicly announced for release. Customers, licensees and other third parties are not authorized by Intel to use code names in advertising, promotion or marketing of any product or servicing such use of Intel's internal code names is at the sole risk of the user.

Intel, HD Graphics and the Intel logo are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries.

\*Other names and brands may be claimed as the property of others.

Copyright © 2013, Intel Corporation. All rights reserved.



# Table of Contents

---

- 1 Introduction .....5
- 2 Collage Display feature.....6
  - 2.1 What’s Innovation with the Collage Display Feature? .....8
- 3 Minimum System / Hardware Requirements .....9
  - 3.1 Platform (Processor/Chipset) – Specifications .....9
  - 3.2 Software and Drivers.....10
  - 3.3 Operating Systems support .....10
  - 3.4 What is the Maximum Resolution of Collage Displays without external Splitter? ..... 10
  - 3.5 Horizontal Collage Display: ..... 11
  - 3.6 Vertical Collage Display: ..... 11
  - 3.7 Collage Display Feature Supports and Validation Tips ..... 11
  - 3.8 How to Enable Collage Display? ..... 12
    - 3.8.1 Panels: ..... 12
    - 3.8.2 Intel Processors: ..... 12
    - 3.8.3 Intel Chipsets: ..... 12
    - 3.8.4 Operating systems: ..... 12
    - 3.8.5 Installation instructions for Collage Display Setups: ..... 13
    - 3.8.6 Horizontal Collage Display (3XxY) or (2XxY) where X is width and Y is Height of a Resolution. .... 18
    - 3.8.7 Bezel in Horizontal Collage Display ..... 18
    - 3.8.8 Steps for Bezel Correction ..... 19
    - 3.8.9 Bezel Correction for X (width) Part of Resolution ..... 20
    - 3.8.10 Vertical Collage Display (Xx3Y) or (Xx2Y) where X is width and Y is height of a Resolution..... 22
    - 3.8.11 Bezel Correction for Y (Width) Part of resolution ..... 23
- 4 Disable Collage Display Feature ..... 25
- 5 Audio with Collage Display Feature ..... 26
  - 5.1.1 Collage Display with external DisplayPort\* Splitter..... 26
- 6 Quick Recap of Collage Display Feature ..... 29
  - 6.1 Shortcuts for Reference ..... 30



## Figures

Figure 1. Horizontal Collage View- 3 displays .....	6
Figure 2. Horizontal Collage View -2 displays.....	7
Figure 3. Vertical Collage View-2 Displays.....	7
Figure 4. Processor .....	9
Figure 5. Chipset .....	9
Figure 6. Horizontal Collage Display in Intel® HD Graphics Control Panel .....	15
Figure 7. Vertical Collage Display In Intel® HD Graphics Control Panel.....	16
Figure 8. View after Clicking after Identify Display Button.....	17
Figure 9. Apply any Resolutions under Intel HD Graphics Control Panel .....	17
Figure 10. Horizontal Native Collage Display Mode Setup .....	18
Figure 11. Look of Horizontal Collage Mode/Bezel .....	20
Figure 12. View before Bezel Correction.....	21
Figure 13. View after Bezel Correction .....	21
Figure 14. Vertical Collage Display Mode Setup .....	22
Figure 15. Look of Vertical Collage Mode/Bezel .....	23
Figure 16. View after Bezel Correction with 3 Displays.....	24
Figure 17. Disable Collage by OFF in Enable Collage Tab.....	25
Figure 18. Audio with Collage display .....	26
Figure 19. Two External DisplayPort* Splitters .....	27
Figure 20. Look of Horizontal Collage Mode (4x1) with External DisplayPort* Splitter .....	27
Figure 21. Look of Vertical Collage Display Mode (2x2) with External DisplayPort Splitter.....	28

## Tables

Table 1. Recommended Platform Configurations .....	10
--	----



## ***Revision History***

---

<b>Document Number</b>	<b>Revision Number</b>	<b>Description</b>	<b>Date</b>
	1.0	<ul style="list-style-type: none"><li>• Initial release of the document.</li></ul>	December 2013



# **1 Introduction**

---

Welcome to the world of high definition displays where you want to see High Resolutions, pure Quality to vision but at the reduced cost of huge panels. Do you have problems in projecting live telecasts to a bigger audience by connecting several panels and systems? The search ends here-with the Collage Display Feature.

Collage is a picture art which is prepared by combining all tiles/pictures together in a single image. Similarly Intel collage displays make a single image across multiple displays and enhances Image quality using a technique called as Bezel correction to view a Continuous image across all displays

The Collage Display feature of Intel's Iris™ and HD Graphics driver has various applications in different fields such as digital signage, financial viewers, medicine, digital surveillance, casino gaming, and office environments for running high resolution images across multiple monitors at lower total platform cost. A cleaner solution can be realized through a reduction in cabling typically required of these setups.



## 2 Collage Display Feature

---

Collage display is a feature that allows users to combine multiple monitors to create a single unified desktop user interface to achieve a bigger viewing area and resolution. This capability allows user to enjoy higher quality pictures and videos with multiple low resolution supported panels. It is very cost effective in comparison to purchase of one single high resolution panel.

Multi-monitor display is a current market trending segment and finds commercial viability in the fields of digital signage, financial, stock market, medical, transportation, call center & surveillance among others. With the 3<sup>rd</sup> and 4<sup>th</sup> Generation Intel® Core™ Processor Family supporting 3 display pipes, it opens the potential to venture into this un-touched market segment with support via Collage Display mode (both horizontal & vertical) with a potential to support 4 displays using external DisplayPort\*(DP) Splitters. It expands upon the capability to support beyond clone/extended displays. Bezel pattern scheme is used to view image flawless across all monitors

If multiple displays (minimum two displays) are placed horizontally, it is known as Horizontal Collage Display (i.e., positioning displays one next to another where one image stretches across panels, as shown in Figures 1 & 2). If multiple displays (more than 2) are placed vertically, it is known as Vertical Collage Display (i.e., where the upper part of the image is shared across the vertical direction, as shown in Figure 3). Bezel correction Patterns are being used in order to make continuous image across all displays.

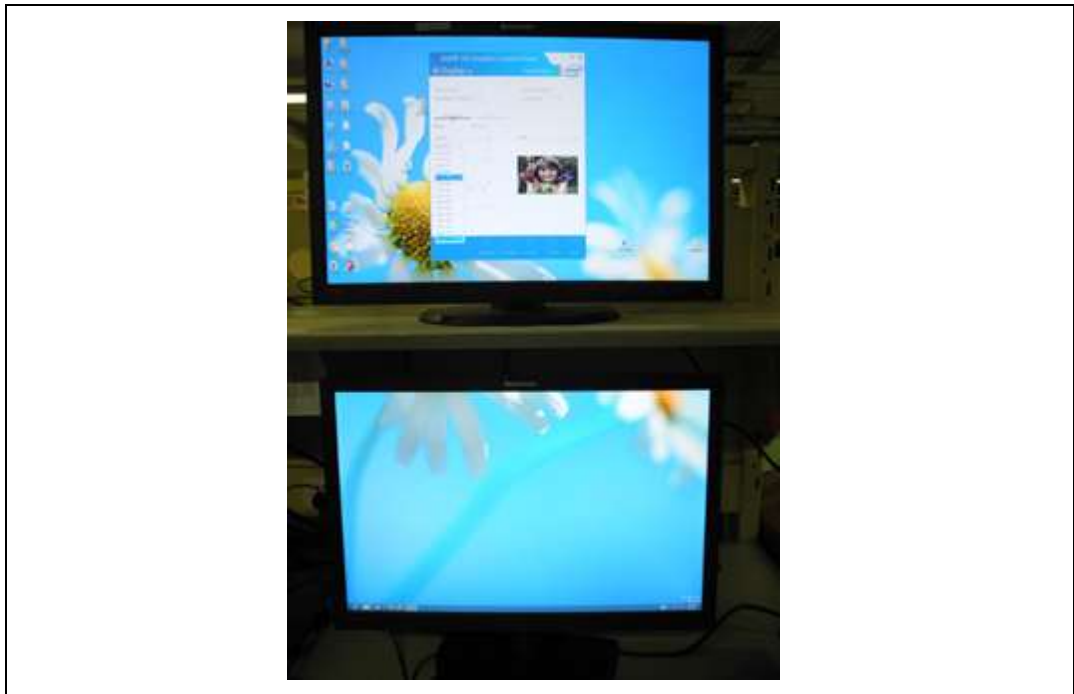
**Figure 1. Horizontal Collage View- 3 displays**



**Figure 2. Horizontal Collage View -2 displays**



**Figure 3. Vertical Collage View-2 Displays**



Currently Intel supports a maximum of 3 independent displays up to 1920x1200 in platforms based on the 3rd Generation Intel® Core™ Processor and 2560x600 in platforms based on the 4<sup>th</sup> Generation Intel® Core™ Processor.

In upcoming sections you will know how to get this exciting feature provided by Intel that is enabled on 4th Generation Intel Core Processor based systems.





## **2.1 What's Innovation with the Collage Display Feature?**

Collage display feature saves a lot of power, enhances performance capability, and offers bezel correction in order to display a single continuous image across multiple panels.

§

# 3 Minimum System / Hardware Requirements

---

## 3.1 Platform (Processor/Chipset) – Specifications

Figure 4. Processor



Figure 5. Chipset



Table below lists both desktop and mobile recommended platform components for processor, chipset, and memory configurations.



**Table 1. Recommended Platform Configurations**

System	Processor Name	Graphics	Panels
<b>Desktop/AIO</b>	3rd and 4th Generation Intel® Core™ i5/i7 Processor Family	Intel® HD Graphics 4000/2500	Any 2 or 3 Panel Combination type VGA/Display Port/Extended DisplayPort*(eDP)/HDMI/DVI up to Optimal resolution without DP splitter or 4 DP displays with DP-splitters
<b>Mobile including Ultra book</b>	3rd and 4th Generation Intel® Core™ i5/i7 Processor Family	Intel® HD Graphics 5000/4600/4400/4200 Iris™ Graphics 5100 and Iris™ Pro Graphics 5200	Any 2 or 3 Panel Combination type VGA/Display Port/Extended DisplayPort* /DP/HDMI/DVI up to Optimal resolution without DP splitter or 4 DP displays with DP-splitters

### 3.2 Software and Drivers

Download the latest Iris™ and graphics driver from the Intel website (<http://downloadcenter.intel.com>) for 3rd and 4th Generation Intel® Core™ Processor Family.

### 3.3 Operating Systems support

32-bit and 64-bit versions for the following operating systems are supported: Microsoft Windows 7\*, Windows 8\*, and Windows 8.1\*

### 3.4 What is the Maximum Resolution of Collage Displays without External Splitter?

Maximum resolution for Collage Display is always dependent on type of Display connected to a system and also the system’s Platform capability (Processor/Chipset). Below is a generalized formula for a system:



### 3.5 Horizontal Collage Display:

Assuming all the connected display devices are of same model, maximum collage resolution will be  $(N * W) \times H$ . Here N is the number of displays; W and H are width and height of the maximum resolution supported by the displays.

If the connected display devices are not the same, the maximum collage resolution will be:

(Sum of widths of the maximum resolutions supported by the displays) x Minimum of Heights of the highest resolutions supported by the displays.

### 3.6 Vertical Collage Display:

Assuming all the connected display devices are of same model, maximum collage resolution will be  $W \times (N * H)$ . Here N is the number of displays; W and H are width and height of the maximum resolution supported by the displays.

If the connected display devices are not the same, the maximum collage resolution will be:

Minimum of Widths of the widths of highest resolutions supported by the displays x (Sum of heights of the maximum resolutions supported by the displays)

### 3.7 Collage Display Feature Supports and Validation Tips

Collage Display is supported on two/three displays and helps to provide-1x2, 2X1, 1X3, 3X1 Collage modes. With 4 displays in combination of two DisplayPort splitters can provide 2X2 and 4X1 Collage modes with resolutions depending on the type of panels connected.

- Collage mode does not support Content protected playback from Blu-ray\* disk since it is a single image shared across all displays.
- Collage mode does not support Touch enabled Feature across all monitors in Microsoft Windows 8 operating system.
- Collage is possible only with similar Refresh rates up to 60 Hz at landscape mode only.
- Performance of video/game playback in collage mode will vary in accordance with work load in computer.
- Audio splitting across all monitors is not possible.
- Hot plug and Scaling is enabled to support collage but to a Maximum resolution of 1920x1200 across each monitor.



- Intel® WiDi/Miracast or InTru™ 3D with Collage is not supported
- Media playback (Non premium content) shall be supported at 24, 30 and 60 (interlaced) Frame per Second.
- Collage Display feature shall be supported in Switchable graphics and Hybrid graphics designs
- Collage also supports Bezel Correction

## **3.8 How to Enable Collage Display?**

### **3.8.1 Panels:**

- 2 or 3 Panels-any type of Display connectivity-eDP, DP, VGA, HDMI, DVI
- For 4-display collage, we need to use 4 DP –Display with Native resolution 1920\*1200
- Panels should be of same model in order to achieve best viewing experience.

### **3.8.2 Intel Processors:**

- 4th Generation Intel® Core™ Processors with Iris™ Pro Graphics 5200
- 4th Generation Intel® Core™ Processors with Iris™ Graphics 5100
- 4th Generation Intel® Core™ Processors with Intel® HD Graphics 5000/4600/4400/4200
- 3rd Generation Intel® Core™ Processors with Intel® HD Graphics 4000/2500
- Intel® Pentium® Processor 3000/G3000 Series
- Intel® Celeron® Processor 2000 Series

### **3.8.3 Intel Chipsets:**

- Intel® 7 Series Chipsets
- Intel® 8 Series Chipsets

### **3.8.4 Operating systems:**

Microsoft Windows 7\*, Windows 8\*, and Windows 8.1\* (Both 32 and 64 bit)



### 3.8.5 Installation Instructions for Collage Display Setups:

Verify that your computer is connected with 2 displays and Download latest Iris™ and graphics driver from (<http://downloadcenter.intel.com>) Intel website for 3rd and 4th Generation Intel® Core™ Processor Family

1. Press **Ctrl+Alt+F12** to open the Intel® HD Graphics Control Panel.

**Note:** For other methods to open the Intel Graphics Control Panel, see [How to open the Intel® graphics properties window.](#)

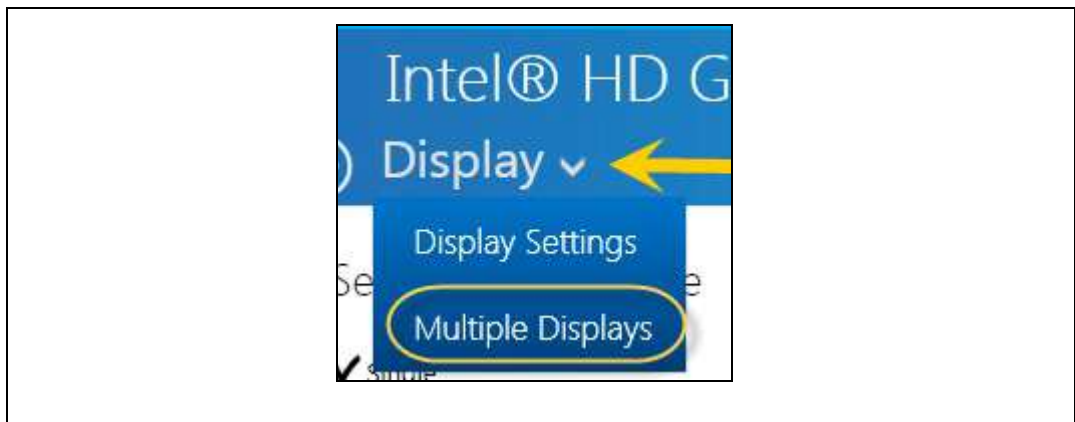
2. After opening the Intel® HD Graphics Control Panel, do the following to reach the Display settings:

With Intel® HD Graphics drivers, select Display:



3. Use the following steps to select multiple displays.

With Graphics drivers, click on the **Display** drop down menu and select **Multiple Displays**:



4. Select **Collage**. Under Enable Collage, select **On**. Click **Apply**.

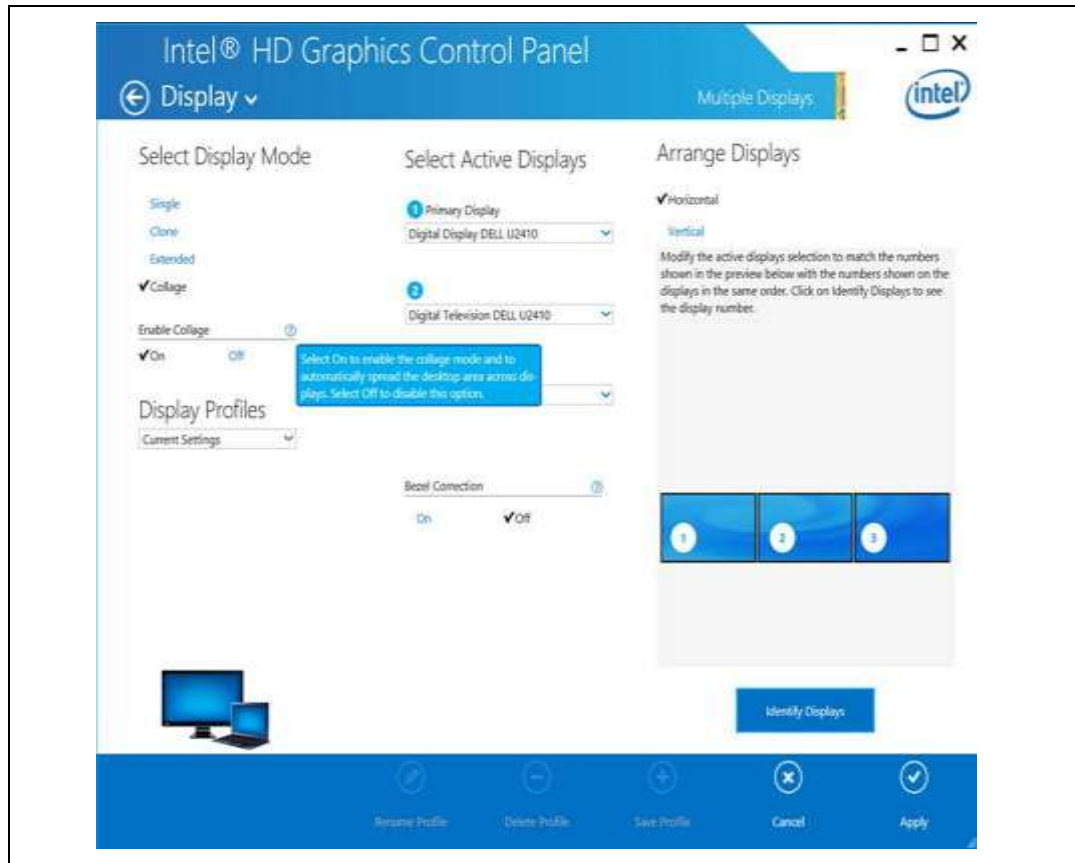


5. Select active displays to enable.
6. Arrange displays type as horizontal or vertical depending on the physical placing of the display devices.
7. Click **Apply**

If Horizontal is selected under Arrange displays then a single image will stretch from left to right across two or three displays. This is called Horizontal Collage Mode.



Figure 6. Horizontal Collage Display in Intel® HD Graphics Control Panel

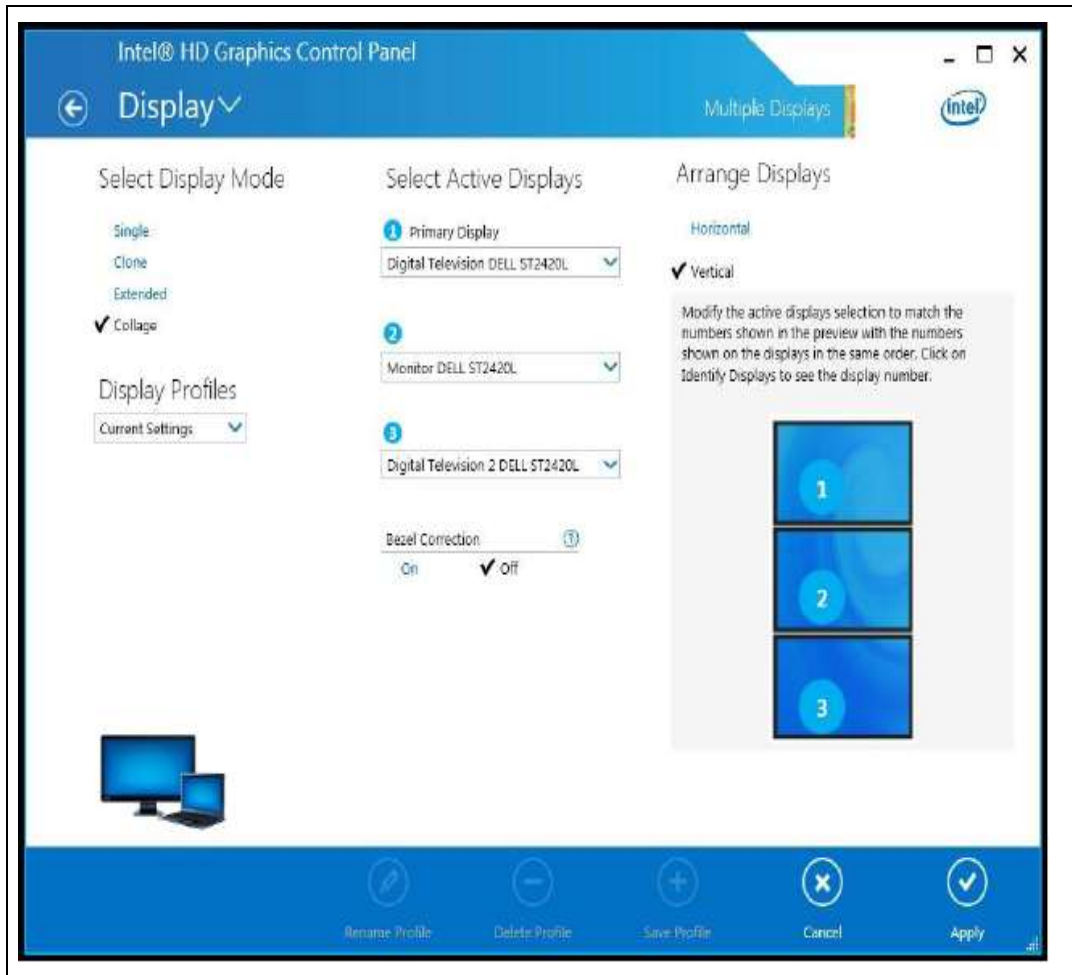


If Vertical is selected under Arrange displays then a single image will stretch from top to bottom across two or three displays. This is called Vertical Collage Mode.



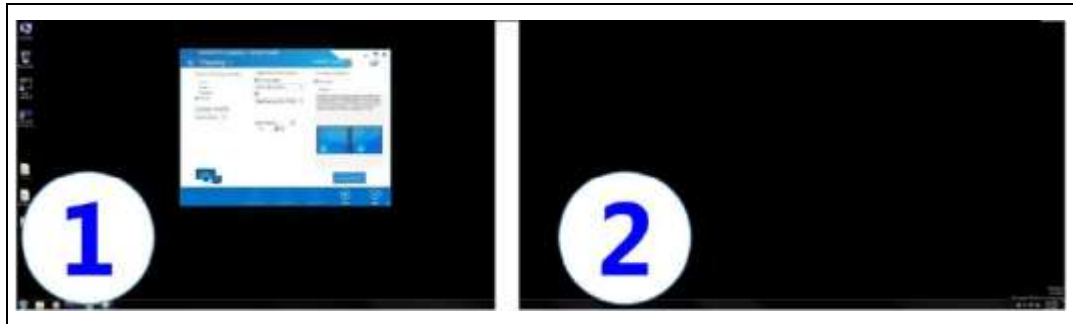


Figure 7. Vertical Collage Display in Intel® HD Graphics Control Panel



1. We can arrange displays as per our physical placement. Select **identify display buttons** in Intel control panel .Clicking on these buttons causes appearing of numbered circles on active displays. The number indicates whether display is Primary (1),secondary (2)or tertiary (3) as per our selection.

Figure 8. View after Clicking after Identify Display Button



2. Apply any resolutions under the Display settings for the active displays selected. Collage resolutions are dependent on native, EDID supported resolutions of the display panels.

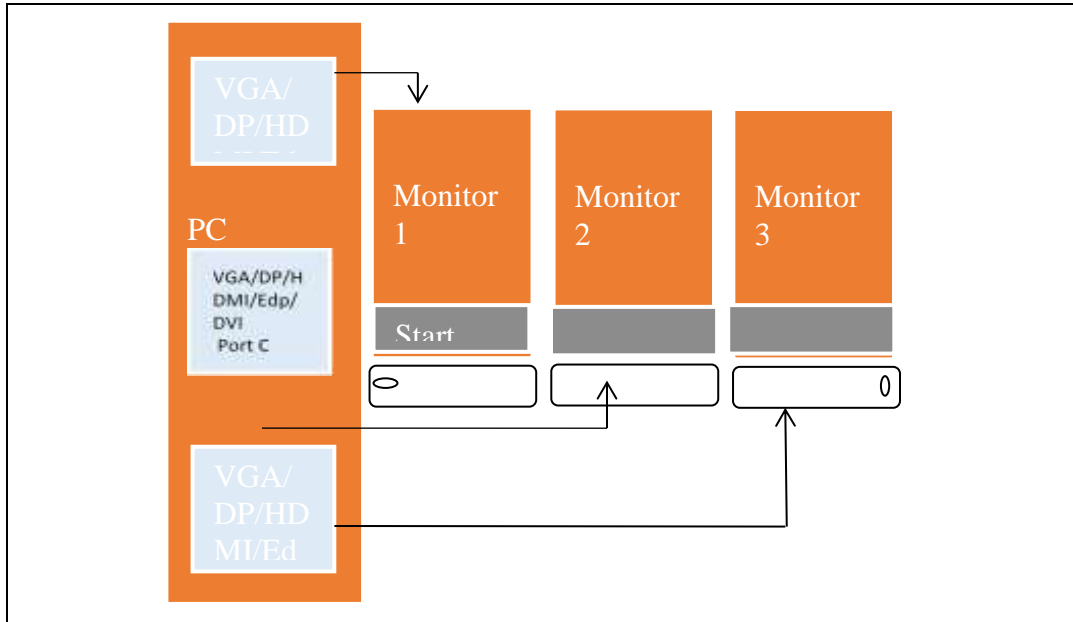
Figure 9. Apply any Resolutions under Intel HD Graphics Control Panel





### 3.8.6 Horizontal Collage Display (3XxY) or (2XxY) where X is width and Y is Height of a Resolution.

Figure 10. Horizontal Native Collage Display Mode Setup



### 3.8.7 Bezel in Horizontal Collage Display

Bezel is the outside frame area around the monitor glass. When 2 or more displays are connected to share a single image then continuity of image across different monitors gets disrupted. Bezel correction can be done in accordance with the type of displays (Same DPI and size for all panels) being used in the Collage Display setup.

- The User can do Trial and error method to change bezel values and align Continuous Image across all displays by their viewing judgment.
- User can use Bezel correction patterns in order to view the best the image across all displays.

The patterns (square within a circle along with two diagonal lines) are used for Bezel Correction with greater accuracy. The patterns appear popped up when the Bezel correction is ON, all of the selected settings are applied and Multiple Displays page is opened. The patterns can also be displayed by clicking on the DISPLAY PATTERN button. The

Patterns can be dragged until a circle and square is perceived by the user. Fine alignment can be done by using a ruler until the diagonal lines appear continuous, or by making the edges of the square the same length. User Interface Controls for



pattern-based Bezel Correction will be shown when all of the following Conditions are satisfied:

- Native resolutions of all the active displays are the same
- All display related settings (excluding color) have been applied – i.e. selected settings are the same as the applied settings.
- All of the displays use Full screen scaling
- System DPI is default (96)

**Note:** Current Pattern based Bezel correction solution will not be effective if adjacent Display Bezels are not equally thick. Moving patterns by dragging or other means moves the halves of the patterns in a symmetric manner. This method is not effective when adjacent Bezels are of different physical widths.

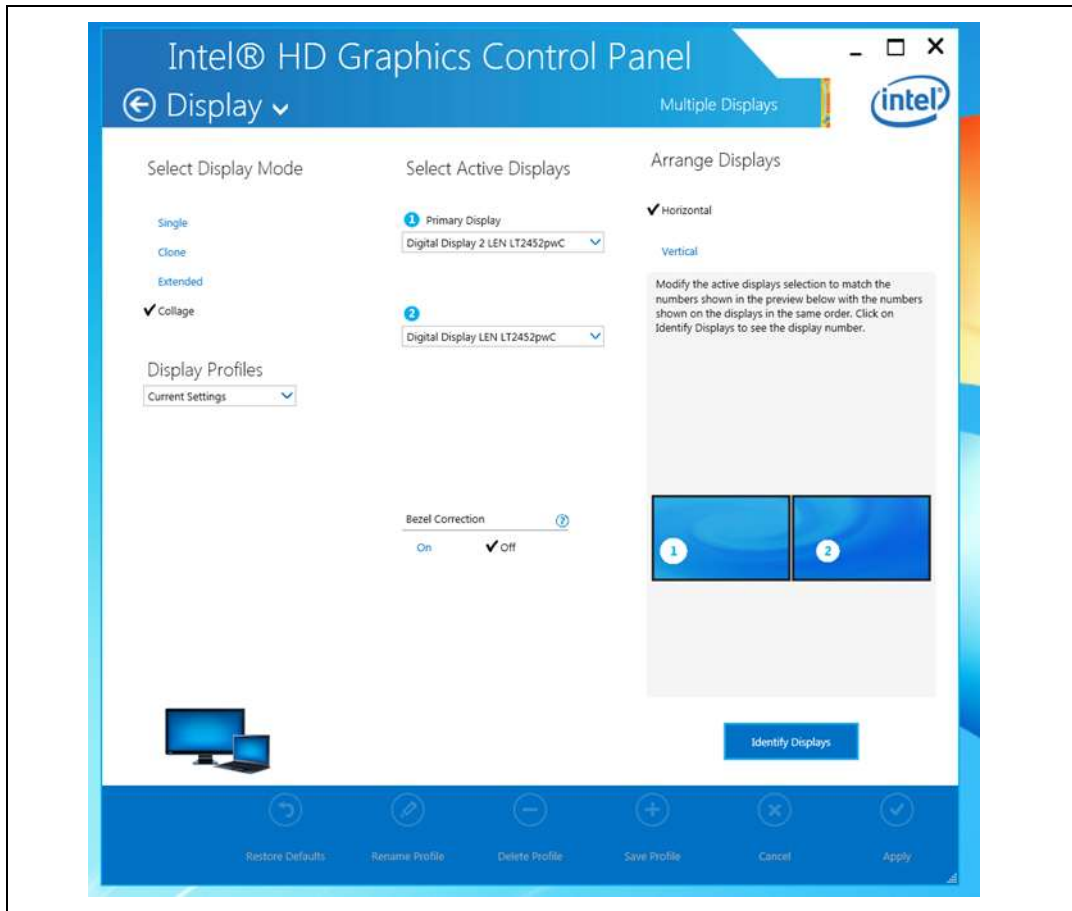
### **3.8.8 Steps for Bezel Correction**

1. Verify Collage Display mode is enabled. See Sec: 3.8: How to enable Collage Display?
2. Keep or reopen the Intel Graphics Control Panel and open the Display settings.
3. Under Bezel Correction, select On.
4. Enter values in whole numbers and adjust the values until the image looks smoother.

The Intel Graphics driver will make an internal calculation to add a value selected by the User in the resolution and apply across the collage displays.



Figure 11. Look of Horizontal Collage Mode/Bezel



### 3.8.9 Bezel Correction for X (width) Part of Resolution

If two or three panels having with a Bezel are connected then in order to get the Continuous Image effect, use the Bezel tab from the Intel® Graphics control panel to align the image.

1. Open Intel® Graphics control panel (Ctrl+Alt+F12)
2. Click "Display"
3. Click "Multiple Displays"
4. Click Select Active Displays->Click Bezel Correction.
5. Enable Bezel correction by ON Mode.
6. User will See Bezel values from "0" to till " X/2"
7. Change Bezel values by entering different values on a Trial and Error method or by using bezel correction Pattern.

Figure 12. View before Bezel Correction

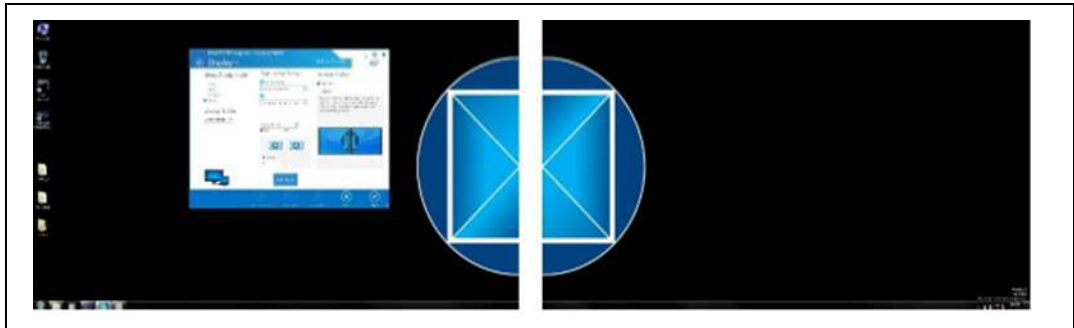


Figure 13. View after Bezel Correction

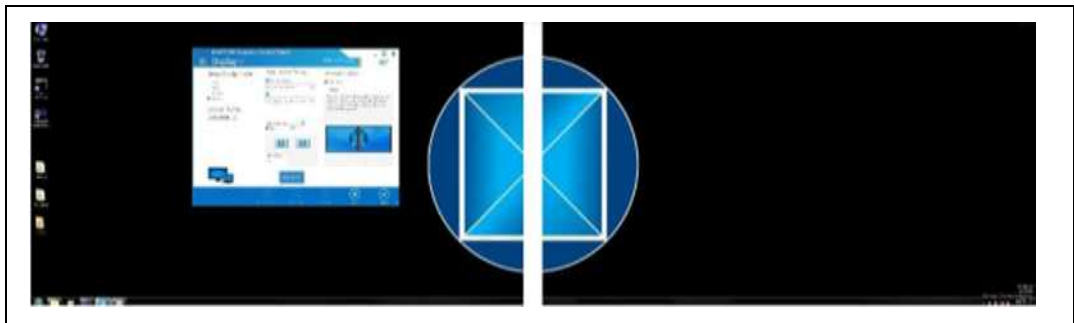
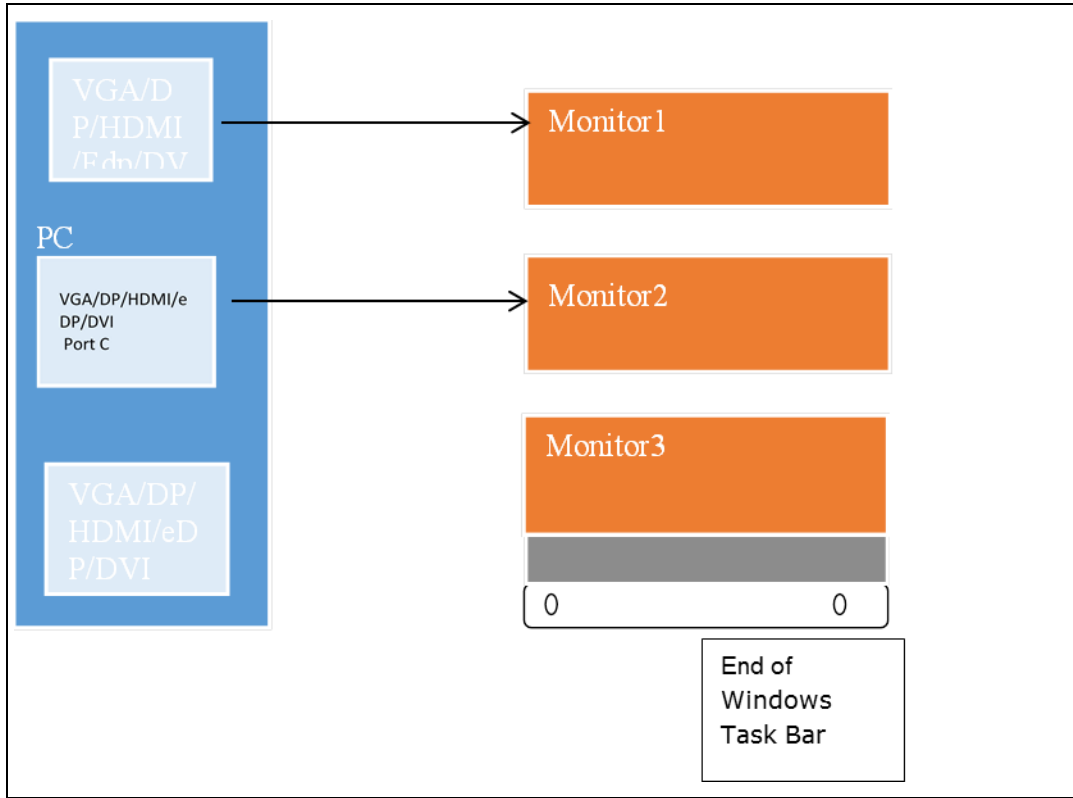




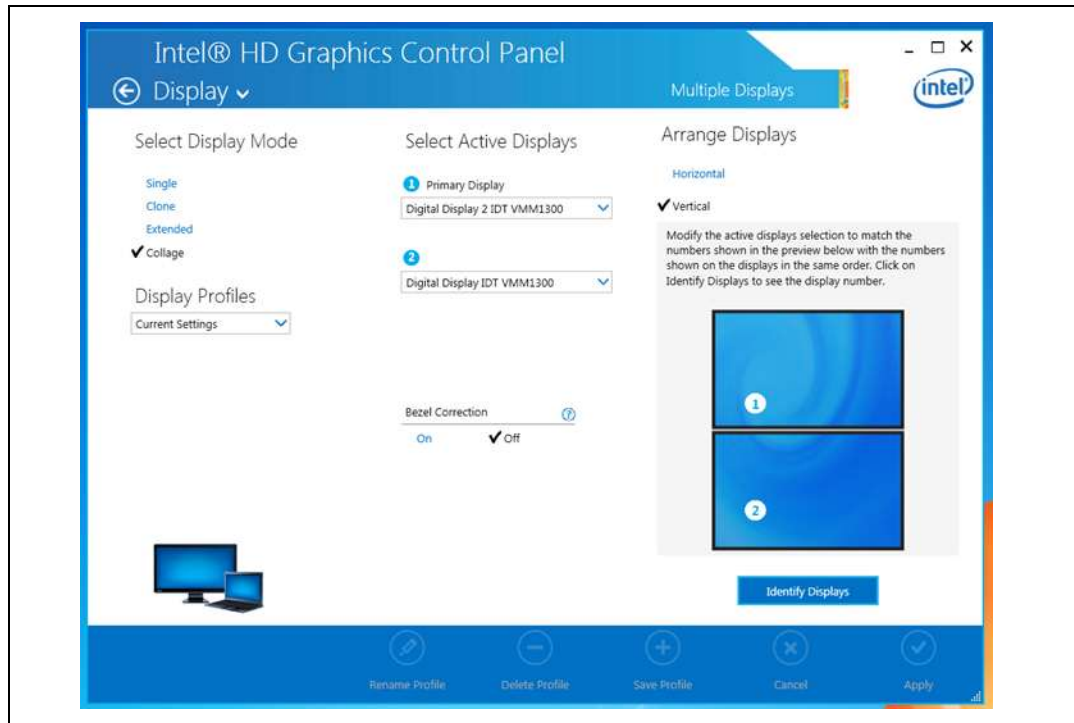
Figure 14. Vertical Collage Display Mode Setup



**3.8.10 Vertical Collage Display (Xx3Y) or (Xx2Y) where X is width and Y is height of a Resolution.**

Bezel in Vertical Collage Display

Figure 15. Look of Vertical Collage Mode/Bezel



### 3.8.11 Bezel Correction for Y (Width) Part of resolution

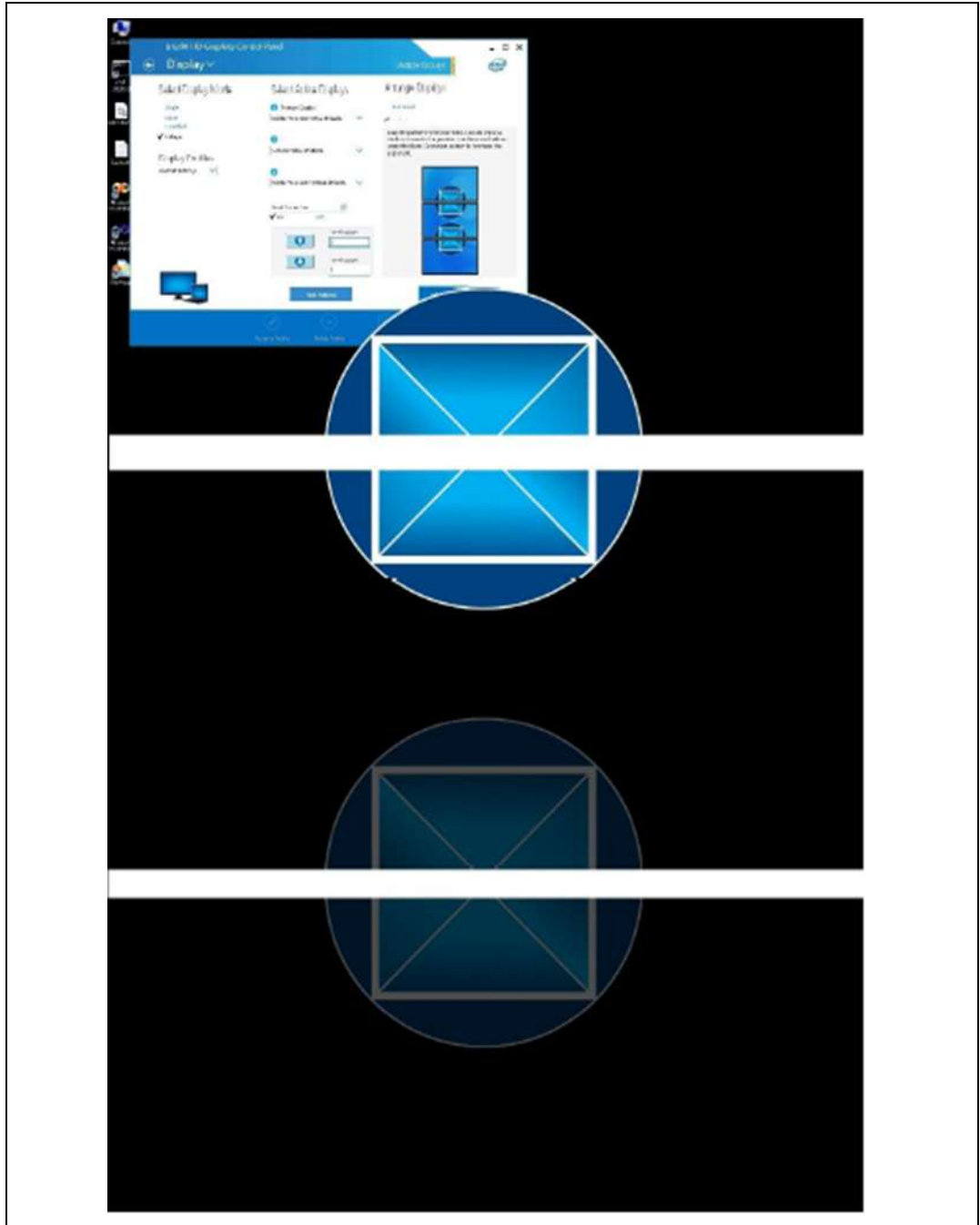
If three panels with a Bezel are connected then in order to get the Continuous Image effect, use the Bezel tab from the Intel® HD and Iris Graphics control panel to align the image.

- Open Intel® Graphics control panel (Ctrl+Alt+F12)
- Click "Display"
- Click "Multiple Displays"
- Click Select Active Displays->Click Bezel Correction.
- Enable Bezel correction by ON Mode.
- User will See Bezel values from "0" to till " Y/2"
- Apply Bezel Values as desired by user and bezel correction Pattern based





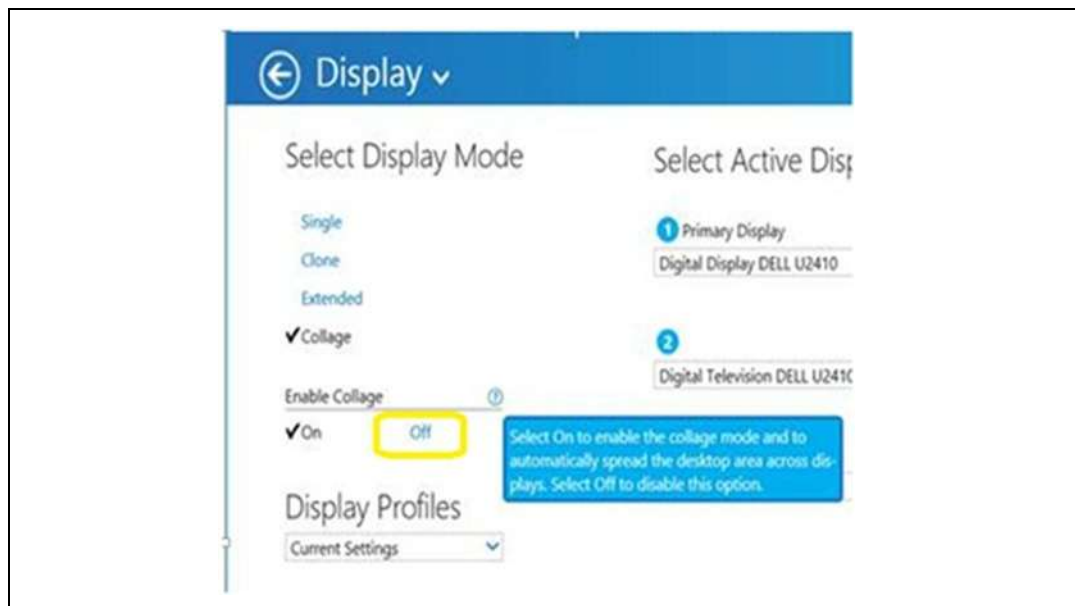
Figure 16. View after Bezel Correction with 3 Displays



## 4 *Disable Collage Display Feature*

1. Press **Ctrl+Alt+F12** to open the Intel Graphics Control Panel.
2. Select **Display**.
3. Click the **drop-down menu** and select **Multiple Displays**.  
Select **Collage**, under Enable Collage, select **Off**. Click **Apply**.

Figure 17. Disable Collage by OFF in Enable Collage Tab

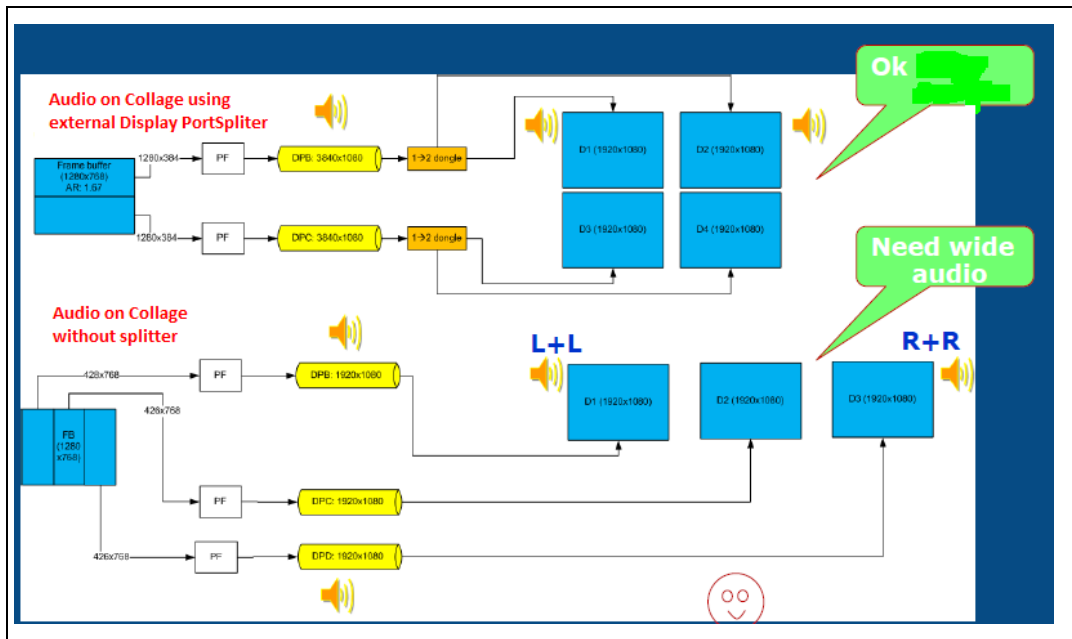


## 5 Audio with Collage Display Feature

Audio splitting across multiple monitors in Collage display in both Horizontal and Vertical Modes will have a single stream audio support because a single image is shared across multiple monitors. A single audio will be available across all monitors connected.

Audio splitting across collage displays with Two external DisplayPort\* splitters will have single audio stream by having one splitter DisplayPort will get LEFT Audio effect and other will get RIGHT audio effect

Figure 18. Audio with Collage Display



### 5.1.1 Collage Display with external DisplayPort\* Splitter

Enable collage on 4 displays by using External Display port splitter, DP->2 DP splitters by providing collage modes of 4x1, 2X2 with Maximum resolution of 1920x1200 at each independent DP Panel. Collage Display with external DisplayPort splitters provides maximum resolutions such as 7680x1200 or 3840x2400



For Collage Display across 4 displays, there is no additional software required. However, four displays that support 1920x1200 native resolution and DigitalPort are required to connect to two DisplayPort splitters from a computer.

**Note:** Splitter should also have higher resolution support capability

**Figure 19. Two External DisplayPort\* Splitters**



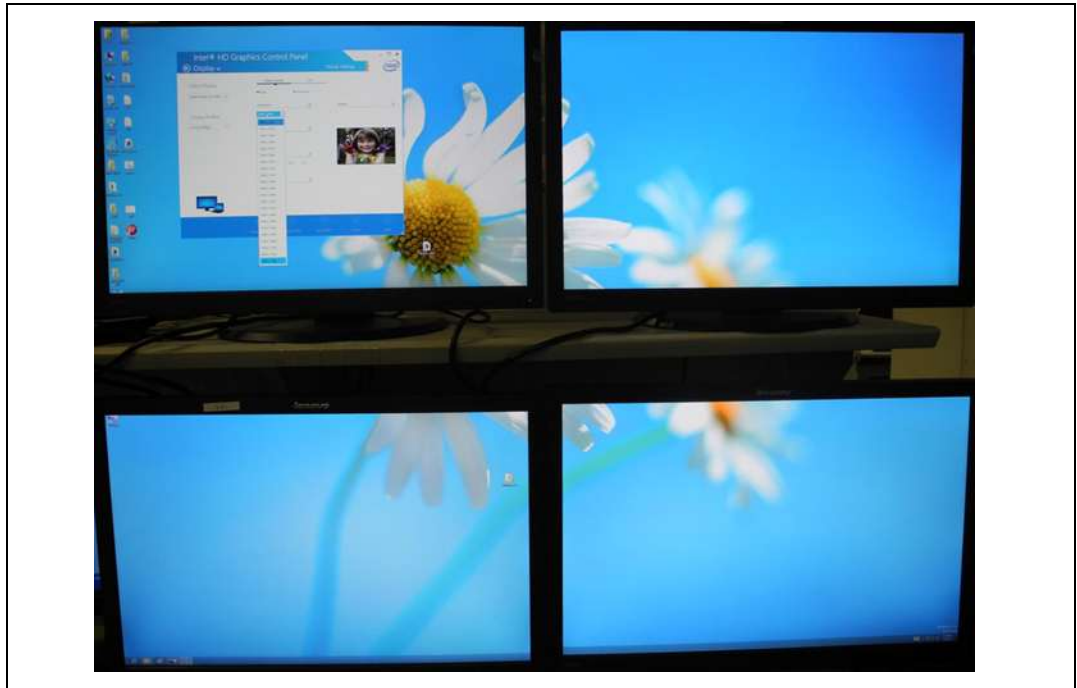
Look and Feel of Collage Display with Two External Display port Splitter

**Figure 20. Look of Horizontal Collage Mode (4x1) with External DisplayPort\* Splitter**





Figure 21. Look of Vertical Collage Display Mode (2x2) with External DisplayPort\* Splitter





## **6 Quick Recap of Collage Display Feature**

---

Multi-monitor display is a current market trending segment and finds commercial viability in the fields of Digital signage, Financial, Stock market, Medical, Transportation, Call centre & Surveillance etc. With the 3<sup>rd</sup> and 4<sup>th</sup> Generation Intel® Core™ Processor Family supporting 3 display pipes, it opens the potential to venture into this un-touched market segment with support via Collage Display mode (both horizontal & vertical) with a potential to support 4 displays (with two external display port splitters). It expands upon the capability to support beyond clone/extended displays.

Link for FAQ: <http://www.intel.com/support/graphics/sb/CS-034596.htm>



## 6.1 Shortcuts for Reference

Term	Description
<b>4X1</b>	Horizontal collage when 4 displays are used
<b>2x2</b>	Vertical Collage when 4 displays are used
<b>1x3</b>	Vertical Collage when 3 displays are used
<b>3X1</b>	Horizontal Collage when 3 displays are used
<b>1x2</b>	Vertical Collage when 2 displays are used
<b>2X1</b>	Horizontal Collage when 2 displays are used
<b>Horizontal Collage</b>	Image is stretched horizontally along all displays
<b>Vertical Collage</b>	Image is stretched vertically along all displays
<b>Bezel</b>	Thickness of Panel Border. Some panel comes without Bezel.
<b>Native Collage</b>	Collage without External Dongles. Using Ports Available on Intel Chipset systems
<b>External DisplayPort splitter</b>	A special kind of connector cable Splitter-One DP-IN to Two DP-out
<b>Dongle</b>	It is another name for splitter
<b>DP Panel</b>	DisplayPort Panel
<b>DisplayPort(DP)</b>	It is digital Display Interface
<b>1x2 Dongle</b>	Connector/Splitter which has 1 input & 2 outputs
<b>W x H</b>	Width x Height
<b>Resolution</b>	Number of Pixels used to display the image. Number of pixels =W x H